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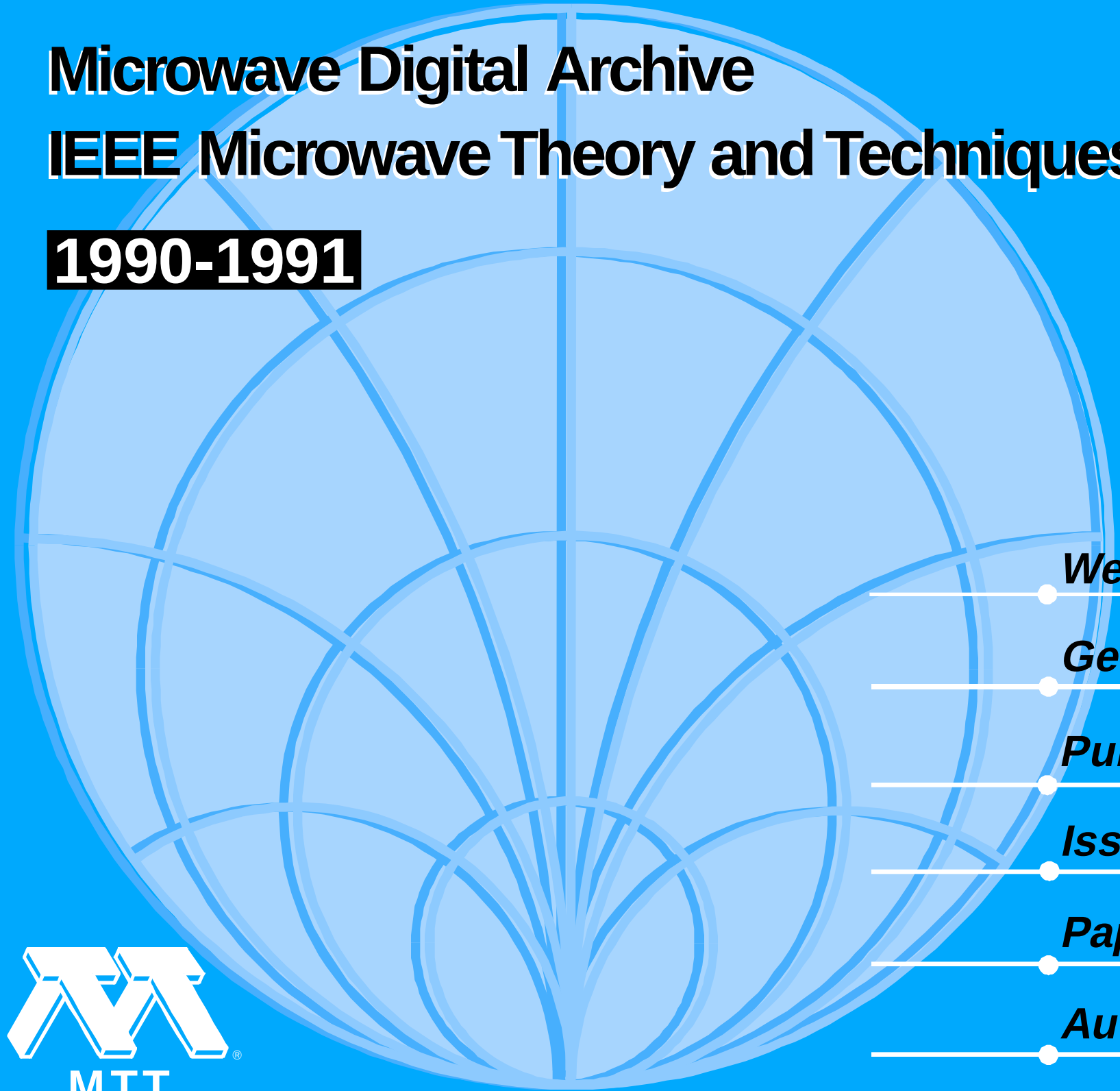
1990-1991



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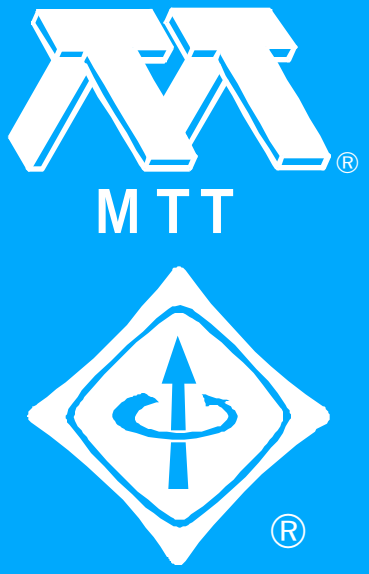

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ACKNOWLEDGMENTS

This CD- ROM was assembled from the electronic files provided to us by Adam Philippidis at IEEE headquarters and from scanned originals provided by Ted Saad. Many people have contributed to the entire CD-ROM Archival effort. Most notably, Ted Saad provided nearly all the hard copy material, and sacrificed his entire collection of journals for the project. He also wrote a number of the original articles. Another notable contributor, Roger Pollard convinced the Society that this was a worthwhile project. The team at Sony Electronic Publishing Services, and Adam Philippidis, at the IEEE Headquarters, have also provided substantial amounts of help in completing this archival project.

REFERENCES

IEEE Catalog Number: JP-17-0-0-C-0

ISBN: 0-7803-9906-4

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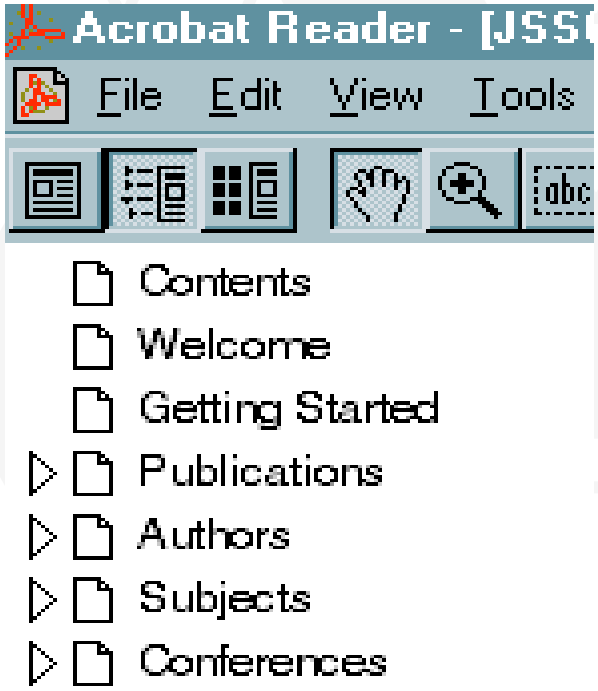

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The Electronic Guide is constructed in sections: e.g. Sessions, Authors, Getting Started. The current section is shown at the top of each page. The “path” to this section is shown at the right. Clicking these text buttons moves you to the start of that section.

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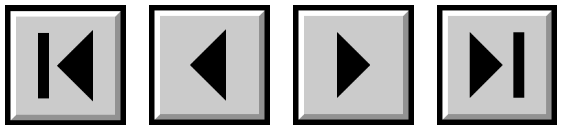

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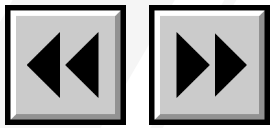

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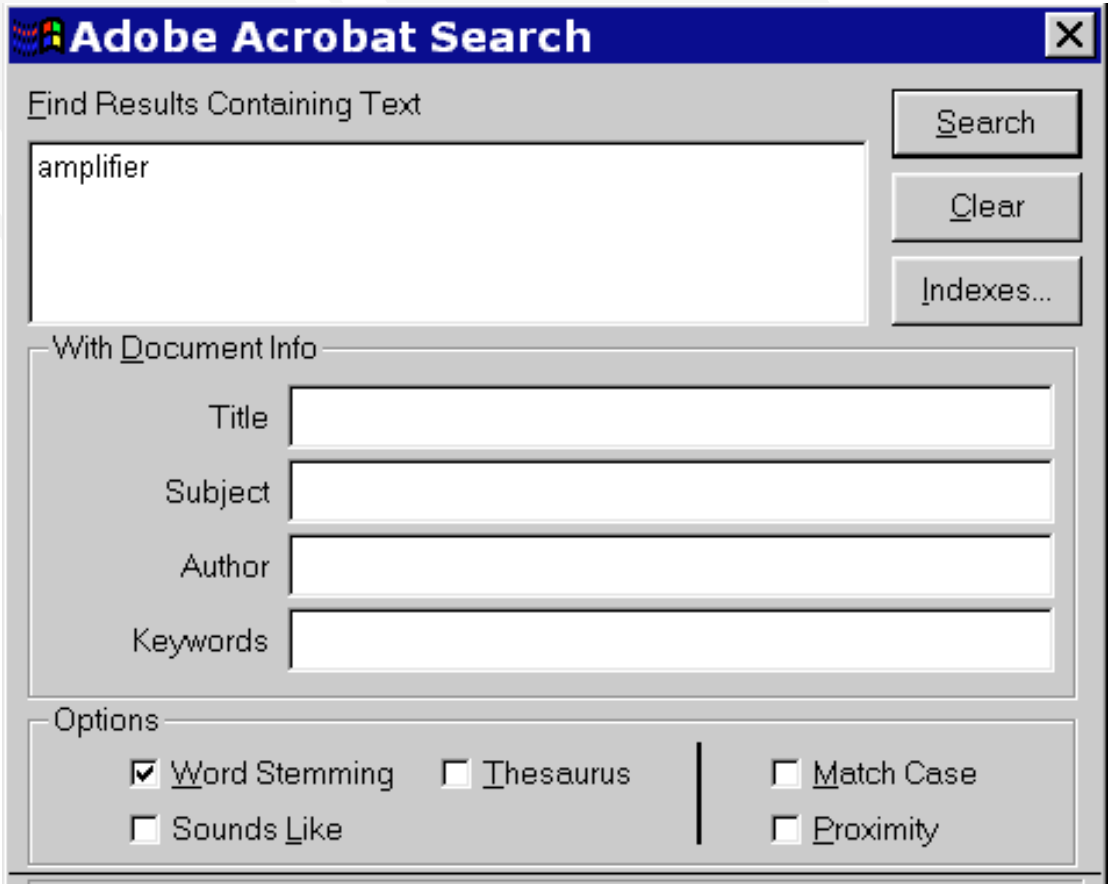

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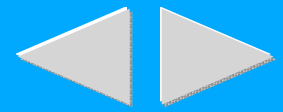

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RF Performance of a Novel Planar Millimeter-Wave Diode Incorporating an Etched Surface Channel

D.G. Garfield, R.J. Mattauch and S. Weinreb. "RF Performance of a Novel Planar Millimeter-Wave Diode Incorporating an Etched Surface Channel." 1991 Transactions on Microwave Theory and Techniques 39.1 (Jan. 1991 [T-MTT]): 1-5.

A new whiskerless millimeter wave mixer diode has performance comparable to that of the highest quality whisker-contacted diodes. The diode rises an etched surface channel and planar air bridge to obtain greatly reduced parasitic capacitance. At 94 GHz the room-temperature diode exhibited a conversion loss of 5.3 ± 0.5 dB and an equivalent input noise temperature of 518 ± 50 K SSB.

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Low-Loss Design Method for a Planar Dielectric-Waveguide Y Branch: Effect of a Taper of Serpentine Shape

M. Tsuji, O. Tanaka and H. Shigesawa. "Low-Loss Design Method for a Planar Dielectric-Waveguide Y Branch: Effect of a Taper of Serpentine Shape." 1991 Transactions on Microwave Theory and Techniques 39.1 (Jan. 1991 [T-MTT]): 6-13.

A new design method is proposed for a planar dielectric waveguide Y branch with low loss caused by radiation. In contrast to the usual design methods, in which the generation of the radiation wave is kept as small as possible, the present method positively uses, for the first time, the behavior of such a radiation wave. We intentionally generate the radiation wave at any local position along a taper section of the Y branch, and its power conversion and reconversion with the surface-wave mode are controlled to reduce the insertion loss for the surface-wave mode. A design example shows that the low-loss Y branch should have a serpentine taper, which is an unexpected shape from the usual design point of view. The effectiveness of our design method presented here is confirmed by comparing the numerical results with those of the usual types of Y branches and with measurements.

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Study of TE/sub 0/ and TM/sub 0/ Modes in Dielectric Resonators by a Finite Difference Time-Domain Method Coupled with the Discrete Fourier Transform

A. Navarro, M.J. Nufiez and E. Martin. "Study of TE/sub 0/ and TM/sub 0/ Modes in Dielectric Resonators by a Finite Difference Time-Domain Method Coupled with the Discrete Fourier Transform." 1991 Transactions on Microwave Theory and Techniques 39.1 (Jan. 1991 [T-MTT]): 14-17.

We present an application of a numerical method of finite differences in the time domain (FDTD), coupled with the discrete Fourier transform, to determine the resonant frequencies of the TE/sub 0/ and TM/sub 0/ modes of axially symmetric dielectric resonators closed in a cavity. We analyze the cylindrical cavity dielectrically loaded at the base and the resonant frequency of the TE/sub 0/, a mode in two systems: a cylindrical cavity with a cylindrical dielectric resonator of variable radius and the shielded dielectric resonator on a microstrip substrate. The results obtained are compared first with the rigorous (exact) theoretical solutions and then with experimental results.

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Transient RF Signals During the Switching of MESFET Control Devices

J. Nitirt, R.J. Gutmann and D.M. Johnson. "Transient RF Signals During the Switching of MESFET Control Devices." 1991 Transactions on Microwave Theory and Techniques 39.1 (Jan. 1991 [T-MTT]): 18-24.

An analytical model that predicts the intrinsic small-signal switching transients for MESFET control devices is developed. Theoretical results for video-breakthrough and small signal RF switching wave-forms are in excellent agreement with measurements on many devices. Although the intrinsic transients are less than a few nanoseconds in duration, FET material aspects (such as surface states) can induce much longer transients. The 10-90% switching time, which is dominated by intrinsic effects, can be lowered by reducing gate length and gate bias resistance (the latter is more feasible with recently reported diode-gate FET's).

Abstracts

Conversion Matrix and Gain of Self-Oscillating Mixers

M. Claassen and U. Guttich. "Conversion Matrix and Gain of Self-Oscillating Mixers." 1991 Transactions on Microwave Theory and Techniques 39.1 (Jan. 1991 [T-MTT]): 25-30.

The conversion matrix of self-oscillating mixers is derived from the bias, amplitude, and frequency-dependent admittance of the active. device together with its dynamic current-voltage characteristic. Components at the image frequency are also taken into account. With this matrix and the circuit admittances at the different frequencies involved, the conversion gain can be expressed. For better insight into the relevant mechanisms, the conversion gain is subdivided into the amplitude response of the self-excited oscillation to an input signal and the demodulation caused by the device internal rectification. The formalism is applied to a simplified model of an oscillating BARITT diode. The resulting analytical expressions allow a discussion of the influence of different device and circuit parameters as well as a qualitative and quantitative comparison with experimental results from a self-oscillating BARITT-diode mixer operating in the V band at 60 GHz.

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Currents Induced in an Anatomically Based Model of a Human for Exposure to Vertically Polarized Electromagnetic Pulses

J.-Y. Chen and O.P. Gandhi. "Currents Induced in an Anatomically Based Model of a Human for Exposure to Vertically Polarized Electromagnetic Pulses." 1991 Transactions on Microwave Theory and Techniques 39.1 (Jan. 1991 [T-MTT]): 31-39.

The finite-difference time-domain (FDTD) technique is used to calculate the internal fields and the induced current densities in anatomically based models of a human using 5628 or 45024 cubical cells of dimensions 2.62 and 1.31 cm, respectively. A layer of dielectric constant epsilon/sub r/ = 4.2 and thickness 2.62 cm is assumed under the feet to simulate a human wearing rubber soled shoes. The total induced currents for the various sections of the body and the specific absorption for several organs are given for two representative electromagnetic pulses. The calculated results for the induced currents are in excellent agreement with the data measured for a human subject. The FDTD method is ideally suited for exact representation of the pulse shapes and offers numerical efficiency to allow detailed modeling of the human body and the various organs.

Abstracts

Novel Filter Design Incorporating Asymmetrical Stripline Y-Junction Circulators

H. How, C. Vittoria and C. Carosella. "Novel Filter Design Incorporating Asymmetrical Stripline Y-Junction Circulators." 1991 Transactions on Microwave Theory and Techniques 39.1 (Jan. 1991 [T-MTT]): 40-46.

Theoretical treatments of an asymmetrical stripline Y-junction circulator have been carried out. These include a formulation of the circulation conditions of an asymmetrical circulator as well as its transmission characteristics under wide-frequency-band consideration. We found that filter designs incorporating circulators are very plausible, which give rise to a narrow transmission band around the desired transmission frequency and a wide stopband extending many times the fundamental transmission frequency. In our design higher order mode excitations inherent in other filter designs are attenuated. In addition, owing to the off-resonance operation of the ferrites, our design could be applied under higher power conditions than traditional resonant ferrite filters.

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Nonuniformly Coupled Microstrip Transversal Filters for Analog Signal Processing

L.A. Hayden and V.K. Tripathi. "Nonuniformly Coupled Microstrip Transversal Filters for Analog Signal Processing." 1991 Transactions on Microwave Theory and Techniques 39.1 (Jan. 1991 [T-MTT]): 47-53.

The Fourier transform relationship between frequency response and impedance profile for single nonuniform transmission lines is used to derive the time-domain step response of single and coupled nonuniform lines. The expression for the step response of a characteristically terminated nonuniformly coupled transmission line structure is shown to correspond to the characteristic impedance profile. By using this relationship any arbitrary step response can be realized by utilizing nonuniformly coupled strip or microstrip lines for possible applications as waveform-shaping networks and chirp filters. A numerical procedure to compute the step response of the nonuniform coupled line four-port is also formulated in terms of frequency-domain parameters of an equivalent cascaded uniform coupled line model with a large number of sections. Sinusoidal and chirp responses are presented as examples that are readily implemented using coupled microstrip structures. Step response of an experimental nonuniformly coupled microstrip structure is presented to validate the theoretical results.

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Full-Wave Spectral-Domain Computation of Material, Radiation, and Guided Wave Losses in Infinite Multilayered Printed Transmission Lines

N.K. Das and D.M. Pozar. "Full-Wave Spectral-Domain Computation of Material, Radiation, and Guided Wave Losses in Infinite Multilayered Printed Transmission Lines." 1991 Transactions on Microwave Theory and Techniques 39.1 (Jan. 1991 [T-MTT]): 54-63.

A unified solution for full-wave computation of losses in a general multilayered planar transmission line is presented. It includes material losses (dielectric and conductor losses), losses due to radiation leakage, and losses caused by leakage of power to source-free characteristic modes (surface wave or waveguide modes, for example) of the multilayered geometry. A spectral-domain moment method is used with the Galerkin testing procedure. Significant modification of the conventional spectral-domain analysis of planar transmission lines is necessary in enforcing proper boundary conditions in the Galerkin testing procedure and, what is more important, is accounting for poles and branch cuts in the complex Fourier transform domain in order to rigorously account for the different loss mechanisms discussed above. Results for a few representative geometries, namely strip and/or material loss in a microstrip line and a slotline, surface parallel plate mode leakage loss in a conductor-backed slotline and a two-layer stripline, and radiation loss in a single and a coupled stripline at the interface between two infinite mediums, are presented to demonstrate these various loss effects.

Abstracts

Analysis of Slotlines and Microstrip Lines on Anisotropic Substrates

M. Geshiro, S. Yagi and S. Sawa. "Analysis of Slotlines and Microstrip Lines on Anisotropic Substrates." 1991 Transactions on Microwave Theory and Techniques 39.1 (Jan. 1991 [T-MTT]): 64-69.

The propagation characteristics of the dominant mode in slotlines, as well as in microstrip lines, on anisotropic substrates are studied. The dielectric tensor in the substrate may have nondiagonal elements which represent misalignment, on the substrate surface, between the material coordinate system and the waveguide coordinate system. The analysis is devoted to the slotline and is based on Galerkin's method applied in the spectral domain. Numerical results are presented for a sapphire substrate and a boron nitride substrate. It is found that the coordinate misalignment on the substrate surface has a significant influence on the propagation characteristics of the slotline.

Abstracts

Analysis of Shielded Striplines and Finlines with Finite Metallization Thickness Containing Magnetized Ferrites

T. Kitazawa. "Analysis of Shielded Striplines and Finlines with Finite Metallization Thickness Containing Magnetized Ferrites." 1991 Transactions on Microwave Theory and Techniques 39.1 (Jan. 1991 [T-MTT]): 70-74.

The applicability of the spectral-domain approach is extended to analyze various types of shielded planar transmission lines, taking the anisotropy of the magnetized ferrites and the finite metallization thickness into consideration. The numerical computations include the propagation characteristics of finlines and striplines and the metallization thickness effect in these lines. Numerical data of simpler structures are compared with the available exact solution as well as with published data.

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Abstracts

Analysis of Arbitrarily Oriented Microstrip Lines Utilizing a Quasi-Dynamic Approach

T.R. Arabi, A.T. Murphy, T.K. Sarkar, R.F. Harrington and A.R. Djordjevic. "Analysis of Arbitrarily Oriented Microstrip Lines Utilizing a Quasi-Dynamic Approach." 1991 Transactions on Microwave Theory and Techniques 39.1 (Jan. 1991 [T-MTT]): 75-82.

In this paper a "quasi-dynamic" approach is presented for the analysis of arbitrarily oriented printed microstrip circuits. The metallic structures are assumed to be planar metals of zero thickness. The quasi-dynamic approach differs from the quasi-static solution in the sense that phase variation is included in the quasi-dynamic analysis. The region of validity of the quasi-dynamic approach is investigated. Finally, numerical results are presented to illustrate the use of this technique.

Abstracts

An Efficient Algorithm for the Three-Dimensional Analysis of Passive Microstrip Components and Discontinuities for Microwave and Millimeter-Wave Integrated Circuits

A. Hill and V.K. Tripathi. "An Efficient Algorithm for the Three-Dimensional Analysis of Passive Microstrip Components and Discontinuities for Microwave and Millimeter-Wave Integrated Circuits." 1991 Transactions on Microwave Theory and Techniques 39.1 (Jan. 1991 [T-MTT]): 83-91.

A numerical technique for the full-wave analysis of shielded, passive microstrip components on a two-layer substrate is presented. The distinct feature of the technique is a novel, efficient formulation for establishing the system matrix in the moment method procedure which allows the derivation of the elements of any large matrix by a linear combination of elements in a precomputed index table, The table is obtained from a two-dimensional discrete fast Fourier transform. In the moment method procedure, the two-dimensional surface current is represented by locally defined rooftop functions. The effect of the resonant modes associated with the metallic enclosure on the numerical procedure is examined. In order to demonstrate the features and the accuracy of the technique, numerical results for microstrip open end and for a right-angle bend with and without the compensated corner are computed by using the resonant technique and are compared with other published computational and experimental data.

Abstracts

Analysis of Cascaded Sections of T Junctions Between Rectangular and Circular Waveguides

B.N. Das and P.V.D.S. Rao. "Analysis of Cascaded Sections of T Junctions Between Rectangular and Circular Waveguides." 1991 Transactions on Microwave Theory and Techniques 39.1 (Jan. 1991 [T-MTT]): 92-97.

This paper presents an analysis of the cascaded sections of a number of slot coupled T junctions between rectangular, circular waveguides taking into account the mutual interactions of all possible modes generated by the discontinuities, as well as the effect of wall thickness. The formulation is based on solving a set of coupled integral equations resulting from the boundary conditions at the two interfaces of the waveguide sections representing the coupling slots. The integral equations are transformed into sets of matrix equations using the moment method with entire basis, testing functions. Numerical results on input VSWR, coupling are presented for the case of cascaded section of two air-filled T junctions for different frequencies, different values of interelement spacing.

Abstracts

A Simple Method to Account for Edge Shape in the Conductor Loss in Microstrip

E.L. Barsotti, E.F. Kuester and J.M. Dunn. "A Simple Method to Account for Edge Shape in the Conductor Loss in Microstrip." 1991 Transactions on Microwave Theory and Techniques 39.1 (Jan. 1991 [T-MTT]): 98-106.

A new technique has been developed to examine the effect of strip edge shape on conductor loss in planar transmission lines using a modified incremental inductance rule. Based on Lewin's and Vainshtein's zero-thickness strip perturbation in loss calculations, this method requires an expression for the infinitely thin strip inductance, as well as prescribed integration stopping points for the different strip shapes. Results are given comparing loss for different edge shapes in a microstrip system, using both this new method and the Lewin/Vainshtein technique. Finally, the differing results of some other published analytical and numerical loss methods based on the surface impedance boundary condition are compared.

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The Method of Lines for the Analysis of Planar Waveguides with Finite Metallization Thickness

F.J. Schmuckle and R. Pregla. "The Method of Lines for the Analysis of Planar Waveguides with Finite Metallization Thickness." 1991 Transactions on Microwave Theory and Techniques 39.1 (Jan. 1991 [T-MTT]): 107-111.

The method of lines has been applied to many different planar waveguide structures, but up to now only infinitely thin metallizations have been considered. In this paper it will be shown how the method can be extended for the analysis of waveguides with finite metallization thickness. The results for microstrip and finline are presented and compared with those of other authors.

Abstracts

Analysis of Coplanar Waveguide Radiating End Effects Using the Integral Equation Technique

M. Drissi, V.F. Hanna and J. Citerne. "Analysis of Coplanar Waveguide Radiating End Effects Using the Integral Equation Technique." 1991 Transactions on Microwave Theory and Techniques 39.1 (Jan. 1991 [T-MTT]): 112-116.

An integral equation technique solved by the moment method associated with the single one-port model is used to analyze radiating end effects of coplanar waveguides (CPW's). Theoretical results obtained on a CPW short circuit end are compared with those obtained experimentally using series-gap-coupled straight CPW resonators.

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Abstracts

Very Small Control Modules with Line Unified FET Configuration for Array Processing

S. Hara and T. Tokumitsu. "Very Small Control Modules with Line Unified FET Configuration for Array Processing." 1991 Transactions on Microwave Theory and Techniques 39.1 (Jan. 1991 [T-MTT]): 117-123.

Very small, broad-band circuit function modules which operate as signal pass switches, phase inverters, and balanced modulators are proposed. They are realized by mutual on/off switching of the FET's in the line unified FET (LUFET) configuration, with which a main circuit function can be realized in almost the same size as a conventional FET. It is demonstrated that a balanced modulator with a chip size of only 0.6 mm X 0.5 mm can control signal gain from 0.7 to -0.7 continuously while input and output impedances are independent of control bias and isolation is more than 35 dB up to 18 GHz. These circuit function modules are valuable in constructing miniaturized phase shifters and highly integrated circuits for array processing.

Abstracts

Computation of Near-Field Microwave Radiometric Signals: Definition and Experimental Verification

A. Mamouni, Y. Leroy, B. Bocquet, J.C. van de Velde and P. Gelin. "Computation of Near-Field Microwave Radiometric Signals: Definition and Experimental Verification." 1991 Transactions on Microwave Theory and Techniques 39.1 (Jan. 1991 [T-MTT]): 124-132.

Applications of microwave radiometry for thermometry of bulk materials require the development of methods of computation of the radiometric signals. Owing to the reciprocity theorem, the radiometric signals can be deduced from a knowledge of the near field radiated in the assumed lossy material by the antenna which is being used as a probe in the radiometric operation. In this paper, we propose a modal method for computing the field. This method has first been tested in an active process by measurements of the radiated field. It also gives excellent agreement with experimental data obtained in the bands around 1.5 and 3 GHz over a lossy material (water) in both total power and correlation radiometry.

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A Low-Noise K-Ka Band Oscillator Using AlGaAs/GaAs Heterojunction Bipolar Transistors (Short Papers)

M. Madihian and H. Takahashi. "A Low-Noise K-Ka Band Oscillator Using AlGaAs/GaAs Heterojunction Bipolar Transistors (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.1 (Jan. 1991 [T-MTT]): 133-136.

The design considerations, fabrication process, and performance of the first K -- Ku band oscillator implemented rising a self-aligned AIGaAs/GaAs heterojunction bipolar transistor (HBT) are described. A large-signal time-domain based design approach has been used which applies a SPICE-F simulator to optimization of the oscillator circuit parameters for maximum output power. The oscillator employs a 2 x 10 μm² emitter AIGaAs/GaAs HBT fabricated using a pattern inversion technology. The HBT has a base current 1/f noise power density lower than 1 X 10/sup -20/ A²/Hz at 1 kHz, and lower than 1 X 10/sup -22/ A²/Hz at 100 kHz, for a collector current of 1 mA. The oscillator, which is composed of only low-Q microstrip transmission lines, has a phase noise of -80 dBc/Hz at 100 kHz off carrier when operated at 26.6 GHz. These results indicate the applicability of the HBT's to low-phase-noise monolithic oscillators at microwave and millimeter-wave frequencies, where both Si bipolar transistors and GaAs FET's are absent.

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Noise Power Sensitivities and Noise Figure Minimization of Two-Ports with Any Internal Topology (Short Papers)

J.A. Dobrowolski. "Noise Power Sensitivities and Noise Figure Minimization of Two-Ports with Any Internal Topology (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.1 (Jan. 1991 [T-MTT]): 136-140.

A theoretical foundation is presented for the efficient CAD-oriented computation of first-order noise power sensitivities of networks with respect to network parameters. Application to the CAD of low-noise circuits with minimum noise figure using efficient gradient optimization methods is envisaged. The approach is applicable to circuits with any internal topology composed of any number of passive linear multiports and active linear two-ports. It is based on the scattering matrix description for circuit elements and wave representation for noise.

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Equal-Gain Loci and Stability of a Microwave GaAs MESFET Gate Mixer (Short Papers)

M. Shimizu and Y. Daido. "Equal-Gain Loci and Stability of a Microwave GaAs MESFET Gate Mixer (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.1 (Jan. 1991 [T-MTT]): 140-142.

The performance of a microwave GaAs MESFET gate mixer is theoretically investigated to clarify the existence of a conditionally stable RF frequency range as well as an unconditionally stable frequency range in which maximum available conversion gain (MACG) can be defined. For the unconditionally stable range, the MACG, and load and source impedances are calculated as functions of RF frequency. For the conditionally stable frequency range, the stability circle and equal gain loci are shown for source RF and load IF impedances. The conditionally stable region of the GaAs MESFET mixer appears around f/sub T/ of the MESFET. Higher conversion gain is easily obtained by choosing a MESFET of which the f/subT/ is close to the RF frequency.

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Abstracts

Projected Frequency Limits of GaAs MESFET's (Short Papers)

J.M. Golio and J.R.J. Golio. "Projected Frequency Limits of GaAs MESFET's (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.1 (Jan. 1991 [T-MTT]): 142-146.

Limits to the ultimate frequency performance which can be realized with GaAs MESFET's have been projected. These predictions are based on the reported performance of 137 devices fabricated between 1966 and 1988 and on first-order modeling. The predictions indicate that ultimate maximum frequency of oscillation values may approach 700 GHz while gain-bandwidth product values as high as 200 GHz may be realized.

Abstracts

A Method of Tolerance Enhancement for Filters and Amplifier Matching Networks (Short Papers)

A.N. Riddle and R.J. Trew. "A Method of Tolerance Enhancement for Filters and Amplifier Matching Networks (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.1 (Jan. 1991 [T-MTT]): 146-148.

A new filter prototype for increasing the tolerance of passive networks to load variations is presented. A method based on the way in which a networks reflection coefficient changes in response to component and load reactance variations is used to develop the filter polynomial. This new filter polynomial has greater tolerance to load reactance variations, component variations, and finite element Q than Butterworth, Chebyshev, or elliptic structures. Examples using this new filter for tolerance enhancement of filters and matching structures are presented.

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Abstracts

Equivalent Network for an Aperture in the Center Conductor of Microstrip Line (Short Papers)

K.S. Rao and V.M. Pandharipande. "Equivalent Network for an Aperture in the Center Conductor of Microstrip Line (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.1 (Jan. 1991 [T-MTT]): 149-151.

The equivalent circuits for discontinuities in the form of a thin transverse slot and a circular aperture in the center conductor of a microstrip line are determined by a quasi-static analysis using equivalent dipole moments. The series reactance as a function of frequency is evaluated in terms of the geometrical parameters of the discontinuity. Data obtained from transmission measurements are presented to support the theory.

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Abstracts

Analysis of Stripline Filled with Multiple Dielectric Regions (Short Papers)

A. Nyshadham and K.V.S. Rao. "Analysis of Stripline Filled with Multiple Dielectric Regions (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.1 (Jan. 1991 [T-MTT]): 151-155.

The determination of the characteristic impedance of the stripline filled with different dielectric regions is discussed in this paper. Four rectangular dielectric regions whose interfaces are perpendicular to the ground planes are considered. The data on the characteristic impedance and effective dielectric constant are presented for the case of stripline filled with four rectangular regions having different dielectric constants. Results for impedance are compared with the data in the literature. Design data (w/b ratio and effective dielectric constant) are also presented.

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Abstracts

Magnetostatic Waves in a Normally Magnetized Waveguide Structure (Comments and Reply)

I.V. Vasil'ev, M. Radmanesh, C.-M. Chu and G.I. Haddad. "Magnetostatic Waves in a Normally Magnetized Waveguide Structure (Comments and Reply)." 1991 Transactions on Microwave Theory and Techniques 39.1 (Jan. 1991 [T-MTT]): 156-156.

The authors of the above paper made reference to a paper that I wrote with G. S. Makeeva [1] ([3] in the above paper). Some remarks are in order in connection with this.

Abstracts

Accuracy Improvements in Microwave Noise Parameter Measurements (Comments and Reply)

A. Uhlir, Jr., A.C. Davidson and E. Strid. "Accuracy Improvements in Microwave Noise Parameter Measurements (Comments and Reply)." 1991 Transactions on Microwave Theory and Techniques 39.1 (Jan. 1991 [T-MTT]): 157-157.

The above article contains an incorrect description of the contents of a much earlier article, of which I am one of the authors. The statement is made that "points out that only one measurement of noise figure is necessary together with several 'cold' noise power measurements." While that important point is made in the abstract, the paper contains much more.

Abstracts

Optical Control of Microwave Semiconductor Devices (Corrections)

A.J. Seeds and A.A. de Salles. "Optical Control of Microwave Semiconductor Devices (Corrections)." 1991 Transactions on Microwave Theory and Techniques 39.1 (Jan. 1991 [T-MTT]): 157-157.

In the above paper, the following corrections should be made: 1) On page 577, in the 18th line of the Introduction, the word simulated should be stimulated. 2) On page 581, in the 15th line of the left column. "530 MHz" should be "5-30 MHz."

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Call for Papers - Special Issue on Microwaves in Space (Jan. 1991 [T-MTT])

"Call for Papers - Special Issue on Microwaves in Space (Jan. 1991 [T-MTT])." 1991 Transactions on Microwave Theory and Techniques 39.1 (Jan. 1991 [T-MTT]): 158-158.

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Call for Papers - Process-Oriented Microwave CAD and Modeling (Jan. 1991 [T-MTT])

"Call for Papers - Process-Oriented Microwave CAD and Modeling (Jan. 1991 [T-MTT])." 1991 Transactions on Microwave Theory and Techniques 39.1 (Jan. 1991 [T-MTT]): 159-159.

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Random Signal Analysis (Advertisement) (Jan. 1991 [T-MTT])

"Random Signal Analysis (Advertisement) (Jan. 1991 [T-MTT])." 1991 Transactions on Microwave Theory and Techniques 39.1 (Jan. 1991 [T-MTT]): bm1-bm1.

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"Back Cover (Jan. 1991 [T-MTT])." 1991 Transactions on Microwave Theory and Techniques 39.1 (Jan. 1991 [T-MTT]): b1-b2.

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Abstracts

A 100-MESFET Planar Grid Oscillator

Z.B. Popovic, R.M. Weikle, II, M. Kim and D.B. Rutledge. "A 100-MESFET Planar Grid Oscillator." 1991 Transactions on Microwave Theory and Techniques 39.2 (Feb. 1991 [T-MTT]): 193-200.

In this work we present a 100-MESFET oscillator which gives 21 W of CW effective radiated power (ERP) with a 16 dB directivity and a 20% dc to RF conversion efficiency at 5 GHz. The oscillator is a planar grid structure periodically loaded with transistors. The grid radiates and the devices combine quasi-optically and lock to each other. The oscillator can also be quasi-optically injection-locked to an external signal. The planar grid structure is very simple. All of the devices share the same bias, and they can be power and frequency tuned with a mirror behind the grid or dielectric slabs in front of it. An equivalent circuit for an infinite grid predicts the mirror frequency tuning. The planar property of the oscillator offers the possibility of a wafer-scale monolithically integrated source. Thousands of active solid-state devices can potentially be integrated in a high-power source for microwave or millimeter-wave applications.

Abstracts

A Double-Stage Injection-Locked Oscillator for Optically Fed Phased Array Antennas

T. Berceli, W.D. Jemison, P.R. Herczfeld, A.S. Daryoush and A. Paolella. "A Double-Stage Injection-Locked Oscillator for Optically Fed Phased Array Antennas." 1991 Transactions on Microwave Theory and Techniques 39.2 (Feb. 1991 [T-MTT]): 201-208.

In an optically fed phased array antenna system, the microwave carrier signal is transmitted via a modulated lightwave to each active T/R (transmit/receive) module, where it must be converted back to the microwave domain. Currently, efficient optical to microwave conversion is extremely difficult, as the detected microwave signal is weak and noisy. A novel circuit, containing a high-gain/low-noise microwave injection-locked oscillator, has been developed to improve the interface between the optical and microwave components. The circuit utilizes two FET's and a dielectric resonator, which serves as a frequency dependent feedback element. The circuit, designed to operate at about 8 GHz, provides significant amplitude and phase noise suppression. In addition, the circuit realization is compatible with MMIC technology.

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Design and Performance of Low-Current GaAs MMIC's for L-Band Front-End Applications

Y. Imai, M. Tokumitsu and A. Minakawa. "Design and Performance of Low-Current GaAs MMIC's for L-Band Front-End Applications." 1991 Transactions on Microwave Theory and Techniques 39.2 (Feb. 1991 [T-MTT]): 209-215.

GaAs MMIC's with very low current and of very small size have been developed for L-band front-end applications. The MMIC's fully employ lumped LC elements with uniplanar configurations. There are two kinds of MMIC's: a low-noise amplifier and a mixer. The low-noise amplifier has a noise figure of 2.5 dB and a gain of 11.5 dB. The mixer has a conversion gain of 12.5 dB with small LO power of -3 dBm. Total current dissipation of the two MMIC's is less than 8 mA with 3 V drain bias voltages.

Abstracts

A New Programmable Load for Noise Parameter Determination

B.M. Albinsson, H. Guo, M. Schoon and H.-O. Vickes. "A New Programmable Load for Noise Parameter Determination." 1991 Transactions on Microwave Theory and Techniques 39.2 (Feb. 1991 [T-MTT]): 216-223.

A new computer-controlled programmable load is presented. The load consists of a cascade of p-i-n diodes bonded to each other. The capacitance of the reverse-biased p-i-n diode, together with the interconnecting bonding wires, forms an artificial transmission line. A complete phase coverage in the Smith chart is obtained by forward-biasing any diode pair, using only two current generators and two multiplexer. The amplitude coverage will depend on the diode spacing. The load may be set to any reflection coefficient within its coverage area. Synthesis formulas for the determination of the current driver settings have been derived. A calibration procedure determining the unknown synthesis parameters from input port measurements only is presented. Only the p-i-n diode parameters are characterized separately, The programmable load has been built and tested. Measurements verify the principle and show good agreement with computer simulations. The load has been developed for noise parameter determination. Other applications for variable impedance measurements are circuit or device optimization of gain and output power performance.

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High-Frequency Equivalent Circuit of GaAs FET's for Large-Signal Applications

M. Berroth and R. Bosch. "High-Frequency Equivalent Circuit of GaAs FET's for Large-Signal Applications." 1991 Transactions on Microwave Theory and Techniques 39.2 (Feb. 1991 [T-MTT]): 224-229.

The application of GaAs field effect transistors in digital circuits requires a valid description by an equivalent circuit at all possible gate and drain bias voltages for all frequencies from dc up to the GHz range. This paper discribes an equivalent circuit which takes into account the gate current of positively biased transistors as well as the symmetrical nature of the devices at low drain voltages. A fast method to determine the elements of the equivalent circuit from measured S parameters is presented, which delivers for the first time very good agreement for all operating points.

Abstracts

Transmission and Attenuation of the Dominant Mode in Uniformly Bent Circular Hollow Waveguides for the Infrared: Scalar Analysis

S.-I. Abe and M. Miyagi. "Transmission and Attenuation of the Dominant Mode in Uniformly Bent Circular Hollow Waveguides for the Infrared: Scalar Analysis." 1991 Transactions on Microwave Theory and Techniques 39.2 (Feb. 1991 [T-MTT]): 230-238.

We numerically evaluate electric field distributions, phase constants, and attenuation constants of the lowest eigenmode in the general class of uniformly bent circular hollow waveguides. The analysis is based on a scalar equation, and numerical results are compared with those of existing approximate theories. Numerically fitting curves of attenuation constants are also presented.

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Abstracts

Full-Wave Spectral-Domain Analysis of Coplanar Strips

S.G. Pintzos. "Full-Wave Spectral-Domain Analysis of Coplanar Strips." 1991 Transactions on Microwave Theory and Techniques 39.2 (Feb. 1991 [T-MTT]): 239-246.

In this paper a dynamic analysis of coplanar strips (CPS's) is presented. A spectral-domain stationary expression for the propagation constant has been derived making use of proven concepts of electromagnetic theory (e.g. the "reaction concept"). For the strip surface current distribution, which is the trial quantity in the stationary expression, a suitable approximation is used. The numerical results, obtained in a straightforward and efficient way, are in excellent agreement with results arrived at by means of more complex methods. Further, the characteristic impedance of CPSS has been determined on the base of two commonly used definitions. The numerical results show a novel aspect of the dynamic behavior of the impedance (power-related definition) in the upper frequency region.

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Variational Analysis of the Dielectric Rib Waveguide Using the Concept of "Transition Function" and Including Edge Singularities

T. Rozzi, G. Cerri, M.N. Husain and L. Zappelli. "Variational Analysis of the Dielectric Rib Waveguide Using the Concept of "Transition Function" and Including Edge Singularities." 1991 Transactions on Microwave Theory and Techniques 39.2 (Feb. 1991 [T-MTT]): 247-257.

Dielectric rib waveguide, being a key transmission medium in millimetrics and integrated optics, has been the object of extensive investigation. Although various approximate analyses of the EDC type exist, these break down for many practical configurations. More complete transverse resonance formulations also exist, but if accuracy is required, they involve mode matching, with a partially discrete, partially continuous spectrum. Whereas finite difference (finite element) numerical solutions are accurate, they are also expensive and their extension to more, complex structures is correspondingly difficult. In this contribution, we focus on the pure LSE/LSM cases. We derive a highly accurate transverse resonance diffraction variational solution of the problem, of order 1 (a scalar dispersion equation), by assuming at the transverse step discontinuity a single function "trial field" which incorporates the physical properties of the solution. This is, in fact, the surface wave mode of a slab waveguide of height intermediate between that of the rib and that of the cladding slab, including dielectric edge singularities in the LSM case. The height of the "intermediate guide" is obtained by optimizing the overlapping integral with the slab mode in the rib and in the cladding. This criterion turns out to be equivalent to choosing an intermediate guide whose EDC is the geometric mean of those of the rib and cladding. Numerical results are in excellent agreement with those obtained by finite difference, even at cutoff, where the EDC fails and most methods tend to overestimate the value of beta.

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A Modified Finite-Element Method for Dielectric Waveguides Using an Asymptotically Correct Approximation on Infinite Elements

J.A.M. Svedin. "A Modified Finite-Element Method for Dielectric Waveguides Using an Asymptotically Correct Approximation on Infinite Elements." 1991 Transactions on Microwave Theory and Techniques 39.2 (Feb. 1991 [T-MTT]): 258-266.

A modified finite-element method for the propagation analysis of such dielectric waveguides as optical fibers and integrated optical waveguides is presented. Possible applications include nondissipative structures of arbitrary anisotropic media with, in some cases, inhomogeneous exterior regions. The method is based on the frill vectorial finite-element formulation, which is known to be without spurious solutions. With this formulation all appropriate boundary and interelement conditions on both tangential and normal components are a priori satisfied. For the unbounded, exterior region a novel type of asymptotically correct approximation on infinite elements is proposed that simultaneously, for each mode and frequency, locally adapts the rate of radial decay to the transversal wavenumbers. The linearity of the original finite-element method has been retained by using beta/k/sub 0/ as a parameter, which results in a sparse generalized eigenvalue problem. Numerical examples including both optical fibers and integrated optical waveguides, isotropic as well as anisotropic, have been analyzed to confirm the validity of the method. The observed correspondence with analytical solutions has been found to be excellent. For some examples a special near-field wavenumber has been added to preserve a high accuracy close to cutoff.

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Implementation of Radiation Boundary Conditions in the Finite Element Analysis of Electromagnetic Wave Propagation

E. Sumbar, F.E. Vermeulen and F.S. Chute. "Implementation of Radiation Boundary Conditions in the Finite Element Analysis of Electromagnetic Wave Propagation." 1991 Transactions on Microwave Theory and Techniques 39.2 (Feb. 1991 [T-MTT]): 267-273.

"Radiation boundary conditions" are formulated which permit the simulation of two-dimensional electromagnetic wave phenomena with the finite element method using conventional elements over a bounded domain. Implementation of such boundary conditions preserves the symmetry of the global stiffness matrix with all the advantages that this implies, including economy of storage and solution, A number of wire-antenna systems have been modeled with this technique in a finite element computer program called FEAST. The results demonstrate good agreement with published reference data.

Abstracts

Penetration of Fields through a Circular Hole in a Wall of Finite Thickness

R.L. Gluckstern and J.A. Diamond. "Penetration of Fields through a Circular Hole in a Wall of Finite Thickness." 1991 Transactions on Microwave Theory and Techniques 39.2 (Feb. 1991 [T-MTT]): 274-279.

We consider a uniform, static electric field on one side of a plane metallic wall of finite thickness with a circular hole. The field induces a charge distribution on the metallic surface which behaves, at large distances from the hole, as a dipole moment, with different values for the polarizability on the inside (same side as the driving field) and outside surfaces of the hole. We have derived two integral equations for the potential in the hole and constructed variational forms for the "symmetric" and "asymmetric" polarizabilities. Trial functions with adjustable parameters lead to accurate numerical values for the "inside" and "outside" polarizabilities. A similar approach yields corresponding values for the "inside" and "outside" magnetic susceptibilities.

Abstracts

Comparison of Mode-Matching and Differential Equation Techniques in the Analysis of Waveguide Transitions

W.A. Huting and K.J. Webb. "Comparison of Mode-Matching and Differential Equation Techniques in the Analysis of Waveguide Transitions." 1991 Transactions on Microwave Theory and Techniques 39.2 (Feb. 1991 [T-MTT]): 280-286.

The solution of the continuous waveguide transition problem can be obtained by discretizing the boundary and applying mode matching or by using a system of ordinary differential equations. Both approaches involve approximate representations of the boundary. When using the differential equation approach, it was found necessary to consider the transition as several sections in series in order to avoid numerical instabilities. When this is done, one may cascade rising a generalized scattering matrix approach or a generalized ABCD matrix method. Results are shown comparing the accuracy of the boundary discretization approach and the differential equation approach for the Marie transducer and for linear transitions of various lengths in rectangular waveguide. Experimental results are also given for the Marie transducer.

Abstracts

A Simple and Rigorous Analysis of the Transmission Properties of a Sector Horn Junction in a Rectangular Waveguide

T. Tsushima, S. Kuwano and K. Kokubun. "A Simple and Rigorous Analysis of the Transmission Properties of a Sector Horn Junction in a Rectangular Waveguide." 1991 Transactions on Microwave Theory and Techniques 39.2 (Feb. 1991 [T-MTT]): 287-293.

Rigorous representations of expansion with a modal function, reflection and transmission coefficients for the electromagnetic field at the junction between a sector horn and a rectangular waveguide are obtained. So far, this problem has been approximately treated by limiting the mode number of the electromagnetic field expansion or the flare angle of the horn. In this paper, the electromagnetic fields at the discontinuity are expanded by a modal function of integer order. As a result, rigorous solutions are simply obtained by the orthogonality of a trigonometric function without any qualification. By using the numerical results with strict accuracy calculated from these representations, the transmission properties at the junction between a sector horn and a rectangular waveguide are examined in detail.

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Abstracts

Wide-Band Orthomode Transducers

S.J. Skinner and G.L. James. "Wide-Band Orthomode Transducers." 1991 Transactions on Microwave Theory and Techniques 39.2 (Feb. 1991 [T-MTT]): 294-300.

A summary of the results of a mainly experimental investigation into the development of wide-band orthomode transducers (OMT's) is presented. We show that satisfactory performance for many applications is possible over bandwidths in excess of 2:1. The wide-band return loss and cross-polarization behavior is given where the OMT used is measured in conjunction with a wide-band corrugated horn, Two types of OMT are considered one based on a finline technique and the other on a quad-ridged waveguide geometry. Overall, the latter design gives superior performance.

Abstracts

Design of Short High-Power TE/sub 11/- HE/sub 11/ Mode Converters in Highly Overmoded Corrugated Waveguides

M. Thumm, A. Jacobs and M.S. Ayza. "Design of Short High-Power TE/sub 11/- HE/sub 11/ Mode Converters in Highly Overmoded Corrugated Waveguides." 1991 Transactions on Microwave Theory and Techniques 39.2 (Feb. 1991 [T-MTT]): 301-303.

A theoretical parametric study of TE/sub 11/ to HE/sub 11/ mode conversion in highly oversized, circumferentially corrugated circular waveguides with different inner diameters is presented for various frequencies in the range of 28 to 140 GHz. The depth of the annular slots is tapered gradually from one half to one quarter wavelength. Computer-aided optimization of converter length, shape of corrugations, and nonlinear slot depth variation has been achieved with a scattering matrix code employing the modal field matching techniques (modular analysis concept). Relatively short mode transducers with matched converter lengths of L /spl ap/ pi/Delta beta/sub [TE/sub 11/-TM/sub11/]/ are feasible. In all cases the HE/sub 11/ output mode purity is 99% to 99.5%. The maximum cross-polarization and input-reflection levels are below -29 dB and -50 dB, respectively. Experimental results at 70 GHz (I.D. = 27.79 mm) are in excellent agreement with the theoretically predicted performance.

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A Modified Parallel-Coupled Filter Structure that Improves the Upper Stopband Rejection and Response Symmetry

C.-Y. Chang and T. Itoh. "A Modified Parallel-Coupled Filter Structure that Improves the Upper Stopband Rejection and Response Symmetry." 1991 Transactions on Microwave Theory and Techniques 39.2 (Feb. 1991 [T-MTT]): 310-322.

A modified parallel-coupled microstrip line filter structure is presented. Using this new structure, the filter upper stopband rejection is improved by at least 15 dB, and the filter response symmetry is also improved. Compared with the traditional parallel-coupled filter, the modified filter uses less space and is easy to lay out owing to its in-line structure. Several examples show the performance improvement of the filters fabricated in both low-dielectric-constant (2.55) and high-dielectric-constant (10.2) substrates.

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Investigation of Millimeter-Wave Scattering from Frequency Selective Surfaces

T.R. Schimert, A.J. Brouns, C.H. Chan and R. Mittra. "Investigation of Millimeter-Wave Scattering from Frequency Selective Surfaces." 1991 Transactions on Microwave Theory and Techniques 39.2 (Feb. 1991 [T-MTT]): 315-322.

A comparative numerical and experimental analysis of scattering from dielectric-backed frequency selective surfaces in W-band (75-110 GHz) has been carried out. The examples studied include metal (aluminum), resistive (bismuth), and bismuth-loaded I-pole or "linearized" Jerusalem cross arrays on fused silica, all of which exhibit a band-stop resonance in W-band as a general feature. The arrays were fabricated using standard photolithographic techniques. The numerical analysis involves the solution of an electric field integral equation rising subdomain "rooftop" basis and testing functions within the framework of the Galerkin testing procedure. The lossy nature of the materials has been fully accounted for. A comparative analysis of doubly stacked aluminum I-pole arrays was also carried out. The numerical analysis exploits a variant of the cascade method in that the immediately adjacent dielectric layers are included in the constriction of the scattering matrix for the frequency selective surface. This allows the higher order evanescent Floquet modes to sufficiently decay at the dielectric boundaries so they can be ignored in the scattering matrix.

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Abstracts

IEEM FFT - A Fast and Efficient Tool for Rigorous Computations of Propagation Constants and Field Distributions in Dielectric Guides with Arbitrary Cross-Section and Permittivity Profiles

M.P. Mrozowski. "IEEM FFT - A Fast and Efficient Tool for Rigorous Computations of Propagation Constants and Field Distributions in Dielectric Guides with Arbitrary Cross-Section and Permittivity Profiles." 1991 Transactions on Microwave Theory and Techniques 39.2 (Feb. 1991 [T-MTT]): 323-329.

An efficient approach to the analysis of dielectric guides is presented. The technique described is based on a recently proposed iterative scheme, known as the iterative eigenfunction expansion method (IEEM), which was designed specifically to allow the rigorous analysis of dielectric guides of arbitrary cross section and permittivity profile. In the approach presented herein, which we shall call the IEEM FFT, the bottleneck of the IEEM is removed by the application of the FFT to the calculation of the inner product. As a result, a reduction in the computer storage and an increase in speed are achieved. In some aspects the method seems to be superior to certain full-wave approaches, including the finite difference and finite element methods. It is believed that the method can be used for investigating guides used in millimeter-wave techniques, optical fibers with arbitrary cross section and refractive index profiles, and nonlinear effects in electromagnetic wave propagation.

Abstracts

Spectral Representation of Self-Adjoint Problems for Layered Anisotropic Waveguides

C.R. Paiva and A.M. Barbosa. "Spectral Representation of Self-Adjoint Problems for Layered Anisotropic Waveguides." 1991 Transactions on Microwave Theory and Techniques 39.2 (Feb. 1991 [T-MTT]): 330-338.

Layered waveguides with lossless anisotropic layers in the polar configuration are analyzed through the unifying concept of a real self-adjoint operator. For a suitable definition of two-vector transverse eigenfunctions, general properties such as orthogonality and completeness relations are derived. The linear operator formalism is applied to closed waveguides inhomogeneously filled with anisotropic materials, including crystals and gyrotropic media. As an extension of the former theory to open waveguides, a grounded uniaxial dielectric slab with a coplanar optic axis is also analyzed as for open isotropic waveguides, a complete spectral representation including the surface (improper eigenfunctions) as well as the pseudosurface modes (proper eigenfunctions) is presented.

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Abstracts

Magnetostatic Wave Propagation in YIG Double Layers

K. Sun and C. Vittoria. "Magnetostatic Wave Propagation in YIG Double Layers." 1991 Transactions on Microwave Theory and Techniques 39.2 (Feb. 1991 [T-MTT]): 339-345.

This paper presents calculations for the magnetostatic surface wave propagation characteristics in single-crystal double layers of yttrium iron garnet (YIG) with arbitrary direction of magnetization. The induced uniaxial magnetic anisotropy field is assumed to be different in the two layers; hence, the magnetization in one layer is aligned at an angle with respect to the magnetization direction in the other layer. The magnetostatic field interactions between layers depend on the angle between the two magnetization directions and on the separation between the two YIG layers. The wave propagation directions and time delays in each layer can be strongly affected by the application of an applied magnetic field and the magnetostatic coupling between the two layers, as well as by the uniaxial anisotropy energy in each layer.

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On the Location of Leaky Wave Poles for a Grounded Dielectric Slab (Short Papers)

C.G. Hsu, R.F. Harrington, J.R. Mautz and T.K. Sarkar. "On the Location of Leaky Wave Poles for a Grounded Dielectric Slab (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.2 (Feb. 1991 [T-MTT]): 346-349.

A simple numerical procedure is implemented to find the loci of the TE and TM leaky wave poles for a grounded dielectric slab as the frequency or the thickness varies. Information on how these complex poles are distributed is very important when various deformed integration paths for Sommerfeld integrals are considered.

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Abstracts

Dispersion Characteristics of Strip Dielectric Waveguides (Short Papers)

K.S. Chiang. "Dispersion Characteristics of Strip Dielectric Waveguides (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.2 (Feb. 1991 [T-MTT]): 349-352.

A simple and accurate dispersion relation is derived for the guided modes of a strip dielectric waveguide. This relation shows explicitly the effect of the width of the waveguide and involves only the solution for a single three-layer slab waveguide. It is discovered that there always exists a strip waveguide with a specific aspect ratio in which the E/sup x/over /sub mn/ and E/sup y/over /sub mn/ modes propagate at the same phase velocity.

Abstracts

Microwave Measurement of the Dielectric Constant of High-Density Polyethylene (Short Papers)

K. Seeger. "Microwave Measurement of the Dielectric Constant of High-Density Polyethylene (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.2 (Feb. 1991 [T-MTT]): 352-354.

By applying a new microwave technique which involves observing interference fringes in transmission, metallizing the sample faces adjacent to the waveguide, and thus using the sample as a dielectric-filled metallic waveguide, the real part of the dielectric function of high-density polyethylene has been determined as 2.34 at room temperature and 2.29 at liquid nitrogen temperature (77 K) for the frequency range from 26.5 to 40 GHz.

Abstracts

Equivalence of Propagation Characteristics for the Transmission-Line Matrix and Finite-Difference Time-Domain Methods in Two Dimensions (Short Papers)

N.R.S. Simons and E. Bridges. "Equivalence of Propagation Characteristics for the Transmission-Line Matrix and Finite-Difference Time-Domain Methods in Two Dimensions (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.2 (Feb. 1991 [T-MTT]): 354-357.

In previous papers an equivalence between the TLM and FD-TD methods has been established by altering the definitions of field components and operation of the TLM algorithm such that the appropriate finite-difference expressions are satisfied. In this paper the equivalence of propagation characteristics for the TLM and FD-TD methods in two dimensions is discussed. Propagation analysis of a TLM shunt node complete with permittivity and loss stubs, and dispersion analysis of the two-dimensional FD-TD method in an arbitrary medium are performed and yield dispersion relations. The relations are identical when the FD-TD method is operated at the upper limit of its stability range.

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Abstracts

Analysis of a Transition Between Rectangular and Circular Waveguides (Short Papers)

B.N. Das and P.V.D.S. Rao. "Analysis of a Transition Between Rectangular and Circular Waveguides (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.2 (Feb. 1991 [T-MTT]): 357-359.

This paper presents analysis of a transition between rectangular and circular waveguides coupled by a rectangular slot in a metallic wall of finite thickness in the common transverse cross section. Expressions for VSWR and admittance are obtained using a moment method formulation with entire basis and testing functions. Numerical data on the variation of input VSWR with frequency are obtained and a comparison between the theoretical and experimental results is presented. The variations in the values of minimum VSWR with change in slot dimensions are also studied.

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LED-Induced Distributed Bragg Reflection Microwave Filter with Fiber-Optically Controlled Change of Center Frequency via Photoconductivity Gratings (Short Papers)

W. Platte. "LED-Induced Distributed Bragg Reflection Microwave Filter with Fiber-Optically Controlled Change of Center Frequency via Photoconductivity Gratings (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.2 (Feb. 1991 [T-MTT]): 359-363.

A light-induced distributed Bragg reflection band-reject microwave filter is reported in which the grating elements are optoelectronically generated through periodic-structure photoexcitation of a silicon coplanar waveguide. The center frequency can be optically adjusted to 11 GHz and 22 GHz, respectively, by means of a pattern-controlled fiber bundle array fed from six CW-operated 50 mW, 840 nm LED's. Experimental results are in good agreement with theoretical predictions. The principle of operation demonstrated also applies to millimeter-wave integrated circuits.

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Abstracts

Determination of Intrinsic FET Parameters Using Circuit Partitioning Approach (Short Papers)

H.-O. Vickes. "Determination of Intrinsic FET Parameters Using Circuit Partitioning Approach (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.2 (Feb. 1991 [T-MTT]): 363-366.

A technique useful in extracting intrinsic parameters for a compound semiconductor FET is presented. The technique makes use of a method provided by Dambrine et al. A modified active circuit that accounts for charge accumulation in the conducting channel is presented. The model has the further advantage of using control voltage modeling in agreement with the Curtice convention for large-signal analysis. The equations are presented for each active element as a function of the intrinsic gamma parameters. Measurements verify the parameter extraction technique with the circuit topology used and show good results.

Abstracts

D-Band Subharmonic Mixer with Silicon Planar Doped Barrier Diodes (Short Papers)

U. Giittich, K.M. Strohm and F. Schaffler. "D-Band Subharmonic Mixer with Silicon Planar Doped Barrier Diodes (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.2 (Feb. 1991 [T-MTT]): 366-368.

A subharmonically pumped mixer for RF frequencies in the D-band range has been realized applying silicon planar doped barrier (PDB) diodes grown by molecular beam epitaxy (MBE). Excellent RF performance data have been achieved with a finline/microstrip mixer design.

Abstracts

A Simple Method for Characterizing Planar Transmission Line Discontinuities on Dissipative Substrates (Small Papers)

T.G. Livernois and P.B. Katehi. "A Simple Method for Characterizing Planar Transmission Line Discontinuities on Dissipative Substrates (Small Papers)." 1991 Transactions on Microwave Theory and Techniques 39.2 (Feb. 1991 [T-MTT]): 368-370.

A simple, least-squares sum curve fitting technique is presented which accurately models surface currents on planar transmission lines. This approach is useful for characterizing discontinuities occurring in MIC's fabricated on dissipative substrates. Numerical results for the microstrip open end on a lossy GaAs substrate are given.

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Abstracts

Parallel Processing Application to Nonlinear Microwave Network Design (Comments)

B.R. Sperber. "Parallel Processing Application to Nonlinear Microwave Network Design (Comments)." 1991 Transactions on Microwave Theory and Techniques 39.2 (Feb. 1991 [T-MTT]): 371-372.

In the above paper, Fig. 6 shows a speedup curve for a network of Transputer processors and apparently is a plot of the data given there in Table I. Could the authors please explain how the data shown support their summarized result in Section IX, where they state that "the addition of more Transputers will also reduce the computational time."

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A Generalized Theory of Tapered Transmission Line Matching Transformers and Asymmetric Couplers Supporting Non-TEM Modes (Corrections)

P. Pramanick and P. Bhartia. "A Generalized Theory of Tapered Transmission Line Matching Transformers and Asymmetric Couplers Supporting Non-TEM Modes (Corrections)." 1991 Transactions on Microwave Theory and Techniques 39.2 (Feb. 1991 [T-MTT]): 371-371.

The above paper contains four typographical errors.

Abstracts

Call for Papers - Special Issue on Microwaves in Space (Feb. 1991 [T-MTT])

"Call for Papers - Special Issue on Microwaves in Space (Feb. 1991 [T-MTT])." 1991 Transactions on Microwave Theory and Techniques 39.2 (Feb. 1991 [T-MTT]): 373-373.

Abstracts

Call for Papers - Process-Oriented Microwave CAD and Modeling (Feb. 1991 [T-MTT])

"Call for Papers - Process-Oriented Microwave CAD and Modeling (Feb. 1991 [T-MTT])." 1991 Transactions on Microwave Theory and Techniques 39.2 (Feb. 1991 [T-MTT]): 374-374.

Abstracts

Interactive Learning Programs from IEEE (Advertisement) (Feb. 1991 [T-MTT])

"Interactive Learning Programs from IEEE (Advertisement) (Feb. 1991 [T-MTT])." 1991 Transactions on Microwave Theory and Techniques 39.2 (Feb. 1991 [T-MTT]): 375-375.

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Welcome to the New Proceedings (Advertisement) (Feb. 1991 [T-MTT])

"Welcome to the New Proceedings (Advertisement) (Feb. 1991 [T-MTT])." 1991 Transactions on Microwave Theory and Techniques 39.2 (Feb. 1991 [T-MTT]): 376-376.

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Back Cover (Feb. 1991 [T-MTT])

"Back Cover (Feb. 1991 [T-MTT])." 1991 Transactions on Microwave Theory and Techniques 39.2 (Feb. 1991 [T-MTT]): b1-b2.

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Front Cover (Mar. 1991 [T-MTT])

"Front Cover (Mar. 1991 [T-MTT])." 1991 Transactions on Microwave Theory and Techniques 39.3 (Mar. 1991 [T-MTT]): f1-f2.

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A New Boundary Description in Two-Dimensional TLM Models of Microwave Circuits

Z. Chen, M.M. Ney and W.J.R. Hoefer. "A New Boundary Description in Two-Dimensional TLM Models of Microwave Circuits." 1991 Transactions on Microwave Theory and Techniques 39.3 (Mar. 1991 [T-MTT]): 377-382.

In this paper, we describe a new boundary representation for the two-dimensional transmission line matrix method of numerical analysis (TLM). In conventional TLM simulations, boundary conditions are realized by introducing the appropriate impulse reflection coefficients halfway between two nodes. Since the total field quantities are defined on the nodes, their values at the boundary are not directly available from TLM solutions. We have thus modified the TLM procedure so that boundaries can be placed across the nodes. The boundary conditions in TLM can then be formulated in terms of the field boundary conditions derived from Maxwells equations, rather than in terms of impulse reflection coefficients, The essential differences between the conventional TLM and our proposed procedure are presented. Examples are given for several typical problems, and the results obtained with the two methods are compared. These were found to be in excellent agreement.

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Origin of Vector Parasites in Numerical Maxwell Solutions

D.R. Lynch and K.D. Paulsen. "Origin of Vector Parasites in Numerical Maxwell Solutions." 1991 Transactions on Microwave Theory and Techniques 39.3 (Mar. 1991 [T-MTT]): 383-394.

Dispersion relations are derived for conventional finite element and finite difference approximations of four versions of the Maxwell equations in the plane: the double-curl equation; the vector Helmholtz equation; the penalty equation and the primitive, coupled Maxwell curl equations. Comparison with their analytic counterparts reveals the presence and origin of vector parasites. In each case there are no essential qualitative differences between the finite difference and finite element approaches per se; all of the issues surround the form of the differential equation underlying the discretization. For the double-curl and penalty methods, the dispersion relations are double-valued, admitting an extra, spurious dispersion surface of real. valued wavenumbers. As a result, low wavenumbers support both well-resolved and poorly resolved vector parasites. Additionally the "physical" modes in these solutions have nonzero divergence, such that satisfaction of divergence-free boundary conditions necessarily invokes the parasitic modes. The Helmholtz schemes have monotonic, single valued dispersion relations for divergence-free physical modes. Specification of divergence free boundary conditions is sufficient to guarantee the absence of parasites. The primitive schemes have single-valued but folded (nonmonotonic) dispersion relations, supporting poorly resolved vector parasites at low wavenumbers. Use of a staggered finite difference grid eliminates these parasites and results in a dispersion relation identical to that for the Helmholtz scheme. In all cases where vector parasites arise the same essential weakness in the discretized form of either the first or cross-derivative is responsible. Overall, this analysis iliuminates fatal weaknesses in the double-curl schemes considered, the reliance on a staggered mesh in the primitive schemes, and the strength of the vector Helmholtz schemes.

Abstracts

Elimination of Vector Parasites in Finite Element Maxwell Solutions

K.D. Paulsen and D.R. Lynch. "Elimination of Vector Parasites in Finite Element Maxwell Solutions." 1991 Transactions on Microwave Theory and Techniques 39.3 (Mar. 1991 [T-MTT]): 395-404.

The vector parasite problem is studied in the context of finite element solutions of Maxwell's equations for driven boundary-value problems. An expanded weak form is introduced which combines the divergence equation with the conventional weak form of the double-curl equation. This new form is related to penalty methods where the penalty or weighting factor varies with the dielectric constant. The resulting algebraic system is identical to the Galerkin-Helmholts operator on homogeneous subregions. Normal and tangential boundary conditions arise in terms of the divergence and curl of the field on the boundary. Computational results show the occurrence of two distinct types of parasitic modes in driven problems and their elimination with the new formulation. Practical observations concerning the conditions which provoke spurious modes in these problems are reported. Spurious solutions also arise from improper or unphysical boundary conditions, and the importance of careful specification of boundary-value problems is illustrated. Most conceptual difficulties with boundary conditions per se are removed when hybrid methods are used to couple the interior finite element solution to the exterior problem, which focuses attention on the physics of the source distribution.

Abstracts

A Simple Approach to Mode Analysis for Parabolic Waveguides

C.S. Kenney and P.L. Overfelt. "A Simple Approach to Mode Analysis for Parabolic Waveguides." 1991 Transactions on Microwave Theory and Techniques 39.3 (Mar. 1991 [T-MTT]): 405-412.

Difficulty in obtaining accurate values for parabolic cylinder functions has been an impediment to mode analysis for parabolic waveguides. A simple method, based on one-dimensional analytic continuation, is presented which gives essentially exact values for these functions; i.e., the relative error in the computed result is on the order of the machine round-off. When supplemented with a Newton-Poisson shooting method and simple homotopy techniques, this continuation method can be used to find the TE and TM mode eigenvalues, and associated separation constants, for arbitrary parabolic domains. These methods are then used to compute a power handling efficiency factor for a range of parabolic regions.

Abstracts

Electromagnetic Coupling and Radiation Loss Considerations in Microstrip (M)MIC Design

W.P. Harokopus, Jr. and L.P.B. Katehi. "Electromagnetic Coupling and Radiation Loss Considerations in Microstrip (M)MIC Design." 1991 Transactions on Microwave Theory and Techniques 39.3 (Mar. 1991 [T-MTT]): 413-421.

The high-frequency characterization of microstrip meander lines, junctions, and stubs has been performed by the application of the method of moments to the electric field integral equation. Electromagnetic coupling, radiation, and substrate effects are inherently included with the use of the space-domain Green's function. Conductor loss is also included by replacing the conductive strips with appropriate surface impedance boundaries.

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Analysis of Discontinuities in Planar Dielectric Waveguides: An Eigenmode Propagation Method

Q.-H. Liu and W.C. Chew. "Analysis of Discontinuities in Planar Dielectric Waveguides: An Eigenmode Propagation Method." 1991 Transactions on Microwave Theory and Techniques 39.3 (Mar. 1991 [T-MTT]): 422-430.

In this paper the eigenmode propagation method is proposed to analyze the discontinuity problems in planar dielectric waveguides. This new recursive algorithm is based on the numerical mode matching method, but it uses less computation time and computer memory, which makes the analysis of multiregion, vertically stratitied media much more effective. With this algorithm, the required computer memory is independent of the number of regions in the problem, and the computation time is linearly proportional to the number of regions. Therefore, it is particularly suitable for the analysis of planar waveguide discontinuities and waveguide bends. Using this method, we can analyze larger problems which are impractical with the finite element method. From the numerical examples given in the paper, it is demonstrated that the computation time is linearly proportional to the number of discontinuities, while the computer memory is almost a constant independent of the number of discontinuities, N.

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Analysis of Closed Arbitrary Dielectric Waveguides Using a Modified Rayleigh-Ritz Technique

B. Young. "Analysis of Closed Arbitrary Dielectric Waveguides Using a Modified Rayleigh-Ritz Technique." 1991 Transactions on Microwave Theory and Techniques 39.3 (Mar. 1991 [T-MTT]): 431-437.

To avoid the meshing difficulties of the finite-element method, the classical Rayleigh-Ritz method is combined with an additional optimization to analyze closed arbitrary dielect waveguides. The method is easily implemented in compact code and is user-friendly. The paper develops the method and its rationale and presents numerical examples to demonstrate its accuracy in propagation constant and nonperturbational loss calculations. In addition, the method is shown to be rapidly convergent and extremely stable.

Abstracts

TE/sub 10/ Mode Scattering by a Rectangular Resistive Film of Arbitrary Dimensions Placed Along the Rectangular Waveguide Axis

I.M. Braver, P.S. Fridberg, K.L. Garb, S.V. Makarov and I.M. Yakover. "TE/sub 10/ Mode Scattering by a Rectangular Resistive Film of Arbitrary Dimensions Placed Along the Rectangular Waveguide Axis." 1991 Transactions on Microwave Theory and Techniques 39.3 (Mar. 1991 [T-MTT]): 438-443.

TE/sub 10/ mode scattering by a resistive film of arbitrary width (d) and length (l) placed in the longitudinal section of a rectangular waveguide parallel to its narrow faces is investigated. The vector integral equation for the discontinuity (/sup /spl rarr//h) of the tangential magnetic field on the film is formulated. The equation is solved by Galerkin method using basis functions, each of them taking into account the /sup /spl rarr//h behavior near the film edge. For a film that is sufficiently short (l « d), approximate expressions for the scattering matrix elements are obtained. The scattering matrix for a wide range of values of the film width, length, surface impedance (W), and frequency is calculated. This is believed to be the first study establishing that the attenuation caused by a film having particular d and W values tends to be constant over the entire band of waveguide operating frequencies.

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A Method of Moments Analysis and a Finite-Difference Time-Domain Analysis of a Probe-Sleeve Fed Rectangular Waveguide Cavity

J.M. Jarem. "A Method of Moments Analysis and a Finite-Difference Time-Domain Analysis of a Probe-Sleeve Fed Rectangular Waveguide Cavity." 1991 Transactions on Microwave Theory and Techniques 39.3 (Mar. 1991 [T-MTT]): 444-451.

A multifilament method of moments (MOM) analysis and a finite-difference time-domain (FD-TD) analysis have been used to numerically calculate the input impedance of a probe-sleeve fed rectangular waveguide which has been short-circuited on one side. The input impedance of the system has been determined by using the above methods for several probe-sleeve configurations and reasonable agreement between the two methods for the cases studied has been found. A MOM Green's function formulation which is based on scattering super-position has also been derived which allows the input impedance of a probe-sleeve feed to be calculated when the waveguide is terminated in a given load. The MOM results and FD-TD numerical results are compared for this loaded waveguide input impedance case and reasonable agreement between the methods has been found. A comparison of theory and experiment is given when the waveguide is terminated in a ground plane aperture.

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Integral Equation Solution to the Skin Effect Problem in Conductor Strips of Finite Thickness

J.-F. Kiang. "Integral Equation Solution to the Skin Effect Problem in Conductor Strips of Finite Thickness." 1991 Transactions on Microwave Theory and Techniques 39.3 (Mar. 1991 [T-MTT]): 452-460.

The skin effect of single and coupled conductor strips of finite thickness is analyzed using the dyadic Green's function and the integral equation formulation. Galerkin's method is used to solve the integral equation for the dispersion characteristics. The effects of the geometrical and electrical parameters on the conductor loss are investigated. Results are compared with the literature and shown to be in good agreement. This approach is very useful for analyzing the electrical properties of interconnects in high-performance computer circuitries.

Abstracts

Normal Mode Nomenclature of Quadrupole Gyromagnetic Waveguides

J. Helszajn, W.A. Leeson, D.J. Lynch and B.C. O'Donnell. "Normal Mode Nomenclature of Quadrupole Gyromagnetic Waveguides." 1991 Transactions on Microwave Theory and Techniques 39.3 (Mar. 1991 [T-MTT]): 461-470.

An important nonreciprocal rhombic or circular gyromagnetic waveguide used in the design of nonreciprocal quarter and half-wave plates is one with a quadrupole direct magnetic field. This paper reviews the normal mode nomenclature of this type of waveguide and gives a perturbation and anisotropic formulation of the normal modes of this type of waveguide which is in keeping with the existing literature. It also describes a closed-form formulation of the problem. The field distributions in this type of waveguide display a classic edge mode effect.

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A Subgridding Method for the Time-Domain Finite-Difference Method to Solve Maxwell's Equations

S.S. Zivanovic, K.S. Yee and K.K. Mei. "A Subgridding Method for the Time-Domain Finite-Difference Method to Solve Maxwell's Equations." 1991 Transactions on Microwave Theory and Techniques 39.3 (Mar. 1991 [T-MTT]): 471-479.

The time-domain finite-difference method (TDFDM) gives accurate results for the calculation of electromagnetic wave propagation but uses a large amount of computer memory. This paper investigates a modification to this technique that employs a variable step size. The entire computational volume is divided into a coarse grid with a large step size; a fine grid with a small step size is introduced only around discontinuities. The corresponding time increments will be related to the spatial increments with the same ratio in order to minimize the numerical dispersion. The fields within both the coarse and fine grids are found using the TDFDM while an interpolation in both space and time is utilized to calculate the tangential electric field on the coarse-fine grid boundary. This subgridding decreases the required computer memory and therefore expands the capability of the TDFDM. The technique is shown to be numerically stable, and does not entail any extra numerical error. Finally, the method is applied to the calculation of waveguides and microstrips.

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Abstracts

Microwave Diversity Imaging of Perfectly Conducting Objects in the Near-Field Region

T.-H. Chu and D.-B. Lin. "Microwave Diversity Imaging of Perfectly Conducting Objects in the Near-Field Region." 1991 Transactions on Microwave Theory and Techniques 39.3 (Mar. 1991 [T-MTT]): 480-487.

In this paper, analytical and numerical studies of microwave diversity imaging of continuous and discrete conducting objects in the near-field region are presented. Analytical results show that the image of the scattering object can be reconstructed via Fourier inversion of the data acquired from the recorded scattered field using angular and frequency diversity techniques. Furthermore, different feature information of the scattering object can be obtained using a polarization diversity technique. Various scattering arrangements are studied and compared on the basis of the reconstructed image quality and practical considerations. Numerical results show that the described frequency, angular, and polarization diversity techniques in the backward scattering arrangement can be a cost-effective approach in near-field microwave imaging systems.

Abstracts

Rigorous Analysis of the GTEM Cell

R. De Leo, T. Rozzi, C. Svara and L. Zappelli. "Rigorous Analysis of the GTEM Cell." 1991 Transactions on Microwave Theory and Techniques 39.3 (Mar. 1991 [T-MTT]): 488-500.

This work deals with the modeling of the new GTEM cell, recently in use for field measurements, which consists of a tapered rectangular waveguide loaded with an eccentric sloping plate conductor. We derive the fields of the cross section of the uniform structure by transverse resonance diffraction and apply the "local modes" approach to the study of the longitudinal field distribution. The first few modes of the cell are obtained. Numerical results agree with those in the literature, where available. The treatment is highly accurate and requires no more computer power than that of a desktop computer.

Abstracts

Covariant-Projection Quadrilateral Elements for the Analysis of Waveguides with Sharp Edges

R. Miniowitz and J.P. Webb. "Covariant-Projection Quadrilateral Elements for the Analysis of Waveguides with Sharp Edges." 1991 Transactions on Microwave Theory and Techniques 39.3 (Mar. 1991 [T-MTT]): 501-505.

Covariant-projection elements are shown to be a good way of finding the dispersion characteristies of arbitrarily shaped waveguides. They have been demonstrated to produce no spurious modes, and because only tangential continuity is imposed between elements, either the electric field or the magnetic field may be solved for, in the presence of both dielectric and magnetic materials. Further, waveguides with sharp metal edges may be analyzed more efficiently than with earlier methods. Results are presented for a rectangular waveguide half loaded with dielectric, a double-ridged waveguide a shielded microstrip line, and coupled microstrip lines on a cylindrical substrate.

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Multimodal Variational Analysis of Uniaxial Waveguide Discontinuities

J.-W. Tao and H. Baudrand. "Multimodal Variational Analysis of Uniaxial Waveguide Discontinuities." 1991 Transactions on Microwave Theory and Techniques 39.3 (Mar. 1991 [T-MTT]): 506-516.

A unified multimodal variational formulation is described for the characterization of uniaxial waveguide discontinuities. A variational form is obtained by using a self-adjoint susceptance operator which is defined in terms of two eigenmode sets corresponding to the two constituent waveguides. By making use of the similarity between the field and network theory, the final admittance matrix will be of small size owing to the use of the "accessible" and "localized" modes. This formulation leads to an appreciable reduction in the computation time and computer memory space and facilitates in this way the use of the optimization process on personal computers and workstations. Examples are given for both homogeneous and inhomogeneous waveguide discontinuity problems, showing good agreement with the experiments. An evanescent-mode ridge-waveguide filter has been designed on this theoretical basis with success.

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Scattering Matrix of Dielectric Resonator Coupled with Two Microstrip Lines

S. Verdeyme and P. Guillon. "Scattering Matrix of Dielectric Resonator Coupled with Two Microstrip Lines." 1991 Transactions on Microwave Theory and Techniques 39.3 (Mar. 1991 [T-MTT]): 517-520.

The coupling between a dipolar, TE/sub 01delta/ cylindrical dielectric resonator and two microstrip lines terminated by different loads is modeled by a lumped equivalent circuit. A three-dimensional finite element method is used to determine the resonant frequency, quality factor, and coupling coefficients as a function of the electromagnetic parameters of the structure.

Abstracts

Radiation From Planar Resonators

S.E. Schwarz, M.D. Prouty and K.K. Mei. "Radiation From Planar Resonators." 1991 Transactions on Microwave Theory and Techniques 39.3 (Mar. 1991 [T-MTT]): 521-525.

Radiation from planar resonators is troublesome because it tends to inject spurious signals into neighboring circuits. Power radiated from microstrip-based resonators is calculated by integration of a Green's function with assumed currents, a method that is convenient and is thought to be more accurate than methods used in earlier calculations of radiation Q. Resonators consisting of two coupled microstrips excited in the odd mode are found to radiate very much less than conventional single microstrip resonators or U-shaped "hairpin" resonators suggested earlier. However, when the resonator is loaded by a semiconductor device, as in an oscillator, radiation is increased. Asymmetries in these resonators, arising from output coupling or fabrication errors, introduce even-symmetric currents which radiate much more strongly than odd-mode currents; the effects of such asymmetries on radiated power are estimated. On the basis of these findings a convenient geometry for high-power planar oscillators with low radiation is proposed.

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Radiation-Corrected Open-Ended Coax Line Technique for Dielectric Measurements of Liquids Up to 20 GHz

Y.-Z. Wei and S. Sridhar. "Radiation-Corrected Open-Ended Coax Line Technique for Dielectric Measurements of Liquids Up to 20 GHz." 1991 Transactions on Microwave Theory and Techniques 39.3 (Mar. 1991 [T-MTT]): 526-531.

An experimental technique and associated analysis are described for the measurement of the dielectric constants of liquids at microwave frequencies using an open-ended coax probe. The analysis includes radiative corrections to the probe-liquid interface impedance. The technique is applicable to liquid and liquidlike (e.g., biological) samples, having dielectric constants comparable to water, at frequencies up to 20 GHz and possibly as high as 40 GHz.

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Influence of Wall Contacts on Measured Complex Permittivity Spectra at Coaxial Line Frequencies

K.E. Mattar, D.G. Watters and M.E. Brodwin. "Influence of Wall Contacts on Measured Complex Permittivity Spectra at Coaxial Line Frequencies." 1991 Transactions on Microwave Theory and Techniques 39.3 (Mar. 1991 [T-MTT]): 532-537.

We examine the effects on observed complex permittivity caused by gaps between a sample and the conductors of the coaxial sample holder. A transverse resonance model relates the observed and true values given the dimensions of the gap. This model also confirms the accuracy of the simpler capacitance model for small conductivities and low frequencies. We describe, how, experimentally, variation in the observed sample characteristics with frequency may be used to identify a gap problem. Experimental results demonstrate the usefulness of conducting pastes or copper plating in reducing the gap effect.

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Time-Domain Measurements with the Hewlett-Packard Network Analyzer HP 8510 Using the Matrix Pencil Method

Z.A. Maricevic, T.K. Sarkar, Y. Hua and A.R. Djordjevic. "Time-Domain Measurements with the Hewlett-Packard Network Analyzer HP 8510 Using the Matrix Pencil Method." 1991 Transactions on Microwave Theory and Techniques 39.3 (Mar. 1991 [T-MTT]): 538-547.

The HP 8510 time-domain network measurements are frequency-domain measurements transformed to the time domain using the inverse Fourier transform, the objective being to discriminate various scattering centers. This computational technique benefits from the wide dynamic range and the error correction of the frequency-domain data, but requires a frequency-domain response measured over a wide frequency range to give useful resolution in the time domain. The generalized pencil of function (GPOF) method, also known as the matrix pencil method, provides for much higher resolution than the Fourier techniques. A comparison of the two methods is given for the example of the Beatty standard.

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Abstracts

Electronically Switchable and Tunable Coplanar Waveguide-Slotline Band-Pass Filters

Y.-H. Shu, J.A. Navarro and K. Chang. "Electronically Switchable and Tunable Coplanar Waveguide-Slotline Band-Pass Filters." 1991 Transactions on Microwave Theory and Techniques 39.3 (Mar. 1991 [T-MTT]): 548-554.

A novel coplanar waveguide (CPW) slotline band-pass filter has been developed. The circuit allows planar integration of active and passive semiconductor devices both in series and in shunt. To test the filter, a new microstrip to slotline transition was designed and two of these transitions exhibited an insertion loss of less than 1.0 dB over the 2.0 to 4.0 GHz range. A three-section CPW-slotline band-pass filter demonstrated an insertion loss of less than 0.2 dB over the passband centered at 2.9 GHz. A three-section CPW-slotline switchable band-pass filter integrated with three p-i-n diodes was developed with a 0.7 dB insertion loss in the passband when the p-i-n diodes are OFF and 25.0 dB isolation across the entire band when the p-i-n diodes are on. A three-section CPW-slotline varactor-tunable filter integrated with three varactor diodes was demonstrated with a 2.0 dB insertion loss and over 20% electronic tuning range. Simple transmission line circuit models were used to optimize the design.

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An Experimental 225 GHz Pulsed Coherent Radar

R.W. McMillan, C.W. Trussell, Jr., R.A. Bohlander, J.C. Butterworth and R.E. Forsythe. "An Experimental 225 GHz Pulsed Coherent Radar." 1991 Transactions on Microwave Theory and Techniques 39.3 (Mar. 1991 [T-MTT]): 555-562.

An experimental coherent pulsed radar operating at 225 GHz is described. This system uses a pulsed, phase-locked extended interaction oscillator transmitter and an f/4 (frequency divided by 4) subharmonic mixer pumped by a phase-locked Gunn oscillator as the receiver. A quasi-optical circular polarization duplexer combines transmitter and receiver signals into the same antenna. Results obtained with this system include the detection of targets out to ranges of 3.5 km and observation of Doppler spectra of trucks and tracked vehicles, including contributions from both body and tracks.

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Abstracts

An Analysis of a Waveguide T Junction with an Inductive Post (Short Papers)

J. Hirokawa, K. Sakurai, M. Ando and N. Goto. "An Analysis of a Waveguide T Junction with an Inductive Post (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.3 (Mar. 1991 [T-MTT]): 563-566.

The authors analyze the T junction with an inductive post taking its diameter into account for the case where the current distribution is assumed on the surface of the post. A single cylindrical post placed in a T junction improves the impedance matching and compensates the junction discontinuity in a wide frequency band. The analysis clarifies the effects of the design parameters such as the diameter of the post and its location. It accurately predicts the measured return loss. On the basis of this analysis, an effective design procedure of the T junction is proposed and the reflection below -30 dB is realized over 4% bandwidth.

Abstracts

A Theoretical Examination of Tangential Signal to Noise Ratio (Short Papers)

H.E. Green. "A Theoretical Examination of Tangential Signal to Noise Ratio (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.3 (Mar. 1991 [T-MTT]): 566-567.

The tangential signal to noise ratio (TSNR) continues to be used as a measure of receiver sensitivity. It is found in practice to be remarkably robust against a variety of equipment and observers. Based on the physiology of the eye, an explanation of why this is so is given in this note. The theory leads to a result for TSNR which is very close to the generally agreed value.

Abstracts

Cryogenic Performance of a GaAs MMIC Distributed Amplifier (Short Papers)

C.R. Moore, W.C. Trimble, M.L. Edwards and T.R. Sanderson. "Cryogenic Performance of a GaAs MMIC Distributed Amplifier (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.3 (Mar. 1991 [T-MTT]): 567-571.

A three-stage GaAs MMIC distributed amplifier chip, fabricated to our design, was specially packaged in a two-chip, six-stage amplifier for cryogenic operation from 1 to 10 GHz, when immersed in liquid nitrogen a fourfold reduction in amplifier noise was observed over the 4 GHz to 8 GHz frequency range. This is in agreement with the generally observed scaling with ambient temperature (in Kelvin) for discrete GaAs FET amplifiers.

Abstracts

An Improved Version of the Almost Periodic Fourier Transform Algorithm with Applications in the Large-Signal Domain (Short Papers)

J. Dreifuss, A. Madjar and A. Bar-lev. "An Improved Version of the Almost Periodic Fourier Transform Algorithm with Applications in the Large-Signal Domain (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.3 (Mar. 1991 [T-MTT]): 571-575.

The almost periodic Fourier transform (APFT) algorithm is a useful tool in the analysis and design of nonlinear microwave circuits to which several large signals are applied simultaneously. It suffers, however, from a large spread in the calculated results. By combining the waveform balance (WB) approach with a modified form of the APFT algorithm, in which the number of randomly selected sampling points is increased, the overall computation accuracy is enhanced, the spread among results is reduced, and the computation time is practically unchanged. This modified approach is applied to the evaluation of large, signal S parameters of a MESFET and to the calculation of its 1 dB compression power, the intermodulation distortion (IMD) products, and the IP/sub 3/ points for a range of frequencies. The results are in excellent agreement with those parameters that are available from the manufacturer's measurements. The conversion gain of a MESFET mixer is also calculated and the reduced spread among the results is compared with that obtained by use of the original APFT algorithm.

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Abstracts

High-Frequency Efficient Reflection Multiplier (Short Papers)

K. Rauschenbach, C.A. Lee and M.V. Schneider. "High-Frequency Efficient Reflection Multiplier (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.3 (Mar. 1991 [T-MTT]): 575-579.

We propose and calculate the performance of a new resistive balanced reflection multiplier capable of high-efficiency operation at submillimeter wavelengths, beyond the useful range of varactor-type multipliers. The multiplier and associated filters can be fabricated with monolithic thin-film techniques to sufficiently minimize high-frequency parasitic elements so that near ideal efficiencies can be realized. A closed-form distributed analysis is used to show that this reflection design can achieve a 6.7% third-harmonic conversion efficiency, an approximate 23% increase compared with an ideal resistive balanced transmission multiplier.

Abstracts

Scattering Effects in the Dielectric Slab Waveguide Caused by Electrically Dissipative or Active Regions (Short Papers)

T.G. Livernois, D.P. Nyquist and M.J. Cloud. "Scattering Effects in the Dielectric Slab Waveguide Caused by Electrically Dissipative or Active Regions (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.3 (Mar. 1991 [T-MTT]): 579-583.

A polarization electric field integral equation (EFIE) is used to model conducting discontinuities in the dielectric slab waveguide. A complex refractive index accounts rigorously for effects of conduction current in the discontinuity region. Both dissipative and active cases are treated; power balance, based on Poynting's theorem, is used to determine the fractional radiated power in each case. The method of moments is invoked to solve the integral equation. The accuracy of the analysis method is confirmed through comparison of results for the air gap case with those of other recently published methods. Numerical results illustrate application to a typical GaAs ternary system.

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Toward a Unified Efficient Algorithm for Characterizing Planar Periodic Waveguides and Their Applications to MIC and MMIC Circuits (Short Papers)

K. Wu, P. Saguet and A. Coumes. "Toward a Unified Efficient Algorithm for Characterizing Planar Periodic Waveguides and Their Applications to MIC and MMIC Circuits (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.3 (Mar. 1991 [T-MTT]): 583-586.

An efficient new algorithm (modified three-dimensional spectral-domain solution with "modal spectrum") applied to a variety of planar waveguides with periodically loaded stubs is achieved. In this paper, slow-wave propagation characteristics and their mechanism of both symmetrically and asymmetrically loaded periodic structures with lossy dielectric layer such as finline and coplanar waveguides (CPW's) are investigated. Using two sets of familiar basis functions, the convergence behavior of the high-speed numerical computation is presented toward a unified efficient algorithm. Many important features such as passband and stopband phenomena related to cutoff and resonant frequencies are discussed in detail based on numerical results, which are compared with measured results obtained by transmission line experimental procedures.

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Abstracts

On the Calculation of Conductor Loss on Planar Transmission Lines Assuming Zero Strip Thickness (Short Papers)

P. Heitkamper and W. Heinrich. "On the Calculation of Conductor Loss on Planar Transmission Lines Assuming Zero Strip Thickness (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.3 (Mar. 1991 [T-MTT]): 586-588.

The incompatibility of the zero-strip-thickness assumption with conductor loss calculation based on the common perturbation approach is addressed. Numerical results are shown that demonstrate the unbounded behaviour of the attenuation constant in this case. This observation is of specific interest because it applies to various data on loss given in the literature.

Abstracts

A Closed-Form Spatial Green's Function for the Thick Microstrip Substrate (Short Papers)

Y.L. Chow, J.J. Yang, D.G. Fang and G.E. Howard. "A Closed-Form Spatial Green's Function for the Thick Microstrip Substrate (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.3 (Mar. 1991 [T-MTT]): 588-592.

The spatial Green's function for the open microstrip structure, especially with a thick substrate, is generally represented by time-consuming Sommerfeld integrals. In this paper, through the Sommerfeld identity, a closed-form spatial Green's function of a few terms is found from the quasi-dynamic images, the complex images, and the surface waves. With the numerical integration of the Sommerfeld integrals thus avoided, this closed-form Green's function is computationally very efficient. Numerical examples show that the closed-form Green's function gives less than 1% error for all substrates and source-to field distances.

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Measurement of Dielectric Constant Using a Microstrip Ring Resonator (Short Papers)

P.A. Bernard and J.M. Gautray. "Measurement of Dielectric Constant Using a Microstrip Ring Resonator (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.3 (Mar. 1991 [T-MTT]): 592-595.

A new approach for measuring the permittivity of dielectric materials by means of a microstrip ring resonator is presented. The method is used in conjunction with the variational calculation of the line capacitance of a multilayer microstriplike transmission line to compute the effective permittivity and hence the resonant frequency of the ring. The results are compared with measurements made in X-band waveguide cavity by cavity perturbation techniques.

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Characterization of Microstrip Open End in the Structure of a Parallel-Coupled Stripline Resonator Filter (Short Papers)

T. Uwano. "Characterization of Microstrip Open End in the Structure of a Parallel-Coupled Stripline Resonator Filter (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.3 (Mar. 1991 [T-MTT]): 595-600.

This paper describes an accurate characterization of stripline open end in the parallel-coupled microstrip filter configuration. The method of analysis is based on a two-port resonance technique where the spectral-domain approach is used as a full-wave analysis. Even- and odd-mode edge effects are characterized separately by solving transcendental equations. Calculated results are used for the design of certain filters and the experimental results show excellent filter performances, which validates this method and leads to accurate filter design in practice.

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Reduced Form of the Green's Functions for Disks and Annular Rings (Short Papers)

F.A. Alhargan and S.R. Judah. "Reduced Form of the Green's Functions for Disks and Annular Rings (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.3 (Mar. 1991 [T-MTT]): 601-604.

Available Green's functions for circular and annular ring microstrip circuits involve doubly infinite series. These series are computationally expensive in terms of the time necessary for summing the series and the memory required to hold the eigenvalues. In this paper the Green's function is simplified to a single series using a new single-summation method. The resulting single series eliminates the need for the eigenvalues and increases the speed of computation.

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A Surface Integral Equation Method for the Finite Element Solution of Waveguide Discontinuity Problems (Short Papers)

O.M. Ramahi and R. Mittra. "A Surface Integral Equation Method for the Finite Element Solution of Waveguide Discontinuity Problems (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.3 (Mar. 1991 [T-MTT]): 604-608.

The surface integral equation method, which is typically employed in the finite element solution of open-region scattering problems, has been applied in this paper to the solution of waveguide discontinuity problems. The major advantage offered by the surface integral equation approach over other available methods is that it allows the mesh-truncating boundaries to be brought as close to the discontinuity as possible, thus helping to reduce the size of the system matrix. In addition, unlike the mode matching technique, the surface integral equation formulation does not require the solution of any auxiliary matrix system. Numerical results are presented to illustrate the validity of the formulation.

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On the Use of Shanks's Transform to Accelerate the Summation of Slowly Converging Series (Short Papers)

S. Singh and R. Singh. "On the Use of Shanks's Transform to Accelerate the Summation of Slowly Converging Series (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.3 (Mar. 1991 [T-MTT]): 608-610.

It is shown that the application of Shanks' transform results in accelerating the convergence of slowly converging series. The transform is applied to a periodic Green's function involving a single summation. The convergence properties of this series are reported for the "on-plane" case, in which the series converges extremely slowly. Numerical results indicate that by employing Shanks's transform the computation time can he reduced by as much as a factor of 200.

Abstracts

An Exact Solution for the Nonuniform Transmission Line Problem (Comments)

S. Amari. "An Exact Solution for the Nonuniform Transmission Line Problem (Comments)." 1991 Transactions on Microwave Theory and Techniques 39.3 (Mar. 1991 [T-MTT]): 611-612.

As the author of the above paper points out in his introduction, this problem has been solved within certain approximations. A limitation of these methods is the fact that some parameters of the line do not vary independently. It is exactly this kind of interdependence between the impedance and admittance that limits the form of lines to which the present solution applies.

Abstracts

Finite-Element Analysis of Waveguide Modes: A Novel Approach that Eliminates Spurious Modes (Comments and Reply)

M. Mrozowski, T. Angkaew, M. Matsuhara and N. Kumagai. "Finite-Element Analysis of Waveguide Modes: A Novel Approach that Eliminates Spurious Modes (Comments and Reply)." 1991 Transactions on Microwave Theory and Techniques 39.3 (Mar. 1991 [T-MTT]): 611-611.

One of the drawbacks of the finite-element analysis of waveguiding structures is that it often yields nonphysical solutions, which are called spurious modes. In the above paper, a novel formulation of the finite element method is presented which allows one to readily identify proper modes. The approach is based on the variational expression of the propagation constant involving transverse electric and magnetic field components. The following generalized eigenvalue problem is obtained from the stationary condition.

Abstracts

TE and TM Modes of Some Triangular Cross-Section Waveguides Using Superposition of Plane Waves (Comments)

J. Zhang and J. Fu. "TE and TM Modes of Some Triangular Cross-Section Waveguides Using Superposition of Plane Waves (Comments)." 1991 Transactions on Microwave Theory and Techniques 39.3 (Mar. 1991 [T-MTT]): 612-613.

In the above paper, Overfelt and White found the exact transverse electric and magnetic mode solution of four triangular cross-section waveguides: 1) equilateral; 2) 30°, 30°, 120°; 3) isosceles right; and 4) 30°, 60° right triangular. But the work of Prof. Lin Weigan some years ago should not be neglected. His results for 30°, 60° right triangular waveguides are as follows.

Abstracts

Call for Papers - Special Issue on Microwaves in Space (Mar. 1991 [T-MTT])

"Call for Papers - Special Issue on Microwaves in Space (Mar. 1991 [T-MTT])." 1991 Transactions on Microwave Theory and Techniques 39.3 (Mar. 1991 [T-MTT]): 614-614.

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Call for Papers - Process-Oriented Microwave CAD and Modeling (Mar. 1991 [T-MTT])

"Call for Papers - Process-Oriented Microwave CAD and Modeling (Mar. 1991 [T-MTT])." 1991 Transactions on Microwave Theory and Techniques 39.3 (Mar. 1991 [T-MTT]): 615-615.

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IEEE Interactive Learning Programs (Advertisement) (Mar. 1991 [T-MTT])

"IEEE Interactive Learning Programs (Advertisement) (Mar. 1991 [T-MTT])." 1991 Transactions on Microwave Theory and Techniques 39.3 (Mar. 1991 [T-MTT]): 616-616.

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"Front Cover (Apr. 1991[T-MTT])." 1991 Transactions on Microwave Theory and Techniques 39.4 (Apr. 1991 [T-MTT]): f1-f2.

Abstracts

High-T/sub c/ Superconductor Waveguides: Theory and Applications

J.H. Winters and C. Rose. "High-T/sub c/ Superconductor Waveguides: Theory and Applications." 1991 Transactions on Microwave Theory and Techniques 39.4 (Apr. 1991 [T-MTT]): 617-623.

In this paper, we study the expected properties of high-T/sub c/ superconductor waveguides, postulating the existence of such devices in the future. These devices offer the potential of 100 GHz of bandwidth for transmission over long distances with low attenuation, with the advantage over optical systems of wider dynamic range (providing a virtually unlimited number of taps). We first study the theoretical performance of superconductor waveguides including attenuation, carrier frequency and bandwidth, maximum transmitted power, and dispersion. We then discuss potential applications in local area networks.

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Calibration of Test Fixtures Using at Least Two Standards

K.J. Silvonen. "Calibration of Test Fixtures Using at Least Two Standards." 1991 Transactions on Microwave Theory and Techniques 39.4 (Apr. 1991 [T-MTT]): 624-630.

A study is made of the determination of the error networks in the measurements of microwave circuits with arbitratrary test fixtures. A general-purpose de-embedding method for known standards is shown. Also a method for symmetrical test fixtures is described. The method uses only two fixture standards, of which one must be a two-port standard with a transmission not equal to zero. A computer simulation is used to compare the error sensitivities of the different calibration algorithms.

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Perturbation Analysis of Electromagnetic Eigenmodes in Toroidal Waveguides

K.W. Kark. "Perturbation Analysis of Electromagnetic Eigenmodes in Toroidal Waveguides." 1991 Transactions on Microwave Theory and Techniques 39.4 (Apr. 1991 [T-MTT]): 631-637.

The propagation of electromagnetic waves in a loss-free inhomogeneous hollow conducting waveguide with circular cross section and uniform plane curvature of the longitudinal axis is considered. The explicit solution of Maxwell's equations cannot be given in toroidal waveguides. For small curvature the field equations can, however, be solved by means of an analytical approximation method. In this approximation the curvature of the axis of the waveguide is considered as a disturbance of the straight circular cylinder, and the perturbed torus field is expanded in eigenfunctions of the unperturbed problem. Using the Rayleigh-Schrodinger perturbation theory eigenvalues and eigenfunctions containing first-order correction terms are derived for the full spectrum of all modes including the degenerate ones. Complicated series expansions are obtained, which are represented in closed form by means of the residue theorem.

Click on title for a complete paper.

Abstracts

Importance of Normal Field Continuity in Inhomogeneous Scattering Calculations

X. Yuan, D.R. Lynch and K. Paulsen. "Importance of Normal Field Continuity in Inhomogeneous Scattering Calculations." 1991 Transactions on Microwave Theory and Techniques 39.4 (Apr. 1991 [T-MTT]): 638-642.

The finite element method with conventional scalar bases is coupled with the moment method to handle the three-dimensional scattering and/or absorption from inhomogeneous, arbitrarily shaped objects. The C/sup 0/ finite element basis enforces continuity of both normal and tangential E at element boundaries within homogeneous regions. At dielectric interfaces, the continuity of normal D and tangential E are enforced in a strong sense. Excellent agreement between the numerical solution and the Mie series is obtained for both internal and scattered fields for homogeneous and layered spheres under plane wave illumination. Compared to an alternative finite element method using edge elements which lack strong enforcement of normal field continuity, the present method produces higher-order approximations, especially at dielectric interfaces, with no penalties in computational effort.

Abstracts

Tunable Microwave and Millimeter-Wave Band-Pass Filters

J. Uher and W.J.R. Hoefer. "Tunable Microwave and Millimeter-Wave Band-Pass Filters." 1991 Transactions on Microwave Theory and Techniques 39.4 (Apr. 1991 [T-MTT]): 643-653.

This paper presents an overview of tunable microwave and millimeter-wave band-pass filters realized in different technologies. Some general design principles are described. Recent progress in the performance of various tunable filters is reported. The paper surveys magnetically tunable filters (ferromagnetic resonance filters, MSW filters, evanescent waveguide filters, E-plane printed circuit filters), electronically tunable filters, and mechanically tunable filters. The typical performance parameters are summarized and compared in terms of suitability for different applications.

Abstracts

Computer-Aided Synthesis of a Lossy Commensurate Line Network and its Application in MMIC's

L. Zhu. "Computer-Aided Synthesis of a Lossy Commensurate Line Network and its Application in MMIC's." 1991 Transactions on Microwave Theory and Techniques 39.4 (Apr. 1991 [T-MTT]): 654-659.

In this paper, a useful theorem which extends a previously introduced lossy transformation technique to more general applications is proposed for transformation between distributed lossy and lumped lossless networks, and a corollary is given for extension of the well-know Kuroda identities to the general lossy case. A new computer-aided approach is developed for the synthesis of lossy commensurate line networks with all lines having arbitray frequency-dependent losses. As an application, two broad-band amplifiers are designed for monolithic microwave integrated circuits (MMIC's) and their performances are compared with the examples in [2] and [3].

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Abstracts

Lagrangian Formulation of a Linear Microstrip Resonator: Theory and Experiment

H. How, A. Widom and C. Vittoria. "Lagrangian Formulation of a Linear Microstrip Resonator: Theory and Experiment." 1991 Transactions on Microwave Theory and Techniques 39.4 (Apr. 1991 [T-MTT]): 660-665.

The electromagnetic scattering properties of a linear microstrip resonator are formulated utilizing a Lagrangian approach. The resonator design includes a center microstrip separated from the source and output loads by dielectric gaps. The gaps of the resonator are represented by capacitively coupled pi-networks, whose capacitance values are fitted by experimental data. Calculated and measured reflection coefficients of linear microstrip resonators are compared and general agreements are found between theory and experiments.

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Abstracts

Slotline Impedance

J.J. Lee. "Slotline Impedance." 1991 Transactions on Microwave Theory and Techniques 39.4 (Apr. 1991 [T-MTT]): 666-672.

A theoretical model is presented to compute the characteristic impedance and wavelength in a slotline printed on or embedded in a dielectric substrate. In this treatment the effects of fringing field caused by the finite width of the conducting strips are taken into account. The main task was to calculate the capacitance per unit length of the slotline. First, the Green's function for the potential of a pair of filament sources in a dielectric substrate is solved, which was used as a building block to construct the overall solution of the boundary value problem. Then the surface charge density on the conducting strips is found by using a moment method and imposing the source condition (equal potential) on the conductors. From the surface charge density, the characteristic impedance of the slotline is computed for various input parameters. The formulation is applicable to a single-sided, sandwiched, or double-sided slotline printed on or embedded in a dielectric substrate.

Abstracts

Full-Wave Analysis of Coupled Perfectly Conducting Wires in a Multilayered Medium

N. Fache, F. Olyslager and D. De Zutter. "Full-Wave Analysis of Coupled Perfectly Conducting Wires in a Multilayered Medium." 1991 Transactions on Microwave Theory and Techniques 39.4 (Apr. 1991 [T-MTT]): 673-681.

This paper presents a full-wave analysis of coupled perfectly conducting cylindrical wires in a multilayered dielectric medium. The analysis is based on a Fourier series expansion of the unknown surface currents on each wire and on an integral equation for the longitudinal field on the wires. The calculations are not restricted to the propagation constants of the different modes, but explicit results are presented for the impedances associated with each wire and each eigenmode and this as a function of frequency. Propagation constants, longitudinal currents on the wires and impedances lead to a complete circuit equivalent for the structures being considered.

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Abstracts

Accurate Computation of Wide-Band Response of Electromagnetic Systems Utilizing Narrow-Band Information

K. Kottapalli, T.K. Sarkar, Y. Hua, E.K. Miller and G.J. Burke. "Accurate Computation of Wide-Band Response of Electromagnetic Systems Utilizing Narrow-Band Information." 1991 Transactions on Microwave Theory and Techniques 39.4 (Apr. 1991 [T-MTT]): 682-687.

We investigate Cauchy's technique for interpolating a rational function from samples of frequency responses and/or their derivatives. This technique can be used to speed up the numerical computations of parameters including input impedance and RCS of any linear time-invariant electromagnetic system. Here we have applied the technique to find the electromagnetic response of a conducting cylinder over a spectrum of frequency. The numerical results presented are in good agreement with exact computational data. This technique is a true interpolation/extrapolation technique as it provides the same defective result as the original electric field integral equation at a frequency which corresponds to the internal resonance of the closed structure.

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A Circuit Model of a System of VLSI Interconnects for Time Response Computation

R. Wang and O. Wing. "A Circuit Model of a System of VLSI Interconnects for Time Response Computation." 1991 Transactions on Microwave Theory and Techniques 39.4 (Apr. 1991 [T-MTT]): 688-693.

A new computational model based on the spectral-domain approach for the characterization of a dispersive multiconductor system is developed for time response computation. The model consists of two identical impedance networks and equivalent voltage-controlled voltage sources and it is particularly suitable for timing analysis. Since full-wave analysis is employed for the derivation, the computational model is valid at very high frequencies when the longitudinal field components are no longer negligible.

Abstracts

An Exact TEM Calculation of Loss in a Stripline of Arbitrary Dimensions

S. Rawal and D.R. Jackson. "An Exact TEM Calculation of Loss in a Stripline of Arbitrary Dimensions." 1991 Transactions on Microwave Theory and Techniques 39.4 (Apr. 1991 [T-MTT]): 694-699.

An exact expression for the quasi-static conductive attenuation in a symmetrical stripline is derived. The formulation is based on a TEM assumption, which assumes that the skin depth is much smaller than the strip thickness. The conductive attenuation is related to the charge density on the conductive surfaces, which is determined by a conformal mapping originally proposed by Bates. An analytic extraction of a charge singularity term is used to obtain a numerically efficient calculation, in which no singular integrations appear.

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Resonance in Spherical--Circular Microstrip Structures

W.-Y. Tam and K.-M. Luk. "Resonance in Spherical--Circular Microstrip Structures." 1991 Transactions on Microwave Theory and Techniques 39.4 (Apr. 1991 [T-MTT]): 700-704.

The resonance problem of a circular microstrip disk mounted on a spherical surface is studied theoretically. The radiator is replaced by a surface current distribution. The effects of the dielectric substrate as well as the curvature effect are taken into account by the Green's function formulation in the spectral domain. A new vector Legendre series is defined. Cavity model current distribution is used as the current basis. Galerkin's procedure is employed to solve for the complex resonant frequencies. Some numerical results are given to illustrate the effects of curvature and dielectric substrate on the resonance of the microstrip patch.

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Characterization of Radiation Loss from Microstrip Discontinuities Using a Multiport Network Modeling Approach

A. Sabban and K.C. Gupta. "Characterization of Radiation Loss from Microstrip Discontinuities Using a Multiport Network Modeling Approach." 1991 Transactions on Microwave Theory and Techniques 39.4 (Apr. 1991 [T-MTT]): 705-712.

This paper presents a convenient method for evaluating radiation loss from microstrip discontinuities. The multiport network model is used to find voltage distributions around discontinuity edges, and an equivalent magnetic current model is used to compute the resulting radiation fields. As an example, the results show that for a 90° bend in a 50 Omega line on a 10-mil-thick substrate with epsilon/sub r/spl ap/2.2, the radiation loss is 0.1 dB at 30 GHz. Typical power levels radiated by several other discontinuities are reported. The analysis model is verified experimentally by fabricating microstrip resonators with discontinuities incorporated therein and making measurement of Q factors of these resonators.

Abstracts

Distortion in Broad-Band Gallium Arsenide MESFET Control and Switch Circuits

R.H. Caverly. "Distortion in Broad-Band Gallium Arsenide MESFET Control and Switch Circuits." 1991 Transactions on Microwave Theory and Techniques 39.4 (Apr. 1991 [T-MTT]): 713-717.

This paper will discuss the origins of MESFET distortion in passive control applications, such as single transistor switch and reflective attenuator circuits. The discussion is based on a lumped element equivalent circuit model and is limited to applications where the MESFET is operating in its conducting state. In switch circuits, the analysis indicates that distortion maybe reduced by the use of MESFET's with pinch off voltages in the 2-3 V range and with large open channel current capacities. In attenuators, the analysis shows extreme variations in the level of distortion over a relatively narrow range of attenuation levels. Distortion in the case of the reflective attenuator maybe reduced by the use of MESFET's with small open channel current capacities.

Abstracts

Analysis and Closed-Form Solutions of Circular and Rectangular Apertures in the Transverse Plane of a Circular Waveguide

G.B. Eastham and K. Chang. "Analysis and Closed-Form Solutions of Circular and Rectangular Apertures in the Transverse Plane of a Circular Waveguide." 1991 Transactions on Microwave Theory and Techniques 39.4 (Apr. 1991 [T-MTT]): 718-723.

An analysis has been carried out to determine the discontinuity susceptance of a circular or rectangular aperture in the transverse plane of a circular waveguide. Closed-form solutions based on the scattered amplitude calculation and aperture coupling theory have been derived. The theoretical results agree very well with the experiments. The results should have many applications in the design of circular waveguide components and circular waveguide-backed aperture antennas.

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Abstracts

A Generalized Theory and New Calibration Procedures for Network Analyzer Self-Calibration

H.-J. Eul and B. Schiek. "A Generalized Theory and New Calibration Procedures for Network Analyzer Self-Calibration." 1991 Transactions on Microwave Theory and Techniques 39.4 (Apr. 1991 [T-MTT]): 724-731.

A general theory for performing network analyzer calibration is presented. New calibration procedures are derived which allow for partly unknown standards. The most general procedure derived is called TAN and allows for five unknown parameters in the three calibration standards. The values of the unknown parameters are determined during the calibration procedure via eigenvalue conditions. The good performance of all the procedures is shown by measured results.

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Efficient Computation of the Steady-State Response of Periodic Nonlinear Microwave Circuits Using a Convolution-Based Sample-Balance Technique (Short Papers)

P.J.C. Rodrigues, M.J. Howes and J.R. Richardson. "Efficient Computation of the Steady-State Response of Periodic Nonlinear Microwave Circuits Using a Convolution-Based Sample-Balance Technique (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.4 (Apr. 1991 [T-MTT]): 732-737.

This paper describes an efficient and robust approach to the computation of the steady-state response of periodic nonlinear microwave circuits. The problem of solving a set of differential equations, in this case, is converted into that of solving a system of nonlinear algebraic equations using a technique which is termed convolution-based sample balance. Although exact in all cases for which harmonic-balance techniques are exact, this technique does not require the use of discrete Fourier transforms, and calculating the Jacobian is straightforward. For the solution of the resulting system of nonlinear equations, an efficient and yet very robust algorithm has been developed. In the examples given, savings in computational effort of over 85% are reported when this algorithm is compared with Newton's method.

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Phase Shift Determination of Imperfect Open Calibration Standards (Short Papers)

G. Biddle. "Phase Shift Determination of Imperfect Open Calibration Standards (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.4 (Apr. 1991 [T-MTT]): 737-740.

A new measurement technique for determining the inherent phase shift of open calibration standards for network analyzers due to fringing capacitance is presented. The resultant phase shift is directly measured using an uncalibrated network analyzer and requires no modeling of coefficients of capacitance as conventional methods do. An exact expression for the phase shift of an imperfect open is derived for each frequency point. Two sets of standard one-port error equations are developed for the application. The traditional set of calibration standards, the match, short, and imperfect open, are used. The standards are measured twice: once at the reference plane and then offset by a precision piece of air line. Results are presented for the phase shifts of a few open calibration standards at discrete frequencies.

Abstracts

An Analytical Approach to the Analysis of Dispersion Characteristics of Microstrip Lines (Short Papers)

D. Homentcovschi. "An Analytical Approach to the Analysis of Dispersion Characteristics of Microstrip Lines (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.4 (Apr. 1991 [T-MTT]): 740-743.

A new analytical method for determining the dispersion characteristics of microstrip lines is given. The method uses dual integral equations, and the dispersion relation is obtained in terms of a double infinite system of linear equations with good convergence properties.

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Abstracts

Admittance Calculation of a Slot in the Shield of a Multiconductor Transmission Line (Short Papers)

R.G. Plumb. "Admittance Calculation of a Slot in the Shield of a Multiconductor Transmission Line (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.4 (Apr. 1991 [T-MTT]): 743-747.

The admittance calculation for a narrow slot in the conducting shield of a multiconductor transmission line is presented. The admittance represents a generalized admittance resulting from an asymptotic, one-term moment method solution and is approximated using transmission line theory. The calculated admittance is useful in modeling connectors for multiconductor transmission lines. Some useful impedance calculations for multiconductor transmission lines are developed.

Abstracts

Full-Wave Analysis of Multilayer Coplanar Lines (Short Papers)

C.-N. Chang, W.-C. Chang and C.H. Chen. "Full-Wave Analysis of Multilayer Coplanar Lines (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.4 (Apr. 1991 [T-MTT]): 747-750.

A full-wave analysis of a coplanar wave-guiding structure with multiple dielectric layers is presented. In this study, the results of the hybrid approach that combines the finite-element method and the conformal-mapping technique are compared with those of the spectral-domain approach. Numerical results for effective dielectric constants, characteristic impedances, current distributions, and field distributions for various multilayer coplanar line structures are presented and discussed. Comparisons are also made of the computed results with the available quasi-static ones.

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Call for Papers - Special Issue on Microwaves in Space (Apr. 1991 [T-MTT])

"Call for Papers - Special Issue on Microwaves in Space (Apr. 1991 [T-MTT])." 1991 Transactions on Microwave Theory and Techniques 39.4 (Apr. 1991 [T-MTT]): 751-752.

Abstracts

Call for Papers - Process-Oriented Microwave CAD and Modeling (Apr. 1991[T-MTT])

"Call for Papers - Process-Oriented Microwave CAD and Modeling (Apr. 1991[T-MTT])." 1991 Transactions on Microwave Theory and Techniques 39.4 (Apr. 1991 [T-MTT]): 752-752.

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Back Cover (Apr. 1991 [T-MTT])

"Back Cover (Apr. 1991 [T-MTT])." 1991 Transactions on Microwave Theory and Techniques 39.4 (Apr. 1991 [T-MTT]): b1-b2.

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Front Cover (May 1991 [T-MTT])

"Front Cover (May 1991 [T-MTT])." 1991 Transactions on Microwave Theory and Techniques 39.5 (May 1991 [T-MTT] (Special Issue on Directions in Design and Applications of Microwave Systems)): f1-f2.

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Guest Editorial (May 1991 [T-MTT])

G.L. Heiter. "Guest Editorial (May 1991 [T-MTT])." 1991 Transactions on Microwave Theory and Techniques 39.5 (May 1991 [T-MTT] (Special Issue on Directions in Design and Applications of Microwave Systems)): 753-754.

Periodically, the Technical Committee on Microwave Systems (MTT-16) of the Microwave Theory and Techniques Society (MTT-S) sponsors various types of events to promote the exchange of information on selected aspects of system design. Workshops and panel sessions at International Microwave Symposia (IMS), together with summaries of their proceedings and special issues of this Transactions, have been used to provide such a forum.

Abstracts

A Review of the Panel Discussion on Advances in Millimeter-Wave Subsystems--1990

J.B. Horton. "A Review of the Panel Discussion on Advances in Millimeter-Wave Subsystems--1990." 1991 Transactions on Microwave Theory and Techniques 39.5 (May 1991 [T-MTT] (Special Issue on Directions in Design and Applications of Microwave Systems)): 755-758.

Advances in millimeter-wave subsystems formed the basis of a panel discussion at the 1990 International Microwave Symposium, in Dallas, Texas. Highlights from the state-of-the-art reviews and technology projections by the presenters are included. The panelists were from Europe, Japan, and the U.S. Additional references are listed, including papers written by panelists for this Special Issue.

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Millimeter-Wave Technology Advances Since 1985 and Future Trends

H.H. Meinel. "Millimeter-Wave Technology Advances Since 1985 and Future Trends." 1991 Transactions on Microwave Theory and Techniques 39.5 (May 1991 [T-MTT] (Special Issue on Directions in Design and Applications of Microwave Systems)): 759-767.

The availability of hybrid and monolithic millimeter-wave integration techniques has fostered the use of millimeterwave systems. Short-range radar and line-of-sight communication are the major application areas. Very stringent system requirements can be met using today's available hybrid technology. The finline technique, for example, has major advantages: almost all types of components can be realized, as a high level of integration and low-cost circuit design and development are combined. Even more important, the finline technique is suitable for small series production. An excellent example of this approach is the German AVES System, featuring a 60 GHz traffic monitoring sensor realized in finline technique. However, to the extent available, monolithic technology will be applied using analog GaAs circuits as well as SIMMWIC, a silicon-based technology. Specific applications demand tailored approaches. Sensors operating at 94 GHz for collision avoidance and intelligent ammunition applications from Philips Microwave, U.K., and Telefunken SystemTechnik, Germany, are described to demonstrate the maturity of today's millimeter-wave technology.

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Millimeter-Wave Components and Subsystems Built Using Microstrip Technology

D.A. Williams. "Millimeter-Wave Components and Subsystems Built Using Microstrip Technology." 1991 Transactions on Microwave Theory and Techniques 39.5 (May 1991 [T-MTT] (Special Issue on Directions in Design and Applications of Microwave Systems)): 768-774.

This paper describes how various circuit elements have been realized on microstrip for operation in the millimeter-wave bands. The manufacturing process for thin-film MIC's on single-crystal quartz is described. Designs for various circuit elements are discussed, and an integrated subsystem is described in which MIC techniques are used to produce a miniature millimeter-wave distance-measuring sensor. Range measurement results for the miniature sensor are presented.

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Advances in Millimeter-Wave Subsystems in Japan

S. Kitazume. "Advances in Millimeter-Wave Subsystems in Japan." 1991 Transactions on Microwave Theory and Techniques 39.5 (May 1991 [T-MTT] (Special Issue on Directions in Design and Applications of Microwave Systems)): 775-781.

With the increase in demand for communication system capacity, the millimeter-wave frequency band has become a valuable resource because of its bandwidth, extending from 30 GHz to 300 GHz, nine times the presently developed communications bands. As a result, research and development on millimeter-wave systems have been promoted in several organizations in Japan (NTT, CRL, NASDA, SCR). This paper describes the development trends and results of millimeter-wave systems in Japan in such fields as communication, radar, and measurement systems. Also, it describes the development of devices such as high-power FET amplifiers, TWTA's, IMPATT amplifiers, low-noise amplifiers, and MMIC devices used in constructing the millimeter-wave systems.

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An Overview of Frequency Synthesizers for Radars

Z. Galani and R.A. Campbell. "An Overview of Frequency Synthesizers for Radars." 1991 Transactions on Microwave Theory and Techniques 39.5 (May 1991 [T-MTT] (Special Issue on Directions in Design and Applications of Microwave Systems)): 782-790.

This paper presents an overview of frequency synthesizer techniques suitable for radar systems. Included are the requirements which have a direct impact on the selection of synthesizer architectures and the choice of synthesizer components. Both direct and indirect architectures are presented, along with advantages, disadvantages, and representative examples. A brief discussion of analytical procedures is followed by a survey of key synthesizer components and future trends.

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Microwave Systems Design for High-Performance Moving Target Indicators in Radars (May 1991 [T-MTT])

P.A. Sorrell. "Microwave Systems Design for High-Performance Moving Target Indicators in Radars (May 1991 [T-MTT])." 1991 Transactions on Microwave Theory and Techniques 39.5 (May 1991 [T-MTT] (Special Issue on Directions in Design and Applications of Microwave Systems)): 791-797.

Clutter cancellation of 65 dB and better is directly proportional to good radar stability, and since many hardware areas produce instabilities at various lebels, the architecture of a radar requires special design considerations to support this high stability. The noise character and generation methods of these instabilities in the various hardware areas are described and design solutions given to eliminate them. A reliable, accurate method of measuring radar stability in L- and S-band radars is described.

Abstracts

An Experimental Adaptive Nulling Receiver Utilizing the Sample Matrix Inversion Algorithm with Channel Equalization

J.R. Johnson, A.J. Fenn, H.M. Aumann and F.G. Willwerth. "An Experimental Adaptive Nulling Receiver Utilizing the Sample Matrix Inversion Algorithm with Channel Equalization." 1991 Transactions on Microwave Theory and Techniques 39.5 (May 1991 [T-MTT] (Special Issue on Directions in Design and Applications of Microwave Systems)): 798-808.

The suppression of external interference in an adaptive radar is often limited by frequency-dependent channel tracking errors. Techniques for effectively equalizing a narrow-band side-lobe canceler are discussed in this paper, and an experimental four-channel receiver that supports both open-loop and closed-loop operation is described. As implemented, three different canceler modes are possible: feedforward, feedback, and a tandem feedback/feedforward combination. All three modes have been successfully demonstrated in bench experiments with a broad-band noise source using the sample matrix inversion algorithm.

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Detection of Target Distance in the Presence of an Interfering Reflection Using a Frequency-Stepped Double Side-Band Suppressed Carrier Microwave Radar System

G.A. Ybarra, S.H. Ardalan, C.P. Hearn, R.E. Marshall and R.T. Neece. "Detection of Target Distance in the Presence of an Interfering Reflection Using a Frequency-Stepped Double Side-Band Suppressed Carrier Microwave Radar System." 1991 Transactions on Microwave Theory and Techniques 39.5 (May 1991 [T-MTT] (Special Issue on Directions in Design and Applications of Microwave Systems)): 809-818.

A technique for detecting the distance to a highly reflective target in the presence of an interfering reflection using a frequency-stepped double side-band suppressed carrier (DSBSC) microwave-millimeter-wave radar system is analytically derived. Although this system is being developed for measuring nonuniform electron plasma densities as a function of distance from a heat tile on a space reentry vehicle, the technique is quite general and could be applied to other short-range radar problems. The main result of the analysis shows that the measured group delays produced by the DSBSC system possess a periodicity inversely proportional to the difference between the time delays to the target and interferer, independent of the signal-to-interference ratio (SIR), Thus, if the distance to the interferer is known, then the periodicity of the measured group delays may be used to extract the target distance, independent of SIR. Simulation results are presented in the context of electron plasma density range estimation using a block diagram communications CAD tool. A unique and accurate plasma model is introduced. A high-resolution spectral estimation technique based on an autoregressive time series analysis is applied to the measured group delays, and it is shown that accurate target distance estimates may be obtained, independent of SIR.

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94 GHz Three-Dimensional Imaging Radar Sensor for Autonomous Vehicles

M. Lange and J. Detlefsen. "94 GHz Three-Dimensional Imaging Radar Sensor for Autonomous Vehicles." 1991 Transactions on Microwave Theory and Techniques 39.5 (May 1991 [T-MTT] (Special Issue on Directions in Design and Applications of Microwave Systems)): 819-827.

Sensing 3-D geometrical properties of an environment is essential for an autonomous vehicle operating in indoor situations such as production plants. Since the common acoustical and optical sensors fulfill this task insufficiently, this paper reports on an alternative approach using millimeter-wave images for real-time vehicle guidance. For application in the field of autonomous locomotion, the main advantage of this sensor concept is direct access to range and velocity information. System design and imaging results of a multitask 94 GHz pulse Doppler radar with 25 cm radial and 1.5° angular resolution are discussed. To point out specific millimeter-wave scattering phenomena, various radar images of typically structured indoor situations are presented. Extraction of information from sensor data, for example, obstacle detection, is demonstrated by radar image processing.

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Microwave Aquametry--Needs and Perspectives

A.W. Kraszewski. "Microwave Aquametry--Needs and Perspectives." 1991 Transactions on Microwave Theory and Techniques 39.5 (May 1991 [T-MTT] (Special Issue on Directions in Design and Applications of Microwave Systems)): 828-835.

Determination of moisture content or water content in materials with microwave radiation has several advantages over other electrical methods applying lower frequencies. Problems concerning the development of microwave equipment for those purposes are reviewed. Trends of further development of the instrumentation and research concepts are considered.

Abstracts

Cylindrical Geometry: A Further Step in Active Microwave Tomography

A. Broquetas, J. Romeu, J.M. Rius, A.R. Elias-Fuste, A. Cardama and L. Jofre. "Cylindrical Geometry: A Further Step in Active Microwave Tomography." 1991 Transactions on Microwave Theory and Techniques 39.5 (May 1991 [T-MTT] (Special Issue on Directions in Design and Applications of Microwave Systems)): 836-844.

A prototype imaging system for active microwave tomography using cylindrical geometry has been developed, making is possible to obtain images of the dielectric properties of biological targets at 2.45 GHz. The system requires no mechanical movements to illuminate the body from multiple directions (views) and measure the scattered fields. In this way a complete data set consisting in 64 views is acquired in 3 s using low-power illumination. The system is described, including images obtained with biological phantoms and actual bodies.

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A Multiview Microwave Imaging System for Two-Dimensional Penetrable Objects

S. Caorsi, G.L. Gragnani and M. Pastorino. "A Multiview Microwave Imaging System for Two-Dimensional Penetrable Objects." 1991 Transactions on Microwave Theory and Techniques 39.5 (May 1991 [T-MTT] (Special Issue on Directions in Design and Applications of Microwave Systems)): 845-851.

The microwave imaging system proposed in this paper is based on a multiview numerical solution to the integral equation of 2-D TM scattering. This solution is achieved by the moment method, and a pseudoinversion transformation is used to face ill-conditioning problems. An experimental setup is described that employs a scanning subsystem for measuring the values of the scattered electric field inside an observation domain located outside the investigation one (i.e., the area containing the cross sections of cylindrical dielectric scatters). Rotations of the investigation domain with respect to the scanning subsystem and the transmitting antenna allow a multiview imaging process. The proposed imaging system does not require plane-wave illumination and does not use any first-order approximations; hence it may be used even in the case of strong scatterers. In addition, the off-line and once-and-for-all computation of the pseudoinverse matrix allows an inexpensive reconstruction in terms of computer resources. Some tests of the system were carried out, and the results are reported.

Abstracts

Optimization of SAR Distributions in Liver and Lung Regions Irradiated by the H-Horn Annular Phased Array Hyperthermia System

T. Deng. "Optimization of SAR Distributions in Liver and Lung Regions Irradiated by the H-Horn Annular Phased Array Hyperthermia System." 1991 Transactions on Microwave Theory and Techniques 39.5 (May 1991 [T-MTT] (Special Issue on Directions in Design and Applications of Microwave Systems)): 852-856.

This paper discusses a new type of annular phased array system the H-horn APA. The phase and amplitude control of power deposition patterns for this system has been theoretically analyzed at a frequency of 200 MHz. The formulas for calculating the E field and SAR for this APA system have been derived, and can be applied to other types of APA systems. Models on computerized tomography (CT) scans from liver and lung regions have been used for predicting optimization of the E field and SAR patterns in the case of the relative phase and amplitude changes. It is shown that the technique of the phase and amplitude control of SAR patterns results in a more selective and effective heating of tumors situated eccentrically and deeply within the body. The APA hyperthermia system described in this paper shows great promise, and looks very useful for developing clinical applications.

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Capacitance-Voltage Characteristics of Microwave Schottky Diodes

B. Gelmont, M. Shur and R.J. Mattauch. "Capacitance-Voltage Characteristics of Microwave Schottky Diodes." 1991 Transactions on Microwave Theory and Techniques 39.5 (May 1991 [T-MTT] (Special Issue on Directions in Design and Applications of Microwave Systems)): 857-863.

The capacitance of small-area microwave Schottky diodes is strongly affected by the edge effect, which is not adequately described by existing analytical models. Based on an analytical solution of Poisson's equation, we calculated capacitances of metal circular dots and metal stripes on the surface of a doped semiconductor material. When the dimensions of the dot or stripe are much larger than the depletion region, the results are reduced to the conventional formula for a parallel plate capacitor. In the opposite limit, the overall capacitance is determined by the edge effect. This edge capacitance is proportional to the device periphery, with the coefficient of proportionality dependent on the shape of the metal. In the most interesting case of a round metal dot, the edge capacitance is given by C = 4 epsilon a, where epsilon is the dielectric permittivity of the semiconductor and a is the radius of the metal dot. The parallel-plate component of the device capacitance is modulated by the applied voltage; the edge component is nearly independent of the applied voltage. Hence, the largest capacitance modulation is achieved in devices with the smallest ratio of the device periphery over the device area, which has the smallest edge effect. The measured capacitances of small round GaAs Schottky barrier diodes are in reasonable agreement with the results of our calculation.

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Abstracts

Mathematical Methods for Treatment Planning in Deep Regional Hyperthermia

D. Sullivan. "Mathematical Methods for Treatment Planning in Deep Regional Hyperthermia." 1991 Transactions on Microwave Theory and Techniques 39.5 (May 1991 [T-MTT] (Special Issue on Directions in Design and Applications of Microwave Systems)): 864-872.

Computer simulation for treatment planning in deep regional hyperthermia cancer therapy using the Sigma 60 applicator involves the optimization of several parameters. Because the programs to simulate such treatments are computationally intensive, it is impractical to rerun the programs for each new set of input parameters. Techniques are described which accelerate this process by separating the problem into responses by individual quadrants and by employing an impulse response to get multiple frequencies per run. The implementation of these techniques using the finite-difference time-domain (FDTD) method is described. The accuracy is tested against three-dimensional measurements made in a homogeneous phantom. The result is a method capable of planning an optimum treatment for deep regional hyperthermia.

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Theoretical and Experimental Characterization of Coplanar Waveguide Discontinuities for Filter Applications

N.I. Dib, L.P.B. Katehi, G.E. Ponchak and R.N. Simons. "Theoretical and Experimental Characterization of Coplanar Waveguide Discontinuities for Filter Applications." 1991 Transactions on Microwave Theory and Techniques 39.5 (May 1991 [T-MTT] (Special Issue on Directions in Design and Applications of Microwave Systems)): 873-882.

A full-wave analysis of shielded coplanar waveguide two-port discontinuities based on the solution of an appropriate surface integral equation in the space domain is presented. Using this method, frequency-dependent scattering parameters for open-end and short-end CPW stubs are computed. The numerically derived results are compared with measurements performed in the frequency range 5-25 GHz and show very good agreement. Equivalent circuit models and closed-form expressions to compute the circuit element values for these discontinuities are also presented.

Abstracts

Phase Noise Characterization of SAW Oscillators Based on a Newton Minimization Procedure (May 1991 [T-MTT])

D.P. Klemer, K.-M. Shih and E.E. Clark, III. "Phase Noise Characterization of SAW Oscillators Based on a Newton Minimization Procedure (May 1991 [T-MTT])." 1991 Transactions on Microwave Theory and Techniques 39.5 (May 1991 [T-MTT] (Special Issue on Directions in Design and Applications of Microwave Systems)): 883-889.

An iterative minimization technique is used to optimize the values of circuit and device parameters which determine the phase noise response of a voltage-controlled SAW-stabilized oscillator (VCSO). An expression developed by Parker is used to calculate the double-sideband phase noise to carrier ratio from circuit parameter values; good agreement between calculations and phase noise measurements is achieved by minimizing the squared error through the use of a steepest-descent/ Newton-Raphson minimization scheme. Less accurately known circuit parameters are thus optimized in an iterative fashion. Exact expressions for the elements of the Hessian matrix are need in the Newton-Raphson procedure, allowing for fast computations. Although this technique is primarily useful in the determination of circuit parameter values, it can also be used to develop an understanding of the effect of individual parameters on phase noise response (i.e., the sensitivity of phase noise characteristics to circuit and device parameter variations). Additionally it may be of use in the design of low-phase-noise oscillators by using desired (rather than measured) phase noise values in the objective function to be minimized.

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Measurement of the Microwave Absorption for Small Samples in a Coaxial Line (Short Papers)

H.R. Garner, A.C. Lewis and T. Ohkawa. "Measurement of the Microwave Absorption for Small Samples in a Coaxial Line (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.5 (May 1991 [T-MTT] (Special Issue on Directions in Design and Applications of Microwave Systems)): 890-892.

Microwave absorption measurements in terms of power loss per unit volume of very small liquid and solid samples (0.003-2.6 µL) contained in capillaries inserted across the dielectric of a coaxial line have been made between 2 and 26.5 GHz. This perturbation technique makes it possible to measure small differences in the absorption of the samples in a swept fashion. This technique is applicable to biological measurements where the samples are often very small. It is also of use in monitoring and process control environments in biotechnology and polymer technology.

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Abstracts

A Frequency-Dependent Basis Function Applied to Microstrip (Short Papers)

C. Hechtman, H. Zmuda and D. Gabbay. "A Frequency-Dependent Basis Function Applied to Microstrip (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.5 (May 1991 [T-MTT] (Special Issue on Directions in Design and Applications of Microwave Systems)): 893-896.

Spheroidal wave functions and the spectral-domain method are used to compute the effective dielectric constant for microstrip. A single-term expansion for the vector current density provides excellent results over a broad spectrum (1-100 GHz). Numerical results compare favorably with other commonly used techniques.

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X-Band 0.5, 1, and 2 Watt Power Amplifiers with Marked Improvement in Power-Added Efficiency (Comments)

R.D. Boesch. "X-Band 0.5, 1, and 2 Watt Power Amplifiers with Marked Improvement in Power-Added Efficiency (Comments)." 1991 Transactions on Microwave Theory and Techniques 39.5 (May 1991 [T-MTT] (Special Issue on Directions in Design and Applications of Microwave Systems)): 897-897.

Power-added efficiency results from MMIC amplifiers which were designed, fabricated, and tested based on work reported in the above paper have caused a reassessment of measuremtmts made in February 1989 for that work. The new MMIC amplifiers exhibited a maximum power-added efficiency of 32% in X-band at 1 watt output power. These results are significantly lower than the 53% average power-added efficiency for the 1 watt hybrid amplifiers previously reported.

Abstracts

Call for Papers - Special Issue on Microwaves in Space (May 1991 [T-MTT])

"Call for Papers - Special Issue on Microwaves in Space (May 1991 [T-MTT])." 1991 Transactions on Microwave Theory and Techniques 39.5 (May 1991 [T-MTT] (Special Issue on Directions in Design and Applications of Microwave Systems)): 898-898.

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Call for Papers - Process-Oriented Microwave CAD and Modeling (May 1991 [T-MTT])

"Call for Papers - Process-Oriented Microwave CAD and Modeling (May 1991 [T-MTT])." 1991 Transactions on Microwave Theory and Techniques 39.5 (May 1991 [T-MTT] (Special Issue on Directions in Design and Applications of Microwave Systems)): 899-899.

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IEEE Interactive Learning Programs (Advertisement) (May 1991 [T-MTT])

"IEEE Interactive Learning Programs (Advertisement) (May 1991 [T-MTT])." 1991 Transactions on Microwave Theory and Techniques 39.5 (May 1991 [T-MTT] (Special Issue on Directions in Design and Applications of Microwave Systems)): 900-900.

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Back Cover (May 1991 [T-MTT])

"Back Cover (May 1991 [T-MTT])." 1991 Transactions on Microwave Theory and Techniques 39.5 (May 1991 [T-MTT] (Special Issue on Directions in Design and Applications of Microwave Systems)): b1-b2.

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Abstracts

New Fast and Accurate Line Parameter Calculation of General Multiconductor Transmission Lines in Multilayered Media

F. Olyslager, N. Fache and D. De Zutter. "New Fast and Accurate Line Parameter Calculation of General Multiconductor Transmission Lines in Multilayered Media." 1991 Transactions on Microwave Theory and Techniques 39.6 (Jun. 1991 [T-MTT]): 901-909.

This paper presents a considerably enhanced method to calculate C, L, and R of a multiconductor bus in a multilayered medium. Different board technologies, conductors of complicated shape, and conductors embedded in different layers can be handled without loss of accuracy or substantial increase in CPU time compared with existing simulation techniques. Correct determination of skin effect losses is shown to depend critically on surface charge modeling. Surface charge discontinuities are explicitly taken into account, which results in reduced computation time. A further reduction of computation time is obtained by a new treatment of the calculation of the Green's function.

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Terahertz Attenuation and Dispersion Characteristics of Coplanar Transmission Lines

M.Y. Frankel, S. Gupta, J.A. Valdmanis and G.A. Mourou. "Terahertz Attenuation and Dispersion Characteristics of Coplanar Transmission Lines." 1991 Transactions on Microwave Theory and Techniques 39.6 (Jun. 1991 [T-MTT]): 910-916.

We present experimental verification of analytic formulas for the dispersion and the attenuation of electrical transient signals propagating on coplanar transmission lines. The verification is done in the frequency domain over a teraherz range, although the experiments are in the time domain. The analytic formulas have been obtained from fits to the full-wave analysis results. We quantitatively verify that the full-wave steady-state solutions can be directly applied to the transient time-domain propagation experiments. We use subpicosecond electrical pulses and an external electro-optic sampling technique to obtain the time-domain propagation data. From the Fourier transforms of the time-domain data we extract both the attenuation and the phase information as a function of frequency. The dispersion and the attenuation characteristics are investigated for both coplanar waveguide and coplanar strip transmission lines. The investigation was also carried out on both semi-insulating semiconductor and dielectric substrate materials and indicates no observable losses caused by the semi-conductor material.

Abstracts

A Novel Method for Modeling Coupling Between Several Microstrip Lines in MIC's and MMIC's

D.G. Swanson, Jr.. "A Novel Method for Modeling Coupling Between Several Microstrip Lines in MIC's and MMIC's." 1991 Transactions on Microwave Theory and Techniques 39.6 (Jun. 1991 [T-MTT]): 917-923.

This paper presents a novel technique for modeling the adjacent and nonadjacent couplings between several microstrip lines. The technique assumes that the primary transmission paths in the circuit can be modeled with conventional single or coupled microstrip models. A new four-port model is then superimposed on the existing circuit for each adjacent or nonadjacent coupling that is present. The new model uses analytical equations for microstrip coupled lines and is, therefore, fast and easy to compute.

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Phase Compensation and Waveform Reshaping of Picosecond Electrical Pulses Using Dispersive Microwave Transmission Lines

Y. Qian and E. Yamashita. "Phase Compensation and Waveform Reshaping of Picosecond Electrical Pulses Using Dispersive Microwave Transmission Lines." 1991 Transactions on Microwave Theory and Techniques 39.6 (Jun. 1991 [T-MTT]): 924-929.

In this paper we study the phase compensation effect of microwave transmission line dispersion and propose a simple, effective method for reshaping and compressing picosecond electrical pulses generated from photoconductive switches. We show that a piece of a dispersive strip transmission line can be used as a "phase equalizer" to compensate the phase distortion included in asymmetric pulses, resulting in effective reshaping and compression of these ultrashort pulses. Initial design formulas of the strip transmission lines for this purpose are presented, together with computer simulation results which confirm the theoretical predictions. Finally we present experimental results to show the substantial pulse reshaping effect, as well as a comparison between theory and measurement.

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Propagation Characteristics of Picosecond Electrical Pulses on a Periodically Loaded Coplanar Waveguide

C. Shu, X. Wu, E.S. Yang, X.-C. Zhang and D.H. Auston. "Propagation Characteristics of Picosecond Electrical Pulses on a Periodically Loaded Coplanar Waveguide." 1991 Transactions on Microwave Theory and Techniques 39.6 (Jun. 1991 [T-MTT]): 930-936.

We have developed a theoretical model to investigate the propagation charcteristics of picosecond electrical pulses on a coplanar waveguide capacitively coupled to periodically spaced sampling channels. Various factors which affect the signal waveform were analyzed in both the frequency and the time domain. The results showed that in addition to modal dispersion, conductor loss, and radiation loss of the electrical signals, multiple reflections among the sampling gaps constitute another feature of the signal transfer along the waveguide. We have measured the picosecond pulse dispersion using the optoelectronic correlation technique. The experimental data were compared with the theoretical results.

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Abstracts

Characterization of Corrugated Waveguides by Modal Analysis

J. Esteban and J.M. Rebollar. "Characterization of Corrugated Waveguides by Modal Analysis." 1991 Transactions on Microwave Theory and Techniques 39.6 (Jun. 1991 [T-MTT]): 937-943.

A general formulation for the characterization of corrugated waveguides is presented. The formulation is based on modal expansion in the different smooth-walled waveguides which constitute the corrugated structure and on the use of mode matching at discontinuities. The use of an admittance matrix formulation and a suitable root-finding algorithm leads to a rigorous and efficient technique. Dispersion curves are presented for corrugated waveguides of circular and rectangular cross sections. As predicted by other authors, complex modes have been obtained for deep corrugations. The effect of the finite thickness and width of teeth and slots on the dispersion behavior is also shown.

Abstracts

Application of the Generalized Spectral-Domain Technique to the Analysis of Rectangular Waveguides with Rectangular and Circular Metal Inserts

A.S. Omar and K.F. Schunemann. "Application of the Generalized Spectral-Domain Technique to the Analysis of Rectangular Waveguides with Rectangular and Circular Metal Inserts." 1991 Transactions on Microwave Theory and Techniques 39.6 (Jun. 1991 [T-MTT]): 944-952.

The generalized spectral-domain (GSD) technique, which was developed and tested for some special cases in [1], is applied to the analysis of rectangular waveguides with rectangular and circular metal inserts. These include conventional ridge waveguides, circular-ridge waveguides, and rectangular coaxial lines with either rectangular or circular inner conductors. The numerical results show that the edge behavior of the electromagnetic field described in [2] is incomplete. A constant term must be added to the expansion of the magnetic field component which is parallel to the edge. Excellent agreement with other publications is achieved, with a drastic reduction of CPU time for the conventional ridge waveguide. The accuracy of the results is demonstrated by two- and three-dimensional plots of the field distributions.

Abstracts

A Weak Form of the Conjugate Gradient FFT Method for Two-Dimensional TE Scattering Problems

P. Zwamborn and P.M. van den Berg. "A Weak Form of the Conjugate Gradient FFT Method for Two-Dimensional TE Scattering Problems." 1991 Transactions on Microwave Theory and Techniques 39.6 (Jun. 1991 [T-MTT]): 953-960.

The problem of two-dimensional scattering of a transversal electric (TE) polarized wave by a dielectric object can be formulated in terms of a hypersingular integral equation, in which a grad-div operator acts on a vector potential. The vector potential is a spatial convolution of the free-space Green's function and the contrast source over the domain of interest. A weak form of the integral equation for the unknown electric flux density is obtained by testing it with rooftop functions. As the next step, the vector potential is expanded in a sequence of the rooftop functions and the grad-div operator is integrated analytically over the dielectric object domain only. This method shows excellent numerical performance.

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A Method for the Analysis of Biaxial Graded-Index Optical Fibers

S.F. Kawalko and P.L.E. Uslenghi. "A Method for the Analysis of Biaxial Graded-Index Optical Fibers." 1991 Transactions on Microwave Theory and Techniques 39.6 (Jun. 1991 [T-MTT]): 961-968.

The problem of wave propagation in a biaxial graded-index fiber with circular symmetry is considered. The problem is formulated in terms of four first-order differential equations for the tangential components of the electric and magnetic fields. A general solution method for solving systems of differential equations is presented. This solution method is then used to solve the system of equations for a particular example of a biaxial graded-index fiber. Numerical results for the propagation constant in the fiber are also given.

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New Synthesis Method for a Branch-Line 3 dB Hybrid: A Hybrid Approach Comprising Planar and Transmission Line Circuit Concepts

T. Anada, J.-P. Hsu and T. Okoshi. "New Synthesis Method for a Branch-Line 3 dB Hybrid: A Hybrid Approach Comprising Planar and Transmission Line Circuit Concepts." 1991 Transactions on Microwave Theory and Techniques 39.6 (Jun. 1991 [T-MTT]): 969-976.

This paper presents a new synthesis method for a stripline-type branch-line 3 dB hybrid based on an equivalent circuit derived by the planar circuit approach. The equivalent circuit of an ideal 3 dB hybrid is derived first from those of the segmented circuit elements, i.e., four three-port junctions and four quarter-wave transmission lines. A systematic synthesis process is then developed upon the basis of the equivalent circuit. Practical hybrid circuits having optimized circuit patterns were constructed for center frequencies of 3, 5, and 7 GHz, and their characteristics were measured. The results agree well with the theory, demonstrating the validity and effectiveness of the proposed synthesis method.

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Novel Microstrip Multifunction Directional Couplers and Filters for Microwave and Millimeter-Wave Applications

S. Uysal and J. Watkins. "Novel Microstrip Multifunction Directional Couplers and Filters for Microwave and Millimeter-Wave Applications." 1991 Transactions on Microwave Theory and Techniques 39.6 (Jun. 1991 [T-MTT]): 977-985.

The design of a new class of microstrip couplers and filters is presented in this paper. The synthesis functions obtained from the solution of first-order nonlinear differential equation of nonuniform lines with a loose coupling assumption are modified and validated for higher coupling values. The design employs a nonuniform coupled line configuration along which a realizable continuous coupling coefficient is obtained by modifiing the reflection coefficient distribution function. This modification results in a frequency selective coupling which minimizes the out-of-band coupling in the specified frequency range. As a result it is possible to realize -3 dB directional couplers using double-coupled lines without the need for tandem connections or extreme photolithographic techniques. Experimental results for microwave band-pass and periodic couplers are presented together with the computed results. Potential applications of these novel components are discussed and the work is extended to include millimeter-wave realization.

Abstracts

A New Multiharmonic Loading Method for Large-Signal Microwave and Millimeter-Wave Transistor Characterization

F.M. Ghannouchi, R. Larose and R.G. Bosisio. "A New Multiharmonic Loading Method for Large-Signal Microwave and Millimeter-Wave Transistor Characterization." 1991 Transactions on Microwave Theory and Techniques 39.6 (Jun. 1991 [T-MTT]): 986-992.

A new multiharmonic loading method for nonlinear microwave and millimeter-wave transistor characterization using six-port techniques is presented. The system allows independent load tuning of an excitation signal and its harmonics. Load-pull measurements on a MESFET have been performed at the fundamental frequency, f/sub 0/, and at the second (2f/sub 0/) and third (3f/sub 0/) harmonics. The results highlight the importance of such measurement in designing and modeling nonlinear devices and circuits. The experimental results were found to be directly applicable for optimizing efficiency and output power in high-power MESFET amplifiers and MESFET frequency multipliers.

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A 22-GHz-Band Low-Noise Down-Converter for Satellite Broadcast Receivers

K. Imai and H. Nakakita. "A 22-GHz-Band Low-Noise Down-Converter for Satellite Broadcast Receivers." 1991 Transactions on Microwave Theory and Techniques 39.6 (Jun. 1991 [T-MTT]): 993-999.

A simple low-cost and high-performance 22 GHz band down-converter is developed for a future direct-to-home satellite broadcasting system. The down-converter consists of a low-noise HEMT preamplifier, an image recovery mixer with a novel structure using dielectric resonator filters, a 21.4 GHz GaAs FET oscillator stabilized by a dielectric resonator, and an IF amplifier. These components are fully integrated using MIC technology into a small size. A total noise figure of less than 2.8 dB is obtained over the 22.5 -23.0 GHz frequency range. The local oscillator achieves a frequency variation of less than 600 kHz/sub p-p/ over a temperature range of -20° to + 60°C.

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Quasi-Optical Power Combining Using Mutually Synchronized Oscillator Arrays

R.A. York and R.C. Compton. "Quasi-Optical Power Combining Using Mutually Synchronized Oscillator Arrays." 1991 Transactions on Microwave Theory and Techniques 39.6 (Jun. 1991 [T-MTT]): 1000-1009.

A quasi-optical method for solid-state power combining is discussed, with application to high-power millimeter-wave generation. The approach uses two-dimensional planar arrays of weakly coupled oscillators. Limiting the strength of the coupling avoids multifrequency moding problems and simplifies the design. A radiating element is embedded in each oscillator so that the power combining is accomplished in free space. The concept has been demonstrated with two prototype arrays, one rising Gunn diodes and the other MESFET's. A theoretical description of the coupled-oscillator arrays is also presented for design purposes, and is used to investigate phasing problems and stability. Experiments indicate that in-phase operation is facilitated by using a quasi-optical reflector element, which influences the operating frequency and coupling between the elements. Equivalent isotropic radiated powers of 22 W at 1% efficiency for a 16-element Gunn array and 10 W at 26% efficiency for a 16-element MESFET array have been obtained at X band.

Abstracts

Cold Tests of Quasi-Optical Gyrotron Resonators (Short Papers)

R.P. Fischer, T.A. Hargreaves and A.W. Fliflet. "Cold Tests of Quasi-Optical Gyrotron Resonators (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.6 (Jun. 1991 [T-MTT]): 1010-1012.

Cold tests are performed on quasi-optical gyrotron resonators at frequencies near 94 and 120 GHz to measure cavity Q. The separation between the resonator mirrors is varied between 0.15 and 0.35 m, with measured quality factors ranging from 10000 to 100000. Good agreement is obtained between the measured data and values calculated from scalar diffraction theory. The effect of misaligning the mirrors is also examined experimentally.

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Frequency-Domain Solution for Coupled Striplines with Crossing Strips (Short Papers)

G.-W. Pan, K.S. Olson and B.K. Gilbert. "Frequency-Domain Solution for Coupled Striplines with Crossing Strips (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.6 (Jun. 1991 [T-MTT]): 1013-1017.

In this paper we present a frequency-domain approach to the modeling of the propagation of short-rise-time digital pulses along groups of coupled striplines which are overcrossed or undercrossed by orthogonally positioned signal conductors on adjacent signal planes in a high-density circuit board or multichip module substrate. Although this "crossing strip problem" has been described previously, most recently in a contribution by Gu and Kong, the solution presented here has several completely new features which are important in the application of this method to real-world modeling problems in the following ways: First, the new solution significantly simplifies the mathematical formulas which sum the multiple reflections and crosstalk components with the primary digital pulse to generate the final waveform conformations on the multiple conductors (four pages of equations in [1] are reduced to only 16 lines). As a result, this method is much easier to implement than earlier techniques, especially as a software kernel for a computer-aided design tool. The method presented here also reduces the central processing unit (CPU) time needed to execute these solutions by a nontrivial factor of 2-3 in comparison with the earlier method presented by Gu and Kong. Second, the new method removes the earlier constraint that the crossing strips on the orthogonal signal layer be uniformly spaced; that is, nonuniformly spaced crossing strips are now supported by the mathematical derivation. Third, the new derivation allows for nonideal (i.e., "real-world") voltage sources, in contrast to methods described previously (e.g. [1]), which have permitted only ideal step and ramp signals to be directly applied to the signal nets.

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Spectral-Domain Analysis of Shielded Microstrip Lines on Biaxially Anisotropic Substrates (Short Papers)

T.Q. Ho and B. Beker. "Spectral-Domain Analysis of Shielded Microstrip Lines on Biaxially Anisotropic Substrates (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.6 (Jun. 1991 [T-MTT]): 1017-1021.

The spectral-domain technique has been extended to the study of shielded microstrip lines on biaxial substrates. The analysis simultaneously includes both dielectric and magnetic anisotropy effects. A fourth-order formulation leads to the determiuation of the approproate Green's function for the structure. The characteristic equation is formed through the application of the Galerkin method to the equations resulting from the boundary conditions on the strip. Numerical results are validated against the data previously published for special isotropic and dielectrically anisotropic cases. New data on the propagation constant of the shielded microstrip with different substrate permittivities and permeabilities are presented to illustrate the effects of the material parameters on the characteristics of the microstrip line.

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Frequency-Dependent Characteristics of Shielded Broadside Coupled Microstrip Lines on Anisotropic Substrates (Short Papers)

T.Q. Ho and B. Beker. "Frequency-Dependent Characteristics of Shielded Broadside Coupled Microstrip Lines on Anisotropic Substrates (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.6 (Jun. 1991 [T-MTT]): 1021-1025.

In this paper, a spectral-domain technique is applied to compute the propagation characteristics of a shielded broadside coupled microstrip line printed on homogeneous uniaxial and biaxial substrates. The formulation derives the Green's functions for even and odd modes of the guiding structure via the transformed fourth-order differential equations. The analysis includes anisotropic substrates which are simultaneously characterized by both [epsilon] and [μ] tensors. This rigorous full-wave approach to the solution of the problem is shown to yield results agreeing well with the existing data. The propagation characteristics are studied with respect to different line width/thickness ratios as well as to the material substrate parameters.

Abstracts

Picosecond Pulse Propagation in Coplanar Waveguide Forward Directional Couplers (Short Papers)

P. Singkornrat and J.A. Buck. "Picosecond Pulse Propagation in Coplanar Waveguide Forward Directional Couplers (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.6 (Jun. 1991 [T-MTT]): 1025-1028.

The spectral domain method is used to calculate the frequency-dependent even- and odd-mode effective dielectric constants of symmetric coplanar waveguide forward directional couplers. Comparisons are made with symmetric microstrip forward couplers on the same substrate that have the same line spacing and access port characteristic impedance. Results indicate that certain coplanar designs will have lower loss and greater bandwidth than the microstrip devices. Picosecond pulse propagation in both structures is studied using the calculated dispersion data.

Abstracts

A Full-Wave Analysis of an Arbitararily Shaped Dielectric Waveguide Using Green's Scalar Identity (Short Papers)

J. Charles, H. Baudrand and D. Bajon. "A Full-Wave Analysis of an Arbitararily Shaped Dielectric Waveguide Using Green's Scalar Identity (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.6 (Jun. 1991 [T-MTT]): 1029-1034.

An integral equation analysis is proposed to determine the phase constant of an arbitrarily shaped dielectric waveguide. The main feature of this approach is the use of Green's scalar identity in which only simple contour integrals have to be evaluated. Different scalar Green's functions are considered to satisfy the boundary conditions for the electric and magnetic fields in each region. This approach is combined with the boundary element technique with linear elements for the computation. The case of the rectangular dielectric image waveguide is first discussed, and numerical results are found to be consistent with other theories and experiments. Also, the cases of hollow rectangular and semicircular image waveguides are analyzed and numerical results are presented.

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Eigenvalues for Ridged and Other Waveguides Containing Corners of Angle 3pi/2 or 2pi by the Finite Element Method (Short Papers)

B. Schiff. "Eigenvalues for Ridged and Other Waveguides Containing Corners of Angle 3pi/2 or 2pi by the Finite Element Method (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.6 (Jun. 1991 [T-MTT]): 1034-1039.

Superelements have been developed to enable the finite element method to be used for computing eigenvalues of the Laplacian over domains containing reentrant corners of angle 3pi/2 or 2pi. The superelements embody mesh refinement and include basis functions which emulate the singular behavior of the solution at the corner. Being compatible with linear or bilinear elements, the superelements are easily incorporated into standard finite element programs. The method has been used to compute TE and TM mode eigenvalues for ridged and other waveguides, and the results agree well with those obtained rising various other methods.

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Characteristic Impedances of Coaxial Structures of Various Cross Section by Conformal Mapping (Short Papers)

E. Costamagna and A. Fanni. "Characteristic Impedances of Coaxial Structures of Various Cross Section by Conformal Mapping (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.6 (Jun. 1991 [T-MTT]): 1040-1043.

In a recent paper, Pan presented numerical results for the characteristic impedance of a large number of coaxial systems with different geometry, and compared them with earlier published results. Here, the recently developed numerical techniques for the inversion of the Schwarz-Christoffel conformal transformation have been used to compare the results presented in [1]. The results agree very well, thus lending further weight to the two calculation techniques discussed in [1] and [2].

Abstracts

A Procedure for Solving the Electric Field Integral Equation for a Dielectric Scatterer with a Large Permittivity Using Face-Centered Node Points (Short Papers)

C.-C. Su. "A Procedure for Solving the Electric Field Integral Equation for a Dielectric Scatterer with a Large Permittivity Using Face-Centered Node Points (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.6 (Jun. 1991 [T-MTT]): 1043-1048.

A numerical procedure for solving the electric field integral equation (EFIE) using the pulse-basis block model is proposed. The main features of the method are the use of face-centered node points and a unique way of choosing the unknown fields. Such a procedure keeps the resulting matrix relatively well conditioned, even when the magnitude of the permittivity is large. In addition, the proposed procedure can preserve the convolution property contained in the EFIE and, hence, the FFT can be incorporated into the algorithm.

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Abstracts

A Dipole Antenna for Interstitial Microwave Hyperthermia (Short Papers)

W. Hurter, F. Reinhold and W.J. Lorenz. "A Dipole Antenna for Interstitial Microwave Hyperthermia (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.6 (Jun. 1991 [T-MTT]): 1048-1054.

An improved interstitial microwave antenna design was investigated in static phantom experiments at 915 MHz, different insertion depths. Compared with conventional interstitial antennas, the dipole microwave antenna presented in this paper shows heating patterns which are concentrated on the dipole irrespective of the insertion depth. By analogy to interstitial radiotherapy, the microwave antenna we have developed thus allows a high concentration of energy in the target volume with as little damage as possible to the healthy surrounding tissue. The undesired heating of healthy tissue along the feeding line observed with conventional interstitial antennas is avoided. A lambda/4 sleeve on the feeding line (which does not radiate microwave energy itself to the surrounding tissue) transforms an open end, i.e., a high impedance at the generator end of the dipole antenna. The current flowing back along the outside of the outer conductor of the feeding line in the direction of the generator is 0 at this point. Both dipole sections thus have the same terminating impedance. Since the lambda/4 sleeve is mounted outside the antenna, its mechanical length is not restricted by the mechanical length of the antenna. It can hence be charged with dielectric materials of low dielectricity constants, e.g. PTFE.

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Abstracts

DC Conduction and Low-Frequency Noise Characteristics of GaAIAs/GaAs Single Heterojunction Bipolar Transistors at Room Temperature and Low Temperatures (Short Papers)

V.K. Raman, C.R. Viswanathan and M.E. Kim. "DC Conduction and Low-Frequency Noise Characteristics of GaAIAs/GaAs Single Heterojunction Bipolar Transistors at Room Temperature and Low Temperatures (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.6 (Jun. 1991 [T-MTT]): 1054-1058.

The dc conduction and low-frequency noise characteristics of GaAIAs/GaAs single heterojunction bipolar transistors (HBT's) have been investigated at room temperature and at temperatures down to 5 K. The I/sub c/ dependence of the current gain has been investigated at various temperatures. The low-frequency noise characteristics exhibit both 1/f and generation-recombination (g-r) components. The noise characteristics are sensitive to changes in base current and insensitive to changes in V/sub ce/, thus suggesting that the noise source is located in the vicinity of the emitter-base heterojunction. The noise spectrum follows a simple model based on minority carrier trapping effects at the heterointerface.

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Abstracts

Design of a Low Phase Distortion GaAs FET Power Limiter (Short Papers)

T. Parra, M. Gayral, O. Llopis, M. Pouysegur, J.F. Sautereau and J. Graffeuil. "Design of a Low Phase Distortion GaAs FET Power Limiter (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.6 (Jun. 1991 [T-MTT]): 1059-1062.

A simple design technique for a GaAs FET limiter exhibiting minimum phase distortion is presented. The key idea in removing phase distotion by selecting an appropriate device and designing a bias circuit is based on the observed properties of the gate barrier under large-signal conditions. Also presented are some illustrative examples and simulation results. The proposed technique is suitable for MMIC design.

Abstracts

An Approach to Microwave Imaging Using a Multiview Moment Method Solution for a Two-Dimensional Infinite Cylinder (Short Papers)

S. Caorsi, G.L. Gragnani and M. Pastorino. "An Approach to Microwave Imaging Using a Multiview Moment Method Solution for a Two-Dimensional Infinite Cylinder (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.6 (Jun. 1991 [T-MTT]): 1062-1067.

An approach based on a multiview solution to the inverse-scattering problem of a two-dimensional infinite cylinder is developed in a space-frequency domain. Microwave imaging is simulated by a computer algorithm using the moment method. To overcome ill-conditioning and solve nonsquare systems, a pseudoinverse transformation is employed. The equivalent current density and the complex conductivity are considered as object functions for image formation. The results of some numerical simulations in a noisy environment are reported, and a discussion of monoview and multiview imaging techniques for a space-frequency domain is presented.

Abstracts

Call for Papers - Process-Oriented Microwave CAD and Modeling (Jun. 1991 [T-MTT])

"Call for Papers - Process-Oriented Microwave CAD and Modeling (Jun. 1991 [T-MTT])." 1991 Transactions on Microwave Theory and Techniques 39.6 (Jun. 1991 [T-MTT]): 1068-1068.

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"Back Cover (Jun. 1991 [T-MTT])." 1991 Transactions on Microwave Theory and Techniques 39.6 (Jun. 1991 [T-MTT]): b1-b2.

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"Front Cover (Jul. 1991 [T-MTT])." 1991 Transactions on Microwave Theory and Techniques 39.7 (Jul. 1991 [T-MTT]): f1-f2.

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Abstracts

Indium Gallium Arsenide Microwave Power Transistors

G.A. Johnson, V.J. Kapoor, M. Shokrani, L.J. Messick, R. Nguyen, R.A. Stall and M.A. McKee. "Indium Gallium Arsenide Microwave Power Transistors." 1991 Transactions on Microwave Theory and Techniques 39.7 (Jul. 1991 [T-MTT]): 1069-1075.

Depletion-mode InGaAs microwave power MISFET's with 1 µm gate lengths and up to 1 mm gate widths have been fabricated using an ion-implanted process. The devices employed a plasma-deposited silicon/silicon dioxide gate insulator. The dc current-voltage (1-V) characteristics and RF power performance at 9.7 GHz are presented. The output power, power-added efficiency, and power gain as a function of input power are reported. An output power of 1.07 W at 9.7 GHz with a corresponding power gain and power-added efficiency of 4.3 dB and 38%, respectively, was obtained. The large-gate-width devices provided over twice the previously reported output power for InGaAs MISFET's at X band. In addition, the first report of RF output power stability of InGaAs MISFET's over a 24 h period is also presented. An output power stability within 1.2% over 24 h of continuous operation was achieved. In addition, a drain current drift of 4% over 10/sub 4/ s was obtained.

Abstracts

Analytically Unified DC/Small-Signal/Large-Signal Circuit Design

J.W. Bandler, R.M. Biernacki, S.H. Chen, J. Song, S. Ye and Q.-J. Zhang. "Analytically Unified DC/Small-Signal/Large-Signal Circuit Design." 1991 Transactions on Microwave Theory and Techniques 39.7 (Jul. 1991 [T-MTT]): 1076-1082.

This paper exploits the inherent analytical relationship between the dc, small-signal, and harmonic balance circuit equations. This provides the basis for unified dc, small-signal, and large-signal analyses using a single nonlinear circuit description. Our approach ensures consistent circuit simulation results and permits simultaneous optimization of dc, small-signal, and large-signal responses with multidimensional specifications. Applying this concept to FET parameter extraction leads to nonlinear device models suitable for both small-signal and large-signal analyses. We also demonstrate simultaneous small-signal and large-signal minimax optimization of an FET broadband amplifier to extend the dynamic operating range.

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Abstracts

Systematic Determination of the Propagation Characteristics of Coplanar Lines on Semiconductor Substrate

P. Pribetich, C. Seguinot and P. Kennis. "Systematic Determination of the Propagation Characteristics of Coplanar Lines on Semiconductor Substrate." 1991 Transactions on Microwave Theory and Techniques 39.7 (Jul. 1991 [T-MTT]): 1083-1089.

A method allowing the systematic determination of the propagation characteristics of micron-size waveguides and overcoming the influence of feeding access discontinuities is presented. The complex propagation constant and characteristic impedance of a slow-wave Schottky contact coplanar line are determined in the 1 to 26 GHz frequency range under different dc bias conditions. Comparisons with transmission line model theoretical results show very good agreement, despite the large slow-wave factor, attenuation, and dispersion of the waveguide. The electric schemes of the feeding access discontinnities are also presented. This measurement technique, which has been tested under extreme conditions, should be easily extended to other transmission line structures.

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Abstracts

On the Modeling of Conductor and Substrate Losses in Multiconductor, Multidielectric Transmission Line Systems

T.R. Arabi, A.T. Murphy, T.K. Sarkar, R.F. Harrington and A.R. Djordjevic. "On the Modeling of Conductor and Substrate Losses in Multiconductor, Multidielectric Transmission Line Systems." 1991 Transactions on Microwave Theory and Techniques 39.7 (Jul. 1991 [T-MTT]): 1090-1097.

Most models used for the analysis of lossy multiconductor, multidielectric transmission line systems are noncausal and fail to predict accurately the signal distortion on practical printed circuits. This paper reviews the method of analysis and assumptions made in these models and presents more accurate models. Finally, to illustrate the theory, numerical examples are presented.

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Abstracts

Surface Wave Excitation from Open Microstrip Discontinuities

W.P. Harokopus, Jr., L.P.B. Katehi, W.Y. Ali-Ahmad and G.M. Rebeiz. "Surface Wave Excitation from Open Microstrip Discontinuities." 1991 Transactions on Microwave Theory and Techniques 39.7 (Jul. 1991 [T-MTT]): 1098-1107.

Radiation properties of open microstrip discontinuities are investigated using a full-wave integral equation technique. The method of moments provides the current distribution over the discontinuity which is used to determine radiation loss. The radiation loss for microstrip bends and stubs is separated into the individual contributions of space and surface wave excitation. Patterns depicting the power propagating in the substrate have been computed and verified experimentally.

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Full-Wave Analysis of Aperture-Coupled Microstrip Lines

N. Herscovici and D.M. Pozar. "Full-Wave Analysis of Aperture-Coupled Microstrip Lines." 1991 Transactions on Microwave Theory and Techniques 39.7 (Jul. 1991 [T-MTT]): 1108-1114.

Two methods are presented for the analysis of aperture-coupled microstrip lines. Assuming a quasi-TEM traveling wave incident on the feeding line, an expression for the wave on the coupled line is derived. First, the moment method is used and the current on the coupled line is represented by a traveling wave propagating away from the slot. In the second method, the reciprocity theorem is applied to the coupled line. An equivalent circuit is derived and the S parameters are computed. Theoretical results are verified with measurements.

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Closed-Form Expressions for the Current Distributions on Open Microstrip Lines

M. Kobayashi and H. Sekine. "Closed-Form Expressions for the Current Distributions on Open Microstrip Lines." 1991 Transactions on Microwave Theory and Techniques 39.7 (Jul. 1991 [T-MTT]): 1115-1119.

An open microstrip line with isotropic dielectric substrate is numerically analyzed by the spectral-domain method to clarify current distributions on a strip conductor. The current distributions obtained are illustrated in figures for typical cases. A full view of current distributions on a strip conductor in any microstrip line is provided by showing those closed-form expressions.

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Complex Images for Electrostatic Field Computation in Multilayered Media

Y.L. Chow, J.J. Yang and G.E. Howard. "Complex Images for Electrostatic Field Computation in Multilayered Media." 1991 Transactions on Microwave Theory and Techniques 39.7 (Jul. 1991 [T-MTT]): 1120-1125.

A rapidly convergent algorithm is presented to find the spatial simulated images of a point charge in multilayered media. The simulated images turn out to be complete i.e., they have complex amplitudes and are located at complex positions. Surprisingly, these complex images give very accurately (error ~ 0.1%) the static field in multilayered media. The examples of two- and three-layered media are examined, together with the available exact image solutions of singly or doubly infinite series. It is believed that the accuracy and rapid convergence of the complex images derive from the extra degrees of freedom arising from the imaginary components of the amplitude and position.

Abstracts

Space-Charge Wave Considerations in MIS Waveguide Analysis

K. Han and T.T.Y. Wong. "Space-Charge Wave Considerations in MIS Waveguide Analysis." 1991 Transactions on Microwave Theory and Techniques 39.7 (Jul. 1991 [T-MTT]): 1126-1132.

A transport-based small-signal analysis of the fundamental mode of propagation in a metal-insulator-semiconductor (MIS) waveguide is presented. The formulation incorporates the full set of Maxwell's equations, the equations of motion of the carriers based on a drift-diffusion model, providing a quantitative description of the space-charge wave induced at the surface of the semiconductor. Effects of an external dc bias on the propagation characteristics are also accounted for. Numerical solutions to the system of equations for a waveguide with typical material parameters, dimensions are obtained using an iterative algorithm. Results indicate that the transverse component of the electric field in the semiconductor is strongly influenced by the screening effect of the charge carriers, whereas the longitudinal component is governed mainly by energy dissipation arising from the conduction current. The presented formulation can also find application for other multilayer structures which support a strong interaction between the electro-magnetic field, the charge carriers.

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An Efficient Finite-Element Formulation without Spurious Modes for Anisotropic Waveguides

I. Bardi and O. Biro. "An Efficient Finite-Element Formulation without Spurious Modes for Anisotropic Waveguides." 1991 Transactions on Microwave Theory and Techniques 39.7 (Jul. 1991 [T-MTT]): 1133-1139.

A numerically efficient finite-element formulation is presented for the analysis of lossless, inhomogeneously loaded, anisotropic waveguides of arbitrary shape. The electromagnetic field is described either by the three components of a magnetic vector potential and an electric scalar potential or by the three components of an electric vector potential and a magnetic scalar potential. The uniqueness of the potentials is ensured by the incorporation of the Coulomb gauge and by proper boundary conditions. Owing to the implementation of the solenoidality condition for the vector potential even in the case of zero wavenumber, no spurious modes appear. Variational expressions suited to the finite-element method are formulated in terms of the potentials. Standard finite-element techniques are employed for the numerical solution, leading to a generalized eigenvalue problem with symmetric, sparse matrices. This is solved by means of the bisection method with the sparsity of the matrices fully utilized. Dielectric- and ferrite-loaded waveguides with closed and open boundaries and including both isotropic and anisotropic materials are presented as examples.

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Abstracts

Low-Loss Optical Branching Waveguides Consisting of Anisotropic Materials

S. Sawa, M. Geshiro and F. Takeda. "Low-Loss Optical Branching Waveguides Consisting of Anisotropic Materials." 1991 Transactions on Microwave Theory and Techniques 39.7 (Jul. 1991 [T-MTT]): 1140-1147.

Low-loss branching waveguides of the mode-conversion type consisting of anisotropic materials are proposed and their basic wave-guiding characteristics are studied by means of coupled-mode theory. Two mode-conversion sections are introduced on both input and output sides of a conventional symmetric branching waveguide. Each arm of the branching waveguides is assumed to be a single-mode slab waveguide except for the tapered section. A coupled-mode system of equations describing mode-conversion phenomena with respect to the TM mode in the branching waveguides is derived from the field expansion in terms of local normal modes. A Runge-Kutta-Gill method is used to numerically solve the coupled-mode equations. It is found that the branching waveguides proposed here suffer mode-conversion losses to a much lesser extent than conventional branching waveguides.

Abstracts

Measurements of All Complex Permeability Tensor Components and the Effective Line Widths of Microwave Ferrites Using Dielectric Ring Resonators

J. Krupka. "Measurements of All Complex Permeability Tensor Components and the Effective Line Widths of Microwave Ferrites Using Dielectric Ring Resonators." 1991 Transactions on Microwave Theory and Techniques 39.7 (Jul. 1991 [T-MTT]): 1148-1157.

A method of measuring all the complex permeability tensor components of microwave ferrites using a single cylindrical ferrite sample is described. Two dielectric ring resonators having the same height and internal diameter but different external diameters, operating on HE/sup ±//sub 111/ and H/sub 011/ modes respectively, are applied for these measurements. Permeability tensor components are computed from the measured resonant frequencies and Q factors of these resonators with and without the ferrite sample. Computations are based on the exact eigenvalue equations for these modes. Measurements of all permeability tensor components versus static magnetic field intensity, performed for different ferrite materials, generally confirm results obtained by earlier researchers but they also contain certain new aspects concerning relations between particular permeability tensor components below saturation.

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Abstracts

Measurement of the Microwave Conductivity of a Polymeric Material with Potential Applications in Absorbers and Shielding

K. Naishadham and P.K. Kadaba. "Measurement of the Microwave Conductivity of a Polymeric Material with Potential Applications in Absorbers and Shielding." 1991 Transactions on Microwave Theory and Techniques 39.7 (Jul. 1991 [T-MTT]): 1158-1164.

The microwave conductivity of a new material, the polymer PBT made conductive by ion-implantation doping with iodine, is measured at 9.89 GHz as a function of temperature using the cavity perturbation technique applicable to thin films of arbitrary shape. The dc and microwave conductivities of PBT are seen to approach asymptotically the low-temperature limit predicted by Mott's energy-dependent hopping model. The potential utilization of conductive polymers in microwave absorbers and EMI shielding is examined.

Abstracts

Propagation of Transients in Dispersive Dielectric Media

M.D. Bui, S.S. Stuchly and G.I. Costache. "Propagation of Transients in Dispersive Dielectric Media." 1991 Transactions on Microwave Theory and Techniques 39.7 (Jul. 1991 [T-MTT]): 1165-1172.

The propagation of transient electromagnetic fields in dispersive dielectric media is studied. The dielectric medium is assumed to be linear, isotropic, and homogeneous and is described by the Debye model. Incident fields are assumed to be TEM plane wave pulses. The dielectric body can assume the form of infinite half space or an infinite circular cylinder, either of which may be homogeneous or stratified. The electric fields induced in the dielectric are calculated from time-domain Maxwell equations using the finite-difference time-domain method, The results of this investigation can be used to study possible biological effects of pulsed electromagnetic fields.

Abstracts

Dielectric-Loaded Lens Applicator for Microwave Hyperthermia

Y. Nikawa and F. Okada. "Dielectric-Loaded Lens Applicator for Microwave Hyperthermia." 1991 Transactions on Microwave Theory and Techniques 39.7 (Jul. 1991 [T-MTT]): 1173-1178.

One characteristic desirable in the hyperthermia treatment of cancer is the ability to achieve deep, localized microwave heating of the human body. A newly developed lens applicator has achieved this through the integration of a waveguide partially filled with dielectric. The heating pattern of the applicator can be controlled by varying the size of the dielectric material. Heating experiments on a model simulating human muscle have shown that an applicator with an aperture of 150 X 100 mm² achieves a maximum heating depth of over 80 mm, results that are well in line with the deep, localized heating required for hyperthermia.

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Abstracts

Optoelectronic Approach to On-Chip Device and Circuit Characterization at Microwave and Millimeter-Wave Frequencies

C. Rauscher. "Optoelectronic Approach to On-Chip Device and Circuit Characterization at Microwave and Millimeter-Wave Frequencies." 1991 Transactions on Microwave Theory and Techniques 39.7 (Jul. 1991 [T-MTT]): 1179-1193.

Scattering parameter measurements performed on semiconductor chip devices and circuits critically depend on the predictability of high-frequency connections between chip and pertinent test equipment. This is of particular concern at high microwave frequencies, and even more so at millimeter wavelengths. The technique to be described here solves the problem through chip-level integration of measurement system front end and device or circuit under test. Arrays of high-speed photoconductive circuit elements, in conjunction with special compensation networks, are thereby utilized to implement, on chip, all signal generation and sampling functions needed to efficiently perform time-domain reflectometry. The acquired time-domain information is then converted into equivalent device-under-test scattering parameter responses. The practicability of the approach is experimentally demonstrated with the help of five individual test structures that are realized in monolithic-integrated circuit format on a GaAs substrate and operate over a full, uninterrupted 100 GHz frequency interval.

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Abstracts

GaAs Nonlinear Transmission Lines for Picosecond Pulse Generation and Millimeter-Wave Sampling

M.J.W. Rodwell, M. Kamegawa, R. Yu, M. Case, E. Carman and K.S. Giboney. "GaAs Nonlinear Transmission Lines for Picosecond Pulse Generation and Millimeter-Wave Sampling." 1991 Transactions on Microwave Theory and Techniques 39.7 (Jul. 1991 [T-MTT]): 1194-1204.

The GaAs nonlinear transmission line (NLTL) is a monolithic millimeter-wave integrated circuit consisting of a high-impedance transmission line loaded by reverse-biased Schottky contacts. Through generation of shock waves on the NLTL, we have generated electrical step functions with ~5 V magnitude and less than 1.4 ps fall time. Diode sampling bridges strobed by NLTL shock-wave generators have attained bandwidths approaching 300 GHz and have applications in instruments for millimeter-wave waveform and network measurements. We discuss the circuit design and diode design requirements for picosecond NLTL shock-wave generators and NLTL-driven sampling circuits.

Abstracts

A Multiline Method of Network Analyzer Calibration

R.B. Marks. "A Multiline Method of Network Analyzer Calibration." 1991 Transactions on Microwave Theory and Techniques 39.7 (Jul. 1991 [T-MTT]): 1205-1215.

This paper presents a new method for the calibration of network analyzers. The essential feature is the use of multiple, redundant transmission line standards. The additional information provided by the redundant standards is used to minimize the effects of random errors, such as those caused by imperfect connector repeatability. The resulting method exhibits improvements in both accuracy and bandwidth over conventional methods. The basis of the statistical treatment is a linearized error analysis of the TRL (thru-reflect-line) calibration method. This analysis, presented here, is useful in the assessment of calibration accuracy. It also yields new results relevant to the choice of standards.

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Wide-Bandwidth Optical Phased Array Based on Remote Coding Configuration (Short Papers)

A.P. Goffer, M. Kam and P.R. Herczfeld. "Wide-Bandwidth Optical Phased Array Based on Remote Coding Configuration (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.7 (Jul. 1991 [T-MTT]): 1216-1219.

Wide-bandwidth weighted array processing requires the weighting function, applied to each element in the array, be a function of the frequency. In many applications this requirement leads to the use of costly and bulky true-time delay (TTD) based weighting devices. In this paper, the equivalence between a filter embodiment and a corretator embodiment of the weighting function is used to show that the remote coding configuration can serve as a correlation embodiment of the weighting function, thus avoiding the need for TTD's in the signal path.

Abstracts

Higher Order Mode Coupling Effects in the Feeding Waveguide of a Planar Slot Array (Short Papers)

S.R. Rengarajan. "Higher Order Mode Coupling Effects in the Feeding Waveguide of a Planar Slot Array (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.7 (Jul. 1991 [T-MTT]): 1219-1223.

Method of moments solutions to pertinent coupled integral equations have been investigated for arrays of coupling slots of the centered-inclined and longitudinal-transverse types between a main waveguide and crossed branch waveguides. It has been demonstrated that, by including the TE/sub 20/ mode coupling in the analysis, most of the higher order mode effects can be accounted for in reduced height waveguides, whereas in waveguides of standard height there may be a small additional effect arising from the TE/sub 01/ mode coupling.

Abstracts

A Uniform Asymptotic Expansion for the Green's Functions Used in Microstrip Calculations (Short Papers)

J.M. Dunn. "A Uniform Asymptotic Expansion for the Green's Functions Used in Microstrip Calculations (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.7 (Jul. 1991 [T-MTT]): 1223-1226.

A uniform asymptotic approximation is developed in the limit of small substrate thickness for the Green's functions used in microstrip-type problems. The approximation is valid for a single-layer substrate. The expansions agree with near and far-field results previously published in the literature. Comparison of the approximation is made with numerical evaluations of the exact integral solution available for the problem.

Abstracts

Efficient Computation of the Free-Space Periodic Green's Function

S. Singh and R. Singh. "Efficient Computation of the Free-Space Periodic Green's Function." 1991 Transactions on Microwave Theory and Techniques 39.7 (Jul. 1991 [T-MTT]): 1226-1229.

The application of Shanks's transform is shown to improve the convergence of the series representing the doubly infinite free-space periodic Green's function. Higher order Shanks transforms are computed via Wynn's epsilon algorithm. Numerical results confirm that a dramatic improvement in the convergence rate is obtained for the "on-plane" case, in which the series converges extremely slowly. In certain instances, the computation time can be reduced by as much as a factor of a few thousands. A relative error measure versus the number of terms taken in the series is plotted for various values of a convergence factor as the observation point is varied within a unit cell. Computation times are also provided.

Abstracts

Capacitance of a Circular Symmetric Model of a Via Hole Including Finite Ground Plane Thickness (Short Papers)

P. Kok and D. De Zutter. "Capacitance of a Circular Symmetric Model of a Via Hole Including Finite Ground Plane Thickness (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.7 (Jul. 1991 [T-MTT]): 1229-1234.

The capacitance of a simplified model of a via hole is calculated based on an integral equation approach for the surface charge density. The finite ground plane thickness is explicitly taken into account. Numerical data are obtained for a large range of realistic geometrical data. The relative importance of the contribution to the total capacitance coming from the ground plane opening is explicitly evaluated. It is found that the via capacitance is proportional to the square root of its height, at least for the range of geometrical data considered in this paper.

Abstracts

Multiangle Method for Temperature Measurement of Biological Tissues by Microwave Radiometry (Short Papers)

J. Montreuil and M. Nachman. "Multiangle Method for Temperature Measurement of Biological Tissues by Microwave Radiometry (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.7 (Jul. 1991 [T-MTT]): 1235-1239.

A new approach for deriving the temperature distribution in biological tissues by microwave radiometry is proposed. It consists in the measurement of the thermal radiation of the body, at a given frequency, as a function of the observation angle, for two mutually orthogonal polarizations. Theoretically, this method yields results comparable to those obtained with the multispectral method. In order to derive the relations between the body temperature and the emitted thermal signal, the biological body is modeled by a set of parallel planar layers, each characterized by constant permittivity and temperature.

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A Cooled 1-2 GHz Balanced HEMT Amplifier (Short Papers)

S. Padin and G.G. Ortiz. "A Cooled 1-2 GHz Balanced HEMT Amplifier (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.7 (Jul. 1991 [T-MTT]): 1239-1243.

The design detains and measurement results for a cooled L-band balanced HEMT amplifier are presented. The amplifier rises commercially available packaged HEMT devices (Fujitsu FHR02FH). At a physical temperature of 12 K the amplifier achieves noise temperatures between 3 and 6 K over the 1 to 2 GHz band. The associated gain is ~20 dB.

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Equivalent-Circuit Parameter Extraction for Cold GaAs MESFET's (Short Papers)

R. Anholt and S. Swirhun. "Equivalent-Circuit Parameter Extraction for Cold GaAs MESFET's (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.7 (Jul. 1991 [T-MTT]): 1243-1247.

The physical basis of the cold-FET method for extracting parasitic resistances and inductances is examined. A method to abtain the source resistance from the gate-current dependence of the FET Z parameters is used to analyze FET's with different gate lengths. Inductance results for FET's with different gate widths suggest that inductance extrinsic to the gate fingers is dominant, and models of the gate inductance support this. The effects that possible dependence of the parasitic-FET equivalent-circuit parameters on the gate and drain bias can have on the extracted intrinsic-FET parameters are discussed.

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Measurernent and Analysis of GaAs MESFET Parasitic Capacitances (Short Papers)

R. Anholt and S. Swirhun. "Measurernent and Analysis of GaAs MESFET Parasitic Capacitances (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.7 (Jul. 1991 [T-MTT]): 1247-1251.

From S-parameter measurements and subsequent equivalent circuit parameter extraction for a series of 0.25 µm, ion-implanted GaAs MESFET's with different widths and different gate-source drain-source spacings, parasitic FET pad capacitances and interelectrode capacitances have been separated from active-FET capacitances. The active-FET fringe capacitances extracted at pinch-off are with results from two-dimensional Poisson simulations.

Abstracts

Formulas Useful for the Synthesis and Optimization of General, Uniform Contradirectional Couplers (Corrections)

K. Sachse. "Formulas Useful for the Synthesis and Optimization of General, Uniform Contradirectional Couplers (Corrections)." 1991 Transactions on Microwave Theory and Techniques 39.7 (Jul. 1991 [T-MTT]): 1252-1252.

In the above paper explicit formulas that allow the evaluation and optimization of a very general class of contradirectional couplers are derived using a Y-parameter matrix given by Tripathi.

Abstracts

The Scattering Parameters and Directional Coupler Analysis of Characteristically Terminated Asymmetric Coupled Transmission Lines in an Inhomogeneous Medium (Corrections)

K. Sachse. "The Scattering Parameters and Directional Coupler Analysis of Characteristically Terminated Asymmetric Coupled Transmission Lines in an Inhomogeneous Medium (Corrections)." 1991 Transactions on Microwave Theory and Techniques 39.7 (Jul. 1991 [T-MTT]): 1252-1252.

Haste in preparing the above paper unfortunately entailed certain errors in equations (3), (6), (l0a), (11), and (12). These consist in either a change of sign or index or omission of terms in the expressions.

Abstracts

Call for Papers - Process-Oriented Microwave CAD and Modeling (Jul. 1991 [T-MTT])

"Call for Papers - Process-Oriented Microwave CAD and Modeling (Jul. 1991 [T-MTT])." 1991 Transactions on Microwave Theory and Techniques 39.7 (Jul. 1991 [T-MTT]): 1255-1255.

Abstracts

European Community 1992 (Advertisement) (July 1991 [T-MTT])

"European Community 1992 (Advertisement) (July 1991 [T-MTT])." 1991 Transactions on Microwave Theory and Techniques 39.7 (Jul. 1991 [T-MTT]): 1256-1256.

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"Back Cover (Jul. 1991 [T-MTT])." 1991 Transactions on Microwave Theory and Techniques 39.7 (Jul. 1991 [T-MTT]): b1-b2.

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"Front Cover (Aug. 1991 [T-MTT])." 1991 Transactions on Microwave Theory and Techniques 39.8 (Aug. 1991 [T-MTT]): f1-f2.

Abstracts

A Wide-Band Monolithic Quasi-Optical Power Meter for Millimeter- and Submillimeter-Wave Applications

C.C. Ling and G.M. Rebeiz. "A Wide-Band Monolithic Quasi-Optical Power Meter for Millimeter- and Submillimeter-Wave Applications." 1991 Transactions on Microwave Theory and Techniques 39.8 (Aug. 1991 [T-MTT]): 1257-1261.

A novel monolithic power meter has been developed for submillimeter-wave applications (100 GHz to 10 THz). The detector is a large-area bismuth bolometer integrated on a 1.2- μm-thick dielectric membrane. This approach results in a wide-band, high-responsivity detector. The power meter is simple to fabricate, inexpensive, and can be easily calibrated using a low-frequency network. Quasi-optical measurements at 90, 140, and 240 GHz show that the bolometer is polarization independent and could be modeled by a simple transmission-line model. Absolute power measurements at 90, 140, and 240 GHz show a ±5% accuracy and agree well with a calibrated Anritsu power meter at 90 GHz. Potential application areas are power calibration, antenna coupling efficiency measurements, and absolute power measurements from solid-state devices and far-infrared lasers at submillimeter wavelengths. Absolute output power measurements on a 220-280 GHz tripler using the quasi-optical power meter are presented as an application example.

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Abstracts

Full-Wave Analysis of Dielectric Waveguides Using Tangential Vector Finite Elements

J.-F. Lee, D.-K. Sun and Z.J. Cendes. "Full-Wave Analysis of Dielectric Waveguides Using Tangential Vector Finite Elements." 1991 Transactions on Microwave Theory and Techniques 39.8 (Aug. 1991 [T-MTT]): 1262-1271.

A new method is presented for the analysis of dielectric waveguides. This method provides four major new contributions: 1) a transformation of variables is introduced that allows propagation constants to be computed directly; 2) H/sub 1/(curl) tangential vector finite elements are applied to dielectric waveguides to obtain reliable approximate electromagnetic fields; 3) the Lanczos algorithm is modified to solve the required generalized eigenmatrix equation efficiently; and 4) the reaction principle is used to provide a posteriori error estimates for use in adaptive mesh refinement. The method described here produces reliable solutions and applies to structures that contain both electric and magnetic inhomogeneities. The answers are refined adaptively to generate waveguide eigenmodes to specified accuracy. Numerical results of an image guide, a microstrip transmission line, and a pedestal-supported stripline are shown. Computed solutions agree very well with the previously published results.

Abstracts

A Rigorous Analytical Solution to Abrupt Dielectric Waveguide Discontinuities

N. Morita. "A Rigorous Analytical Solution to Abrupt Dielectric Waveguide Discontinuities." 1991 Transactions on Microwave Theory and Techniques 39.8 (Aug. 1991 [T-MTT]): 1272-1278.

A simple analytical method is proposed for analyzing transmitted, reflected, and radiated fields in abrupt discontinuities of dielectric waveguides, such as step discontinuities and sharp bends. In this method, approximate transmitted fields, both guided mode fields and radiated fields, are first calculated by assuming the incident field to be the source field on the discontinuity interface. Next, the approximate reflected fields are calculated by assuming the difference field of the incident and approximate transmitted fields to be the source field on the discontinuity interface. Then, the improvements for these approximate transmitted fields and approximate reflected fields are calculated in turns, successively. Only a few successive steps suffice for obtaining rigorous solutions. Numerical examples are presented for step discontinuities and sharp bends of dielectric slab waveguides.

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Abstracts

E-Plane Steps in Rectangular Waveguide

T. Rozzi and M. Mongiardo. "E-Plane Steps in Rectangular Waveguide." 1991 Transactions on Microwave Theory and Techniques 39.8 (Aug. 1991 [T-MTT]): 1279-1288.

In this paper, the classical problem of interacting E-plane step discontinuities is reconsidered. New, frequency-independent equivalent circuits are derived by explicitly considering the edge condition in the rigorous Ritz-Galerkin variational approach. A dramatic reduction of the numerical effort has also been achieved; in fact, in no case were more than two basis functions needed. The theoretical results have been compared with those reported in [1] as well as with experimental tests, always with excellent agreement. The very high accuracy, the reduced numerical effort, and the absence of relative convergence phenomena make this method ideally suited for the full-wave analysis of interacting discontinuities in efficient CAD routines for small desk-top computers.

Abstracts

Three-Dimensional Finite-Element Method with Edge Elements for Electromagnetic Waveguide Discontinuities

K. Ise, K. Inoue and M. Koshiba. "Three-Dimensional Finite-Element Method with Edge Elements for Electromagnetic Waveguide Discontinuities." 1991 Transactions on Microwave Theory and Techniques 39.8 (Aug. 1991 [T-MTT]): 1289-1295.

When three-dimensional electromagnetic problems are solved by the finite-element method based on a functional with three components of electric or magnetic field, spurious solutions appear if the traditional tetrahedral elements are used. This paper shows that the finite-element method using edge elements succeeds in suppressing spurious solutions and moreover that this method succeeds in the analysis of three-dimensional electromagnetic waveguide problems with metal wedges.

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Abstracts

Electromagnetic Field Plot of an Inductive Window by the Moment Method

J.R. Natzke, M.R. Wolski and T.K. Ishii. "Electromagnetic Field Plot of an Inductive Window by the Moment Method." 1991 Transactions on Microwave Theory and Techniques 39.8 (Aug. 1991 [T-MTT]): 1296-1297.

A moment method is used to plot the electromagnetic field of an inductive window in a TE/sub 10/ -mode rectangular waveguide. Green's dyadic functions are derived based on Tai's approach, which is a modified form of Hansen's vector wave functions. Based on the computed electric fields, the S matrix and the equivalent aperture reactance of the waveguide window are calculated. This calculation agrees with the previously published closed-form results of Marcuvitz.

Abstracts

A Single-Period TE/sub 02/ -TE/sub 01/ Mode Converter in a Highly Overmoded Circular Waveguide

M.J. Buckley, D.A. Stein and R.J. Vernon. "A Single-Period TE/sub 02/ -TE/sub 01/ Mode Converter in a Highly Overmoded Circular Waveguide." 1991 Transactions on Microwave Theory and Techniques 39.8 (Aug. 1991 [T-MTT]): 1301-1306.

A single-period 60 GHz TE/sub 02/ -TE/sub 01/ mode converter for use in an electron cyclotron heating (ECH) system for magnetically confined plasmas is presented. The mode converter is very compact and has a broad bandwidth and a theoretical conversion efficiency of 97.6%. A method of computing the reflection from mode converters is presented and used to show that reflection from the single-period mode converter is minimal. Experimental results are consistent with theoretical calculations.

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Abstracts

Evanescent-Mode Coupling of Dual-Mode Rectangular Waveguide Filters

H.-C. Chang and K.A. Zaki. "Evanescent-Mode Coupling of Dual-Mode Rectangular Waveguide Filters." 1991 Transactions on Microwave Theory and Techniques 39.8 (Aug. 1991 [T-MTT]): 1307-1312.

A novel coupling method for dual-mode rectangular waveguide filters is presented and analyzed. Unequal coupling between dual-mode pairs of rectangular cavities is achieved without the need of an iris. This method replaces the iris completely while offering a practical, flexible, and wide range of couplings. Mode matching method is used in the analysis and its accuracy is verified by experiments. A four-pole dual-mode elliptic function filter using this new coupling method is built and tested. Results show excellent agreement with the analysis.

Abstracts

Exact Principal Mode Field for a Lossy Coaxial Line

W.C. Daywitt. "Exact Principal Mode Field for a Lossy Coaxial Line." 1991 Transactions on Microwave Theory and Techniques 39.8 (Aug. 1991 [T-MTT]): 1313-1322.

Exact field equations for a lossy coaxial transmission line with an infinite outer conductor are presented. The corresponding determinantal equation is solved to obtain an exact propagation constant from which errors in the usual microwave approximation and an alternative full frequency range approximation are calculated. The calculations show that the microwave approximation, although containing a large relative error at the lower frequencies, is still useful in practical applications.

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Numerical Modeling of Axisymmetric Coaxial Waveguide Discontinuities

G.M. Wilkins, J.-F. Lee and R. Mittra. "Numerical Modeling of Axisymmetric Coaxial Waveguide Discontinuities." 1991 Transactions on Microwave Theory and Techniques 39.8 (Aug. 1991 [T-MTT]): 1323-1328.

Techniques for determining field behavior in the presence of coaxial-to-coaxial discontinuities are presented for axisymmetric geometries. A bilinear functional is formulated from which field solutions are obtained by way of the finite element method. An absorbing boundary condition is applied at the input and output port boundaries to reduce the size and complexity of the problem. An additional approach, mode matching, is outlined and presented as verification of finite element results. Two geometries are investigated, for which numerical results are presented. A comparative evaluation of the two techniques is included.

Abstracts

Characteristics of Microstrip Transmission Lines with High-Dielectric-Constant Substrates

A.K. Ganguly and C.M. Krowne. "Characteristics of Microstrip Transmission Lines with High-Dielectric-Constant Substrates." 1991 Transactions on Microwave Theory and Techniques 39.8 (Aug. 1991 [T-MTT]): 1329-1337.

An efficient numerical code is developed from a full-wave analysis in the Fourier transform domain to determine the characteristics of a single-strip or multistrip coplanar transmission line. Modes of both even and odd symmetries are included. The impedance of the transmission line is calculated using the power-current equivalent model. Coupling constants between the even and the, odd modes are also calculated. Results are provided for a shielded two-strip coupled microstrip transmission line on high-dielectric-constant substrate such as lanthanum aluminate with applications to superconducting transmission lines.

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A Hybrid Method for the Calculation of the Resistance and Inductance of Transmission Lines with Arbitrary Cross Sections

M.J. Tsuk and J.A. Kong. "A Hybrid Method for the Calculation of the Resistance and Inductance of Transmission Lines with Arbitrary Cross Sections." 1991 Transactions on Microwave Theory and Techniques 39.8 (Aug. 1991 [T-MTT]): 1338-1347.

The frequency-dependent resistance and inductance of uniform transmission lines are calculated with a hybrid technique that combines a cross-section coupled circuit method with a surface integral equation approach. The coupled circuit approach is most applicable for low-frequency calculations, while the integral equation approach is best for high frequencies. The low-frequency method consists in subdividing the cross section of each conductor into triangular filaments, each with an assumed uniform current distribution. The resistance and mutual inductance between the filaments are calculated, and a matrix is inverted to give the overall resistance and inductance of the conductors. The high-frequency method expresses the resistance and inductance of each conductor in terms of the current at the surface of that conductor and the derivative of that current normal to the surface. A coupled integral equation is then derived to relate these quantities through the diffusion equation inside the conductors and Laplace's equation outside. The method of moments with pulse basis functions is used to solve the integral equations. An interpolation between the results of these two methods gives very good results over the entire frequency range, even when few basis functions are used. Results for a variety of configurations are shown and are compared with experimental data and other numerical techniques.

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Hybrid-Mode Analysis of Homogeneously and Inhomogeneously Doped Low-Loss Slow-Wave Coplanar Transmission Lines

K. Wu and R. Valdieck. "Hybrid-Mode Analysis of Homogeneously and Inhomogeneously Doped Low-Loss Slow-Wave Coplanar Transmission Lines." 1991 Transactions on Microwave Theory and Techniques 39.8 (Aug. 1991 [T-MTT]): 1348-1360.

A hybrid-mode analysis is presented to characterize the propagation properties of uniplanar slow-wave MIS coplanar transmission lines. The effect of homogeneous versus gradually inhomogeneous doping profile is investigated as well as the influence of the metal conductor losses and finite metallization thickness on the slow-wave factor and the overall losses. Numerical results indicate that thick-film MIS CPW's can support a slow-wave mode with moderate loss up to 40 GHz when the line dimensions are kept in the micrometer range. Furthermore, it is found that an inhomogeneous doping profile can reduce the overall losses and that the effect of metal conductor losses in heavily doped MIS structures is only marginal. On the other hand, in weakly doped or insulating GaAs material a lossy metal conductor leads to a higher propagation constant exhibiting a negative slope with increasing frequency. The numerical simulation is carried out by using the spectral-domain approach for lines with homogeneously doped semiconductor and the method of lines for the ones with inhomogeneously doped semiconductor, respectively. A self-consistent approach is used to represent lossy metal conductor planes.

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Abstracts

Experimental Analysis of Transmission Line Parameters in High-Speed GaAs Digital Circuit Interconnects

K. Kiziloglu, N. Dagli, G.L. Matthaei and S.I. Long. "Experimental Analysis of Transmission Line Parameters in High-Speed GaAs Digital Circuit Interconnects." 1991 Transactions on Microwave Theory and Techniques 39.8 (Aug. 1991 [T-MTT]): 1361-1367.

Transmission line properties of typical high-speed interconnects are experimentally investigated by fabricating and characterizing coplanar strips on semi-insulating GaAs substrates. The strips have thicknesses of about 2500 Å or 5000 Å and widths of 4, 6, or 8 µm so as to be representative of on-chip interconnects in high-speed GaAs digital circuits. Measurements are carried out up to 18 GHz, and the pertinent line parameters, such as resistance, capacitance per unit length, and characteristic impedance, are extracted using the measured S parameters, The measurement results confirm the quasi-TEM properties of such interconnects. In all cases, the measured distributed capacitance and inductance are insensitive to frequency whereas the resistance is found to increase as much as 38% for the widest and thickest conductors.

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Submicron-Gate InP Power MISFET's with Improved Output Power Density at 18 and 20 GHz

M.D. Biedenbender, V.J. Kapoor, K.A. Shalkhauser, L.J. Messick, R. Nguyen, D. Schmitz and H. Jurgensen. "Submicron-Gate InP Power MISFET's with Improved Output Power Density at 18 and 20 GHz." 1991 Transactions on Microwave Theory and Techniques 39.8 (Aug. 1991 [T-MTT]): 1368-1375.

Presented here are the microwave characteristics at 18 and 20 GHz of submicron-gate iridium phosphide (InP) metal-insulator-semiconductor field-effect transistors (MISFET's) for high output power density applications. InP power MISFET's were fabricated with 0.7 µm gate lengths, 0.2 mm gate widths, and drain-source spacings of 2, 3, and 5 µm. The output power density was investigated as a function of drain-source spacing. The best output power density and gain were obtained for drain-source spacings of 3 µm. At 18 GHz output power densities of 1.59 W/mm with a gain of 3.47 dB and a power-added efficiency of 20% were obtained for a drain-source spacing of 3 µm. At 20 GHz output power densities of 1.20 W/mm with a gain of 3.17 dB and a power-added efficiency of 13.6% were obtained for a drain-source spacing of 3 µm. The output power density is 2.7 times greater than has previously been measured for InP MISFET's at 18 and 20 GHz, and the power-added efficiency has also been increased. The output power density is also 50% better than recently reported for comparable gate width pseudomorphic HEMT's at 20 GHz, The power gain was stable to within 3.0% over 12 h, and the drain current variation during the same time was less than 5%.

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Abstracts

A Vector Approach for Noise Parameter Fitting and Selection of Source Admittances

J.M. O'Callaghan and J.P. Mondal. "A Vector Approach for Noise Parameter Fitting and Selection of Source Admittances." 1991 Transactions on Microwave Theory and Techniques 39.8 (Aug. 1991 [T-MTT]): 1376-1382.

Simple vector concepts can be used to determine noise parameters from measured data. The use of such concepts leads to a simplification in the least-square fitting algorithm, complete determination of the admittance loci that produce ill conditioning, and simple criteria for the selection of source admittances that minimize the sensitivity of the noise parameters to experimental error. The sensitivity of the noise parameters to small perturbations in the reflection coefficients is compared for a group of source admittances selected with the techniques described here and a group of admittances presented in a previous work. The results show that a great reduction in the error of the noise parameters can be achieved by properly selecting the source admittances.

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Gain Partitioning: A New Approach for Analyzing the High-Frequency Performance of Compound Semiconductor FET's

H.-O. Vickes. "Gain Partitioning: A New Approach for Analyzing the High-Frequency Performance of Compound Semiconductor FET's." 1991 Transactions on Microwave Theory and Techniques 39.8 (Aug. 1991 [T-MTT]): 1383-1390.

A new approach for analyzing the high-frequency performance of compound semiconductor FET's is presented. The approach is based on a circuit description that separates intrinsic and parasitic circuit elements of active devices in a general way. Mason's gain (U) and current gain (A/sub i/) have been used to illustrate this approach, since their unity gain frequencies, f/sub max/ and f/sub tau/, respectively, are good indicators of high-frequency performance. Significant results from U have been related to a more commonly used nomenclature involving maximum stable gain (MSG) and maximum available gain (MAG) and, in particular, to the transition from a potentially unstable device to a potentially stable device. Results presented here show that tlhe requirements to maximize these cutoff frequencies are different. Minimized parasitic circuit elements maximize f/sub tau/. A maximized f/sub max/, on the contrary, may be obtained if interactions of parasitic and intrinsic circuit elements satisfy certain conditions. The method presented here should be used in conjunction with software that can specify the physical structure required to realize those circuit elements.

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Abstracts

Determination of the Steady State of an Oscillator by a Combined Time-Frequency Method

M.H. Schwab. "Determination of the Steady State of an Oscillator by a Combined Time-Frequency Method." 1991 Transactions on Microwave Theory and Techniques 39.8 (Aug. 1991 [T-MTT]): 1391-1402.

This paper presents a new method for the computation of the steady state of nonlinear oscillators including distributed elements which exploits advantages of both time-domaiin and frequency-domain simulation. The oscillator network is divided into a linear subnetwork described by a hybrid matrix in the frequency domain and a nonlinear subnetwork represented by a set of first-order nonlinear differential equations solved in the time-domain. The periodic steady state of the oscillator is shown to be equivalent to the solution of a boundary value problem, where the boundary conditions are given at a set of points along the time axis. For the solution of the boundary value problem the multiple shooting algorithm is applied, which may be modified in a very effective way owing to the special structure of the boundary value problem. It will be shown that the bandwidth in the nonlinear subnetwork can be, chosen arbitrarily high regardless of the number of harmonics at the ports connecting the subnetworks. An error estimate for the neglected harmonics at the ports is derived, which does not require additional numerical effort. In order to demonstrate the feasibility of the method and to discuss the error mechanisms it is applied to two examples: a Clapp oscillator including a piecewise-linear characteristic and an integrated GaAs MESFET oscillator at 10.7 GHz.

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Abstracts

State-Space Analysis of the Quantum-Well Injection Transit Time Diode

D.R. Conn and P.D. Bauman. "State-Space Analysis of the Quantum-Well Injection Transit Time Diode." 1991 Transactions on Microwave Theory and Techniques 39.8 (Aug. 1991 [T-MTT]): 1403-1412.

A state-space linear model of the quantum-well injection transit time (QWITT) diode is developed in this paper. The resulting system of equations are suitable for time- and frequency-domain analysis of the QWITT diode with its external circuit, and since the eigenvalues (complex resonant frequencies) are an integral part of the formulation, the method is extremely useful for the design of oscillator circuits and for the study of stability problems that are associated with supplying bias to the diode. The model includes the effects of velocity overshoot and carrier diffusivity, as well as the physical geometry of the devices being studied. It is tested by comparing the predicted small-signal impedance with other well-known models for similar devices. Using state-space analysis, it is predicted that long diodes with a positive injection conductance will not have an input impedance with a negative real part at any frequency.

Abstracts

A Simple Analysis of Single- and Double-V-Groove Guides (Short Papers)

S.-F. Li, Z.-X. Shen and X.-M. Lou. "A Simple Analysis of Single- and Double-V-Groove Guides (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.8 (Aug. 1991 [T-MTT]): 1413-1416.

Single- and double-V-groove guides are analyzed by an approach based on a combination of the transverse resonance method and the numerical integration technique. Comparisons between the predicted results and available measured results for a single-V-groove guide show good agreement. The new approach is simple and accurate. Numerical results for the coupling characteristics of a double-V-groove guide are also presented.

Abstracts

Correct Determination of TE and TM Cutoff Wavenumbers in Transmission Lines with Circular Outer Conductors and Eccentric Circular Inner Conductors (Short Papers)

L. Zhang, J. Zhang and W. Wang. "Correct Determination of TE and TM Cutoff Wavenumbers in Transmission Lines with Circular Outer Conductors and Eccentric Circular Inner Conductors (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.8 (Aug. 1991 [T-MTT]): 1416-1420.

The cutoff wavenumbers of TE and TM modes (higher order modes) in transmission lines with circular outer conductors and eccentric circular inner conductors are carefully evaluated. The correctness of Kuttler's bounds is confirmed and the reason why some of the values obtained lie outside the bounds and some of the modes could not be found in Vishen's paper is given. A reliable technique for accurately determining the roots of an analytical function is proposed for finding cutoff wavenumbers in such a way as to avoid missing any modes.

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Abstracts

An Efficient Algorithm for Transmission Line Matrix Analysis of Electromagnetic Problems Using the Symmetrical Condensed Node (Short Papers)

C.-Y.E. Tong and Y. Fujino. "An Efficient Algorithm for Transmission Line Matrix Analysis of Electromagnetic Problems Using the Symmetrical Condensed Node (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.8 (Aug. 1991 [T-MTT]): 1420-1424.

The symmetrical condensed TLM node has been closely examined. An efficient algorithm has been developed from the results of this study which significantly improves the numerical efficiency of the node. Certain physical aspects of the symmetrical condensed node are also discussed.

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Abstracts

Field Distribution in a Circular Waveguide with a Corrugated Dielectric Lining (Short Papers)

T.C. Rao and P. McCormack. "Field Distribution in a Circular Waveguide with a Corrugated Dielectric Lining (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.8 (Aug. 1991 [T-MTT]): 1424-1426.

The problem of wave propagation through a circular cylinder with a periodically interrupted dielectric lining is solved by a boundary value approach by considering the region between the corrugations as a medium with a tensor permittivity. The characteristic equation for the phase constant is derived by matching the field components. Solutions for the phase constant are obtained and the variation of the phase constant with the physical parameters is studied. The variation of the axial and circumferential electric field components in the transverse plane is also studied.

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Asymmetrical Coplanar Waveguide with Finite Metallization Thickness Containing Anisotropic Media (Short Papers)

T. Kitazawa and T. Itoh. "Asymmetrical Coplanar Waveguide with Finite Metallization Thickness Containing Anisotropic Media (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.8 (Aug. 1991 [T-MTT]): 1426-1433.

The spectral-domain approach (SDA) is extended in the present paper for symmetrical and asymmetrical coplanar waveguides with anisotropic media. The quasi-static and the hybrid-mode analytical method are developed in the spectral domain taking the metallization thickness effect into consideration. Numerical computations include the quasi-static and frequency-dependent hybrid-mode values of the phase constants and characteristic impedances for the symmetrical and asymmetrical CPW's and the metallization thickness effects in CPW's. Increased metallization thickness significantly reduces the nonreciprocal properties in CPW with magnetized ferrite and additional dielectric layers.

Abstracts

Quasi-Static Analysis of Three-Line Microstrip Symmetrical Coupler on Anisotropic Substrates (Short Papers)

L. Yu and B. Rawat. "Quasi-Static Analysis of Three-Line Microstrip Symmetrical Coupler on Anisotropic Substrates (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.8 (Aug. 1991 [T-MTT]): 1433-1437.

A method for analyzing the three symmetrically coupled microstrip lines on an anisotropic substrate has been developed. Computer programs based on the method of moments have been employed and the coupler mode impedance, Z, coupling constant, K, and phase velocity, v, as functions of the anisotropy ratio, epsilon/sub xx//epsilon/sub yy/, have been obtained.

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Abstracts

A Recombinant, In-Phase Power Divider (Short Papers)

M.E. Goldfarb. "A Recombinant, In-Phase Power Divider (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.8 (Aug. 1991 [T-MTT]): 1438-1440.

A new topology for a planar power divider suitable for realization using conventional microstrip fabrication techniques is described. This divider is capable of exciting an odd number of output ports with either equal or unequal power division. The recombinant approach produces bandwidth comparable to that of other techniques with fewer and more easily realized elements. Design equations and an example implementation are discussed. Measured data for an octave-bandwidth, three-way power divider at 10 GHz are presented.

Abstracts

Gaussian Beam Representation of Aperture Fields in Layered, Lossy Media Simulation and Experiment (Comments and Reply)

P.S. Neelakanta, M.L.D. Lumori, J.B. Andersen, M.K. Gopal and T.C. Cetas. "Gaussian Beam Representation of Aperture Fields in Layered, Lossy Media Simulation and Experiment (Comments and Reply)." 1991 Transactions on Microwave Theory and Techniques 39.8 (Aug. 1991 [T-MTT]): 1441-1442.

In the above paper, the authors address the three-dimensional Gaussian-beam representation of an aperture-source-excited, linearly polarized electromagnetic wave propagating in a layered lossy medium and apply the relevant concept(s) to elucidate the power absorption in biological media. However, the basis of such representation, as applied to partial-body electromagnetic/microwave irradiation of biological media, is not new. The author of this communication had indicated in [1]-[12] a generalized Gaussian-Laguerre mode model of the emergent field from an aperture. He also indicated in [13]-[15] the partial-body, Gaussian-beam exposure strategies as applied to biological surfaces in determining the complex permittivity of a multilayered lossy medium such as the human skull (in vitro) and the medial palmar space (in vivo).

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Call for Papers - Process-Oriented Microwave CAD and Modeling (Aug. 1991 [T-MTT])

"Call for Papers - Process-Oriented Microwave CAD and Modeling (Aug. 1991 [T-MTT])." 1991 Transactions on Microwave Theory and Techniques 39.8 (Aug. 1991 [T-MTT]): 1443-1443.

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IEEE Interactive Learning Programs (Advertisement) (Aug. 1991 [T-MTT])

"IEEE Interactive Learning Programs (Advertisement) (Aug. 1991 [T-MTT])." 1991 Transactions on Microwave Theory and Techniques 39.8 (Aug. 1991 [T-MTT]): 1444-1444.

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Guest Editorial (Sep. 1991 [T-MTT])

P.H. Carr and B.R. McAvoy. "Guest Editorial (Sep. 1991 [T-MTT])." 1991 Transactions on Microwave Theory and Techniques 39.9 (Sep. 1991 [T-MTT] (Special Issue on Microwave Applications of Superconductivity)): 1445-1447.

The Nobel-prize-winning discovery in 1987 of cuprate-based superconductors, which led to materials such as YBCO with transition temperatures above that of liquid nitrogen, sparked a worldwide research and development effort. Four years later, this special issue shows that the first applications of high-temperature superconductors are in filters and antennas. The 19 papers came from four different countries. Many of the components described in this issue will be tested in the Navy's High-Temperature Superconductivity Space Experiment, scheduled for launch in late 1992. This experiment should demonstrate that this new technology is sufficiently robust to survive the space environment and can significantly improve electronic systems.

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Low- and High-Temperature Superconducting Microwave Filters

S.H. Talisa, M.A. Janocko, C. Moskowitz, J. Talvacchio, J.F. Billing, R. Brown, D.C. Buck, C.K. Jones, B.R. McAvoy, G.R. Wagner and D.H. Watt. "Low- and High-Temperature Superconducting Microwave Filters." 1991 Transactions on Microwave Theory and Techniques 39.9 (Sep. 1991 [T-MTT] (Special Issue on Microwave Applications of Superconductivity)): 1448-1454.

Stripline and microstrip filters at X-band were designed and fabricated using low- and high-temperature super-conductors in quarter-wave, parallel-coupled section configurations. Low-temperature superconducting niobium thin films, deposited on single-crystal sapphire, were used to build two six-pole stripline filters with adjacent passbands and approximately 3 dB crossovers and 1.2% bandwidth. Four- and six-pole microstrip filters were made with in situ epitaxial YBa/sub 2/Cu/sub 3/O/sub 7/ (YBCO) films on LaAlO/sub 3/ substrates. All the YBCO filters showed 77 K passbands with clean skirts and high out-of-band rejection. The YBCO six-pole filters were made after some initial technology developments, together with a reasonably high degree of repeatability, were established with the fabrication of eight working four-pole filters. The six-pole filters had adjacent passbands with -28 dB crossovers and 1.5% bandwidth. The results obtained show the potential of high-temperature superconductors for filters with narrow bandwidths and low insertion losses. Furthermore, they show a very rapid rate of development of superconducting filter technology, leading to system demonstrations and subsequent production in the near future.

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Design and Performance of a High-T/sub c/ Superconductor Coplanar Waveguide Filter

W. Chew, A.L. Riley, D.L. Rascoe, B.D. Hunt, M.C. Foote, T.W. Cooley and L.J. Bajuk. "Design and Performance of a High-T/sub c/ Superconductor Coplanar Waveguide Filter." 1991 Transactions on Microwave Theory and Techniques 39.9 (Sep. 1991 [T-MTT] (Special Issue on Microwave Applications of Superconductivity)): 1455-1461.

Coplanar waveguide is a convenient structure for microwave circuits using high-critical-temperature superconductor thin films. The design of a coplanar waveguide low-pass filter made of YBa/sub 2/Cu/sub 3/O/sub 7-delta/ (YBCO) on an LaAlO/sub 3/ substrate is described. Measurements were incorporated into simple models for microwave CAD analysis to develop a final design. The patterned and packaged coplanar waveguide low-pass filter of YBCO, with dimensions suited for integrated circuits, exhibited measured insertion losses when cooled in liquid nitrogen superior to those of a similarly cooled thin-film copper filter throughout the 0 to 9.5 GHz passband, Coplanar waveguide models for use with thin-film normal metal (with thickness either greater or less than the skin depth) and YBCO are discussed and used to compare the losses of the measured YBCO and copper circuits.

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5 GHz High-Temperature-Superconductor Resonators with High Q and Low Power Dependence up to 90 K

C. Wilker, Z.-Y. Shen, P. Pang, D.W. Face, W.L. Holstein, A.L. Matthews and D.B. Laubacher. "5 GHz High-Temperature-Superconductor Resonators with High Q and Low Power Dependence up to 90 K." 1991 Transactions on Microwave Theory and Techniques 39.9 (Sep. 1991 [T-MTT] (Special Issue on Microwave Applications of Superconductivity)): 1462-1467.

We have fabricated high-temperature superconducting films made of TIBaCaCuO (2212) and YBaCuO (123) by postdeposition annealing techniques on (100) LaAlO/sub 3/ substrates. These films, especially the TIBaCaCuO (2212), exhibit a unique combination of microwave properties: high temperature operation, high Q (low surface resistance), and low power dependence. Both types of films have measured surface resistances which are better than 1/10 that of copper at 20 GHz. (These low surface resistance values are realized below 98 K for TIBaCaCuO (2212) and below 84 K for YBaCuO (123).) Micrcrostrip resonators with a fundamental resonance frequency of 5 GHz were fabricated from these materials. The performance of our best resonator at 90 K (loaded Q >20000 at 5 GHz) was 50 times better than an analogous copper resonator (also measured at 90 K) and can handle more than 10 W of peak power in the resonator with only a small degradation of the Q. In addition, the shift of the resonator frequencies with temperature was fit to a two-fluid model. The parameters for TIBaCaCuO (2212) were T/sub c/ = 101.0 K and lambda/sub 0/ = 4700 Å and for YBaCuO (123) were T/sub c/= 91.1 K and lambda/sub 0/= 6800 Å.

Abstracts

Comparison of High-Temperature-Superconductor and Metal-Based Resonators

M.R. Namordi, A. Mogro-Campero, L.G. Turner and D.W. Hogue. "Comparison of High-Temperature-Superconductor and Metal-Based Resonators." 1991 Transactions on Microwave Theory and Techniques 39.9 (Sep. 1991 [T-MTT] (Special Issue on Microwave Applications of Superconductivity)): 1468-1474.

A 50 Omega coplanar waveguide (CPW) resonator designed for a fundamental frequency of about 4.75 GHz was fabricated on LaAlO/sub 3/. Two versions were fabricated the first using 1.9- µm-thick gold and the second using a high-temperature superconductor (HTS), YBa/sub 2/Cu/sub 3/O/sub 7/, 0.6 µm thick. The devices were identically packaged and tested at 77 K. It was found that the HTS resonator had a surface resistance, R/sub s/, about six to nine times lower than the Au one. At 45 K, the R/sub s/, of the HTS resonator decreases by another factor of 4 compared with its 77 K value. For the HTS resonator, (i) R/sub s/ varies as f² and (ii) R/sub s/, degrades with resonator power density as the RF current density, J/sub c/, approaches typical dc measured values. Five identical HTS resonators were fabricated. At 77 K, mean and standard deviations on R/sub s/, were µ = 1.42 and sigma = 0.46 m Omega /sq., respectively. The measured sigma/µ ratio of 0.3% on the fundamental suggests that narrow passband filters can readily be implemented.

Abstracts

Measured Performance at 77 K of Superconducting Microstrip Resonators and Filters

M.S. Schmidt, R.J. Forse, R.B. Hammond, M.M. Eddy and W.L. Olson. "Measured Performance at 77 K of Superconducting Microstrip Resonators and Filters." 1991 Transactions on Microwave Theory and Techniques 39.9 (Sep. 1991 [T-MTT] (Special Issue on Microwave Applications of Superconductivity)): 1475-1479.

Results on three types of passive microwave devices fabricated and tested using epitaxial thin films of Tl/sub 2/CaBa/sub 2/Cu/sub 2/O/sub 8/ grown on LaAIO/sub 3/ are reported. A microstrip ring resonator with unloaded Q of 2740 at 77 K and 33 GHz is described. A superconducting 4.6 GHz band-reject filter with unloaded Q greater than 15000 when operated at 77 K is reported. In addition, results on a multipole microstrip bandpass filter are presented.

Abstracts

YBCO Superconducting Ring Resonators Millimeter-Wave Frequencies

C.M. Chorey, K.-S. Kong, K.B. Bhasin, J.D. Warner and T. Itoh. "YBCO Superconducting Ring Resonators Millimeter-Wave Frequencies." 1991 Transactions on Microwave Theory and Techniques 39.9 (Sep. 1991 [T-MTT] (Special Issue on Microwave Applications of Superconductivity)): 1480-1487.

Superconducting microstrip ring resonators operating at 35 GHz have been fabricated from laser ablated YBa/sub 2/Cu/sub 3/O/sub 7-x/ (YBCO) films on lanthanum aluminate substrates. The circuits consist of superconducting strips over normal metal ground planes. The circuits are measured from 20 K to 90 K and with microwave input powers ranging from 0.25 mW to 10 mW. The superconducting resonators show significant improvement in Q (six to seven times higher) over identical gold resonators at 20 K, but only marginal improvement at 77 K. No variation in the superconductor performance is observed with varying input power. Using a microstrip loss model, the microwave surface resistance of the superconductors is extracted; the lowest value obtained at 77 K is 9 m Omega. The change in the resonant frequency with temperature is analyzed and a value for the penetration depth computed. "Double resonances" observed in some superconducting ring resonators are described and an explanation for their presence advanced. Factors limiting millimeterwave high-temperature superconductor circuits are explored and potential performance levels calculated based on current reported values for high-temperature superconductor surface resistances.

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Superconducting Millimeter-Wave E-Plane Filters

R.R. Mansour and A. Zybura. "Superconducting Millimeter-Wave E-Plane Filters." 1991 Transactions on Microwave Theory and Techniques 39.9 (Sep. 1991 [T-MTT] (Special Issue on Microwave Applications of Superconductivity)): 1488-1492.

In this paper, we report the measured performance of a three-pole E-plane filter constructed from high-T/sub c/ superconducting bulk materials at 34.5 GHz. Experimental results are presented for the insertion loss and return loss of the filter at 77 K. The problems associated with the use of bulk materials at the millimeter-wave range are addressed. Other possible superconducting waveguide filter configurations are proposed. While the experimental results are taken at low input power level, the current distribution inside the filter structure is calculated, and the power handling capability of the superconducting filter is discussed.

Abstracts

Quasi-Optical Millimeter-Wave Band-Pass Filters Using High-T/sub c/ Superconductors

D. Zhang, M. Matloubian, T.W. Kim, H.R. Fetterman, K. Chou, S. Prakash, C.V. Deshpandey, R.F. Bunshah and K. Daly. "Quasi-Optical Millimeter-Wave Band-Pass Filters Using High-T/sub c/ Superconductors." 1991 Transactions on Microwave Theory and Techniques 39.9 (Sep. 1991 [T-MTT] (Special Issue on Microwave Applications of Superconductivity)): 1493-1497.

Quasi-optical millimeter-wave band-pass filters using YBa/sub 2/Cu/sub 3/O/sub 7/, high- T/sub c/ superconducting films were fabricated on MgO and LaAlO/sub 3/ substrates. Transmitted power through the filter was investigated in the 75 GHz to 110 GHz frequency range at temperatures ranging from 15 to 300 K. At 15 K the measured center frequency and the bandwidth of the superconducting filter were 92 GHz and 0.85 GHz respectively. Measurements of YBa/sub 2/Cu/sub 3/O/sub 7/ filters were compared with similar filters fabricated using gold. At 15 K and 92 GHz, an improvement of 75% in the quality factor of the superconducting filter was obtained compared with a similar gold filter. At lower frequencies, it is expected that such superconducting filters will offer more than an order of magnitude improvement in Q factor over gold filters because of the frequency-squared dependence of the surface resistance versus the gold filter, which has a frequency to the one half dependent surface resistivity. This is the first experimental observation that high-T/sub c/ superconductors can be used as quasi-optical, high-performance, frequency selective surfaces.

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A Survey of Possible Passive Antenna Applications of High-Temperature Superconductors

R.J. Dinger, D.R. Bowling and A.M. Martin. "A Survey of Possible Passive Antenna Applications of High-Temperature Superconductors." 1991 Transactions on Microwave Theory and Techniques 39.9 (Sep. 1991 [T-MTT] (Special Issue on Microwave Applications of Superconductivity)): 1498-1507.

A survey of possible applications of high-temperature superconductors (HTS's) to antennas and antenna feed networks is presented. The frequency range of consideration is 1 MHz to 100 GHz. Three antenna application areas seem appropriate for HTS material: electrically small antennas and their matching networks; feed and matching networks for compact arrays with enhanced directive gain (superdirective arrays); and feed networks for millimeter-wave arrays. Preliminary experimental results are presented on YBaCnO and TIBaCaCnO 500 MHz half-loop antennas that show an increase in radiation efficiency (compared with a copper antenna at the same temperature) by a factor of 5 for the HTS antennas.

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Antenna Applications of Superconductors

R.C. Hansen. "Antenna Applications of Superconductors." 1991 Transactions on Microwave Theory and Techniques 39.9 (Sep. 1991 [T-MTT] (Special Issue on Microwave Applications of Superconductivity)): 1508-1512.

The applicability of superconductors to antennas is examined. Potential implementations that are examined are superdirective arrays; electrically small antennas; tuning and matching of these two; high-gain millimeter-wavelength arrays; and kinetic inductance slow wave structures for array phasers and traveling wave array feeds. Superdirective arrays and small antennas will not benefit directly, but their tuning/matching networks will undergo major improvements. Miniaturization of antennas will not be aided, but much higher gain millimeter-wave arrays will be realizable. Finally, kinetic inductance slow wave lines appear advantageous for array phasers and time delay, as well as for traveling wave array feeds.

Abstracts

Miniaturized High-Temperature Superconductor Microstrip Patch Antenna

H. Chaloupka, N. Klein, M. Peiniger, H. Piel, A. Pischke and G. Splitt. "Miniaturized High-Temperature Superconductor Microstrip Patch Antenna." 1991 Transactions on Microwave Theory and Techniques 39.9 (Sep. 1991 [T-MTT] (Special Issue on Microwave Applications of Superconductivity)): 1513-1521.

This paper presents experimental as well as computational results for 2.4 GHz microstrip antennas which are miniaturized (total length, 6 mm) by both a, new, "stepped impedance" patch shape and a relatively high substrate permittivity. The investigated antennas were fabricated from YBa/sub 2/Cu/sub 3/O/sub 7-delta/ thin films epitaxially grown on single-crystalline LaAlO/sub 3/ substrates by pulsed excimer laser ablation or by high-pressure oxygen dc sputtering and, for comparison, from copper on the same substrate material. It is shown that the radiation efficiency of this antenna structure is only about 1% to 6% (depending on the substrate height) for copper at 77 K but is increased to values between 35% and 65% for HTS films. In the latter case, considerable improvements could be obtained if a substrate compatible with a high-temperature superconductor with a lower loss tangent were available. From experimental investigations of the power dependence of the antenna gain at 77 K nonlinearities, especially a sharp drop at a current density of about 2·10/sup 6/ A/cm/sub 2/ were observed.

Abstracts

Stripline Resonator Measurements of Z/sub s/ Versus H/sub rf/ in YBa/sub 2/Cu/sub 3/O/sub 7-x/ Thin Films

D.E. Oates, A.C. Anderson, D.M. Sheen and S.M. Ali. "Stripline Resonator Measurements of Z/sub s/ Versus H/sub rf/ in YBa/sub 2/Cu/sub 3/O/sub 7-x/ Thin Films." 1991 Transactions on Microwave Theory and Techniques 39.9 (Sep. 1991 [T-MTT] (Special Issue on Microwave Applications of Superconductivity)): 1522-1529.

We report measurements of the surface impedance, Z/sub S/, of YBa/sub 2/Cu/sub 3/ O/sub 7-x/. thin films using a stripline resonator. The films were deposited on LaAlO/sub 3/ substrates by off-axis magnetron sputtering. We obtained Z/sub s/ as a function of frequency from 1.5 to 20 GHz, as a function of temperature from 4 K to the transition temperature (~90 K), and as a function of the RF magnetic field from zero to 300 Oe. At low temperatures the surface resistance, R/sub S/, of the films shows a very weak dependence on the magnetic field up to 225 to 250 Oe. At 77 K, R/sub S/ is proportional to the square of the field. The penetration depth shows a much weaker dependence on the field than does R/sub S/. At 1.5 GHz the surface resistance of the best films is 2 X 10/sup -6/ Omega at 4 K and 8 X 10/sup -6/ Omega at 77 K. We also discuss the origins of the magnetic field dependence of Z/sub S/.

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Microwave Measurement of Temperature and Current Dependence of Surface Impedance for High-T/sub c/ Superconductors

Y. Kobayashi, T. Imai and H. Kayano. "Microwave Measurement of Temperature and Current Dependence of Surface Impedance for High-T/sub c/ Superconductors." 1991 Transactions on Microwave Theory and Techniques 39.9 (Sep. 1991 [T-MTT] (Special Issue on Microwave Applications of Superconductivity)): 1530-1538.

Perturbation formulas for TE/sub 011/ mode dielectric rod resonator and for a TE/sub 011/ mode circular cavity resonator are derived to determine the surface impedance Z/sub s/(= R/sub s/ + jX/sub s/) of superconductors from measured values of resonant frequencies and unloaded Q. Also, the relation between the maximum surface current density of a superconductor, J/sub s/ (A/m), and output power from a signal generator P/sub O/ (W), is derived. On the basis of these analytical results, a measurement technique is proposed to evaluate the temperature and J/sub s/ dependences of Z/sub s/ for superconductors. The measured results of the temperature dependence of Z/sub s/ for YBCO and copper plates, which are obtained from the f/sub 0/ and Q/sub u/ values measured for the dielectric resonator and for the cavity resonator, are presented. From these results, it is verified that the dielectric resonator is suitable for measuring X/sub s/ for YBCO. Furthermore, from these Z/sub s/ values the temperature dependence of the skin depth delta and the penetration depth lambda, and those of the complex conductivity sigma/sub r/ - j sigma/sub i/ are obtained on the basis of the two-fluid model. These measured values agree well with the theoretical curves calculated by introducing the concept of the residual normal state conductivity sigma/sub res/ into sigma/sub r/. From the J/sub s/ dependence of Z/sub s/ measured for the YBCO and copper plates, it is shown that the R/sub s/ of copper does not depend on J/sub s/, that the value for YBCO has a strong J/sub s/ dependence, and that X/sub s/ of YBCO has little dependence on J/sub s/. It is verified that a dielectric resonator is preferred for measuring the J/sub s/ dependence of Z/sub s/, because of energy concentration, compared with a cavity resonator.

Abstracts

Absorption at High Microwave Power by Large-Area TI-Based Superconducting Films on Metallic Substrates

D.W. Cooke, P.N. Arendt, E.R. Gray and A.M. Portis. "Absorption at High Microwave Power by Large-Area TI-Based Superconducting Films on Metallic Substrates." 1991 Transactions on Microwave Theory and Techniques 39.9 (Sep. 1991 [T-MTT] (Special Issue on Microwave Applications of Superconductivity)): 1539-1544.

Microwave surface resistance measurements have been made on large-area Tl-Ba-Ca-Cu-O thick films that are magnetron-sputtered onto oriented Ag alloy substrates by replacing the end wall of an 18 GHz TE/sub 011/ mode Cu cavity with the superconducting film. The best surface resistance values obtained are 4 and 14 m Omega at 10 K and 77 K, respectively; corresponding Cu values are 8 m Omega and 21 m Omega. The dependence of the surface resistance on microwave power was measured in a similar way except that a Nb cavity was used instead of a Cu cavity. Typically, the surface resistance of the film begins to rise in 1-10 Oe of microwave field and saturates in 20-60 Oe. A model is presented relating the observed saturation to critical penetration of Josephson junctions. Films exhibiting the highest degree of c-axis texturing show the weakest dependence of surface resistance on power and also exhibit the sharpest transition to the superconducting state as measured at high frequency. These results are important for the development of high-power microwave cavities.

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Electromagnets of Superconductors

K.K. Mei and G.-C. Liang. "Electromagnets of Superconductors." 1991 Transactions on Microwave Theory and Techniques 39.9 (Sep. 1991 [T-MTT] (Special Issue on Microwave Applications of Superconductivity)): 1545-1552.

The purpose of studying the electromagnetic behavior of superconductors is to identify the relevant material parameters of superconductive media and to examine their effects in the solution of classical electromagnetic boundary value problems. It is shown that a superconductor cannot be simply treated as a low loss conductor; rather, it should be treated as a negative dielectric material (with a negative dielectric constant). This approach is good only for vanishingly small field application with frequency significantly smaller than gap frequency, f/sub c/, and temperature not too close to the critical temperature, T/sub c/, of the superconductor. The electromagnetic of negative dielectric materials are discussed in terms of causality, perturbation technique, surface impedance, time-domain interpretation of current components, and computational electrodynamics.

Abstracts

A General Analysis of Propagation Along Multiple-Layer Superconducting Stripline and Microstrip Transmission Lines

D. Nghiem, J.T. Williams and D.R. Jackson. "A General Analysis of Propagation Along Multiple-Layer Superconducting Stripline and Microstrip Transmission Lines." 1991 Transactions on Microwave Theory and Techniques 39.9 (Sep. 1991 [T-MTT] (Special Issue on Microwave Applications of Superconductivity)): 1553-1565.

A rigorous spectral-domain formulation for a superconducting stripline or microstrip transmission line with a multiple-layer dielectric substrate is presented. The formulation models the strip conductor as a surface current with an equivalent surface impedance, where the surface impedance is approximated in closed form when the strip is either much thinner or much thicker than a penetration depth. In either case the surface impedance is related to the complex conductivity of the material, which is calculated from a two-fluid model. Results are presented to show the slow-wave propagation and attenuation along both microstrip and stripline packages in a realistic multiple-layer configuration, which accounts for the field penetration into the superconducting ground planes.

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Field Theory Investigation of High- T/sub c/ Superconducting Coplanar Waveguide Transmission Lines and Resonators

J. Kebler, R. Dill and P. Russer. "Field Theory Investigation of High- T/sub c/ Superconducting Coplanar Waveguide Transmission Lines and Resonators." 1991 Transactions on Microwave Theory and Techniques 39.9 (Sep. 1991 [T-MTT] (Special Issue on Microwave Applications of Superconductivity)): 1566-1574.

We investigate a coplanar waveguide structure using a partial wave synthesis. By this we take into account the complex conductivity of the high- T/sub c/ superconductor material according to the two-fluid model and the London theory. Micrometer transmission line dimensions are considered in the frequency range up to 100 GHz suitable e.g. for low-loss, low-dispersion chip-to-chip interconnects. The results obtained for superconductors are also compared with the results for normal conductors with real conductivity and the same geometry. Finally we calculate the behavior of measured and published coplanar waveguide lambda/2 resonators made of high-T/sub c/ superconducting thin films.

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A Tapped-Delay-Line Superconductive Chirp Filter in Shielded Microstrip

R. Ramisch, G.R. Olbrich and P. Russer. "A Tapped-Delay-Line Superconductive Chirp Filter in Shielded Microstrip." 1991 Transactions on Microwave Theory and Techniques 39.9 (Sep. 1991 [T-MTT] (Special Issue on Microwave Applications of Superconductivity)): 1575-1581.

A superconducting chirp filter having a dispersive time delay of 26 ns and a 3.4 GHz bandwidth centered at 4.7 GHz has been fabricated using a niobium-on-silicon shielded microstrip technology. Along a 2 X 1.6 m delay line, unequally spaced microstrip directional couplers are employed as sampling devices. To achieve an improvement in dispersion and coupler directivity over conventional microstrip, the device uses a superconductive shield mounted at a distance equal to the height of the dielectric on top of the microstrip structure. Structural support of the 70-µm-thin high-resistivity dielectric is provided by a large-area bond to a glass substrate.

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A Generalized Equivalent Circuit Applied to a Tunable Sapphire-Loaded Superconducting Cavity

M.E. Tobar and D.G. Blair. "A Generalized Equivalent Circuit Applied to a Tunable Sapphire-Loaded Superconducting Cavity." 1991 Transactions on Microwave Theory and Techniques 39.9 (Sep. 1991 [T-MTT] (Special Issue on Microwave Applications of Superconductivity)): 1582-1594.

A Lagrangian technique is used to develop an equivalent circuit for a loop-coupled tunable sapphire-loaded superconducting cavity resonator (T-SLOSC) by considering separately the sapphire dielectric and the cavity. Interaction between modes during tuning is characterized by cross coupling components between equivalent mode circuits. Cross-coupling coefficients are defined with respect to the fields in the resonator and equivalent circuit components. Coupling between modal fields is shown to be predominantly reactive in the sapphire-loaded cavity, and can degrade a mode with Q >10/sup 8/ by a few orders of magnitude. Interactions between line resonances and T-SLOSC modes are observed to be predominantly resistive through the superconducting niobium probes. Cross-coupling coefficients between some interacting modes have been determined and the reflection coefficients modeled.

Abstracts

Spectral-Domain Analysis of Coplanar Waveguide Traveling-Wave Electrodes and Their Applications to Ti:LiNbO/sub 3/ Mach--Zehnder Optical Modulators

K. Kawano, T. Kitoh, H. Jumonji, T. Nozawa, M. Yanagibashi and T. Suzuki. "Spectral-Domain Analysis of Coplanar Waveguide Traveling-Wave Electrodes and Their Applications to Ti:LiNbO/sub 3/ Mach--Zehnder Optical Modulators." 1991 Transactions on Microwave Theory and Techniques 39.9 (Sep. 1991 [T-MTT] (Special Issue on Microwave Applications of Superconductivity)): 1595-1601.

Hybrid-mode and quasi-TEM analyses are carried out for coplanar waveguide traveling-wave electrodes applicable to z-cut Ti:LiNbO/sub 3/ optical modulators. The analyses are based on the spectral-domain approach. The microwave effective index and the characteristic impedance are clarified, together with the microwave conductor loss. These are incorporated to accurately predict the modulator characteristics. It is shown that these characteristics can be greatly improved by employing a thicker buffer layer. High-speed and low-driving-power Ti:LiNbO/sub 3/ optical modulators are realized at a 1.52 μm wavelength. Agreement between the calculated and measured results is good.

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Transistor Oscillators with Impedance Noise Matching

G. Braun and H. Lindenmeier. "Transistor Oscillators with Impedance Noise Matching." 1991 Transactions on Microwave Theory and Techniques 39.9 (Sep. 1991 [T-MTT] (Special Issue on Microwave Applications of Superconductivity)): 1602-1610.

In the past noise optimization of HF and microwave transistor oscillators has usually been achieved experimentally. In this work a theory is derived which makes it possible to predict the carrier-to-noise ratio of a transistor oscillator with real components depending on parameters of the active element and the oscillator circuit which can be easily measured. The theory leads to new aspects of low-noise oscillator design which include the use of a multiple-stage active element and an impedance condition for noise matching. In this context the conditions for the use of GaAs FET's in low-noise oscillators are investigated. A consequent application of this theory in the design of oscillators can improve the carrier-to-noise ratio substantially. According to examples shown in this paper, an improvement of more than 50 dB may be reached over a nonoptimized oscillator. A verification by measurement has been made for seven single-transistor oscillators around 150 MHz. The measured values of the carrier-to-noise ratio show very good agreement with the values derived from theory. The differences between measured and calculated values are smaller than the measurement uncertainty of 3 dB.

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Mechanical Load Cell Based on Cavity-Controlled Microwave Oscillators

F.J.M. Farley, J.K. Vij, A. Kocot, U.M.S. Murthy and M. Burgess. "Mechanical Load Cell Based on Cavity-Controlled Microwave Oscillators." 1991 Transactions on Microwave Theory and Techniques 39.9 (Sep. 1991 [T-MTT] (Special Issue on Microwave Applications of Superconductivity)): 1611-1616.

A novel device consisting of a rectangular resonator to which two oscillators are coupled at right angles to each other is described. The frequency of each oscillator is controlled by the cavity, and distortions caused by mechanical load change the two frequencies in opposite directions. The detector which is arranged at an angle of 45° to the probes of the two oscillators picks up a beat signal whose frequency in the MHz range is linearly related to the mechanical load applied across the cavity. The oscillators using GaAs MESFET's have been designed to detect small distortions in the cavities caused by a mechanical load.

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The Discontinuity Problem of a Rectangular Dielectric Post in a Rectangular Waveguide

K. Siakavara and J.N. Sahalos. "The Discontinuity Problem of a Rectangular Dielectric Post in a Rectangular Waveguide." 1991 Transactions on Microwave Theory and Techniques 39.9 (Sep. 1991 [T-MTT] (Special Issue on Microwave Applications of Superconductivity)): 1617-1622.

A simple numerical technique the discontinuity problem of a symmetric for the solution of loaded rectangular dielectric post centered in a rectangular waveguide is presented. The waveguide is divided into three regions where the field is expressed in suitable waveguide modes. By applying the continuity conditions at the common surfaces of the regions, a system of linear equations determining the reflection and transmission coefficients is formed. Several examples are compared with experimental results and show the validity of the method.

Abstracts

Static Analysis of Microstrip Discontinuities Using the Excess Charge Density in the Spectral Domain

J. Martel, R.R. Boix and M. Horno. "Static Analysis of Microstrip Discontinuities Using the Excess Charge Density in the Spectral Domain." 1991 Transactions on Microwave Theory and Techniques 39.9 (Sep. 1991 [T-MTT] (Special Issue on Microwave Applications of Superconductivity)): 1623-1631.

Galerkin's method in the spectral domain is applied to solve for the excess charge density existing on the strips of open-end and symmetric gap discontinuities in multilayered anisotropic substrates. The excess charge density is used to determine the capacitance components of the equivalent circuits of these discontinuities. Numerical results are provided and a comparison with previous results existing in the literature is carried out.

Abstracts

Electromagnetic Imaging for an Imperfectly Conducting Cylinder

C.-C. Chiu and Y.-W. Kiang. "Electromagnetic Imaging for an Imperfectly Conducting Cylinder." 1991 Transactions on Microwave Theory and Techniques 39.9 (Sep. 1991 [T-MTT] (Special Issue on Microwave Applications of Superconductivity)): 1632-1639.

This paper presents a computational approach to the imaging or inverse scattering of an imperfectly conducting cylinder. A conducting cylinder of unknown shape and conductivity scatters the incident wave in free space and the scattered field is recorded on a circle surrounding the scatterer. By properly processing the scattered data, the shape and conductivity of the scatterer can be reconstructed. The problem is formulated in the form of nonlinear integral equations which can be solved numerically by the Newton-Kantorovitch algorithm. The pseudoinverse technique is used to overcome the ill-posedness, and the condition number of the matrix is also discussed. Numerical examples are given to illustrate the capability of the inversion algorithm using the simulated scattered fields in both near and far zones. Multiple incident directions permit good reconstruction of shape and, to a lesser extent, conductivity in the presence of noise in measured data.

Abstracts

A General Algorithm for Computing the Bidimensional Spectral Green's Dyad in Multilayered Complex Bianisotropic Media: The Equivalent Boundary Method

F.L. Mesa, R. Marques and M. Horno. "A General Algorithm for Computing the Bidimensional Spectral Green's Dyad in Multilayered Complex Bianisotropic Media: The Equivalent Boundary Method." 1991 Transactions on Microwave Theory and Techniques 39.9 (Sep. 1991 [T-MTT] (Special Issue on Microwave Applications of Superconductivity)): 1640-1649.

A systematic method to obtain the bidimensional spectral dyadic Green's function (BSDGF) of stratified planar structures with arbitrary complex bianisotropic layers is developed. The method is based on the uniqueness and equivalence electromagnetic theorems. A first-order partial differential formulation for the electromagnetic field inside each layer is used. An explicit algorithm makes it possible to go from the single-layer formulas to the general n-layer matrix formulation. The perturbative nature of the method provides good numerical efficiency and straightforward determination of asymptotic behavior.

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Abstracts

Mode Filter for High-Power Microwaves

M. Otsuka and M. Shimizu. "Mode Filter for High-Power Microwaves." 1991 Transactions on Microwave Theory and Techniques 39.9 (Sep. 1991 [T-MTT] (Special Issue on Microwave Applications of Superconductivity)): 1650-1654.

A new type resistive-wall mode filter in which the axisymmetric modes, e.g., the TE/sub 01/ and TE/sub 02/ modes, pass almost without attenuation and the nonaxisymmetric modes, e.g., the TE/sub 11/ and TM/sub 11/ modes, attenuate has been developed for 28 GHz high-power microwaves, Pyrolytic graphite having an anisotropic resistivity was installed in the mode filter so that the normal direction to the deposition surface of the pyrolytic graphite was in the axial direction of the mode filter. The inner diameter of the mode filter was 30 mm and its length, 100 mm. Mode attenuation and return losses in the mode filth- were measured for the TE/sub 01/, TE/sub 02/, TE/sub 11/, and TM/sub 11/ modes using a scalar network analyzer with mode converters that convert from the rectangular TE/sub 10/ mode to the circular modes. Measured attenuation was 2.4±0.3 dB for the TE/sub 11/ mode, 5.5±0.2 dB for the TM/sub 11/ mode, and 0.0+0.2 dB for the TE/sub 01/ and TE/sub 02/ modes at 28 GHz. Return losses were in the range of -20 to -25 dB for each mode.

Abstracts

An Inhomogeneous Two-Dimensional Model for the Analysis of Microstrip Discontinuities (Short Papers)

W.K. Gwarek and C. Mroczkowski. "An Inhomogeneous Two-Dimensional Model for the Analysis of Microstrip Discontinuities (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.9 (Sep. 1991 [T-MTT] (Special Issue on Microwave Applications of Superconductivity)): 1655-1658.

The paper proposes a new approach to two-dimensional modeling of microstrip circuits of arbitrary shape. A new model was developed to be used for finite-difference time-domain (FDTD) analysis. A characteristic feature of the new model is its inhomogeneity, i.e., the dependence of the parameters at a particular point in the two-dimensional space on the distance of that point from the strip's edge. Examples of FDTD analysis based on the new model are shown.

Abstracts

Accurate Formulas for Efficient Calculation of the Characteristic Impedance of Microstrip Line (Short Papers)

K.K.M. Cheng and J.K.A. Everard. "Accurate Formulas for Efficient Calculation of the Characteristic Impedance of Microstrip Line (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.9 (Sep. 1991 [T-MTT] (Special Issue on Microwave Applications of Superconductivity)): 1658-1661.

A numerically efficient and accurate method for the derivation of the characteristic impedance of an open microstrip line assuming the quasi-TEM mode of propagation is presented. It is based on the spectral-domain method incorporating functions of rectangular shape for describing the surface charge density distribution on the conductor strip. This gives rise to integrals which can be analytically evaluated. The formulas thus obtained can readily be implemented on a desktop computer. It is found that the discrepancies between the results derived from the proposed method (N = 3) and from the substrip method are less than 0.26% through a wide range of w/h ratios and relative permittivity values.

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Abstracts

Cylindrical Microstrip Line Partially Embedded in a Perfectly Conducting Ground Plane (Short Papers)

H.A. Auda. "Cylindrical Microstrip Line Partially Embedded in a Perfectly Conducting Ground Plane (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.9 (Sep. 1991 [T-MTT] (Special Issue on Microwave Applications of Superconductivity)): 1662-1666.

The quasi-TEM characteristics of a novel cylindrical microstrip line are rigorously determined. The line consists of an infinitesimally thin strip on the surface of a dielectric cylinder partially embedded in a perfectly conducting ground plane. Expressions for the potential distribution inside and outside the dielectric substrate, the charge distribution on the strip, and the capacitance of the microstrip line are derived. Sample numerical results based on the derived expressions are also given and discussed. In particular, it is shown that the effective dielectric constant for the symmetrical microstrip line is a linear function of the substrate's dielectric constant, and is almost independent of the strip width.

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Abstracts

First-Order Model of Symmetrical Six-Port Microstrip Ring Coupler (Short Papers)

S.P. Yeo and C.L. Lau. "First-Order Model of Symmetrical Six-Port Microstrip Ring Coupler (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.9 (Sep. 1991 [T-MTT] (Special Issue on Microwave Applications of Superconductivity)): 1666-1669.

This paper describes, in brief, how the simple eigenmode approach can be utilized to develop a first-order model that yields explicit ready-to-use formulas for predicting the performance characteristics of a symmetrical six-port microstrip ring coupler. Prototype tests conducted over the 2--5 GHz frequency range show the agreement between the predicted and measured values of the coupler's scattering coefficients to be within ±0.05 for magnitude and ±10° for phase.

Abstracts

Properties of TE-TM Mode-Matching Techniques (Short Papers)

G.G. Gentili. "Properties of TE-TM Mode-Matching Techniques (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.9 (Sep. 1991 [T-MTT] (Special Issue on Microwave Applications of Superconductivity)): 1669-1673.

A line integral formulation of TE-TM mode-matching techniques for scattering problems in waveguides is described. The procedure is convenient from a computational point of view when the modes in the waveguides must be computed numerically. Some interesting properties of TE-TM mode-matching techniques are then demonstrated.

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Abstracts

High-Performance HEMT Amplifiers with a Simple Low-Loss Matching Network (Short Papers)

R. Peter, M.V. Schneider and Y.S. Wu. "High-Performance HEMT Amplifiers with a Simple Low-Loss Matching Network (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.9 (Sep. 1991 [T-MTT] (Special Issue on Microwave Applications of Superconductivity)): 1673-1675.

We report on the design and performance of a K-band HEMT amplifier whose passive circuit consists of low-loss suspended stripline elements. The single-stage amplifiers were built at 4 GHz and 22 GHz by using readily available commercial HEMT devices. In the desired frequency range from 21 to 23 GHz for the high-frequency design, the best spot noise temperatures were 150 K and 65 K at 21.5 GHz for room and liquid nitrogen temperatures, respectively.

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Abstracts

Spectral Representation of Self-Adjoint Problems for Layered Anisotropic Waveguides (Corrections)

C.R. Paiva and A.M. Barbosa. "Spectral Representation of Self-Adjoint Problems for Layered Anisotropic Waveguides (Corrections)." 1991 Transactions on Microwave Theory and Techniques 39.9 (Sep. 1991 [T-MTT] (Special Issue on Microwave Applications of Superconductivity)): 1676-1676.

In the above paper, the following corrections should be made.

Abstracts

Coplanar Waveguide and Slot Line on Magnetic Substrates: Analysis and Experiment (Corrections)

E. El-Sharawy and R.W. Jackson. "Coplanar Waveguide and Slot Line on Magnetic Substrates: Analysis and Experiment (Corrections)." 1991 Transactions on Microwave Theory and Techniques 39.9 (Sep. 1991 [T-MTT] (Special Issue on Microwave Applications of Superconductivity)): 1676-1676.

The above paper contains three typographical errors. The value of 4 pi M/sub s/ in Figs. 3, 4, and 5 should be 2262 G instead of 2620 G. The results presented in the figures were not affected by these errors.

Abstracts

Call for Papers - 1992 IEEE-MTT-S International Microwave Symposium (Sep. 1991 [T-MTT])

"Call for Papers - 1992 IEEE-MTT-S International Microwave Symposium (Sep. 1991 [T-MTT])." 1991 Transactions on Microwave Theory and Techniques 39.9 (Sep. 1991 [T-MTT] (Special Issue on Microwave Applications of Superconductivity)): 1677-1677.

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Abstracts

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Front Cover (Oct. 1991 [T-MTT])

"Front Cover (Oct. 1991 [T-MTT])." 1991 Transactions on Microwave Theory and Techniques 39.10 (Oct. 1991 [T-MTT]): f1-f2.

Abstracts

Synthesis of Wide-Band Planar Circulators Using Narrow Coupling Angles and Undersized Disk Resonators

J. Helszajn and R.D. Baars. "Synthesis of Wide-Band Planar Circulators Using Narrow Coupling Angles and Undersized Disk Resonators." 1991 Transactions on Microwave Theory and Techniques 39.10 (Oct. 1991 [T-MTT]): 1681-1687.

A drawback of the classic tracking solution exhibited by a junction circulator using a planar disk resonator is that it requires a wide coupling angle for its realization. This paper describes the theory of circulators using radial/lumped-element resonators with narrow coupling angles which display equally good, if not better, gyrator circuits that are outside of the classic result. The form of the lumped element variable is not unique and one way to realize it is to make use of the fringing capacitance at the interface between a dielectric resonator and a substrate with a higher relative dielectric constant than that of the resonator. The topology requires the adjustment of electromagnetic, electrostatic, and network conditions with common parameters so that a solution which relies on fringing effects only is not generally ensured. The paper includes the description of one such 1-2 GHz circulator.

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Abstracts

Characterization of the Shielding Effects on the Frequency-Dependent Effective Dielectric Constant of a Waveguide-Shielded Microstrip Using the Finite-Difference Time-Domain Method

L.-K. Wu and Y.-C. Chang. "Characterization of the Shielding Effects on the Frequency-Dependent Effective Dielectric Constant of a Waveguide-Shielded Microstrip Using the Finite-Difference Time-Domain Method." 1991 Transactions on Microwave Theory and Techniques 39.10 (Oct. 1991 [T-MTT]): 1688-1693.

The dispersion behavior of waveguide-shielded microstrip line is investigated using the finite-difference time-domain method. The result is a frequency-dependent effective dielectric constant. Structures having centered strip are examined to determine the effects of a top cover alone and the effects of two symmetrically placed sidewalls. Structures with off-centered strip are used to investigate the effects of a single sidewall alone and the combined effects of a single sidewall plus the top wall. Differences between the effects of a single sidewall alone and those of the two symmetrically placed sidewalls are identified. In addition, new results on the combined effects of the top wall plus one sidewall, which are important when considering the placement of the outermost elements of a packaged circuit, are also discussed.

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Abstracts

Propagation Characteristics of Coplanar-Type Transmission Lines with Lossy Media

T. Kitazawa and T. Itoh. "Propagation Characteristics of Coplanar-Type Transmission Lines with Lossy Media." 1991 Transactions on Microwave Theory and Techniques 39.10 (Oct. 1991 [T-MTT]): 1694-1700.

Lossy coplanar-type transmission lines are analyzed based on the hybrid-mode formulation by combining the spectral-domain approach with the perturbation method. Introducing a finite thickness of metallization and choosing the proper basis functions for the thick conductor model prevent the integrals used for calculating the conductor losses from becoming singular when evaluated at the conductor edge. Also, advantage is taken of an orthogonality relation which is used to reduce the double infinite or semi-infinite integral to a single integral, thus reducing the computation labor drastically. Numerical computations by new basis functions for the thick conductor show convergence rates as fast as those for the zero-thickness cases. Numerical results include the effective dielectric constants, characteristic impedances, and total losses (conductor and dielectric losses) for slot lines and symmetrical and asymmetrical coplanar waveguides.

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Abstracts

A Full-Wave Mixed Potential Mode-Matching Method for the Analysis of Planar or Quasi-Planar Transmission Lines

C.T. Ching-Kuang and J.-D. Tseng. "A Full-Wave Mixed Potential Mode-Matching Method for the Analysis of Planar or Quasi-Planar Transmission Lines." 1991 Transactions on Microwave Theory and Techniques 39.10 (Oct. 1991 [T-MTT]): 1701-1711.

A newly proposed and tested full-wave mixed potential mode-matching method is presented for the analysis of planar and/or quasi-planar transmission lines. The transmission lines under investigation consist of layered (stratified) and nonlayered dielectric substrates and metal strips of finite thickness. The y-directed hybrid TE and TM Hertzian potentials, perpendicular to the interfaces between each layered region, are employed in the layered regions. The nonlayered regions, which consist of dielectric step discontinuities that destroy the layered configuration in the horizontal plane, utilize the x-directed hybrid TE and TM Hertzian potentials parallel to the horizontal plane. As a direct result, the full-wave formulation of the transmission line problem becomes systematic and easy to handle. Extensive analyses of a particular case study show that the relative convergence criterion needs to be satisfied to obtain accurate electromagnetic field solutions. The theoretical results obtained here are in very good agreement with the published data for various transmission line structures, which are the special limiting cases of the particular case study. The applications of the new formulation to the proximity effects of microstrip and Microslab lines are also illustrated by examples.

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Abstracts

A Method of Moments Solution of a Cylindrical Cavity Placed Between Two Coaxial Transmission Lines

M.A. Saed. "A Method of Moments Solution of a Cylindrical Cavity Placed Between Two Coaxial Transmission Lines." 1991 Transactions on Microwave Theory and Techniques 39.10 (Oct. 1991 [T-MTT]): 1712-1717.

This paper presents a method for analyzing a dielectric-filled cylindrical cavity separating two coaxial transmission lines. The method of analysis is based on the method of moments and the equivalence principle taking into account higher order modes excited at the junctions between the cavity and the two transmission lines. Expressions relating the cavity's scattering parameters to the structure dimensions and the dielectric parameters are derived and implemented numerically. Numerical simulation results as well as experimental results are presented. The method is also applied to the measurement of the dielectric parameters of certain dielectric materials.

Abstracts

Broad-Band Simultaneous Measurement of the Complex Permittivity Tensor for Uniaxial Materials Using a Coaxial Discontinuity

N.-E. Belhadj-Tahar and A. Fourrier-Lamer. "Broad-Band Simultaneous Measurement of the Complex Permittivity Tensor for Uniaxial Materials Using a Coaxial Discontinuity." 1991 Transactions on Microwave Theory and Techniques 39.10 (Oct. 1991 [T-MTT]): 1718-1724.

A technique is presented for simultaneously measuring the complex values of the permittivity tensor of uniaxial materials. A gap in a coaxial line is filled with the material under test. Complex elements of the permittivity tensor are computed from measurements of the S parameters (S/sub 11/ and S/sub 21/) made on the gap taking into account higher order modes excited at the discontinuity. Measured complex permittivity data are presented from 45 MHz up to 18 GHz. This technique shows good agreement between calculated and generally accepted values.

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Abstracts

Generalized Scattering Matrix of Generalized Two-Port Discontinuities: Application to Four-Port and Nonsymmetric Six-Port Couplers

J. Esteban and J.M. Rebollar. "Generalized Scattering Matrix of Generalized Two-Port Discontinuities: Application to Four-Port and Nonsymmetric Six-Port Couplers." 1991 Transactions on Microwave Theory and Techniques 39.10 (Oct. 1991 [T-MTT]): 1725-1734.

A field theory analysis of multiport, multidiscontinuity structures based on the generalized scattering matrix of a generalized two-port discontinuity concept is presented. The analysis can be used in any structure equipped with any number of input and output ports, and results in substantial simplifications over previous analyses. The GSM's of generalized two-port discontinuities can also be cascaded with the same procedure as the two-port discontinuities and can be used to determine the electromagnetic field and the Poynting vector at every point of the structure, The GSM of the generalized two-port technique is used to analyze four-port and nonsymmetric six-port branch-waveguide directional couplers, and good agreement between the theoretical results and experimental data is obtained.

Abstracts

Computer-Aided Analysis of Free-Running Microwave Oscillators

C.-R. Chang, M.B. Steer, S. Martin and E. Reese, Jr.. "Computer-Aided Analysis of Free-Running Microwave Oscillators." 1991 Transactions on Microwave Theory and Techniques 39.10 (Oct. 1991 [T-MTT]): 1735-1745.

Traditionally, the design of microwave oscillators has been based on small-signal analysis techniques, which generally produced good results. However, large-signal simulations are often necessary to provide a more accurate characterization of oscillator performance. In this paper, an algorithm for free-runing oscillator analysis is presented. Kurokawa's oscillation condition is coupled with the modified nodal admittance form of the circuit equations to avoid degenerate solutions. The algorithm has been implemented using both harmonic balance and frequency-domain spectral balance techniques. The oscillator analysis was applied to the simulation of a monolithically integrated varactor-tuned MESFET oscillator. Good agreement between simulated power and oscillation frequency results and the measured data was obtained.

Abstracts

Phase-Locked Millimeter-Wave Two-Port Second-Harmonic Gunn Oscillators

R.G. Davis, M.J. Leeson, H.D.G. Lennon and M.J. Lazarus. "Phase-Locked Millimeter-Wave Two-Port Second-Harmonic Gunn Oscillators." 1991 Transactions on Microwave Theory and Techniques 39.10 (Oct. 1991 [T-MTT]): 1746-1747.

Two-port harmonic oscillators have been developed which are suitable for VCO operation in frequency stabilized systems. For wide-band tunable operation, an oscillator with a varactor-tunable fundamental cavity located vertically above the harmonic cavity has been constructed, and this oscillator has been stabilized in a phase-locked loop. An alternative bias-tuned in-line configuration is also reported which is on a single plane so that an integrated monolithic version is conceivable.

Abstracts

A New Algorithm for the Accurate Alignment of Microwave Networks

P.M. Marshall and P. Tissi. "A New Algorithm for the Accurate Alignment of Microwave Networks." 1991 Transactions on Microwave Theory and Techniques 39.10 (Oct. 1991 [T-MTT]): 1754-1758.

This paper presents a new algorithm suitable for the accurate alignment of microwave networks. The algorithm is developed from the sensitivity analysis of the network response with respect to the adjustable elements and does not require a knowledge of the network model. The algorithm computes the required adjustment as the solution of a Gauss-Newton system of equations and is implemented by quantifying the adjustment of each individual element setting. This procedure does not demand a previous characterization or calibration of the adjustable elements and has been proved to be efficient for the accurate alignment of different types of microwave filters.

Abstracts

Stability Ranges of Regenerative Frequency Dividers Employing Double Balanced Mixers in Large-Signal Operation (Short Papers)

R.H. Derksen, V. Luck and H.-M. Rein. "Stability Ranges of Regenerative Frequency Dividers Employing Double Balanced Mixers in Large-Signal Operation (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.10 (Oct. 1991 [T-MTT]): 1759-1762.

Regenerative frequency dividers, in general, may suffer from frequency ranges of unstable operation. An analysis of the stable ranges was given by Immovilli and Mantovani in 1973. However, its usability is restricted, since small-signal operation is assumed. In recent years the first monolithically integrated regenerative frequency dividers were presented. These are examples of circuits on which the analysis of Immovilli and Mantovani is not applicable, since the quasi-small-signal assumption is not met. This paper presents a simple theory which makes it possible to calculate the frequency ranges of stable operation for a regenerative divider employing a double balanced mixer in large-signal operation. The validity of the derived formulas is tested by various network simulations. Though the presented theory is simple, it describes the boundaries of the stable ranges quite correctly.

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Abstracts

A Multistrip Moment Method Technique and its Application to the Post Problem in a Circular Waveguide (Short Papers)

X.-H. Zhu, D.-Z. Chen and S.-J. Wang. "A Multistrip Moment Method Technique and its Application to the Post Problem in a Circular Waveguide (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.10 (Oct. 1991 [T-MTT]): 1762-1766.

A moment method technique for solving obstacle problems in a waveguide is presented. Instead of the procedure using a multifilament current representation, which leads to a slowly converging series, a multistrip representation of the current is proposed. In the procedure, the true currents on obstacle surfaces are replaced by equivalent planar currents in a number of waveguide cross sections inside the obstacle. The technique is applied to a pair of metallic posts in the TE/sub 11/-mode circular waveguide. Numerical results are compared with experimental data.

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Numerical Analysis of Waveguide Discontinuity Problems Using the Network Model Decomposition Method (Short Papers)

G. Wen. "Numerical Analysis of Waveguide Discontinuity Problems Using the Network Model Decomposition Method (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.10 (Oct. 1991 [T-MTT]): 1766-1770.

This paper presents an application of the network model decomposition method to the analysis of arbitrarily shaped H- and E-plane waveguide junctions. By using the polygon discretization technique introduced in [1], the waveguide discontinuity region, which is surrounded by a metallic wall and the reference planes chosen, is first discretized; then the topological model and the corresponding network model for the waveguide discontinuity are established. In the formulation, equivalent current sources connected to the nodes on the boundary of the region have been introduced to replace the effect of the field external to the region. The field internal to the region is approximated by the nodal voltage distribution of the network model, which can then be used to determine the scattering parameters of the waveguide junction. A diakoptic algorithm for the solution of the network model has also been developed. To illustrate the applications and show the validity of the method, numerical results for various H- and E-plane junctions have been given and a favorable comparison has been made with other existing theories.

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Abstracts

Analysis of E - H Plane Tee Junction Using a Variational Formulation (Short Papers)

B.N. Das and N.V.S.N. Sarma. "Analysis of E - H Plane Tee Junction Using a Variational Formulation (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.10 (Oct. 1991 [T-MTT]): 1770-1773.

An analysis of an E-H plane tee junction taking the width of the slot and wall thickness into account is presented. The parameters of the three-port equivalent network are determined. The reflection as well as transmission parameters are evaluated. A comparison between theoretical and experimental results is presented.

Abstracts

Theoretical and Experimental Study of the Evolution of Fields in an Overdimensioned Waveguide with a Corrugated Surface (Short Papers)

J.P. Fenelon and A. Papiernik. "Theoretical and Experimental Study of the Evolution of Fields in an Overdimensioned Waveguide with a Corrugated Surface (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.10 (Oct. 1991 [T-MTT]): 1773-1779.

The field of corrugated waveguides has been extensively investigated over a number of years, as such structures have been used for antenna feeds. To obtain an answer to problems arising in many microwave applications, some labs use overdimensioned corrugated waveguides. In the present work, we propose a theoretical approach with eigenmodes that enables us to determine the values of the limiting frequencies (frequencies of pi modes in the periodic structure) of an overdimensioned parallelepipeds cavity loaded with a thin corrugation as a function of the height of the aperture. In this approach, the electric field is represented by different analytical functions. We compared the theoretical results with the experimental values obtained for different apertures and periodicities, according to the value of the wavelength in comparison with the aperture and the period. Each function is in good agreement in a certain frequency range.

Abstracts

Design of New Hybrid-Ring Directional Using lambda/8 or lambda/6 Sections (Short Papers)

D.I. Kim and G.-S. Yang. "Design of New Hybrid-Ring Directional Using lambda/8 or lambda/6 Sections (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.10 (Oct. 1991 [T-MTT]): 1779-1784.

A method for designing 1.25 lambda-ring and 7lambda /6-ring 3 dB directional couplers rising fundamental lambda/8 or lambda/6 sections is proposed and their frequency characteristics are analyzed. Furthermore, experimental verification has been achieved in a microstrip network confirming the validity of the design method for a microwave component with the basic lambda/8 or lambda/6 sections proposed in this paper.

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Abstracts

A Comparison of Two Approximations for the Capacitance of a Circle Concentric with a Cross (Short Papers)

H.J. Riblet. "A Comparison of Two Approximations for the Capacitance of a Circle Concentric with a Cross (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.10 (Oct. 1991 [T-MTT]): 1784-1788.

The maximum and minimum capacitances on circles concentric with an internal cross are determined for a four-lobed as well as an eight-lobed equipotential distribution. The average and geometric mean of these extreme capacitances are then compared with the exact capacitance. The increased accuracy obtained from the eight-lobed equipotential distribution is presented in graphical form.

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Abstracts

A New Procedure for Interfacing the Transmission Line Matrix (TLM) Method with Frequency-Domain Solutions (Short Papers)

Z. Chen, W.J.R. Hoefer and M.M. Ney. "A New Procedure for Interfacing the Transmission Line Matrix (TLM) Method with Frequency-Domain Solutions (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.10 (Oct. 1991 [T-MTT]): 1788-1792.

This paper presents a new procedure that interfaces the transmission-line matrix method (TLM) with frequency-domain solutions of electromagnetic fields. Frequency-domain solutions are transformed into appropriate time-domain sequences using the discrete Fourier transform (DFT). Hence, the corresponding boundary Johns matrix can be determined with minimum computational effort. The subsequent treatment consists in convolving the streams of TLM impulses incident on the boundary with a Johns matrix generated with the new approach. The method is applied to obtain the time-domain reflection sequence of wide-band absorbing terminations in a rectangular waveguide in the dominant mode operation. In addition, the time-domain analysis of pulse penetration through a sheet with high, but finite, conductivity is presented. Good results demonstrate the efficiency of the proposed procedure.

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Open Resonator for Precision Dielectric Measurements in the 100 GHz Band (Short Papers)

B. Komiyama, M. Kiyokawa and T. Matsui. "Open Resonator for Precision Dielectric Measurements in the 100 GHz Band (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.10 (Oct. 1991 [T-MTT]): 1792-1796.

Dielectric properties of fused silica, MgO, AIN, and BN were measured using an open resonator at frequencies around 100 GHz. The resonator is of the semiconfocal type and consists of a concave and a plane mirror, and the frequency variation method is used. To increase the reliability of measurement data, the operating frequency and thickness of the samples were chosen so as to make the parameter Delta = 1 for every sample. The radius of curvature of the concave mirror is deduced with sufficient accuracy from the resonant frequencies of the TEM/sub 0.0/ and TEM/sub 1.0/ modes, which results in a precise determination of resonator length, The standard deviation of measurements was less than 0.1% in permittivity and about 10% in loss tangent.

Abstracts

A Method for the Rapidly Convergent Representation of Electromagnetic Fields in a Rectangular Waveguide (Short Papers)

K. Ishibashi and E. Sawado. "A Method for the Rapidly Convergent Representation of Electromagnetic Fields in a Rectangular Waveguide (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.10 (Oct. 1991 [T-MTT]): 1796-1799.

In numerically analyzing the electromagnetic fields in a rectangular waveguide by the integral equation method it is essential to calculate the electromagnetic fields produced by the electric and magnetic currents and charges. In this paper, a new method is proposed to facilitate rapid calculation of the three-dimensional fields. This method is a modified image method and gives an accurate value in a short time.

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"Call for Papers - 1992 IEEE-MTT-S International Microwave Symposium (Oct. 1991 [T-MTT])." 1991 Transactions on Microwave Theory and Techniques 39.10 (Oct. 1991 [T-MTT]): 1800-1800.

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Microwave Imaging--Complex Permittivity Reconstruction by Simulated Annealing

L. Garnero, A. Franchois, J.-P. Hugonin, C. Pichot and N. Joachimowicz. "Microwave Imaging--Complex Permittivity Reconstruction by Simulated Annealing." 1991 Transactions on Microwave Theory and Techniques 39.11 (Nov. 1991 [T-MTT]): 1801-1807.

This paper refers to quantitative reconstruction of the dielectric properties of a strongly inhomogeneous object by means of active microwave imaging. An iterative reconstruction algorithm based on simulated annealing is presented. In some cases, this method seems to be more efficient than iterative deterministic methods and we show that it can converge to an accurate solution when other methods diverge.

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Mode Orthogonality in Reciprocal and Nonreciprocal Waveguides

P.R. McIsaac. "Mode Orthogonality in Reciprocal and Nonreciprocal Waveguides." 1991 Transactions on Microwave Theory and Techniques 39.11 (Nov. 1991 [T-MTT]): 1808-1816.

Using a general reciprocity theorem as a basis, the orthogonality relations for lossy reciprocal and nonreciprocal waveguides are discussed. To obtain a useful orthogonality relation which can extract a particular mode from a general mode expansion, a reciprocal waveguide must be bidirectional. A nonreciprocal waveguide, however, must be mutually bidirectional with its complementary waveguide (obtained by reversing the dc magnetic field applied to the gyrotropic media). For these bidirectionality conditions to be met, a waveguide must possess at least one of three symmetries: reflection, 180° rotation or rotary reflection symmetry. In those cases warranted by the structure symmetry, simplified forms for the orthogonality relations are presented. The orthogonality relations for the special case of lossless reciprocal or nonreciprocal waveguides are also discussed.

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Power Absorption in Ferromagnetic Implants from Radio Frequency Magnetic Fields and the Problem of Optimization

S.A. Haider, T.C. Cetas, J.R. Wait and J.-S. Chen. "Power Absorption in Ferromagnetic Implants from Radio Frequency Magnetic Fields and the Problem of Optimization." 1991 Transactions on Microwave Theory and Techniques 39.11 (Nov. 1991 [T-MTT]): 1817-1827.

Explicit expressions for absorbed power in small ferromagnetic cylinders from a radio frequency magnetic field (using a quasi-static approximation) due to induced eddy current circulation are obtained for implants used in interstitial hyperthermic therapy. It is found that optimum power absorption per unit volume of cylindrical implant occurs when the applied magnetic field is parallel to the axis of the cylinder and the induction number (i.e., /spl radic/ 2 times the ratio of implant radius to skin depth) is 2.5. This result is used to design geometrical configurations for implants to achieve optimum heating effects. The dependence of absorbed power on the orientation of the cylindrical implant with respect to polarization of the magnetic field is also calculated and found to be in good agreement with experimental results.

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Amplification Factor of Echo Signals in Ferromagnetic Materials

H. How, C. Vittoria and G.E. Everett. "Amplification Factor of Echo Signals in Ferromagnetic Materials." 1991 Transactions on Microwave Theory and Techniques 39.11 (Nov. 1991 [T-MTT]): 1828-1835.

It is well known that spin echoes in ferromagnetic materials can only be excited upon the application of high power microwave signals. In this paper the amplification factor of spin echoes is calculated for ferromagnetic materials in which long-range dipolar fields, external rf-field couplings, and magnetization relaxations are included in the calculations. The inclusion of such interactions provide a mechanism by which realistic amplification of echoes may be calculable. Our theoretical estimate of amplification is in reasonable agreement with previous experiments. We have, thus, systematically calculated the effects of carrier frequency, field gradient, and microwave power upon echo amplification.

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An Improved Formulation of an Optimizing Rayleigh--Ritz Technique for Closed Dielectric Waveguide Analysis

B. Young. "An Improved Formulation of an Optimizing Rayleigh--Ritz Technique for Closed Dielectric Waveguide Analysis." 1991 Transactions on Microwave Theory and Techniques 39.11 (Nov. 1991 [T-MTT]): 1836-1846.

Previous work in the application of the Rayleigh-Ritz method to the analysis of closed dielectric waveguides has shown that if the modes of the homogeneous rectangular waveguide are used to model the modes of an inhomogeneous rectangular waveguide, then it is numerically advantageous to use an optimized value for the permittivity of the homogeneous waveguide's dielectric filling. The paper reformuIates this work to use a complete set of basis functions. It is shown that use of the E/sub z/H/sub z/ formulation to describe the modes of the homogeneous rectangular waveguide leads to a relative convergence phenomena as well as to incorrect loss calculations. The paper reformulates the method using an E/sub x/E/sub y/H/sub x/H/sub y/ description of the homogeneous modes. The new formulation is validated for step-index waveguides through non-perturbational calculations of the propagation and attenuation constants of the round step-index dielectric waveguide. Comparison with the direct eigenvalue solution shows excellent agreement for the dominant and three higher-order modes. The new formulation is validated for graded-index waveguides through calculation of the dispersion curves for three modes of a Gaussian-Gaussian graded-index channel waveguide. Comparison of the results with two other methods shows excellent agreement.

Abstracts

Low-Loss Monolithic Transmission Lines for Submillimeter and Terahertz Frequency Applications

A.G. Engel, Jr. and L.P.B. Katehi. "Low-Loss Monolithic Transmission Lines for Submillimeter and Terahertz Frequency Applications." 1991 Transactions on Microwave Theory and Techniques 39.11 (Nov. 1991 [T-MTT]): 1847-1854.

The design and construction of low-loss monolithic transmission lines are critical to systems which require that THz-power be guided to the antenna front:ends. This paper proposes two types of novel monolithic guiding structures, which are designed for. the 0.3-2.0 THz and 0.1-0.3 THz ranges, respectively. The new waveguides are constructed from dielectric materials and structures which are available in monolithic technology so that the integration of active devices is possible. Propagation in each of the waveguides is characterized over relevant frequency ranges by applying a mode-matching technique, which takes into account all forms of electromagnetic coupling as well as losses in the dielectrics. The structures are predicted to exhibit excellent power confinement and low losses.

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A New Element-Saving Equivalent Circuit for the Analysis of General Coupled n-Wire Transmission Lines

M.A. Larsson. "A New Element-Saving Equivalent Circuit for the Analysis of General Coupled n-Wire Transmission Lines." 1991 Transactions on Microwave Theory and Techniques 39.11 (Nov. 1991 [T-MTT]): 1855-1861.

A new efficient method for modeling the general coupled n-wire transmission line is proposed. The equivalent circuit presented in this paper has the following advantages: 1) no balanced lines are needed 2) all element values are positive and 3) the number of elements required by the equivalent circuit is at most equal to the number of nonzero couplings plus one. A simple method for deriving the equivalent circuit is also outlined. A few examples are supplied to show the application of the method.

Abstracts

Circuit Simulations Combined with the Electromagnetic Field Analysis

T. Shibata. "Circuit Simulations Combined with the Electromagnetic Field Analysis." 1991 Transactions on Microwave Theory and Techniques 39.11 (Nov. 1991 [T-MTT]): 1862-1868.

In order to provide a means of rigorous simulation for wide-band and nonlinear microwave integrated circuits, the concept of a lumped device model is introduced into a three-dimensional, time-domain electromagnetic field analysis method. This makes it possible to perform both a circuit simulation including nonlinear lumped devices and an electromagnetic field analysis for distributed microwave components at the same time. As an example, the generation of picosecond pulses from a nonlinear transmission line circuit is simulated. Based on the results, the features and the validity of the method are discussed in comparison with conventional circuit simulations.

Abstracts

Aspects of the Design of Low Noise, Negative Resistance, Reflection Mode Transistor Amplifiers

P. Gardner and D.K. Paul. "Aspects of the Design of Low Noise, Negative Resistance, Reflection Mode Transistor Amplifiers." 1991 Transactions on Microwave Theory and Techniques 39.11 (Nov. 1991 [T-MTT]): 1869-1875.

In conventional microwave transistor amplifiers the transistor is used in transmission mode. This paper considers the use of microwave transistors in negative resistance reflection mode and presents the conditions for optimum noise performance. Possible advantages include the possibility of higher gain in the mm-wave region, which can be achieved by absorbing the parasitic common lead inductance into the feedback circuit designed to generate the negative resistance, and the existence of a failsafe mode of operation, in that the failure of the active device or its power supply is likely to lead to a low return loss, resulting in a small insertion loss through the amplifier, which may permit continued although degraded system operation. The latter potential advantage has proved to be of interest to radar system designers.

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Characterization of Resonant Tunneling Diodes for Microwave and Millimeter-Wave Detection (Short Papers)

I. Mehdi, J.R. East and G.I. Haddad. "Characterization of Resonant Tunneling Diodes for Microwave and Millimeter-Wave Detection (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.11 (Nov. 1991 [T-MTT]): 1876-1880.

The purpose of this short paper is to report on the direct detection capabilities of resonant tunneling diodes in the 10-100 GHz range. An open circuit voltage sensitivity of 1750 mV/mW (in Ka-Band) is measured which is higher than the sensitivity of comparatively biased commercially available solid state detectors. However, the detector properties are a strong function of diode bias and the measured tangential signal sensitivity (-32 dBm at Ka-Band with 1 MHz bandwidth) and the dynamic range (25 dB) of the diode are smaller compared to other solid state detectors.

Abstracts

A Technique for Correction of Parasitic Capacitance on Microwave f/sub t/ Measurements of MESFET and HEMT Devices (Short Papers)

M. Feng, C.L. Lau and C. Ito. "A Technique for Correction of Parasitic Capacitance on Microwave f/sub t/ Measurements of MESFET and HEMT Devices (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.11 (Nov. 1991 [T-MTT]): 1880-1882.

The current gain cutoff frequency, f/sub t/, has become a critical figure-of-merit for evaluating performance of MESFET and HEMT devices. The f/sub t/ is related to a capacitance parameter, C/sub tot/, through the equation f/sub t/= Gm/(2piC/sub tot/). This capacitance, however, includes a parasitic component primarily due to contact pad and device geometry as well as a parasitic component due to Rd, Rs and Rds. This paper describes a technique which determines this parasitic capacitance for FET-type devices. Consistently accurate corrections can then be made to reported f/sub t/ values. Ion implanted InGaAs MESFETs with 0.25 µ gate lengths have achieved 120 GHz f/sub t/, before correction and 151 GHz f/sub t/ after correction.

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Accurate Measurement of Signals Close to the Noise Floor on a Spectrum Analyzer (Short Papers)

A.A. Moulthrop and M.S. Muha. "Accurate Measurement of Signals Close to the Noise Floor on a Spectrum Analyzer (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.11 (Nov. 1991 [T-MTT]): 1882-1885.

Because most spectrum analyzers are calibrated to read the true power of a sinusoidal signal, a correction factor is necessary to read the true power of a nonsinusoidal signal, such as noise. Consequently, when noise and a sine wave are both present, a correction factor that is a function of the signal-to-noise ratio is necessary to find the true signal power. For some spectrum analyzers the correction factor for pure noise is incorporated into the software, but the correction factor for signal plus noise is generally ignored. This article derives this correction factor, which is significant where the signal-to-noise ratio is near unity.

Abstracts

Synthesis of Schiffman Phase Shifters (Short Papers)

J.L.R. Quirarte and J.P. Starski. "Synthesis of Schiffman Phase Shifters (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.11 (Nov. 1991 [T-MTT]): 1885-1889.

The Schiffman phase shifter is a very useful passive component. In this paper equations to determine its phase deviation and maximum bandwidth when the coupling coefficient is known are presented. Equations are given also to determine the coupling coefficient for a desired bandwidth or maximum phase deviation.

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A Microstrip Line on a Chiral Substrate (Short Papers)

M.S. Kluskens and E.H. Newman. "A Microstrip Line on a Chiral Substrate (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.11 (Nov. 1991 [T-MTT]): 1889-1891.

Right and left circular vector potentials are developed and used in a spectral-domain solution for a microstrip transmission line on a chiral substrate. These vector potentials have properties similar to those of the usual magnetic and electric vector potentials, except that they result in circular rather than linearly polarized fields, thereby simplifying field expansions in chiral media. The chiral microstrip line does not have bifurcated modes like other chiral guided wave structures; however, the chiral substrate causes a significant asymmetry in both the fields and currents.

Abstracts

Time Domain Scattering Parameters of an Exponential Transmission Line (Short Papers)

C.-W. Hsue. "Time Domain Scattering Parameters of an Exponential Transmission Line (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.11 (Nov. 1991 [T-MTT]): 1891-1895.

The scattering parameters of an exponential line are studied in detail both in frequency and time domains. By taking the causality condition into consideration, we cast the time domain scattering parameters in a rapid-convergence power series. Each term of the power series represents a signal component generated by the exponential line when the signal travels a round trip.

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Analysis of 3-D Microwave Resonators Using Covariant-Projection Elements (Short Papers)

J.P. Webb and R. Miniowitz. "Analysis of 3-D Microwave Resonators Using Covariant-Projection Elements (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.11 (Nov. 1991 [T-MTT]): 1895-1899.

Three-dimensional microwave resonators of arbitrary shape can be analyzed with the finite element method using covariant-projection elements, curvilinear bricks which impose only tangential field continuity. The method produces no spurious modes, and works well even when sharp metal edges are present. The matrices involved, though large, are sparse; an appropriate sparse eigenvalue algorithm allows the method to run in modest amounts of memory. Results are presented for a number of test cases, including a rectangular microstrip resonator.

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Microwave Hall Effect in a TE/sub 11p/ Cylindrical Cavity (Short Papers)

A.Y. Al Zoubi. "Microwave Hall Effect in a TE/sub 11p/ Cylindrical Cavity (Short Papers)." 1991 Transactions on Microwave Theory and Techniques 39.11 (Nov. 1991 [T-MTT]): 1899-1901.

A microwave Hall effect signal produced by a TE/sub 11p/ degenerate cylindrical cavity is considered. The analysis presented identifies the cavity end walls as the source of the Hall signal, and a formula is derived relating the Hall output power to the dimensions of the cavity. Experimental results from the measurement of the empty cavity signal at 9.5 GHz are reported.

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Guest Editors' Overview (Dec. 1991 [T-MTT])

Z. Galani and V. Sokolov. "Guest Editors' Overview (Dec. 1991 [T-MTT])." 1991 Transactions on Microwave Theory and Techniques 39.12 (Dec. 1991 [T-MTT] (1991 Symposium Issue)): 1907-1909.

The 1991 International Microwave Symposium (IMS) and Microwave and Millimeter-Wave Monolithic Circuits Symposium (MMWMCS) in Boston attracted a record number of papers. Of the 699 submissions to the IMS and 61 submissions to the MMWMCS, 304 and 25, respectively, were accepted. From these, expanded versions of 74 IMS papers and seven MMWMCS papers were submitted for publication in this issue and, following the review process, 37 IMS and five MMWIVICS papers were accepted. A significant number of papers was returned to the authors for revision and resubmission to Dr. Stephen A. Maas because the publication deadline of this issue did not allow for a second review cycle. Some of these papers will be published in future issues of the Transactions.

Abstracts

1991 IEEE MTT-S International Microwave Symposium (Dec. 1991 [T-MTT])

P. Staecker. "1991 IEEE MTT-S International Microwave Symposium (Dec. 1991 [T-MTT])." 1991 Transactions on Microwave Theory and Techniques 39.12 (Dec. 1991 [T-MTT] (1991 Symposium Issue)): 1910-1913.

The symposium was held at the John. B. Hynes Veterans Memorial Convention Center in Boston, June 10-14, 199. Although the financial committee is still counting the money (and there is some left to count), we know that 1991 was a record year for total attendance (Table I) in spite of the economic uncertainty gripping some parts of the microwave community.

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Awards (Dec. 1991 [T-MTT])

"Awards (Dec. 1991 [T-MTT])." 1991 Transactions on Microwave Theory and Techniques 39.12 (Dec. 1991 [T-MTT] (1991 Symposium Issue)): 1914-1919.

Abstracts

Microwave Systems--Then and Now--Examples at the 50th Reunion of the MIT Radiation Laboratory

I.A. Getting. "Microwave Systems--Then and Now--Examples at the 50th Reunion of the MIT Radiation Laboratory." 1991 Transactions on Microwave Theory and Techniques 39.12 (Dec. 1991 [T-MTT] (1991 Symposium Issue)): 1920-1930.

The delivery by the British in 1940 of a cavity magnetron operating at S-band (10 cm) sparked an intensive effort in the US in response to three urgent wartime system requests. The MIT Radiation Laboratory was established by NDRC; and from this sprang an intense and successful program in microwave components and systems. Because of space restraints, this paper briefly describes the successes attained in two of the three projects; "firecontrol" and "navigation." The paper then skips to the current situation, the impact of advances in technology, both in the microwave field and in complementary fields essential to the design of modern "microwave systems." Three examples are briefly reviewed: the Army patriot, the Navy Aegis, and the AF Navstar or GPS navigation system.

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Aperture Synthesis Concepts in Microwave Remote Sensing of the Earth

C.T. Swift, D.M. LeVine and C.S. Ruf. "Aperture Synthesis Concepts in Microwave Remote Sensing of the Earth." 1991 Transactions on Microwave Theory and Techniques 39.12 (Dec. 1991 [T-MTT] (1991 Symposium Issue)): 1931-1935.

Aperture synthesis concepts have been used for many years in radio astronomy to achieve high image resolution at a reasonable cost. The time has come for earth remote sensing technology to consider some of these techniques to meet the cost challenges of Iarge antennas in space for these and other applications. The electronically scanned thinned array radiometer is put forward as a viable alternative to improve spatial resolution by an order of magnitude over what is presently achieved by microwave imaging systems that are collecting data from earth orbit.

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Novel MIC Bipolar Frequency Doublers Having High Gain, Wide Bandwidth and Good Spectral Performance (Dec. 1991 [T-MTT])

M. Borg and G.R. Branner. "Novel MIC Bipolar Frequency Doublers Having High Gain, Wide Bandwidth and Good Spectral Performance (Dec. 1991 [T-MTT])." 1991 Transactions on Microwave Theory and Techniques 39.12 (Dec. 1991 [T-MTT] (1991 Symposium Issue)): 1936-1946.

New high efficiency Bipolar microwave frequency multipliers have been developed having wideband performance, high conversion gain and good spectral properties. Experimental conversion gains of up to 7 dB have been attained for narrow bandwidths (/spl ap/ 8%) and approximately 0 dB for wide-band designs (40%) at C band. Corresponding fundamental and 3rd harmonic rejections are greater than 40 dBc. Extensive modeling and computer-oriented design have been employed utilizing harmonic balance.

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A Compact Monolithic Microwave Demodulator-Modulator for 64-QAM Digital Radio Links

I. Telliez, A.-M. Couturier, C. Rumelhard, C. Versnaeyen, P. Champion and D. Fayol. "A Compact Monolithic Microwave Demodulator-Modulator for 64-QAM Digital Radio Links." 1991 Transactions on Microwave Theory and Techniques 39.12 (Dec. 1991 [T-MTT] (1991 Symposium Issue)): 1947-1954.

The design, fabrication and performances of a monolithic microwave direct modulation modulator-demodulator are presented. The subsystem is designed to work in a 64-QAM digital radio link. At this level of modulation, it is necessary to have some possibilities of phase and amplitude trimming by external voltages to achieve sufficient accuracy. The circuit includes elementary functions such as quadrature and in-phase splitters, two balanced mixers, a quadrature phase comparator, and circuits giving the possibility to adjust phases and amplitudes for 64 QAM and higher level modulation. The design is such that the same chip can be used either as a direct demodulator or as a modulator. This complex circuit of small dimensions (2.7 mm X 3.65 mm) exhibits good demodulation and modulation performances. These overall performances of this monolithic circuit are achieved without degrading the dc yield.

Abstracts

Design and Performance of Octave S/C-Band MMIC T/R Modules for Multi-Function Phased Arrays

J.J. Komiak and A.K. Agrawal. "Design and Performance of Octave S/C-Band MMIC T/R Modules for Multi-Function Phased Arrays." 1991 Transactions on Microwave Theory and Techniques 39.12 (Dec. 1991 [T-MTT] (1991 Symposium Issue)): 1955-1963.

A complex wideband transmit/receive module that has achieved performance levels superior to any MMIC module will he described. Peak performance within the octave 3.0 to 6,0 GHz hand includes a power output of 21 W at S-band and 19 at C-band, a noise figure of 3.9 to 5.0 dB, 30 to 38 dB of receive gain, 25 to 26 dBm output IP/sub 3/, 40 dB of gain control in 256 steps, dual receive channels with independent amplitude and phase control, and an 8-bit phase shifter with less than 1 degree calibrated rms phase error. Total GaAs area is 146 mm/sup2 / with 170 mm of total gate periphery. The module incorporates a compact digital interface, requires only three supply voltages, and utilizes advanced packaging techniques, resulting in a size compatible with a grating lobe free grid spacing,

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A Novel Planar Diode Mixer for Submillimeter-Wave Applications

T. Newman, W.L. Bishop, K.T. Ng and S. Weinreb. "A Novel Planar Diode Mixer for Submillimeter-Wave Applications." 1991 Transactions on Microwave Theory and Techniques 39.12 (Dec. 1991 [T-MTT] (1991 Symposium Issue)): 1964-1971.

A novel mixer employing a planar GaAs Schottky diode has been designed and tested over a 300-365 GHz band-width at the University of Virginia (UVa). Using a planar diode eliminates the disadvantages of mechanical instability and labor intensive assembly associated with conventional whisker-contacted diodes. The mixer design process used scale model impedance measurements both for the design of individual components and for the measurement of impedances presented to the diode terminals by the mixer mount at fundamental and harmonic frequencies. Results from these impedance measurements were then used in linear and nonlinear numerical mixer analyses to predict the mixer performance. To the best of our knowledge, this represents the first attempt at using a planar diode in a submillimeter-wave mixer, and test results indicate performance comparable with the best whisker-contacted room temperature mixers for submillimeter wavelengths.

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A W-Band Monolithic Downconverter

K.W. Chang, H. Wang, K.L. Tan, S.B. Bui, T.-H. Chen, G.S. Dow, J. Berenz, T.-N. Ton, D.C. Garske, T.S. Lin and L.C.T. Liu. "A W-Band Monolithic Downconverter." 1991 Transactions on Microwave Theory and Techniques 39.12 (Dec. 1991 [T-MTT] (1991 Symposium Issue)): 1972-1979.

This paper presents the design, fabrication, and evaluation of a fully integrated W-band monolithic down-converter based on InGaAs pseudomorphic (PM) HEMT technology. The monolithic downconverter consists of a two-stage low-noise amplifier and a single-balanced mixer. The single-balanced mixer has been designed using the HEMT gate Schottky diodes inherent to the process, Measured results of the complete downconverter show a conversion gain of 5.5 dB and a double-sideband (DSB) noise figure of 6.7 dB at 94 GHz. Also presented in this paper is the downconverter performance characterized over the 35°C to + 65°C temperature range. The downconverter design was a first pass success and has a high circuit yield. Furthermore, this is the first reported monolithic down-converter in the W-band frequency range, and represents the state-of-the-art in monolithic millimeter-wave technology.

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Broadband Monolithic Passive Baluns and Monolithic Double-Balanced Mixer (Dec. 1991 [T-MTT])

T.-H. Chen, K.W. Chang, S.B. Bui, H. Wang, G.S. Dow, L.C.T. Liu, T.S. Lin and W.S. Titus. "Broadband Monolithic Passive Baluns and Monolithic Double-Balanced Mixer (Dec. 1991 [T-MTT])." 1991 Transactions on Microwave Theory and Techniques 39.12 (Dec. 1991 [T-MTT] (1991 Symposium Issue)): 1980-1986.

This paper presents the design and fabrication of four broadband monolithic passive baluns including CPW Marchand, multilayer MS Marchand, planar-transformer and broadside-coupled line baluns. Operational frequencies range from 1.5 GHz to 24 GHz. Maximum relative bandwidths in excess of 3:1 are achieved, Simulated performances using full wave electromagnetic (EM) analysis are in good agreement with the measured results. Also, two accurate equivalent circuit models constructed from either EM simulated or measured s-parameters are developed for the MS Marchand and transformer baluns making the optimization of baluns and circuit design using the bahms much more efficient. Additionally, the design of a monolithic double-balanced diode mixer using two planar-transformer baluns is also presented. Without dc bias, the mixer shows a minimum conversion loss of 6 dB with the RF at 5 GHz and a LO drive of 15 dBm at 4 GHz. The measured input IP/sub 3/ of this mixer is better than 15 dBm over the 4 to 5.75 GHz frequency band.

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X-Band MMIC Amplifier with Pulse-Doped GaAs MESFET's (Dec. 1991 [T-MTT])

N. Shiga, S. Nakajima, K. Otobe, T. Sekiguchi, N. Kuwata, K.-I. Matsuzaki and H. Hayashi. "X-Band MMIC Amplifier with Pulse-Doped GaAs MESFET's (Dec. 1991 [T-MTT])." 1991 Transactions on Microwave Theory and Techniques 39.12 (Dec. 1991 [T-MTT] (1991 Symposium Issue)): 1987-1994.

An X-band monolithic four-stage low noise amplifier (LNA) with 0.5 µm.gate pulse-doped GaAs MESFET's was successfully demonstrated for a direct broadcast satellite (DBS) converter. This paper presents the design and the test results. The key feature of the research is a detailed demonstration of the advantages of using series feedback with experiments and simulations. This LNA shows an excellent input VSWR match of under 1.3 and an output VSWR match of under 1.4 as well as a noise figure of 1.67 dB and a gain of 24 dB at 12 GHz, Moreover, the noise figure, the gain and VSWR's exhibit very little bias current dependence due to the exceptional features of the pulse-doped structure FET's and the optimized circuit design. Insensitivity to bias current implies performance stability in the face of process fluctuations. Thus, the yield of chips with noise figures of less than 2.0 dB is as high as 62.5%, and the variations of gain and VSWR are highly uniform as well.

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Enhancement-Mode Pseudomorphic Inverted HEMT for Low Noise Amplifier (Dec. 1991 [T-MTT])

K. Ohmuro, H.I. Fujishiro, M. Itoh, H. Nakamura and S. Nishi. "Enhancement-Mode Pseudomorphic Inverted HEMT for Low Noise Amplifier (Dec. 1991 [T-MTT])." 1991 Transactions on Microwave Theory and Techniques 39.12 (Dec. 1991 [T-MTT] (1991 Symposium Issue)): 1995-2000.

Characteristics of pseudomorphic inverted HEMT (P-I-HEMT) are compared with that of pseudomorphic HEMT. Both devices were fabricated in enhancement-mode by the same process. P-I-HEMT shows higher maximum transconductance of 590 mS\mm, and higher K-value of 600 mS/Vmm at thresh-old voltage of 0 V, and good pinch-off characteristics than its counterpart. Noise characteristics of P-I-HEMT are reported for the first time in this paper. Lower noise figure (1.0 dB at 18 GHz) was obtained in P-I-HEMT. It is concluded that the P-I-HEMT structure is suitable for fine gate low noise FETs. Furthermore, P-I-HEMT shows far better noise characteristics than the other at low drain voltage and current,

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GaAs HBT Wideband Matrix Distributed and Darlington Feedback Amplifiers to 24 GHz

K.W. Kobayashi, R. Esfandiari, M.E. Hafizi, D.C. Streit, A.K. Oki, L.T. Tran, D.K. Umemoto and M.E. Kim. "GaAs HBT Wideband Matrix Distributed and Darlington Feedback Amplifiers to 24 GHz." 1991 Transactions on Microwave Theory and Techniques 39.12 (Dec. 1991 [T-MTT] (1991 Symposium Issue)): 2001-2009.

This paper reports on the design and performance of a 2-24 GHz distributed matrix amplifier and a 1-20 GHz 2-stage Darlington coupled amplifier based on an advanced HBT MBE profile which increases the bandwidth response of the distributed and Darlington amplifiers by providing lower base-emitter and collector-base capacitances. The matrix amplifier has a 9.5 dB nominal gain and a 3-dB bandwidth to 24 GHz. This result benchmarks the highest bandwidth reported for an HBT distributed amplifier. The input and output VSWR's are less than 1.5:1 and 2.0:1, respectively. The total power consumed is less than 60 mW. The chip size measures 2.5 X 2.6 mm². The 2-stage Darlington amplifier has 7 dB gain and 3-dB bandwidth beyond 20 GHz. The input and ontput VSWR's are less than 1.5:1 and 2.3:1, respectively. This amplifier consumes 380 mW of power and has a chip size of 1.66 X 1.05 mm².

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Al/sub 0.3/Ga/sub 0.7/As/GaAs HEMT's Under Optical Illumination

A.A. de Salles and M.A. Romero. "Al/sub 0.3/Ga/sub 0.7/As/GaAs HEMT's Under Optical Illumination." 1991 Transactions on Microwave Theory and Techniques 39.12 (Dec. 1991 [T-MTT] (1991 Symposium Issue)): 2010-2017.

Theoretical and experimental work for the dc and RF performance of depletion mode Al/sub 0.3/Ga/sub 0.7/As/GaAs HEMT's under optical illumination is presented. Photoconductive effect increasing the 2-DEG channel electron concentration and photovoltaic effect in the gate junction are considered. Optical tuning of a 2 GHz HEMT oscillator and optical control of the gain of a 2 to 6 GHz HEMT amplifier are presented and potential applications are described.

Abstracts

S-Parameter Measurements and Microwave Applications of Flux Flow Superconducting Transistors

J.S. Martens, V.M. Hietala, T.E. Zipperian, D.S. Ginley, C.P. Tigges and J.M. Phillips. "S-Parameter Measurements and Microwave Applications of Flux Flow Superconducting Transistors." 1991 Transactions on Microwave Theory and Techniques 39.12 (Dec. 1991 [T-MTT] (1991 Symposium Issue)): 2018-2025.

We have performed microwave two-port S -parameter measurements and modeling on superconducting flux flow transistors. These transistors, based on the magnetic control of flux flow in an array of high temperature superconducting weak links, can exhibit significant available power gain at microwave frequencies (over 20 dB at 7-10 GHz in some devices). The input impedance is largely inductive while the output impedance is both resistive and inductive. The characteristics are such that these devices are useful in numerous applications including matched amplifiers, phase shifters and active impedance convertors.

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Abstracts

Photoconductive Impulse Generation and Radiation

A. Kim, R.J. Youmans, R. Zeto, M. Weiner, J. Fishback, J. Tsinetakes and B. Lalevic. "Photoconductive Impulse Generation and Radiation." 1991 Transactions on Microwave Theory and Techniques 39.12 (Dec. 1991 [T-MTT] (1991 Symposium Issue)): 2026-2030.

The generation of extremely narrow, high peak power pulses using an optically activated impulse generator has been demonstrated. Radiative measurements at 1 Hz PRF have been conducted at pulse bias levels up to 15 kV, using an optical pulse from a Nd:YAG laser to trigger the device. The measured pulse from a wide-band antenna had a pulsewidth of 1.5 ns with a risetime of 900 ps. The frequency spectrum of this radiated waveform ranged from 50 MHz to 1 GHz.

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Interfaces for High-Speed Fiber-Optic Links: Analysis and Experiment

A.S. Daryoush, E. Ackerman, N.R. Samant, S. Wanuga and D. Kasemset. "Interfaces for High-Speed Fiber-Optic Links: Analysis and Experiment." 1991 Transactions on Microwave Theory and Techniques 39.12 (Dec. 1991 [T-MTT] (1991 Symposium Issue)): 2031-2044.

An analysis of directly and externally modulated fiberoptic links is presented here. The theoretical analysis is based on the signal flow diagram of the interface circuits to the laser diode, Mach-Zehnder electro-optic modulator, and p-i-n photodiode. System parameters such as gain, noise figure, two-tone intermodulation distortion, and spurious free and compression dynamic range are expressed as a function of frequency and operating point of the laser and external modulator. Two directly and externally modulated fiber-optic links were designed and fabricated to verify the analytical models. The direct modulation FO link was developed at the Ku-band (11.6-12.4 GHz), whereas the external modulation link was at L-band (875-925 MHz). Spurious-free dynamic ranges of 95.8 dB·Hz/sup 2/3/ and 113 dB·Hz/sup 2/3/, respectively, were achieved, the best reported to date for these frequency bands. The predictions based on the analytical models match the measured results very well.

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Fiber-Optic Microwave Transmission Using Harmonic Laser Mixing, Optoelectronic Mixing, and Optically Pumped Mixing (Dec. 1991 [T-MTT])

H. Ogawa and Y. Kamiya. "Fiber-Optic Microwave Transmission Using Harmonic Laser Mixing, Optoelectronic Mixing, and Optically Pumped Mixing (Dec. 1991 [T-MTT])." 1991 Transactions on Microwave Theory and Techniques 39.12 (Dec. 1991 [T-MTT] (1991 Symposium Issue)): 2045-2051.

This paper proposes three fiber-optic link configurations for use in microwave and millimeter-wave signal transmission. Harmonic laser mixing, optoelectronic mixing and optically pumped mixing are successfully utilized to achieve high carrier frequencies in fiber-optic links. The performance of harmonic laser diode mixers is experimentally investigated in the X band. The p-i-n photodiode is used as an optoelectronic microwave mixer and an optically pumped microwave mixer, and the microwave characteristics of these mixers are demonstrated. These three fiber-optic link configurations show promise in transmitting microwave and millimeter-wave frequencies.

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Experimental Investigation of Microwave-Optoelectronic Interactions in a Microstrip Ring Resonator

G.K. Gopalakrishnan, B.W. Fairchild, C.L. Yeh, C.-S. Park, K. Chang, M.H. Weichold and H.F. Taylor. "Experimental Investigation of Microwave-Optoelectronic Interactions in a Microstrip Ring Resonator." 1991 Transactions on Microwave Theory and Techniques 39.12 (Dec. 1991 [T-MTT] (1991 Symposium Issue)): 2052-2060.

Microwave optoelectronic mixing is demonstrated on a semi-insulating gallium arsenide substrate, by monolithically integrating Schottky diode photodetectors into a microstrip ring resonator. When operated in the resistive mixing mode, a low frequency difference signal is extracted from the bias pad of the circuit. In the parametric mode, both degenerate and non-degenerate parametric amplification of an optical carrier signal takes place. The circuit shows good potential for application in wide-band fiberoptic systems.

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Dielectric Ring-Gap Resonator for Application in MMIC's (Dec. 1991 [T-MTT])

W.K. Hui and I. Wolff. "Dielectric Ring-Gap Resonator for Application in MMIC's (Dec. 1991 [T-MTT])." 1991 Transactions on Microwave Theory and Techniques 39.12 (Dec. 1991 [T-MTT] (1991 Symposium Issue)): 2061-2068.

A new dielectric resonator--the dielectric ring-gap resonator--is introduced and analyzed. The dielectric ring-gap resonator is obtained by sawing a narrow gap into a dielectric ring resonator. Resonant frequencies and unloaded Q factors of quasi-TE/sub 0pq/ modes in the ring-gap resonator have been calculated by an appropriate equivalent circuit starting from the resonant frequencies and the field distributions of the TE/sub 0pq/ modes in the ring resonator. The calculatnant frequencies of the fundamental quasi-TE/sub 011/ mode show an accuracy of <1% compared with the experimental results. New coupling techniques to couple the ring-gap resonator to e.g. a microstrip line on a thin substrate, using the electric fringing field near the gap, have been experimentally investigated, A new rigorous method of determining resonant frequencies and field distributions of TE modes in a multicomposite multilayered cylindrical dielectric resonator is presented. This resonator consists of numbers of cylinders, which are arbitrarily layered in axial direction.

Abstracts

Dielectric Ring Resonators Loaded in Waveguide and on Substrate

S.-W. Chen and K.A. Zaki. "Dielectric Ring Resonators Loaded in Waveguide and on Substrate." 1991 Transactions on Microwave Theory and Techniques 39.12 (Dec. 1991 [T-MTT] (1991 Symposium Issue)): 2069-2076.

A rigorous mode matching technique is used to analyze the dielectric ring resonators loaded in waveguide and on top of substrate. Variation of several lowest order modes' resonant frequencies as a function of structure parameters is presented and is helpful for optimization of spurious modes separation. Two-dimensional electric and magnetic field lines pattern and three-dimensional field intensities distribution of the ring resonators are plotted and provide valuable information for modes excitation, coupling, and spurious modes suppression. Coupling between two dielectric ring resonators loaded in a metallic cavity are analyzed. The dielectric ring resonators are used to design a C-band elliptic function dual mode band-pass filter employing HE/sub 11/ modes. Experimental results are presented and shows excellent agreement with the analytical solutions.

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Resonant Frequencies of Higher Order Modes in Cylindrical Anisotropic Dielectric Resonators (Dec. 1991 [T-MTT])

M.E. Tobar and A.G. Mann. "Resonant Frequencies of Higher Order Modes in Cylindrical Anisotropic Dielectric Resonators (Dec. 1991 [T-MTT])." 1991 Transactions on Microwave Theory and Techniques 39.12 (Dec. 1991 [T-MTT] (1991 Symposium Issue)): 2077-2082.

An improved method is developed which allows the determination of mode frequencies to high accuracy in cylindrical anisotropic dielectric resonators. This is an extension of Garault and Guillon's method from isotropic to anisotropic dielectrics, applied to four different classes of field patterns. The theory is confirmed by room temperature measurements in two sapphire crystals of different aspect ratios, and in cryogenic sapphire resonators used in high stability fixed and tunable oscillators. The sensitivity of mode frequency to dimensional and permittivity perturbations is analyzed.

Abstracts

A Scattering-Type Transverse Resonance Technique for the Calculation of (M)MIC Transmission Line Characteristics (Dec. 1991 [T-MTT])

J. Bornemann. "A Scattering-Type Transverse Resonance Technique for the Calculation of (M)MIC Transmission Line Characteristics (Dec. 1991 [T-MTT])." 1991 Transactions on Microwave Theory and Techniques 39.12 (Dec. 1991 [T-MTT] (1991 Symposium Issue)): 2083-2088.

A scattering-type formulation of the transverse resonance technique is introduced and applied to a variety of currently practical (M)MIC configurations. By utilizing a reflection coefficient matrix representation of boundary conditions, the characteristics of open, conductor-backed and shielded microstrip, slotline, or coplanar waveguide can be calculated. Excellent agreement with measurements and theoretical data on fundamental and higher-order mode characteristics is obtained. In contrast to other methods, which require mainframe support, the software based on this formulation is operational on 386-compatible personal computers.

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Sensitivity Analysis of Lossy Coupled Transmission Lines (Dec. 1991 [T-MTT])

S. Lum, M.S. Nakhla and Q.-J. Zhang. "Sensitivity Analysis of Lossy Coupled Transmission Lines (Dec. 1991 [T-MTT])." 1991 Transactions on Microwave Theory and Techniques 39.12 (Dec. 1991 [T-MTT] (1991 Symposium Issue)): 2089-2099.

An analysis method, based on the numerical inversion of the Laplace transform, is described for the evaluation of the time domain sensitivity of networks which include lossy coupled transmission lines. The sensitivity can be calculated with respect to network components and parameters of the transmission lines. Sensitivity analysis is useful for waveform shaping and optimization. Examples and comparisons with sensitivity determined by perturbation are presented.

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Asymmetric, Multi-Conductor Low-Coupling Structures for High-Speed, High-Density Digital Interconnects (Dec. 1991 [T-MTT])

J.P.K. Gilb and C.A. Balanis. "Asymmetric, Multi-Conductor Low-Coupling Structures for High-Speed, High-Density Digital Interconnects (Dec. 1991 [T-MTT])." 1991 Transactions on Microwave Theory and Techniques 39.12 (Dec. 1991 [T-MTT] (1991 Symposium Issue)): 2100-2106.

Small interline spacings and high switching speeds emphasize the problems of crosstalk and coupling distortion in high-speed, high-density digital interconnects. The use of substrate compensation allows the design of structures where crosstalk and coupling can be essentially eliminated, even for inter-line spacings of less than one center conductor width. Some of the characteristics of this novel method are presented for both symmetric and asymmetric multi-line geometries. Pulse distortion and crosstalk on a four-line, symmetric structure is analyzed, showing how crosstalk and coupling distortion is reduced by substrate compensation. Pulse distortion on symmetric coupled lines is also studied, showing that it is possible to choose a substrate combination which significantly reduces coupling and crosstalk for a wide range of conductor configurations.

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Analysis of Lossy Multiconductor Transmission Lines Using the Asymptotic Waveform Evaluation Technique (Dec. 1991 [T-MTT])

T.K. Tang, M.S. Nakhla and R. Griffith. "Analysis of Lossy Multiconductor Transmission Lines Using the Asymptotic Waveform Evaluation Technique (Dec. 1991 [T-MTT])." 1991 Transactions on Microwave Theory and Techniques 39.12 (Dec. 1991 [T-MTT] (1991 Symposium Issue)): 2107-2116.

A method is described for the transient analysis of lossy coupled transmission line networks with nonlinear elements. The method combines the asymptotic waveform evaluation technique with a piecewise decomposition algorithm. Two to three orders of magnitude speedup can be achieved relative to previously published methods with comparable accuracy. The method is useful for delay and crosstalk simulation of high speed VLSI interconnects.

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Dispersion Characteristics of Square Pulse with Finite Rise Time in Single, Tapered, and Coupled Microstrip Lines (Dec. 1991 [T-MTT])

P. Pramanick and R.R. Mansour. "Dispersion Characteristics of Square Pulse with Finite Rise Time in Single, Tapered, and Coupled Microstrip Lines (Dec. 1991 [T-MTT])." 1991 Transactions on Microwave Theory and Techniques 39.12 (Dec. 1991 [T-MTT] (1991 Symposium Issue)): 2117-2122.

The distortion of an electrical pulse, with finite rise time (quadratic-linear-quadratic transition) caused by dispersion as it propagates along a uniform microstrip, a tapered microstrip and a coupled pair of microstrips is investigated. Closed form analysis equations for single and coupled microstrips have been used to find the frequency dependent phase velocities. Results have been presented for two different taper profiles (exponential and triangular distributions). It is concluded that the optimization of the taper profile will provide the least pulse distortion.

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Analysis and Design of Slot-Coupled Directional Couplers Between Double-Sided Substrate Microstrip Lines (Dec. 1991 [T-MTT])

M.-F. Wong, V.F. Hanna, O. Picon and H. Baudrand. "Analysis and Design of Slot-Coupled Directional Couplers Between Double-Sided Substrate Microstrip Lines (Dec. 1991 [T-MTT])." 1991 Transactions on Microwave Theory and Techniques 39.12 (Dec. 1991 [T-MTT] (1991 Symposium Issue)): 2123-2129.

This paper proposes to study the characteristics of a slot-coupled directional coupler between two microstrip lines coupled through a rectangular slot in the common ground plane. Firstly, conformal mapping techniques are used to obtain analytic closed-form expressions for the coupler even and odd-mode impedances and propagation constants for any coupler configuration. Secondly, a full-wave analysis is performed using the spectral domain approach to determine the dispersion properties of coupler parameters. Theoretical and experimental results for a 10 dB coupler at 10 GHz are presented.

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New Interesting Leakage Behavior on Coplanar Waveguides of Finite and Infinite Widths (Dec. 1991 [T-MTT])

M. Tsuji, H. Shigesawa and A.A. Oliner. "New Interesting Leakage Behavior on Coplanar Waveguides of Finite and Infinite Widths (Dec. 1991 [T-MTT])." 1991 Transactions on Microwave Theory and Techniques 39.12 (Dec. 1991 [T-MTT] (1991 Symposium Issue)): 2130-2137.

0n previous work we showed that above a critical frequency the dominant mode on coplanar waveguide leaks power in the form of a surface wave on the surrounding substrate, and that this leakage can cause undesirable cross talk and can produce unexpected package effects. Further studies now reveal several new interesting behavioral features, such as unexpected sharp and deep minima (cancellation effects), various dimensional dependence, and how the leakage behavior varies significantly when the guide width changes from finite to infinite.

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A Rigorous Three Plane Mode-Matching Technique for Characterizing Waveguide T-Junctions, and its Application in Multiplexer Design

X.-P. Liang, K.A. Zaki and A.E. Atia. "A Rigorous Three Plane Mode-Matching Technique for Characterizing Waveguide T-Junctions, and its Application in Multiplexer Design." 1991 Transactions on Microwave Theory and Techniques 39.12 (Dec. 1991 [T-MTT] (1991 Symposium Issue)): 2138-2147.

A rigorous method for modeling rectangular wave-guide T-junctions is presented. The method characterizes the waveguide discontinuity three times when the side-arm of the T-junction is terminated in a short circuit with three different lengths, and hence is called the three plane mode-matching technique (TPMMT). Computed and measured data on both E-plane and H-plane T-junctions are compared, showing excellent agreement for the magnitudes and phases of the scattering matrix elements. Element values of equivalent circuit models proposed by Marcuvitz are computed and approximated by simple polynomials or rational functions, giving excellent accuracy. By using the S-parameters obtained from the TPMMT method, a network model of a waveguide manifold multiplexer is formulated. All parameters of the multiplexer, including the manifold dimensions and the filters, are optimized using this network model in terms of the multiplexer specification. The experimental results match the computed optimum results without further adjustment.

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A Modified Dynamic Model for Planar Microwave Circuits (Dec. 1991 [T-MTT])

T. Rozzi, A. Morini, A. Pallotta and F. Moglie. "A Modified Dynamic Model for Planar Microwave Circuits (Dec. 1991 [T-MTT])." 1991 Transactions on Microwave Theory and Techniques 39.12 (Dec. 1991 [T-MTT] (1991 Symposium Issue)): 2148-2153.

The present work is aimed at enhancing the effectiveness of the moments method in solving planar microwave circuits problems. It stems from the same analytical model as [11, [2]. Its novelty consists in introducing a technique, of fundamental mode sampling, that substantially reduces the complexity of the analysis and the computation time involved in the characterization of all practical discontinuities. Moreover, the numerical results are in very good agreement with experimental data.

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Full Wave Analysis of Propagation Characteristics of a through Hole Using the Finite-Difference Time-Domain Method (Dec. 1991 [T-MTT])

S. Maeda, T. Kashiwa and I. Fukai. "Full Wave Analysis of Propagation Characteristics of a through Hole Using the Finite-Difference Time-Domain Method (Dec. 1991 [T-MTT])." 1991 Transactions on Microwave Theory and Techniques 39.12 (Dec. 1991 [T-MTT] (1991 Symposium Issue)): 2154-2159.

A full wave analysis of the propagation characteristics of a through hole (or via hole) was carried out using the finite-difference time-domain (FD-TD) method and resuIts were compared with measurements from a physical model. The effects of rod diameter and microstrip connecting angle were examined. The computed scattering parameters (S-parameters) of a through hole showed excellent agreement with measured results from dc to high frequencies and in the time domain responses. As a result, it was shown that at high frequencies radiation is at a significant level and rod diameter and microstrip connecting angle strongly influence the propagation characteristics of a through hole.

Abstracts

A New Finite-Difference Time-Domain Formulation and its Equivalence with the TLM Symmetrical Condensed Node

Z. Chen, M.M. Ney and W.J.R. Hoefer. "A New Finite-Difference Time-Domain Formulation and its Equivalence with the TLM Symmetrical Condensed Node." 1991 Transactions on Microwave Theory and Techniques 39.12 (Dec. 1991 [T-MTT] (1991 Symposium Issue)): 2160-2169.

This paper describes a new finite-difference time-domain (FD-TD) formulation which is different from the FD-TD based on Yee's scheme. It is shown that the new finite-difference time-domain formulation is exactly equivalent to the symmetrical condensed node model used in the transmission line matrix (TLM) method. More specifically, the TLM method can be exactly formulated in a finite-difference form in terms of total field quantities. Due to a better field resolution and fulfillment of continuity conditions, the new FD-TD formulation or its TLM equivalent model give better convergence and accuracy than the traditional FD-TD method presently used. This is illustrated by numerical results pertaining to a finned waveguide.

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A Unified Framework for Computer-Aided Noise Analysis of Linear and Nonlinear Microwave Circuits (Dec. 1991 [T-MTT])

S. Heinen, J. Kunisch and I. Wolff. "A Unified Framework for Computer-Aided Noise Analysis of Linear and Nonlinear Microwave Circuits (Dec. 1991 [T-MTT])." 1991 Transactions on Microwave Theory and Techniques 39.12 (Dec. 1991 [T-MTT] (1991 Symposium Issue)): 2170-2175.

This paper introduces a concept for noise analysis in analog new unified theoretical and microwave circuits. Based on the adjoint system approach an analysis technique for general purpose CAD-applications is presented. The algorithm is easy to be implemented into existing CAD-tools. Moreover, it exploits the advantages of sparse matrix techniques.

Abstracts

A Combination of FD-TD and Prony's Methods for Analyzing Microwave Integrated Circuits (Dec. 1991 [T-MTT])

W.L. Ko and R. Mittra. "A Combination of FD-TD and Prony's Methods for Analyzing Microwave Integrated Circuits (Dec. 1991 [T-MTT])." 1991 Transactions on Microwave Theory and Techniques 39.12 (Dec. 1991 [T-MTT] (1991 Symposium Issue)): 2176-2181.

It is demonstrated in this paper that in applying the FD-TD technique to analyze microwave integrated circuits, the long FD-TD time record required for generating accurate frequency domain scattering parameters can be extrapolated from a relatively short FD-TD time record by using Prony's method. As shown by comparison with the direct FD-TD generated results, the new approach using the combination of FD-TD and Prony's methods achieves the same type of accuracy with a time record computed over a much shorter time.

Abstracts

High Dielectric Constant Strip Line Band Pass Filters

F.J. Winter, J.J. Taub and M. Marcelli. "High Dielectric Constant Strip Line Band Pass Filters." 1991 Transactions on Microwave Theory and Techniques 39.12 (Dec. 1991 [T-MTT] (1991 Symposium Issue)): 2182-2187.

High dielectric constant (K= 38) strip line was employed to realize selective band-pass filters. Seven-pole gap coupled filters centered at 6.04 GHz and 8.28 GHz were designed for 140 MHz 3-dB bandwidths. The data shows excellent agreement without the need for tuners. Miniaturization of high performance filters has been demonstrated. This technique is applicable to MMIC based microwave systems.

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Narrow Bandstop Filters (Dec. 1991 [T-MTT])

H.C. Bell, Jr.. "Narrow Bandstop Filters (Dec. 1991 [T-MTT])." 1991 Transactions on Microwave Theory and Techniques 39.12 (Dec. 1991 [T-MTT] (1991 Symposium Issue)): 2188-2191.

The synthesis of narrow bandstop filters with arbitrary stopband and equiripple passband responses is demonstrated. A new transformed frequency variable is used for iterative approximation with automatic bandwidth adjustment and prototype circuit realization.

Abstracts

A Two-Step Synthesis of Broadband Ridged Waveguide Bandpass Filters with Improved Performances (Dec. 1991 [T-MTT])

J.-C. Nanan, J.-W. Tao, H. Baudrand, B. Theron and S. Vigneron. "A Two-Step Synthesis of Broadband Ridged Waveguide Bandpass Filters with Improved Performances (Dec. 1991 [T-MTT])." 1991 Transactions on Microwave Theory and Techniques 39.12 (Dec. 1991 [T-MTT] (1991 Symposium Issue)): 2192-2197.

A quarter-wave broadband ridged waveguide band-pass filter with improved attenuation has been designed and realized. The two-steps synthesis uses first an equivalent network whose parameters are obtained with a multimodal variational approach which characterizes the discontinuities involved in the structure. It is shown that the frequency behavior of the filter is determined at this step by the chosen filter prototype. The structure is then optimized taking into account all side effects (higher order modes, dispersion), and also the rectangular to ridged waveguides transformer. Predicted data are compared with measured data and a good agreement is observed. It is shown how the use of lambda/4 resonators improves the attenuation in the upper stop-band and reduces the filter volume, which is very important in the aboard satellite telecommunication systems.

Abstracts

Application of Perturbation Theory to Toroidal Ferrite Phase Shifters

B. Lax and J. Pehowich. "Application of Perturbation Theory to Toroidal Ferrite Phase Shifters." 1991 Transactions on Microwave Theory and Techniques 39.12 (Dec. 1991 [T-MTT] (1991 Symposium Issue)): 2198-2203.

A new application of perturbation formalism is developed to solve for the phase shift of inhomogeneously loaded waveguides containing ferrite toroids with dielectric inserts. The nonreciprocal differential phase shift is derived explicitly for single and double toroidal phase shifters and agrees with experiment over a broad band of frequencies. The formalism that can take into account the coupling of higher order modes to the fundamental mode by the geometrical inhomogeneities and tensor properties of the ferrite is described. The theory can also be used to evaluate the impedances over a broad bandwidth.

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Dual-Ferrite Slot Line for Broadband, High-Nonreciprocity Phase Shifters

E.-B. El-Sharawy and C.J. Koza. "Dual-Ferrite Slot Line for Broadband, High-Nonreciprocity Phase Shifters." 1991 Transactions on Microwave Theory and Techniques 39.12 (Dec. 1991 [T-MTT] (1991 Symposium Issue)): 2204-2210.

A novel phase shifting structure that exhibits both broadband operation and high nonreciprocity is presented. This structure is comprised of a slot line between two oppositely-magnetized ferrite substrates, A full-wave, spectral-domain analysis is used, where Green's functions are formulated using a transmission matrix approach. By eliminating the use of relatively thick high-dielectric substrates, a bandwidth of 3:1 and a differential phase of 50° /cm are feasible. The geometry of the present structure can be optimized to increase both the nonreciprocity and the bandwidth. The characteristic impedance of the slot line is presented and shows a strong dependence on the slot width and the state of ferrite magnetization. The addition of thin layers of high-dielectric material increases the differential phase to over 100° /cm without significantly reducing the bandwidth. These layers were found to reduce the variation of characteristic impedance versus the ferrite magnetization.

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16-Term Error Model and Calibration Procedure for On-Wafer Network Analysis Measurements (Dec. 1991 [T-MTT])

J.V. Butler, D.K. Rytting, M.F. Iskander, R.D. Pollard and M.V. Bossche. "16-Term Error Model and Calibration Procedure for On-Wafer Network Analysis Measurements (Dec. 1991 [T-MTT])." 1991 Transactions on Microwave Theory and Techniques 39.12 (Dec. 1991 [T-MTT] (1991 Symposium Issue)): 2211-2217.

Vector network measurements are enhanced by calibrating the measurement system over the entire band of interest. This is presently done using a 12-term error correction model. Many measurement systems including open air devices, such as MMIC wafer probes, contain leakage and coupling error terms not modeled in current calibration systems. In this paper all error terms in such a system are included in a new 16-term error model and calibration procedure. Corrected measurements using the new 16-term calibration procedure are compared with TRL and 12-term calibration measurements and excellent agreement is observed for a non-leaky system. For a leaky system, the 12-term model is shown to break down while the 16-term model retains its accuracy. These results validate the accuracy and viability of the new calibration procedure for MMIC wafer probe measurements and other measurement systems containing leakage.

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Abstracts

A V-Band Wafer Probe Using Ridge-Trough Waveguide (Dec. 1991 [T-MTT])

E.M. Godshalk. "A V-Band Wafer Probe Using Ridge-Trough Waveguide (Dec. 1991 [T-MTT])." 1991 Transactions on Microwave Theory and Techniques 39.12 (Dec. 1991 [T-MTT] (1991 Symposium Issue)): 2218-2228.

In this paper a V-band (50-75 GHz) wafer probe is presented. The probe features a new type of waveguide developed to allow transition from rectangular waveguide to coplanar waveguide. This new waveguide consists of a ridge extending from the upper waveguide wall into a trough in the lower waveguide wall, and is known as ridge-trough waveguide. A mathematical model is presented that allows the important properties of the ridge-trough waveguide to be calculated such as the cutoff frequency and characteristic impedance.

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Abstracts

A Highly Sensitive Millimeter Wave Quasi-Optical FM Noise Measurement System (Dec. 1991 [T-MTT])

G.M. Smith and J.C.G. Lesurf. "A Highly Sensitive Millimeter Wave Quasi-Optical FM Noise Measurement System (Dec. 1991 [T-MTT])." 1991 Transactions on Microwave Theory and Techniques 39.12 (Dec. 1991 [T-MTT] (1991 Symposium Issue)): 2229-2236.

A highly sensitive, tunable, low loss quasi-optical millimeter wave FM noise measurement system has been constructed, with state of the art performance. It utilizes a novel matched, easily tuneable quasi-optical cavity in reflection, to act as a carrier suppression filter. This can operate with matched cavity Q's of several hundred thousand with almost zero insertion loss to provide an extremely high discriminator slope at low power levels. The FM noise measurement system can allow direct measurement of phase locked sources at low input power levels over ultra-wideband frequency ranges.

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Highly Sensitive Measurements with a Lens-Focused Reflectometer (Dec. 1991 [T-MTT])

D.R. Gagnon. "Highly Sensitive Measurements with a Lens-Focused Reflectometer (Dec. 1991 [T-MTT])." 1991 Transactions on Microwave Theory and Techniques 39.12 (Dec. 1991 [T-MTT] (1991 Symposium Issue)): 2237-2240.

A lens-focused microwave reflectometer is described which offers exceptional sensitivity and very wide band-width. The system produces a well confined spot focus and, with the prescribed calibration procedure, gives effective directivity approaching 70 dB. Applications include dielectric constant measurements and scanned imaging of bodies. Precision of ±1 dB is demonstrated for measurements, in X-band, at the -50 dB level.

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"Call for Papers - 35th Midwest Symposium on Circuits and Systems (Dec. 1991 [T-MTT])." 1991 Transactions on Microwave Theory and Techniques 39.12 (Dec. 1991 [T-MTT] (1991 Symposium Issue)): 2242-2242.

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"Index, IEEE [T-MTT] 1991, Volume 39, and MTT-S Sponsored Conferences." 1991 Transactions on Microwave Theory and Techniques 39.12 (Dec. 1991 [T-MTT] (1991 Symposium Issue)): i1-i61.

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Editorial - On the Occasion of Initiation of a New Publication for the Microwave Community (Jan. 1991 [MGWL])

T. Itoh. "Editorial - On the Occasion of Initiation of a New Publication for the Microwave Community (Jan. 1991 [MGWL])." 1991 Microwave and Guided Wave Letters 1.1 (Jan. 1991 [MGWL]): 1-1.

This is the inaugural issue of the brand new IEEE Microwave and Guided Wave Letters, which is a response of the IEEE Microwave Theory and Techniques Society to the changing needs of the members and other microwave engineers who require an enhanced and quick means of communication. The MTT-S ADCOM has always been sensitive to improving the service to its members with high quality products. It has been debating a need for a quick turn around publication such as those issued by a number of our sister societies and other organizations. This publication has come to reality by the enthusiastic initiative of the Publications Committee of the MTT-S, particularly its Chairman, Dr. Martin V. Schneider. Throughout the planning stage, MTT-S ADCOM has strongly endorsed this effort. The IEEE level of support was also very enthusiastic.

Abstracts

Effects of Superconducting Losses in Pulse Propagation on Microstrip Lines

O.R. Baiocchi, K.-S. Kong, H. Ling and T. Itoh. "Effects of Superconducting Losses in Pulse Propagation on Microstrip Lines." 1991 Microwave and Guided Wave Letters 1.1 (Jan. 1991 [MGWL]): 2-4.

An analysis of the effect of losses in the propagation of pulses on superconducting microstrip lines is presented. It is based on the phenomenological equivalence method (PEM) and the two-fluid model of superconductivity to calculate the propagation characteristics of the superconducting line. For most practical situations, it is shown that these losses do not introduce phase distortion, and the attenuation constant can be approximated by a quadratic expression of the frequency. Therefore, the effect of attenuation can be easily evaluated through a simple equivalent filter.

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Abstracts

Calculation of Multiconductor Microstrip Line Capacitances Using the Semidiscrete Finite Element Method

M. Davidovitz. "Calculation of Multiconductor Microstrip Line Capacitances Using the Semidiscrete Finite Element Method." 1991 Microwave and Guided Wave Letters 1.1 (Jan. 1991 [MGWL]): 5-7.

In the presented analysis partial finite element discretization of the Poisson's equation is implemented. The governing partial differential equation is thus reduced to a coupled set of ordinary differential equations, which is solved analytically. Formulation of the solution with this technique is more general and versatile than with the method of lines. The method of lines is derived as a special case of the semidiscrete finite element method.

Abstracts

Modeling of Nonlinear Active Regions in TLM

P. Russer, P.P.M. So and W.J.R. Hoefer. "Modeling of Nonlinear Active Regions in TLM." 1991 Microwave and Guided Wave Letters 1.1 (Jan. 1991 [MGWL]): 10-13.

The modeling of active and nonlinear subregions of microwave structures using the transmission line matrix (TLM) method is discussed. It is shown that a correct modeling of subregions with negative conductivity is possible by lumped circuit elements connected to the TLM mesh nodes.

Abstracts

THz Dichroic Plates for Use at High Angles of Incidence

P.H. Siegel, R.J. Dengler and J.C. Chen. "THz Dichroic Plates for Use at High Angles of Incidence." 1991 Microwave and Guided Wave Letters 1.1 (Jan. 1991 [MGWL]): 8-9.

The design of a high frequency dichroic plate consisting of an electrically thick self supporting metallic mesh that can be used in a linearly polarized quasi-optical system at high angles of incidence is described. The measured and computed performance of a 2.5-inch aperture mesh is given. This mesh has a 3-dB cutoff frequency of 875 GHz and less than 0.75 dB of transmission loss from 950-1350 GHz at incidence angles of 0, 30, and 45 degrees. The results of a multimode waveguide analysis corroborate the measured data.

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Patent Abstracts Associate Editors (Feb. 1991 [MGWL])

T. Itoh. "Patent Abstracts Associate Editors (Feb. 1991 [MGWL])." 1991 Microwave and Guided Wave Letters 1.2 (Feb. 1991 [MGWL]): 25-25.

For a number of years, the IEEE Transactions on Microwave Theory and Techniques has published in each issue a section called Patent Abstracts. This section has been very popular among many practicing engineers and patent lawyers. When we were planning the IEEE Microwave Guided Wave Letters, the MTT-S Publications Committee decided to transfer the Patent Abstracts section to the Letters journal as this action would benefit many readers requiring quick publication of patent information. The MTT-S ADCOM endorsed this decision.

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Abstracts

A Wide-Band Push-Pull GaAs Monolithic Active Isolator

F. Ali and A. Podell. "A Wide-Band Push-Pull GaAs Monolithic Active Isolator." 1991 Microwave and Guided Wave Letters 1.2 (Feb. 1991 [MGWL]): 26-27.

A novel 2-6 GHz push-pull GaAs monolithic active isolator has been designed and tested. This balanced MESFET isolator has better than 18 db reverse isolation at 6 GHz and provides greater than 15 dB input and output return loss across the band. This small (actual chip area: 12 mils x 24 mils) isolator chip draws 20mA of current from a single +5V supply. The compact chip size makes it an ideal candidate for impedance matching for monolithic sub-systems where a ferrite isolator is not practical.

Abstracts

28-39 GHz Distributed Harmonic Generation on a Soliton Nonlinear Transmission Line

E. Carman, K. Giboney, M. Case, M. Kamegawa, R. Yu, K. Abe, M.J.W. Rodwell and J. Franklin. "28-39 GHz Distributed Harmonic Generation on a Soliton Nonlinear Transmission Line." 1991 Microwave and Guided Wave Letters 1.2 (Feb. 1991 [MGWL]): 28-31.

A second-harmonic generation is reported in the 26-40 GHz band through soliton propagation on a GaAs monolithic nonlinear transmission line. At 20 dBm input power, a 20-diode structure attained <12 db conversion loss for input frequencies from 13.5-18 GHz, with 9.3 dB minimum conversion loss, while a 10-diode structure attained <12 dB loss, 14-19.5 GHz (7.3 dB minimum). With reduction of conductor skin losses, broadband operation and peak conversion efficiencies approaching -3 dB are attainable.

Abstracts

Wide-Band Millimeter Wave Characterization of Sub-0.2 Micrometer Gate-Length AlInAs/GaInAs HEMT's

M. Matloubian, S.E. Rosenbaum, H.R. Fetterman and P.T. Greiling. "Wide-Band Millimeter Wave Characterization of Sub-0.2 Micrometer Gate-Length AlInAs/GaInAs HEMT's." 1991 Microwave and Guided Wave Letters 1.2 (Feb. 1991 [MGWL]): 32-34.

The S parameters of an AlInAs/GaInAs high electron mobility transistor (HEMT) were measured using a picosecond optoelectronic system over a bandwidth of 100 GHz. These picosecond optoelectronic measurements were validated by comparing low frequency measurements to those obtained using on wafer RF probes/vector network analyzer, and W-band results to measurements done using a waweguide-to-microstrip transition/vector network analyzer frequency extender. This is the widest bandwidth of measured S parameters reported on a single transistor.

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A Voltage Tunable 35 GHz Monolithic GaAs FECTED Oscillator

K. Lubke, H. Scheiber and H. Thim. "A Voltage Tunable 35 GHz Monolithic GaAs FECTED Oscillator." 1991 Microwave and Guided Wave Letters 1.2 (Feb. 1991 [MGWL]): 35-37.

Monolithically integrated FECTED-oscillators have been fabricated with high yield, high reliability and precise frequency control. With unoptimized circuits 12 mW with 1.4% efficiency in cw-operation and 25 mW with 2% efficiency in pulsed operation have been obtained. These results represent the highest power output and efficiency of monolithic TED and FET oscillator in this frequency range.

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Transitioning Between Microstrip and Inverted Microstrip

W.C. Drach and T.E. Koscica. "Transitioning Between Microstrip and Inverted Microstrip." 1991 Microwave and Guided Wave Letters 1.3 (Mar. 1991 [MGWL]): 49-50.

A broadband microstrip to inverted microstrip transition is described. Empirical results are presented. A few applications are discussed.

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Low-Resistance Ohmic Contacts for Microwave and Lightwave Devices

P.A. Verlangieri, M. Kuznetsov and M.V. Schneider. "Low-Resistance Ohmic Contacts for Microwave and Lightwave Devices." 1991 Microwave and Guided Wave Letters 1.3 (Mar. 1991 [MGWL]): 51-53.

High-speed solid-state devices for use in microwave and lightwave circuits require high quality ohmic contacts to n- or p-type compound semiconductor layers. The fabrication and electrical properties of a multilayer ohmic contact with contact resistances in the 10-7 ohm-cm/sub 2/ range on both n- and p-type materials are reported.

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Electrical Characteristics of Thin-Film Ba/sub 2/YCu/sub 3/O/sub 7/ Superconducting Ring Resonators

P.A. Polakos, C.E. Rice, M.V. Schneider and R. Trambarulo. "Electrical Characteristics of Thin-Film Ba/sub 2/YCu/sub 3/O/sub 7/ Superconducting Ring Resonators." 1991 Microwave and Guided Wave Letters 1.3 (Mar. 1991 [MGWL]): 54-56.

The development of high-temperature superconducting thin films has opened up new opportunities for microstrip applications to exploit the low-loss properties of these films. It is reported that the microwave performance of superconducting microstrip ring resonators between 2 and 22 GHz for which both microstrip and ground plane were fabricated from Ba/sub 2/YCu/sub 3/0/sub 7/ films deposited on both sides of the same LaAlO/sub 7/ substrate. At 9.5 GHz, resonances were observed with intrinsic Q's of ~7500 at 75 K and ~20,000 at 25 K. The 75 K value represents an improvement of a factor 20 over Au.

Abstracts

Vector Coupled-Mode Calculation of Guided Vector Modes on an Equilateral Three-Core Optical Fiber

H.S. Huang and H.-C. Chang. "Vector Coupled-Mode Calculation of Guided Vector Modes on an Equilateral Three-Core Optical Fiber." 1991 Microwave and Guided Wave Letters 1.3 (Mar. 1991 [MGWL]): 57-59.

The guided vector modes propagating on an equilateral three-core optical fiber, in which the component cores are identical, single-moded, and arrayed in an equilateral triangle, are determined using the coupled-mode approach. It is shown that in the case of weakly guiding fibers, the polarization patterns of the six vector array modes can be correctly obtained if the vectorial-form coupled-mode theory is applied and the coupling among the six HE/sub 11/ modes of the individual cores is considered.

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Experimental Characterization of External Electrooptic Probes

M.Y. Frankel, J.F. Whitaker, G.A. Mourou and J.A. Valdmanis. "Experimental Characterization of External Electrooptic Probes." 1991 Microwave and Guided Wave Letters 1.3 (Mar. 1991 [MGWL]): 60-62.

The accuracy and invasiveness of various external LiTaO/sub 3/ electrooptic probe geometries is investigated experimentally. Such probes are an integral part of external electrooptic sampling systems used for the measurement of high bandwidth electrical signals in microwave integrated circuits. The experimental results indicate that for optimum measurement accuracy and minimum invasiveness of the probe, the electrooptic crystal should be no thicker than the extent of the microwave coplanar transmission line guided mode. Thinned crystals possess additional advantages of reduced thermal drift and reduced stray signal pickup from adjacent signal lines.

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Abstracts

Microwave Thermal Angioplasty in the Normal and Atherosclerotic Rabbit Model

A. Rosen, P. Walinsky, D. Nardone, D. Smith, A. Martinez-Hernandez, M. Consigny, Z. Kosman and H. Rosen. "Microwave Thermal Angioplasty in the Normal and Atherosclerotic Rabbit Model." 1991 Microwave and Guided Wave Letters 1.4 (Apr. 1991 [MGWL]): 73-75.

The results of using Microwave (2450 MHz) Balloon Angioplasty (MBA) in normal and diseased animal model (rabbits) are described. In atherosclerotic rabbits, MBA at 85°C results in an enhanced lumen diameter compared to Conventional Balloon Angioplasty (CBA) immediately post balloon angioplasty.

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InGaAs MESFET's Low-Noise for Millimeter-Wave Applications

G.-W. Wang, R. Kaliski and Y. Chang. "InGaAs MESFET's Low-Noise for Millimeter-Wave Applications." 1991 Microwave and Guided Wave Letters 1.4 (Apr. 1991 [MGWL]): 76-77.

It is reported that excellent device performance and uniformity can be achieved with 0.25-µm gate InGaAs MESFET's fabricated by the mixed manufacturing technology of MOCVD and ion implantation. An average f/sub t/ of 102 GHz with a standard deviation of 12 GHz is derived from the S-parameter measurements of 139 devices uniformly distributed on a 3-inch-diameter GaAs wafer. Two-stage low-noise amplifiers fabricated by using these InGaAs MESFET's demonstrate a typical noise figure of 3.6 dB with an associated gain of 14.4 dB at 44 GHz.

Abstracts

Measured and Computed Performance of a Microstrip Filter Composed of Semi-Insulating GaAs on a Fused Quartz Substrate

P.H. Siegel, J.E. Oswald and R.J. Dengler. "Measured and Computed Performance of a Microstrip Filter Composed of Semi-Insulating GaAs on a Fused Quartz Substrate." 1991 Microwave and Guided Wave Letters 1.4 (Apr. 1991 [MGWL]): 78-80.

The performance of a microstrip hammerhead filter that has been fabricated on an electrically thin layer of semi-insulating GaAs backed by a fused quartz substrate is measured and computed. The filter is intended for applications involving ultra thin "lifted-off" or "etched-back" GaAs containing both active devices and passive microstrip circuitry backed by a much thicker mechanically rigid low-loss low-dielectric-constant substrate. The low pass characteristics of the hammerhead filter with the intermediate GaAs layer are compared with those of the same filter on quartz alone. Both the measured and computed data show a significant (= 10%) shift in the filter response curve when the thin GaAs layer is present.

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A Note on the Calculation of the Current Distribution in Lossy Microstrip Structures

A. Cangellaris. "A Note on the Calculation of the Current Distribution in Lossy Microstrip Structures." 1991 Microwave and Guided Wave Letters 1.4 (Apr. 1991 [MGWL]): 81-83.

The equations that govern the current distribution in the finite-thickness conductor of a microstrip structure are developed in a rigorous manner. It is shown that the cross-sectional variation of the current density is independent of the field variation along the axis of the microstrip line only for the case when the displacement current in the conductor is negligible compared to the conduction current, a condition easily fulfilled for most practical applications, and the line is operated in the quasi-TEM mode. The validity of various methods proposed recently for conductor loss calculations is discussed on the basis of this analysis.

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Evaluation of Superconducting Tl-Ca-Ba-Cu-O Thin-Film Surface-Resistance Using a Microstrip Ring Resonator

V.M. Hietala, J.S. Martens, D.S. Ginley, T.E. Zipperian, C.P. Tigges, M.S. Housel and T.A. Plut. "Evaluation of Superconducting Tl-Ca-Ba-Cu-O Thin-Film Surface-Resistance Using a Microstrip Ring Resonator." 1991 Microwave and Guided Wave Letters 1.4 (Apr. 1991 [MGWL]): 84-86.

The use of thin-film superconductors for microwave applications critically depends on the material parameters of surface resistance and penetration depth. These parameters are generally difficult to measure. A measurement technique is presented using microstrip ring resonators and contactless probing that determines these critical parameters. Analysis accounting for field penetration into the conductors is also presented. Normal metal resonators are used to calibrate/verify the measurement. The surface resistance of a T1-Ca-Ba-Cn-O superconducting thin film measured at 8.03 GHz and 77 K was found to be about 0.5 m omega.

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A New Approach to the Design of Graded-Index Guided Wave Devices

D.W. Mills and L.S. Tamil. "A New Approach to the Design of Graded-Index Guided Wave Devices." 1991 Microwave and Guided Wave Letters 1.4 (Apr. 1991 [MGWL]): 87-89.

An inverse scattering approach to modeling single mode gradient-index planar guided wave devices is presented. The method involves solving the Gelfand-Levitan -Marchenko integral equation to obtain a refractive index profile which is infinite in extent. The theory is developed to account for truncations of this refractive index profile, illustrating the effects of a finite core width upon the propagation constant. Refractive index profiles with symmetric and asymmetric cladding indexes are discussed.

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Full-Wave Analyses of Composite-Metal Multidielectric Lossy Microstrips

W.-K. Wang and C.-K.C. Tzuang. "Full-Wave Analyses of Composite-Metal Multidielectric Lossy Microstrips." 1991 Microwave and Guided Wave Letters 1.5 (May 1991 [MGWL]): 97-99.

The full-wave mode-matching method is extended to analyze composite-metal multidielectric microstrips commonly used in MMIC's. The theoretical data obtained by the present approach agree favorably with the available experimental data for GaAs-SiN-Ti-Au finite-width, composite-metal and multidielectric microstrips. The effect of the thickness of the finite-width titanium layer is reported and discussed.

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W-Band Oscillator Using Ion-Implanted InGaAs MESFET's

J.M. Schellenberg, C.L. Lau, M. Feng and P. Brusenback. "W-Band Oscillator Using Ion-Implanted InGaAs MESFET's." 1991 Microwave and Guided Wave Letters 1.5 (May 1991 [MGWL]): 100-102.

While FET devices dominate microwave applications at lower frequencies, they have not yet demonstrated sufficient power as a source at W-band frequencies to displace 2-terminal Gunn and IMPATT devices. A fundamental FET oscillator is reported operating at 92.3 GHz with an output power of 14 mW. This is the highest reported output power for an FET oscillator at W-band frequencies and is comparable to commercial Gunn diode oscillators. Further, these results were achieved with an InGaAs MESFET device that was fabricated using low-cost ion-implantation techniques.

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A 5-Gb/s Decision Circuit Fabricated in a 1.5-µm Super-Self-Aligned Silicon Bipolar IC Technology

R.G. Swartz, V.D. Archer, T.Y. Chiu, Y. Ota, A.M. Voshchenkov, T. Long, K. Moerschel and W. Possanza. "A 5-Gb/s Decision Circuit Fabricated in a 1.5-µm Super-Self-Aligned Silicon Bipolar IC Technology." 1991 Microwave and Guided Wave Letters 1.5 (May 1991 [MGWL]): 103-106.

The design and, experimental measurements on a clocked decision circuit for optical communication applications are reviewed. The circuit, fabricated in a 1.5-µm super-selfaligned silicon bipolar technology, yields a BER <10/sup -9/ at a bit rate of 5 Gb/s. At 2.5 Gb/s, the small signal input data sensitivity is 10 mV, the clock timing margin is 320 ps (288°), the output eye opening is 300 ps (270°), and the rise/fall times are about 100 ps.

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Monolithic AlGaAs-GaAs HBT Single- and Dual-Stage Ultra-Broadband Amplifiers

F. Ali, R. Ramachandran and A. Podell. "Monolithic AlGaAs-GaAs HBT Single- and Dual-Stage Ultra-Broadband Amplifiers." 1991 Microwave and Guided Wave Letters 1.5 (May 1991 [MGWL]): 107-109.

The circuit design and performance of single- and dual-stage ultra-wideband MMIC amplifiers utilizing AlGaAs-GaAs Heterojunction Bipolar Transistors (HBT's) are presented. The single-stage feedback amplifier has 10 dB gain and a 3-dB bandwidth of DC to 18 GHz. The two-stage ac coupled version achieves over 20 dB of gain and a 3-dB band-width of 0.1 to 18 GHz. Both of these amplifiers are extremely small in size (single-stage--24 mils x 24 mils, two-stage--24 mils x 40 mils) since there are no reactive matching elements. This results in high chip yield and low cost.

Abstracts

A MESFET-Controlled X-Band Active Bandpass Filter

Y. Yamamoto, K.-I. Kawasaki and T. Itoh. "A MESFET-Controlled X-Band Active Bandpass Filter." 1991 Microwave and Guided Wave Letters 1.5 (May 1991 [MGWL]): 110-111.

A new MESFET-controlled active band-pass filter has been developed in X-band. This filter loss is compensated for by the negative resistance generated by a MESFET. The series tank circuit of the filter includes another MESFET that is controlled either by a gate-to-source bias or by a semiconductor laser illumination. The center frequency of the passband can be shifted by 75 MHz with an accompanying bandwidth change from 6 MHz to 17 MHz when the gate-to-source voltage of the tuning MESFET is varied. Laser illumination of this MESFET shifts the center frequency of the filter by 57 MHz with a bandwidth change from 6.5 MHz to 10 MHz.

Abstracts

Two-Port FET Oscillators with Applications to Active Arrays

J. Birkeland and T. Itoh. "Two-Port FET Oscillators with Applications to Active Arrays." 1991 Microwave and Guided Wave Letters 1.5 (May 1991 [MGWL]): 112-113.

Investigations of two-port FET oscillators and their use in active arrays for spatial power combining are reported. The oscillator consists of a single FET amplifier with a microstrip coupler providing feedback, thereby creating distinct input and output ports. This type of oscillator exhibits increased locking bandwidth over alternative approaches. Results are given for a five element linear array operating at 6 GHz.

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A Super Low-Noise 0.1 µm T-Gate InAlAs-InGaAs-InP HEMT

K.H.G. Duh, P.C. Chao, S.M.J. Liu, P. Ho, M.Y. Kao and J.M. Ballingall. "A Super Low-Noise 0.1 µm T-Gate InAlAs-InGaAs-InP HEMT." 1991 Microwave and Guided Wave Letters 1.5 (May 1991 [MGWL]): 114-116.

0.l µm T-gate InAIAs-InGaAs-InP HEMT's developed in our laboratory have exhibited state-of-the-art noise and gain performance well up to 100 GHz. Minimum noise figures of 0.8 and 1.2 dB with gains of 8.9 and 7.2 dB have been measured at 60 and 94 GHz, respectively. The W-band low-noise result is the best noise performance ever observed for any microwave transistors. A high performance W-Band three-stage amplifier has been built using these devices: noise figures between 3.2 dB-3.5 dB with gain of 17.5±0.4 dB from 91 to 96 GHz. 6 dB improvement in the 1 dB compression characteristic of the amplifier has been achieved with a GaAs pseudomorphic HEMT in the third stage.

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Noise Waves and Passive Linear Multiports

S.W. Wedge and D.B. Rutledge. "Noise Waves and Passive Linear Multiports." 1991 Microwave and Guided Wave Letters 1.5 (May 1991 [MGWL]): 117-119.

A simple derivation is given for the relation between a passive circuit's noise wave correlation matrix and its scattering matrix. It is shown that this relation, referred to as Bosma's theorem, comes readily from the fundamental principle that a passive multiport in thermodynamic equilibrium with reflectionless terminations produces uncorrelated output waves.

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Optical Millimeter-Wave Interactions: Measurements, Generation, Transmission and Control (Advertisement) (May 1991 [MGWL])

"Optical Millimeter-Wave Interactions: Measurements, Generation, Transmission and Control (Advertisement) (May 1991 [MGWL])." 1991 Microwave and Guided Wave Letters 1.5 (May 1991 [MGWL]): 128-128.

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Improved Millimeter-Wave Mixer Performance Analysis at Cryogenic Temperatures

P.H. Siegel, I. Mehdi and J. East. "Improved Millimeter-Wave Mixer Performance Analysis at Cryogenic Temperatures." 1991 Microwave and Guided Wave Letters 1.6 (Jun. 1991 [MGWL]): 129-131.

The results are presented of a 600-GHz mixer performance analysis using an improved model for computing the Schottky diode capacitance-voltage (C-V) relationship. The computed C-V data for a realistic submillimeter-waver mixer diode are given as a function of physical temperature and compared to the standard analytic expression based on a solution of Poisson's equation. Both C-V relationships are used to predict the performance of an ideally terminated 600 GHz mixer operating at 300, 140, 80, and 30 K. It is shown that the drift-diffusion model more accurately describes the mixer performance when the physical temperature is reduced below /spl ap/100 K.

Abstracts

Generation of Millimeter-Wave Radiation by Optical Mixing Printed in FET's Integrated with Circuit Antennas

D.V. Plant, D.C. Scott, D.C. Ni and H.R. Fetterman. "Generation of Millimeter-Wave Radiation by Optical Mixing Printed in FET's Integrated with Circuit Antennas." 1991 Microwave and Guided Wave Letters 1.6 (Jun. 1991 [MGWL]): 132-134.

Using optical mixing, we have demonstrated the generation of continuous wave 60-GHz millimeter wave radiation from FET's integrated with planar antennas. The radiation was propagated through narrow band quasi-optical Fabry-Perot filters and heterodyne detected in a second FET antenna structure. In addition to spectroscopic applications, this transmitter/ receiver system demonstrates the feasibility of having optically fed arrays of millimeter wave sources.

Abstracts

Modeling Via Hole Grounds in Microstrip

M.E. Goldfarb and R.A. Pucel. "Modeling Via Hole Grounds in Microstrip." 1991 Microwave and Guided Wave Letters 1.6 (Jun. 1991 [MGWL]): 135-137.

A simple model for a cylindrical via hole in microstrip is presented. The model is based on a modification of the inductance of a cylindrical conductor as derived from Maxwell's equations. The model has been verified experimentally, and corroborated by other solutions using numerical techniques.

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Analysis of Planar Waveguides with the Method of Lines and Absorbing Boundary Conditions

A. Dreher and R. Pregla. "Analysis of Planar Waveguides with the Method of Lines and Absorbing Boundary Conditions." 1991 Microwave and Guided Wave Letters 1.6 (Jun. 1991 [MGWL]): 138-140.

The method of lines is extended to analyze planar waveguides with open boundaries. The efficiency of using absorbing boundary conditions is demonstrated by the calculation of the effective permittivity of a single microstrip line.

Abstracts

Characteristic Impedance Determination Using Propagation Constant Measurement

R.B. Marks and D.F. Williams. "Characteristic Impedance Determination Using Propagation Constant Measurement." 1991 Microwave and Guided Wave Letters 1.6 (Jun. 1991 [MGWL]): 141-143.

A method is demonstrated where by the characteristic impedance of transmission lines may be easily determined from a measurement of the propagation constant. The method is based on a rigorous analysis using realistic approximations to account for the effects of imperfect conductors. Numerical studies indicate that high accuracy is possible, and experiments using coplanar waveguide demonstrate the advantage of the method in the interpretation of S-parameters.

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Sustaining (Voluntary) Page Charge Form (Jun. 1991 [MGWL])

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Editorial - Announcing the Move to Electronic Publishing (Jul. 1991 [MGWL])

T. Itoh. "Editorial - Announcing the Move to Electronic Publishing (Jul. 1991 [MGWL])." 1991 Microwave and Guided Wave Letters 1.7 (Jul. 1991 [MGWL]): 153-153.

For the last several years, the IEEE Publications Department has been moving its operation toward electronic publication. The IEEE Computer Society has pioneered electronic publishing within the IEEE since about 1985 and now publishes all its magazines and Transactions in electronic form. The IEEE has been promoting this form of publishing and making it available to other societies. Since electronic publishing is expected to save both time and cost in publication, IEEE Microwave and Guided Wave Letters will take advantage of the opportunity for electronic publishing beginning with the January 1992 issue. Those authors wishing to make use of this service are requested to follow the guidelines printed on the following page of this issue and in appropriate sections in the "Information for Authors" on the back cover and on the inside back cover in the subsequent issues. Since not every author has an access to computers for the typing of the manuscript, this procedure is still optional.

Abstracts

Suggestions to Authors Wishing to Supply Manuscripts in Electronic Form (Jul. 1991 [MGWL])

"Suggestions to Authors Wishing to Supply Manuscripts in Electronic Form (Jul. 1991 [MGWL])." 1991 Microwave and Guided Wave Letters 1.7 (Jul. 1991 [MGWL]): 154-154.

Abstracts

Integrated 119-µm Linear Corner-Cube Array

S.S. Gearhart, C.C. Ling, G.M. Rebeiz, H. Davee and G. Chin. "Integrated 119-µm Linear Corner-Cube Array." 1991 Microwave and Guided Wave Letters 1.7 (Jul. 1991 [MGWL]): 155-157.

An integrated corner-cube antenna has been designed, fabricated, and measured at 119 µm. The structure consists of a traveling-wave antenna integrated on a 1-µm dielectric membrane and suspended in a longitudinal cavity etched in silicon wafers. The patterns at 119 µm agree well with millimeter-wave patterns measured on a scaled antenna at 222 GHz. A directivity of 18 ± 0.5 dB is calculated from E- and H-plane measurements. This work demonstrates that high-efficiency integrated corner-cube antennas are easily scalable to terahertz frequencies and could be used for radio-astronomical and plasma-diagnostic applications.

Abstracts

Modeling of Planar Circuits Including the Effect of Space-Varying Surface Impedances

A. Janhsen and V. Hansen. "Modeling of Planar Circuits Including the Effect of Space-Varying Surface Impedances." 1991 Microwave and Guided Wave Letters 1.7 (Jul. 1991 [MGWL]): 158-160.

The calculation of microstrip circuits including the effect of lumped impedances can be done by describing the lumped elements mathematically with the help of A-functions. This approach proceeds on the assumption of impedances with infinite small extension in one dimension. This approach is generalized for impedances of finite extend. Therefore space-varying surface impedances are introduced that are incorporated into the mixed space-spectral domain analysis. The circuit is embedded in layered media and is fed by an arbitrary number of planar lines. Examples for microstrip lines with an absorbing impedance region are given.

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Subpicosecond Pulse Propagation on Coplanar Waveguides: Experiment and Simulation

S. Gupta, J.F. Whitaker and G.A. Mourou. "Subpicosecond Pulse Propagation on Coplanar Waveguides: Experiment and Simulation." 1991 Microwave and Guided Wave Letters 1.7 (Jul. 1991 [MGWL]): 161-163.

Experimental results are presented for subpicosecond pulse propagation on normal-metal, coplanar-transmissionline structures. The pulse distortion that occurs is modelled using a semiempirical curve fit to the fullwave analysis for the modal dispersion and quasi-static approximations for the conductor and radiation loss. Without using any adjustable parameters, very good agreement is obtained for the delay, rise time and amplitude of the pulse for various propagation distances. For terahertz-bandwidth pulses on lines similar to the one studied, the modal dispersion and radiation losses are the dominant pulse-shaping mechanisms.

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New Method for the Characteristics Analysis of Dispersion of Various Planar Transmission Lines with Finite Metallization Thickness

L. Zhu and E. Yamashita. "New Method for the Characteristics Analysis of Dispersion of Various Planar Transmission Lines with Finite Metallization Thickness." 1991 Microwave and Guided Wave Letters 1.7 (Jul. 1991 [MGWL]): 164-166.

It is shown that the eigen-function weighted boundary integral equation method can be extended to analyze the dispersion characteristics of various planar transmission lines with finite metallization thickness, such as microstrip lines, conductor-backed coplanar waveguides, and micro-coplanar strip lines. The computational results clearly demonstrate the effect of finite strip thickness on the propagation properties of these transmission lines for MMIC's.

Abstracts

High-Performance and High-Yield Ka-Band Low-Noise MMIC Using 0.25-µm Ion-Implanted MESFET's

J. Mondal, J. Detry, J. Geddes and D.C. Geddes. "High-Performance and High-Yield Ka-Band Low-Noise MMIC Using 0.25-µm Ion-Implanted MESFET's." 1991 Microwave and Guided Wave Letters 1.7 (Jul. 1991 [MGWL]): 167-169.

Three-stage low-noise amplifiers fabricated using high-yield 0.25-µm ion-implanted process showed 4.2 dB average noise figure with a 15-dB gain in Ka-band.

Abstracts

A 29.3-GHz Cavity-Enclosed Aperture-Coupled Circular-Patch Antenna for Microwave Circuit Integration

J.A. Navarro, K. Chang, J. Tolleson, S. Sanzgiri and R.Q. Lee. "A 29.3-GHz Cavity-Enclosed Aperture-Coupled Circular-Patch Antenna for Microwave Circuit Integration." 1991 Microwave and Guided Wave Letters 1.7 (Jul. 1991 [MGWL]): 170-171.

A circular-patch antenna fed by an aperture coupled microstrip line has been demonstrated at 29.3 GHz. The patch was enclosed by a cavity to reduce surface-wave interactions in an array environment and to improve heat dissipation when using active devices. The antenna exhibited a 2:1 input VSWR bandwidth of 12% from 27.52 to 30.95 GFz.

Abstracts

A Flexible Approach Combining the Spectral Domain Method and Impedance Boundary Condition for the Analysis of Microstrip Lines

C.-W. Kuo and T. Itoh. "A Flexible Approach Combining the Spectral Domain Method and Impedance Boundary Condition for the Analysis of Microstrip Lines." 1991 Microwave and Guided Wave Letters 1.7 (Jul. 1991 [MGWL]): 172-174.

Impedance boundary condition model is incorporated in the spectral domain formulation to calculate the transmission characteristics of microstrip line with lossy conducting strip. Subsectional rectangular pulse functions are used as the basis functions for the surface current distribution because of the finite conductivity of the conducting strip. The approach has the advantage of being more flexible without presuming the edge condition of the surface current distribution and numerically efficient. Numerical results for the phase and attenuation constants of superconducting microstrip line are computed for a comparison.

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A Numerical Model of GaAs MESFET's Including Energy Balance for Microwave Applications

S. Yoganathan, S. Banerjee, T. Itoh, H. Shichijo and S. El-Ghazaly. "A Numerical Model of GaAs MESFET's Including Energy Balance for Microwave Applications." 1991 Microwave and Guided Wave Letters 1.7 (Jul. 1991 [MGWL]): 175-177.

Simulation of submicron semiconductor devices cannot be performed accurately using the drift-diffusion model (DDM), because of its inability to include nonlocal, hot carrier transport phenomena. Devices of these sizes require solution of the Poisson equation and the first three moments of the Boltzmann transport equation (BTE). These equations form a system of time-dependent, nonlinear, coupled, partial differential equations. The differential equations can be numerically solved using coupled or decoupled algorithms. Generally, coupled solvers require larger memory space and me computationally intensive, while conventional decoupled solvers have a limitation on the maximum time step which can be taken for transient solutions to less than the dielectric relaxation time (tau/sub d/). A new decoupled solver has been developed that allows larger time steps than conventional decoupled Gummel algorithms and is less CPU memory and time intensive than coupled Newton solvers.

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Analysis of Waveguide Aperture Coupling Using the Finite-Difference Time-Domain Method

P. Alinikula and K.S. Kunz. "Analysis of Waveguide Aperture Coupling Using the Finite-Difference Time-Domain Method." 1991 Microwave and Guided Wave Letters 1.8 (Aug. 1991 [MGWL]): 189-191.

The finite-difference time-domain method has been applied to a variety of scattering and coupling electromagnetic problems. It has not until now been applied to an interior propagation and coupling problem, given here in the form of aperture coupled waveguides. This problem demonstrates the method's ability to model a rather complex problem where energy not only propagates in a waveguide but couples to and then propagates within a second waveguide. The coupling consists of a single and a double aperture, The first case establishes modeling requirements and the second case is compared to experiment. Agreement is typically within experimental error thereby validating the method for this application,

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Velocity-Matched LiNbO/sub 3/ Waveguide Optical Modulator Using Inverted Slot Line

T. Yoneyama, K. Niinuma and S. Kanno. "Velocity-Matched LiNbO/sub 3/ Waveguide Optical Modulator Using Inverted Slot Line." 1991 Microwave and Guided Wave Letters 1.8 (Aug. 1991 [MGWL]): 192-194.

An inverted slot line (ISL) was used to achieve velocity matching in a Ti-diffused LlNb0/sub 3/ waveguide optical modulator. Phase modulation of 1.38 radian could be observed at an optical wavelength of 0.63 µm with 100 mW microwave power around 10 GHz. This ISL optical modulator is expected to operate at millimeter wavelengths.

Abstracts

Monolithic Circuit for Reflection Coefficient Measurement

R.E. Neidert. "Monolithic Circuit for Reflection Coefficient Measurement." 1991 Microwave and Guided Wave Letters 1.8 (Aug. 1991 [MGWL]): 195-197.

A monolithic circuit for measuring complex reflection coefficient using fixed-probe voltage sampling has been investigated. Ion implanted GaAs Schottky diodes, with built-in isolation resistance, have been used as voltage samplers along a microstrip transmission line on semi-insulating GaAs. An algorithm for determining reflection coefficient from three detected dc voltages is described. Circuit analysis and modeling, dc voltage calculations, and experimental results are presented for the 5 to 18 GHz frequency range.

Abstracts

A Dielectric-Defined Process for the Formation of T-Gate Field-Effect Transistors

G.M. Metze, J.F. Bass, T.T. Lee, D. Porter, H.E. Carlson and P.E. Laux. "A Dielectric-Defined Process for the Formation of T-Gate Field-Effect Transistors." 1991 Microwave and Guided Wave Letters 1.8 (Aug. 1991 [MGWL]): 198-200.

A novel process for the fabrication of Tee- or Gamma-shaped gate structures is presented. This process was utilized to fabricate 0.25 µm x 60µm and 0.25 Km x 150 Km T-gate MESFET's. From s-parameter data up to 40 GHz, extrapolated cut-off frequencies (f/sub t/), as high as 55-65 GHz were obtained. This represents some of the highest f/sub t/'s ever reported for a MESFET. DC yields as high as 80% over 3" wafers, were obtained using this dielectric defined T-gate (DDTG) process. Further, step-stress measurements indicate device reliability comparable to our normal MESFET process. Relative to multilayer resist processing techniques usually employed to form T-gates, we believe the DDTG process will substantially increase the yield, uniformity and reliability of FET-like devices/circuits employing T-gates with geometries at or below 0.25 µm.

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Spurious Modes of the TLM-Condensed Node Formulation

J. Nielsen. "Spurious Modes of the TLM-Condensed Node Formulation." 1991 Microwave and Guided Wave Letters 1.8 (Aug. 1991 [MGWL]): 201-203.

The TLM method is based on temporal and spatial sampling of electromagnetic fields. As with the ND-TD method, this results in dispersive effects and propagating spurious modes that corrupt the field solution. The general dispersion relation for the TLM condensed node is used to quantify the propagation attributes of these spurious modes.

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Transverse Segmentation: A Novel Technique for the Efficient CAD of 2 N-Port Branch-Guide Couplers

F. Alessandri, M. Mongiardo and R. Sorrentino. "Transverse Segmentation: A Novel Technique for the Efficient CAD of 2 N-Port Branch-Guide Couplers." 1991 Microwave and Guided Wave Letters 1.8 (Aug. 1991 [MGWL]): 204-207.

Two novel field-matching techniques, the cellular technique (CT) and the transverse segmentation technique (TST), for the CAD of 2N-port branch-guide couplers have been developed and are compared with the bifurcation technique (BT) already adopted by other authors. By comparison with experimental data on 6- and 8-port couplers, all techniques exhibit excellent accuracy, but different numerical efficiency. The TST is shown to be eight times faster than the BT and five times faster than the CT. All methods can also be applied to other wave-guide components.

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A 30 GHz Bandwidth AlGaAs-GaAs HBT Direct-Coupled Feedback Amplifier

N.H. Sheng, W.J. Ho, N.L. Wang, R.L. Pierson, P.M. Asbeck and W.L. Edwards. "A 30 GHz Bandwidth AlGaAs-GaAs HBT Direct-Coupled Feedback Amplifier." 1991 Microwave and Guided Wave Letters 1.8 (Aug. 1991 [MGWL]): 208-210.

A dc to 30 GHz broadband amplifier based on the Darlington connected transistors with series and shunt resistive feedback was implemented with self-aligned AlGaAs-GaAs heterojunction bipolar transistor (HBT) technology. The measured performance shows 7.8 dB of gain with -3-dB roll-off band-width of 30 GHz. Measured at 1 GHz, the noise figure was 5.7 dB, 1-dB compression power was 11 dBm and the third-order intermodulation product intercept point (IP3) was 23.9 dBm.

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Analysis of a Coaxial-to-Waveguide Adaptor Incorporating a Dielectric Coated Probe

M.E. Bialkowski. "Analysis of a Coaxial-to-Waveguide Adaptor Incorporating a Dielectric Coated Probe." 1991 Microwave and Guided Wave Letters 1.8 (Aug. 1991 [MGWL]): 211-214.

An analysis of a coaxial-to-waveguide adaptor that incorporates a solid probe, coated with a dielectric is presented. Based on this analysis, a computer algorithm for an IBM PC is developed. The numerical results for the input impedance of the probe are presented and show good agreement with the other analyses and experiments.

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Mode-Locked Oscillator Arrays

R.A. York and R.C. Compton. "Mode-Locked Oscillator Arrays." 1991 Microwave and Guided Wave Letters 1.8 (Aug. 1991 [MGWL]): 215-218.

The output characteristics of a linear array of oscillators is discussed. By arranging the output frequencies of each oscillator to give a spectrum of equally spaced components, a "mode-locked" system results, thereby producing short, high-power RF pulses. Promising results from a linear array of up to five elements is presented, with good theoretical agreement.

Abstracts

Error in the Finite Element Discretization of the Scalar Helmholtz Equation Over Electrically Large Regions

A.F. Peterson and R.J. Baca. "Error in the Finite Element Discretization of the Scalar Helmholtz Equation Over Electrically Large Regions." 1991 Microwave and Guided Wave Letters 1.8 (Aug. 1991 [MGWL]): 219-222.

Discretization error arising from a finite element solution of the scalar Helmholtz equation for open-region geometries is studied for the simple case of scattering from dielectric slabs. In electrically-large homogeneous regions, the primary source of error is found to be phase error that increases progressively in a direction away from the boundary where the excitation is coupled into the computational domain. The error can be reduced by using smaller cell sizes, employing higher order polynomial basis functions, or using a modified "scattered field" formulation that couples the excitation into the equation in a different manner.

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Scattering Parameter Characterization of Microwave Optoelectronic Devices and Fiber-Optic Networks

S. Iezekiel, C.M. Snowden and M.J. Howes. "Scattering Parameter Characterization of Microwave Optoelectronic Devices and Fiber-Optic Networks." 1991 Microwave and Guided Wave Letters 1.9 (Sep. 1991 [MGWL]): 233-235.

A microwave fiber-optic network analyzer test set is proposed that will allow the application of two-port calibration theory to the measurement of optical and optoelectronic components in high frequency fiber-optic links. Formulae for the optoelectronic calibration are presented, and a unified approach to optical and optoelectronic two-port calibration theory is covered.

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Picosecond Characterization of Bent Coplanar Waveguides

S. Alexandrou, R. Sobolewski, H. Nakano, B.C. Tousley and T.Y. Hsiang. "Picosecond Characterization of Bent Coplanar Waveguides." 1991 Microwave and Guided Wave Letters 1.9 (Sep. 1991 [MGWL]): 236-238.

Picosecond electrical pulse propagation on Au coplanar waveguides fabricated on semi-insulating GaAs substrates has been analyzed. Propagation speed and signal distortion between the straight and bent transmission lines of different geometries were measured and compared with the aid of an electrooptic sampling system. The results indicate that the bent coplanar waveguides are capable of linking electronic devices operating in the sub-THz frequency regime. It is also found that smoothing of the bends can considerably improve high-frequency performance of these lines.

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Dual-Series Solution to Scattering from a Semicircular Channel in a Ground Plane

M.K. Hinders and A.D. Yaghjian. "Dual-Series Solution to Scattering from a Semicircular Channel in a Ground Plane." 1991 Microwave and Guided Wave Letters 1.9 (Sep. 1991 [MGWL]): 239-242.

Exact dual-series eigenfunction solutions, and simple closed-form low-frequency asymptotic approximations are determined for the problems of TM and TE scattering from a semicircular channel in a perfectly conducting ground plane. The eigenfunction solutions provide benchmarks for channel scattering, and the low-frequency solutions can be used to determine directly incremental length diffraction coefficients for narrow channels.

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Transmission Line Capacitance Measurement

D.F. Williams and R.B. Marks. "Transmission Line Capacitance Measurement." 1991 Microwave and Guided Wave Letters 1.9 (Sep. 1991 [MGWL]): 243-245.

The capacitance of coplanar lines is measured with two new techniques, one utilizing the resistance of the line and the other that of a resistor embedded in the line. The results of both measurements agree closely with calculations. A technique for directly comparing the capacitance of two similar transmission lines is also demonstrated. The relevance of these measurements to the determination of characteristic impedance is discussed.

Abstracts

Method for Extrinsic Characterization of Intrinsic and Components of Semiconductor Laser Diode Circuit Model

M.L. Majewski and D. Novak. "Method for Extrinsic Characterization of Intrinsic and Components of Semiconductor Laser Diode Circuit Model." 1991 Microwave and Guided Wave Letters 1.9 (Sep. 1991 [MGWL]): 246-248.

It is shown that measurements of intensity noise, small-signal modulation response and input reflection coefficients of a semiconductor laser diode can be used to characterize the intrinsic and extrinsic parameters of the laser. These measurements, combined with the analytical expressions presented here enable one to determine the intrinsic 3 dB-modulation bandwidth and the extrinsic parasitic components associated with the laser diode that generally introduce modulation bandwidth limitation.

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Universal Taper for Compensation of Step Discontinuities in Microstrip Lines

D. Raicu. "Universal Taper for Compensation of Step Discontinuities in Microstrip Lines." 1991 Microwave and Guided Wave Letters 1.9 (Sep. 1991 [MGWL]): 249-251.

A simple closed form expression is derived for the contour of a taper compensating step discontinuities in microstrip lines. The procedure is based on the observation that a function playing a prominent role in the differential equation of the taper admits a simple approximation. The contour formula is shown to be valid, with good accuracy, for a very broad range of conditions.

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Rigorous Formulation for Fields and Currents in Superconducting Microwave Transmission Lines

S.M. El-Ghazaly. "Rigorous Formulation for Fields and Currents in Superconducting Microwave Transmission Lines." 1991 Microwave and Guided Wave Letters 1.9 (Sep. 1991 [MGWL]): 252-254.

A direct approach is described for obtaining current distributions, power handling capabilities, and propagation characteristics of high T/sub c/ superconductor microwave lines. A rigorous formulation based on coupling a full-wave electromagnetic model with London's equations and the two fluid model for superconducting materials is suggested. The finite-difference scheme is employed to obtain a simplified solution. Calculated results showing current distributions and quality factor of a superconducting microstrip line are presented.

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Peak Current and Magnetic Flux Density Variations with Strip Width in Superconducting Microstrip Lines

S.M. El-Ghazaly, T. Itoh and R.B. Hammond. "Peak Current and Magnetic Flux Density Variations with Strip Width in Superconducting Microstrip Lines." 1991 Microwave and Guided Wave Letters 1.9 (Sep. 1991 [MGWL]): 255-257.

A computer model based on London's equations and Maxwell equations is used to investigate the characteristics high T/sub c/ superconducting microstrip lines. Distributions of superconducting current densities inside the strip, the magnetic flux density, and the quality factor variations with the strip width and operating frequency are presented. The obtained results are very useful for CAD. It is observed that an empirical relation between the strip width and the peak current density on strip can be deduced. The structure can be optimized to produce the highest quality factor or the largest current carrying capacity according to the application.

Abstracts

0.7 W X-Ku-Band High-Gain, High-Efficiency Common Base Power HBT

N.L. Wang, W.J. Ho and J.A. Higgins. "0.7 W X-Ku-Band High-Gain, High-Efficiency Common Base Power HBT." 1991 Microwave and Guided Wave Letters 1.9 (Sep. 1991 [MGWL]): 258-260.

Small sized AIGaAs-GaAs HBT's have achieved excellent power performance throughout the microwave frequency band. With the implementation of the multi-via-hole design, the HBT performance (gain and efficiency) is maintained as the size increases. A 0.7 W common-base (CB) power HBT with performance around 10 dB gain and 50% PAE well into the Ku band is reported. The performance is comparable to the pseudomorphic HEMT in this frequency range. The yield and uniformity are excellent. The high bias voltage (9.3 V V/sub ce/) is also strongly desired from system viewpoint.

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The Effect of Air Bridge Height on the Propagation Characteristics of Microstrip

M.E. Goldfarb and V.K. Tripathi. "The Effect of Air Bridge Height on the Propagation Characteristics of Microstrip." 1991 Microwave and Guided Wave Letters 1.10 (Oct. 1991 [MGWL]): 273-274.

The air bridge is often used for lowering the effective capacitance per unit length as well as fabricating crossovers in monolithic microwave integrated circuits (MMIC's). The static and dynamic propagation characteristics of this type of transmission line are computed by utilizing the spectral domain technique. The cases of air bridged lines on 100-µm GaAs substrate and spiral inductors are examined.

Abstracts

Characteristics of Valley Microstrip Lines for Use in Multilayer MMIC's

T. Hasegawa, S. Banba, H. Ogawa and H. Nakamoto. "Characteristics of Valley Microstrip Lines for Use in Multilayer MMIC's." 1991 Microwave and Guided Wave Letters 1.10 (Oct. 1991 [MGWL]): 275-277.

A valley microstrip line fabricated by using multilayer MMIC technologies is proposed and its performance is investigated experimentally. Insertion loss of the valley microstrip line is smaller than that of conventional microstrip lines having the same width of strip conductor.

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Ka-Band MMIC Receiver with Ion-Implanted Technology for High-Volume and Low-Cost Application

J. Mondal, J. Geddes, J. Detry and D. Carlson. "Ka-Band MMIC Receiver with Ion-Implanted Technology for High-Volume and Low-Cost Application." 1991 Microwave and Guided Wave Letters 1.10 (Oct. 1991 [MGWL]): 278-281.

An MMIC receiver in ion-implantation technology, with LNA and mixer, shows 4.7 dB noise figure and 6.8 dB conversion gain at 35 GHz with a low IF frequency of 10-50 MHz.

Abstracts

Surface Wave Diffraction by a Finite Metal Grating and Numerical Model for Design of Leaky-Wave Antennas

V.I. Kalinichev and Y.V. Kuranov. "Surface Wave Diffraction by a Finite Metal Grating and Numerical Model for Design of Leaky-Wave Antennas." 1991 Microwave and Guided Wave Letters 1.10 (Oct. 1991 [MGWL]): 282-284.

The electrodynamics problem of surface wave diffraction by a finite grating made of thin metal rods and placed on the dielectric plate is studied. Green's function of a dielectric slab situated on a metal substrate is used for mathematics. The system of algebraic linear equations in unknown complex amplitudes of currents in the rods is obtained in a particular case of normal incidence of the traveling wave upon the grating. The effective algorithm for numerical investigation of all diffraction characteristics of the structure is also elaborated. An example of the diffraction model application for design of a leaky-wave antenna in millimeter waveband is presented.

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A Compressed-Length 90°-Bent Offset Broadside-End-Coupled Bandpass Filter

C.-K.C. Tzuang, Y.-C. Chiang and S. Su. "A Compressed-Length 90°-Bent Offset Broadside-End-Coupled Bandpass Filter." 1991 Microwave and Guided Wave Letters 1.10 (Oct. 1991 [MGWL]): 285-287.

A 21-22 GHz compressed-length offset broadside-end-coupled three-resonator bandpass falter is presented. The filter length, defined as the distance between the two interface planes governing the input and output ports, is reduced by approximately two-thirds for the particular filter as compared to the conventional colinear realization. The measured response shows less than 1.5 dB insertion loss and greater than 10 dB return loss in the passband. The noncolinear and offset broadside-end-coupled arrangement of such filter makes it flexible to interface with other microwave circuits in a communication system or subsystem design.

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Stacked Slot-Coupled Printed Antenna

F. Croq and A. Papiernik. "Stacked Slot-Coupled Printed Antenna." 1991 Microwave and Guided Wave Letters 1.10 (Oct. 1991 [MGWL]): 288-290.

An aperture-coupled microstrip stacked patch antenna is studied with the goal of obtaining wide bandwidth, low cross-polarization and weak parasitic radiation from the feeding aperture for applications in printed phased array antennas.

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A Reflective Microwave Switch Made of Tl-Ca-Ba-Cu-O for Signal Control Applications

J.S. Martens, V.M. Hietala, T.E. Zipperian, D.S. Ginley, C.P. Tigges and G.K.G. Hohenwarter. "A Reflective Microwave Switch Made of Tl-Ca-Ba-Cu-O for Signal Control Applications." 1991 Microwave and Guided Wave Letters 1.10 (Oct. 1991 [MGWL]): 291-293.

Some high performance control applications in high temperature superconductors (HTS) require switches that can be easily integrated with transmission lines. A microwave switch in Tl-Ca-Ba-Cu-O has been developed based on driving a small bridge, embedded in a transmission line, normal via a current in an external control line. In the on-state, insertion loss was less than 1 dB over the tested range of 0.5- 8.5 GHz. Isolation in the off-state exceeded 30 dB over this frequency range. Response times are on the order of a microsecond, adequate for many microwave/millimeter-wave applications such as switched phase shifters.

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Mode-Matching Approach for Superconducting Planar Transmission Lines Including Finite Conductor Thickness

W. Heinrich. "Mode-Matching Approach for Superconducting Planar Transmission Lines Including Finite Conductor Thickness." 1991 Microwave and Guided Wave Letters 1.10 (Oct. 1991 [MGWL]): 294-296.

An analysis of superconducting planar transmission lines is presented. The full-wave mode-matching approach holds for arbitrary values of conductor thickness and does not involve approximations such as the skin-effect description or the resistive boundary condition. Results on phase constant and attenuation of a superconducting CPW are reported including both conductor-thickness dependence and frequency characteristics. The results demonstrate that the high-TC superconductor materials available to date greatly improve the performance of coplanar waveguides as used in mm-wave MMIC's.

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An Impedance Model for the Quasi-Optical Diode Array

L.B. Sjogren and N.C. Luhmann, Jr.. "An Impedance Model for the Quasi-Optical Diode Array." 1991 Microwave and Guided Wave Letters 1.10 (Oct. 1991 [MGWL]): 297-299.

A circuit representation is presented for the quasi-optical impedance of an infinite array of strips or slots periodically loaded with two terminal semiconductor devices (diode array). The circuit elements are obtained by method of moments analysis of the equivalent waveguide discontinuity problem. A set of design curves for the circuit model components at 99 GHz is provided. The curves are applicable at other frequencies by scaling. For the strip array, the results indicate the presence of a substantial capacitance in parallel with the diode. This capacitance can be substantially reduced by incorporation of an appropriately designed "rectangular unit cell." A slot version of the diode array has also been simulated and modeled, and may prove useful in future applications.

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Abstracts

A Strip-Loaded Feed-Horn Antenna

S. Rodrigues, P. Mohanan and K.G. Nair. "A Strip-Loaded Feed-Horn Antenna." 1991 Microwave and Guided Wave Letters 1.11 (Nov. 1991 [MGWL]): 318-319.

Design and development of a new feed-horn antenna with low sidelobe levels is reported. The E-walls of this antenna are fabricated with low-loss dielectric substrate, periodically loaded with thin conducting strips. The antenna is found to be simulating the radiation characteristics of metallic corrugated horns. This can be an ideal substitute for metallic corrugated horns with added advantages like light-weight and low production cost.

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A Resonant Tunneling Diode Self-Oscillating Mixer with Conversion Gain

G. Millington, R.E. Miles, R.D. Pollard, D.P. Steenson and J.M. Chamberlain. "A Resonant Tunneling Diode Self-Oscillating Mixer with Conversion Gain." 1991 Microwave and Guided Wave Letters 1.11 (Nov. 1991 [MGWL]): 320-321.

An 11 GHz self-oscillating microwave mixer using resonant tunneling diode has been constructed. Operating in a non-optimised system a maximum conversion gain of 10 dB with an associated noise figure of 11.5 dB has been observed. As result of the conversion gain and self-oscillating configuration, simpler construction with fewer components than conventional circuits is obtained. The local oscillator can be injection locked and swept over a frequency range of 200 MHz.

Abstracts

A Grid Amplifier

M. Kim, J.J. Rosenberg, R.P. Smith, R.M. Weikle, II, J.B. Hacker, M.P. De Lisio and D.B. Rutledge. "A Grid Amplifier." 1991 Microwave and Guided Wave Letters 1.11 (Nov. 1991 [MGWL]): 322-322.

The first demonstration of a grid amplifier is reported. A 50-MESFET grid has shown a gain of 11 dB at 3.3 GHz. The grid isolates the input from the output by using vertical polarization for the input beam and horizontal polarization for the transmitted output beam. The grid unit cell is a two-MESFET differential amplifier. A simple calibration procedure allows the gain to be calculated from a relative power measurement. This grid is a hybrid circuit, but the structure is suitable for fabrication as a monolithic wafer-scale integrated circuit, particularly at millimeter wavelengths.

Abstracts

A Numerical Study of Vector Absorbing Boundary Conditions for the Finite-Element Solution of Maxwell's Equations

V.N. Kanellopoulos and J.P. Webb. "A Numerical Study of Vector Absorbing Boundary Conditions for the Finite-Element Solution of Maxwell's Equations." 1991 Microwave and Guided Wave Letters 1.11 (Nov. 1991 [MGWL]): 325-327.

In three-dimensional vector solutions to Maxwell's equations, boundary conditions of the Bayliss-Turkel kind can be used to absorb outgoing radiation. The boundary conditions were used with curvilinear brick finite elements to analyze spherical test problems for which the exact fields are known. Errors due to incomplete absorption decrease as the outer boundary is moved further away. The second-order boundary condition is appreciably more accurate than the first-order, at the same cost.

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GaAs on Quartz Coplanar Waveguide Phase Shifter

M.S. Islam, A.J. Tsao, V.K. Reddy and D.P. Neikirk. "GaAs on Quartz Coplanar Waveguide Phase Shifter." 1991 Microwave and Guided Wave Letters 1.11 (Nov. 1991 [MGWL]): 328-330.

An optically controlled Schottky-contacted coplanar waveguide (CPW) phase shifter on a thin epitaxial GaAs film bonded to a quartz substrate has been fabricated using the epitaxial lift off (ELO) technique. This allows the original semi-insulating GaAs substrate to be replaced by an optically transparent, low dielectric constant quartz substrate. A significant reduction in insertion loss and increase in phase shift was observed after lift-off. The ELO device allows the use of backside illumination for optical control, avoiding any metal shadowing effects, thus producing higher sensitivity to the optical signal. From 5 to 40 GHz, the ELO device gave an insertion loss of approximately -0.1 dB per degree of phase shift. At a backside illumination intensity of 0.65 mW/cm², a one centimeter long device produced over 350° of phase shift at 30 GHz.

Abstracts

Microwave Imaging Method Using a Simulated Annealing Approach

S. Caorsi, G.L. Gragnani, S. Medicina, M. Pastorino and G. Zunino. "Microwave Imaging Method Using a Simulated Annealing Approach." 1991 Microwave and Guided Wave Letters 1.11 (Nov. 1991 [MGWL]): 331-333.

A new method of microwave imaging in the space domain is presented, which is based on a simulated annealing approach. Markov random fields are used to model the distributions of dielectric features, and a stochastic relaxation algorithm is developed to solve the imaging problem. Computationally heavy inversions of large matrices are avoided. Numerical results confirming the capabilities of the proposed method are reported: they seem better than those obtained by other imaging techniques in space domain.

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A 2.3-ps Time-Domain Reflectometer for Millimeter-Wave Network Analysis

R.Y. Yu, M. Kamegawa, M. Case, M. Rodwell and J. Franklin. "A 2.3-ps Time-Domain Reflectometer for Millimeter-Wave Network Analysis." 1991 Microwave and Guided Wave Letters 1.11 (Nov. 1991 [MGWL]): 334-336.

A GaAs monolithic time-domain reflectometer (TDR) for millimeter-wave network analysis has been fabricated. The TDR has two outputs from which the incident and reverse waves can be determined. The two channels show 2.3 ps falltime, hence 150 GHz-3 dB TDR bandwidth. The reflection coefficient in the time domain obtained after a partial calibration clearly indicates a prominent reflection when the TDR is under open-circuit load. With the use of network analysis calibration routines, corrected millimeter-wave vector measurements will be feasible with these devices.

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Permittivity Measurements Using a Short Open-Ended Coaxial Line Probe

H. Zheng and C.E. Smith. "Permittivity Measurements Using a Short Open-Ended Coaxial Line Probe." 1991 Microwave and Guided Wave Letters 1.11 (Nov. 1991 [MGWL]): 337-339.

Improvements for permittivity measurements with short, open-ended coaxial line probes are achieved by using a more accurate formulation and by adding a finite conductor flange at the aperture of the probe. A conductor flange with a diameter of about 10 times the outer diameter of the coaxial line greatly improves the performance of the coaxial line probe. For a probe without a flange, a three-term admittance formula with calculated coefficients gives good measured results as compared to standards. However, for a probe with flange, a two-term admittance formula with a calibration coefficient gives better measured results.

Abstracts

A Microstrip Patch Antenna with Coplanar Feed Line

W. Menzel and W. Grabherr. "A Microstrip Patch Antenna with Coplanar Feed Line." 1991 Microwave and Guided Wave Letters 1.11 (Nov. 1991 [MGWL]): 340-342.

An experimental investigation of a microstrip patch antenna with a coplanar feed line is presented. The coupling from the coplanar line to the patch is accomplished via a slot in the ground plane to which the coplanar line is connected either inductively or capacitively. The input return loss can easily be adjusted via the slot length. Additional frequency tuning is possible by switching between inductive and capacitive coupling.

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Efficient Simulation of Millimeter-Wave IMPATT Oscillators by FATE, a Combined Time- and Frequency-Domain Method

T. Goeller, M. Schwab and P. Russer. "Efficient Simulation of Millimeter-Wave IMPATT Oscillators by FATE, a Combined Time- and Frequency-Domain Method." 1991 Microwave and Guided Wave Letters 1.11 (Nov. 1991 [MGWL]): 343-345.

The FATE method for the determination of the periodic steady state in oscillators proposed recently is shown to be ideally suited for the simulation of oscillators with strongly nonlinear active devices, e.g., IMPATT oscillators. Simulations of a waveguide oscillator illustrate the choice of a favorable network partition and the advantage of the bandwidth-unlimited time-domain simulation of the nonlinear subnetwork. A V-band hybrid-integrated IMPATT oscillator is simulated with agreement in output power within 4 dB over the dc current range from 100 mA to 220 mA compared to the measured levels and a time-domain simulation.

Abstracts

Multilayer MMIC Branch-Line Hybrid Using Thin Dielectric Layers

S. Banba, T. Hasegawa and H. Ogawa. "Multilayer MMIC Branch-Line Hybrid Using Thin Dielectric Layers." 1991 Microwave and Guided Wave Letters 1.11 (Nov. 1991 [MGWL]): 346-347.

A miniature MMIC branch-line hybrid circuit utilizing a multilayer structure composed of thin-film transmission lines is proposed. The branch-line hybrid circuit is designed for a center frequency of 20 GHz and fabricated in a 0.49 mm x 0.53 mm area. A coupling loss of 5.5 dB ± 0.5 dB over a 3 GHz bandwidth is achieved.

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A Ku-Band Oscillator Subsystem Using a Broadband GaAs MMIC Push-Pull Amplifier/Doubler

R. Martin and F. Ali. "A Ku-Band Oscillator Subsystem Using a Broadband GaAs MMIC Push-Pull Amplifier/Doubler." 1991 Microwave and Guided Wave Letters 1.11 (Nov. 1991 [MGWL]): 348-350.

The design and performance results of a Ku-band voltage controlled oscillator subsystem using a broadband GaAs MMIC push-pull amplifier as a frequency doubler is described. The subsystem utilizes both GaAs MMIC and Si Bipolar technologies to achieve the desired performance objectives. The oscillator sub-system is tunable over the 14-18 GHz frequency range with minimum output power of 18 dBm and phase noise of -88 dBc/Hz at 100 KHz offset from the carrier over 0 to +65°C temperature range.

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An Evaluation of HEMT Potential for Millimeter-Wave Signal Sources Using Interpolation and Harmonic Balance Techniques

Y. Kwon, D. Pavlidis and M.N. Tutt. "An Evaluation of HEMT Potential for Millimeter-Wave Signal Sources Using Interpolation and Harmonic Balance Techniques." 1991 Microwave and Guided Wave Letters 1.12 (Dec. 1991 [MGWL]): 365-367.

A large-signal analysis method based on harmonic balance technique and 2-D cubic spline interpolation function has been developed and applied to the prediction of InP-based HEMT oscillator performance for frequencies extending up to submillimeter-wave range. The large-signal analysis method uses a limited number of dc and small-signal S-parameter data and allows the accurate characterization of HEMT large-signal behavior. The method has been validated experimentally using load-pull measurement. Oscillation frequency, power performance and load requirements are discussed, predicting the operation capability to 300 GHz using state-of-the-art devices (f/sub max/~450 GHz).

Abstracts

Laser Diode Pumping with a Transmission Line Transformer

M.C.R. Carvalho and W. Margulis. "Laser Diode Pumping with a Transmission Line Transformer." 1991 Microwave and Guided Wave Letters 1.12 (Dec. 1991 [MGWL]): 368-370.

A semiconductor laser was fed by a high-frequency transmission line transformer in an impedance matched circuit. The laser threshold for short duration electrical pulses is showed to be significantly lower than with conventional 50 Omega transmission line arrangements. This set-up can be used to increase the overall efficiency of laser diode systems.

Abstracts

Microwave Reflection Measurements on Doped Semiconductors with Picosecond Transient Radiation

W.M. Robertson, G. Arjavalingam, G.V. Kopcsay and J.-M. Halbout. "Microwave Reflection Measurements on Doped Semiconductors with Picosecond Transient Radiation." 1991 Microwave and Guided Wave Letters 1.12 (Dec. 1991 [MGWL]): 371-373.

Broad-band microwave reflection spectroscopy is demonstrated with picosecond transient radiation from optoelectronically pulsed antennas. The validity of the technique is verified by reflection measurements on isotropic and anisotropic dielectrics. Reflection studies on a series of doped silicon samples demonstrate that the carrier dynamics in the 15-140 GHz frequency range are well described by a simple Drude model.

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Abstracts

Rapid Pulsed Microwave Propagation

G.C. Giakos and T.K. Ishii. "Rapid Pulsed Microwave Propagation." 1991 Microwave and Guided Wave Letters 1.12 (Dec. 1991 [MGWL]): 374-375.

Transit time measurements of the leading edge of pulse modulated microwaves in open space and inside a rectangular waveguide have been performed. Both measurements show that a part of the energy associated with the leading edge of the pulse propagates with the phase velocity. Calibration techniques and repeated measurements confirm this phenomenon.

Abstracts

Analysis of Open-Type Waveguides by the Vector Finite-Element Method

M. Matsuhara, H. Yunoki and A. Maruta. "Analysis of Open-Type Waveguides by the Vector Finite-Element Method." 1991 Microwave and Guided Wave Letters 1.12 (Dec. 1991 [MGWL]): 376-378.

A novel variational expression that is suitable for the waveguide analysis is proposed. In addition, a new mapping technique to analyze open-type waveguides is introduced. Any arbitrarily shaped waveguides can be analyzed by the finite-element method with this variational expression and the mapping technique. The dispersion characteristics of the rectangular dielectric waveguide and the microstrip line are demonstrated and these results shows the validity and usefulness of this method well.

Abstracts

Picosecond Time-Domain Electromagnetic Scattering from Conducting Cylinders

W.M. Robertson, G.V. Kopcsay and G. Arjavalingam. "Picosecond Time-Domain Electromagnetic Scattering from Conducting Cylinders." 1991 Microwave and Guided Wave Letters 1.12 (Dec. 1991 [MGWL]): 379-381.

The microwave scattering properties of conducting cylinders are characterized by measuring their response to picosecond duration electromagnetic pulses. The ultrafast electromagnetic transients are generated and detected with optoelectronically pulsed antennas. The time-domain response gives physical insight into the scattering process. In addition, Fourier analysis is used to obtain the frequency dependence of the scattered amplitude and phase from 15 to 140 GHz.

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Abstracts

A New Finite-Difference Time-Domain Algorithm for Solving Maxwell's Equations

Z. Bi, K. Wu, C. Wu and J. Litva. "A New Finite-Difference Time-Domain Algorithm for Solving Maxwell's Equations." 1991 Microwave and Guided Wave Letters 1.12 (Dec. 1991 [MGWL]): 382-384.

A new algorithm is presented for deriving finite-difference time-domain (FD-TD) solutions of Maxwell's equations. When compared with Yee's method, it is found that the stability conditions for this method exceed those of Yee's method by the factors 1.41 and 1.73, respectively, for the two-dimensional and three-dimensional cases. Two additional important advantages of the method are given in the conclusions.

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Boundary Element Characterization of Coplanar Waveguides

T.-K. Lee, H. Ling and T. Itoh. "Boundary Element Characterization of Coplanar Waveguides." 1991 Microwave and Guided Wave Letters 1.12 (Dec. 1991 [MGWL]): 385-387.

The quasi-static capacitance and inductance of the coplanar waveguide (CPW) are characterized independently using the boundary element method (BEM). The inductance calculation utilizes the magnetic scalar potential and avoids the usual vector formulation. The proposed method can be easily extended to characterize three-dimensional problems such as CPW discontinuities.

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Active Optomechanical Media for Nonlinear Microwave Processes

D. Rogovin and T.P. Shen. "Active Optomechanical Media for Nonlinear Microwave Processes." 1991 Microwave and Guided Wave Letters 1.12 (Dec. 1991 [MGWL]): 388-390.

Theory asserts that three-dimensional arrays of electrically small particles are excellent media for wave-mixing processes at microwave and millimeter wavelengths. As a specific example, spheres that are free to move on a stack of flat, transparent surfaces and that interact with incident radiation are examined. Electrostrictive forces move the spheres in such a way as to form density index gratings that can be used for controlling the propagation characteristics of coherent radiation. Phase conjugation in this medium is also examined.

Abstracts

Boundary Element Analysis of a Trapezoidal Transmission Line

B. Toland and T. Itoh. "Boundary Element Analysis of a Trapezoidal Transmission Line." 1991 Microwave and Guided Wave Letters 1.12 (Dec. 1991 [MGWL]): 391-392.

A transmission line with a trapezoidal cross section is analyzed using the boundary element method (BEM) and the quasi-static approximation. By utilizing a convenient choice for the fundamental solution, the efficiency of the method is clearly established. The analysis is verified by comparisons with results in the literature and measured data.

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Abstracts

A Theoretical Three-Port Coaxial-Line Rectangular-Waveguide Model and its Application to Millimeter-Wave Structures

A. Rydberg and B.N. Lyons. "A Theoretical Three-Port Coaxial-Line Rectangular-Waveguide Model and its Application to Millimeter-Wave Structures." 1991 Microwave and Guided Wave Letters 1.12 (Dec. 1991 [MGWL]): 393-395.

A theoretical three-port model for coaxial-line rectangular-waveguide junction is described and evaluated using several different realistic millimeter-wave mount structures, The model is found to be usable with good accuracy over a large variation in mount dimensions. The model is specifically applied in calculations of the embedding impedance seen by the diode in a millimeter-wave frequency multiplier. The three-port model is an improvement over simpler models hitherto used for devices such as millimeter-wave frequency multipliers, in taking into account all parameters in the mount.

Abstracts

Millimeter-Wave Four-Port Circulator Using Distributed Coupling Effect

J. Mazur and M. Mrozowski. "Millimeter-Wave Four-Port Circulator Using Distributed Coupling Effect." 1991 Microwave and Guided Wave Letters 1.12 (Dec. 1991 [MGWL]): 396-398.

The design and experimental results for a four port circulator based on new concept using a distributed coupling phenomenon are presented. The circulator consists of a E-H junction cascaded with the section of two coupled lines containing ferrite magnetized in the propagation direction. The choice of configuration and the design procedure are described. Isolation 15 dB in the 26-30 GHz band is obtained confirming the validity of the theory and design procedure.

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Scattering Parameter Characterization of Microwave Optoelectronic Devices and Fiber-Optic Networks (Corrections)

"Scattering Parameter Characterization of Microwave Optoelectronic Devices and Fiber-Optic Networks (Corrections)." 1991 Microwave and Guided Wave Letters 1.12 (Dec. 1991 [MGWL]): 399-399.

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Asia and Pacific Abstracts (Dec. 1991 [MGWL])

"Asia and Pacific Abstracts (Dec. 1991 [MGWL])." 1991 Microwave and Guided Wave Letters 1.12 (Dec. 1991 [MGWL]): 400-416.

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"Third Intemational Symposium on Space Terahertz Technology (Advertisement) (Dec. 1991 [MGWL])." 1991 Microwave and Guided Wave Letters 1.12 (Dec. 1991 [MGWL]): 427-427.

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Call for Papers - 1992 IEEE International Microwave Symposium (Dec. 1991 [MGWL])

"Call for Papers - 1992 IEEE International Microwave Symposium (Dec. 1991 [MGWL])." 1991 Microwave and Guided Wave Letters 1.12 (Dec. 1991 [MGWL]): 428-428.

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"Call for Papers - Electrical Performance of Electronic Packaging (Dec. 1991 [MGWL])." 1991 Microwave and Guided Wave Letters 1.12 (Dec. 1991 [MGWL]): 429-429.

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Abstracts

Session A -- (Joint with the MMIC Symposium) - T/R Modules

"Session A -- (Joint with the MMIC Symposium) - T/R Modules." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 101-101.

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Abstracts

European MMIC Activities (1990 Vol. I [MWSYM])

J. Magarsrack. "European MMIC Activities (1990 Vol. I [MWSYM])." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 103-108.

A brief review of the development programmes involving MMIC's in Europe supported by the EEC and military administrations will be given. Then a glance at a European outlook on civil applications leads to examples from four leading European Manufacturers of MMIC's namely, PLESSEY, TELEFUNKEN, PHILIPS and THOMSON-CSF. These show how systems people are now exploiting MMIC's in new types of applications.

Abstracts

MIMIC Technology Transportability (1990 Vol. I [MWSYM])

W.H. Perkins, N. Jansen, T.A. Midford, W.C. Niehaus, D.H. Reep and J. Tenedorio. "MIMIC Technology Transportability (1990 Vol. I [MWSYM])." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 109-112.

Technology transportability is a primary goal of the MIMIC program. Successful transfer of GE's design and process for a C-band 3-watt, 2-stage amplifier from GE's pilot line to four Hughes/GE MIMIC team foundries is an important milestone in that effort. This paper details the cooperative exchange of technology which has enabled transport of this C-band MIMIC, and describes fabrication status, examines process variations, and compares data achieved by the foundries.

Abstracts

Multifunction Chip Set for T/R Module Receive Path (1990 Vol. I [MWSYM])

D. Willems, I. Bahl, M. Pollman, J. Jorgenson, E. Griffin, M. Coluzzi, S. Tantod and C. Andricos. "Multifunction Chip Set for T/R Module Receive Path (1990 Vol. I [MWSYM])." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 113-116.

This paper presents design and test results for multifunction MMICs for C-Band Transmit/Receive (T/R) modules. This small signal chip set contains the entire receive path (5 stages of amplification and 10 passive devices) in just three chips. These IC's fabricated with the Multi-functional Self-Aligned Gate (MSAG) process, demonstrate a high level of integration, excellent performance and a good yield. The variable gain low noise amplifier has 30 ± 1 dB gain, 2.5 dB noise figure, the phase shifter/SPDT switch has 8 ± 1 dB loss and the buffer amplifier has 6.5 ± 0.2 gain and 3.5 dB noise figure. Average yield for these circuits was 40% or better.

Abstracts

A Single Chip 2-20 GHz T/R Module (1990 Vol. I [MWSYM])

M.J. Schindler, S.L. Chu, T.E. Kazior, A.M. Bertrand and K.M. Simon. "A Single Chip 2-20 GHz T/R Module (1990 Vol. I [MWSYM])." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 117-120.

A single chip 2-20 GHz Transmit/Receive (T/R) module has been demonstrated. This MMIC includes a 4-stage power amplifier chain, a 4-stage low noise amplifier chain, and two T/R switches. A selective ion implantation process was used. One implant profile was optimized for low-noise operation, a second was optimized for power performance. All circuits were designed to be relatively insensitive to process variations to ensure adequate yield, despite the complexity of the chip. Distributed amplifiers are used throughout, and the T/R switches use a standard series-shunt FET configuration. All circuits have been miniaturized to keep the total chip size small. The entire T/R circuit measures only .143" x .193" (3.6 mm x 4.9 mm).

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Session B -- Microwave Filters

"Session B -- Microwave Filters." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 121-121.

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Classes of Bandpass Filters Having an Arbitrary Wide Stopband and Design Tables for One Such Class

J.H. Kotze. "Classes of Bandpass Filters Having an Arbitrary Wide Stopband and Design Tables for One Such Class." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 123-126.

Several new classes of bandpass filters having an arbitrary stopband width are defined and the general synthesis procedures for these filter classes are described. Furthermore, design tables for one particular class are given and practical results of a stripline filter are presented.

Abstracts

Tchebyscheff Time-Delay Dielectric Band-Pass Filter Using Q Control Method of Normal Modes

Y. Ishikawa, K. Wakino, K. Takehara, T. Tanizaki and T. Nishikawa. "Tchebyscheff Time-Delay Dielectric Band-Pass Filter Using Q Control Method of Normal Modes." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 127-130.

We have developed a Tchebyscheff time-delay three-pole band-pass filter in the 900MHz band by using the Q control method of normal modes. The group delay ripple of the filter is 50nsec within the 300kHz bandwidth. The size of the equipment is W482.0 X D300.0 X H132.6 mm, and it can be put into a 19" standard rack. This filter is expected to be applicable for channel filters used in digital cellular base stations.

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Abstracts

Printed-Circuit Realization of a Tapped Combline Bandpass Filter

C.-K.C. Tzuang and W.-T. Lo. "Printed-Circuit Realization of a Tapped Combline Bandpass Filter." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 131-134.

The design of a tapped combline bandpass filter realized by planar or quasi-planar commensurate length transmission lines is presented. The design procedure takes into account the composite effects of multiple quasi-TEM modes, couplings between non-adjacent microstrips, and cover height. An 8-to-12 GHz bandpass prototype is built and tested. Its performance agrees favorably with the theoretical result.

Abstracts

Simplified Analysis of Inhomogeneous Dielectric Block Combline Filters

R. Levy. "Simplified Analysis of Inhomogeneous Dielectric Block Combline Filters." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 135-138.

Dielectric block combline filters constructed of low-loss temperature stable high dielectric constant ceramic materials are used in very large quantities for mobile communications. An inhomogeneous version having significant advantages in terms of achievable Q factor and symmetry of response characteristics was introduced by Fukasawa. A new analysis of this structure which clearly depicts its novel aspects by giving a physically significant equivalent circuit is presented. In addition to improved understanding, the simplification could lead to wider utilization of such inhomogeneous structures and stimulate advances in the technology.

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Abstracts

A Computer Aided Accurate Adjustment of Cellular Radio RF Filters

T. Ishizaki, H. Ikeda, T. Uwano, M. Hatanaka and H. Miyake. "A Computer Aided Accurate Adjustment of Cellular Radio RF Filters." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 139-142.

An accurate and speedy tuning algorithm of cellular radio filters is presented. From measured performance, a computer instructs you how much to trim the dielectric resonators. To reduce the optimization error and secure the good convergence, analytical considerations are taken to derive the proper expression of a resonator equivalent circuit. By using this method, it took a beginner only 5 minutes to adjust a five-resonator-filter.

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Abstracts

Mechanically Tunable MSW Bandpass Filter with Combined Magnetic Units

Y. Ishikawa, T. Nishikawa, T. Okada, S. Shinmura, Y. Kamado, F. Kanaya and K. Wakino. "Mechanically Tunable MSW Bandpass Filter with Combined Magnetic Units." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 143-146.

An MSW bandpass filter with combined magnetic units composed of main and sub magnetic units has been developed. Its volume is reduced to one-fifth compared to conventional YIG-sphere filters. The filter can be tuned mechanically and keep the same shape of transmission response in 2.5~2.75 GHz. The insertion loss can be kept less than 3dB within 20MHz bandwidth by adjusting the magnetic field distribution.

Abstracts

Session C -- Lightwave Technology for Microwave Antennas I and II (Focused Session) (Joint with AP Symposium)

"Session C -- Lightwave Technology for Microwave Antennas I and II (Focused Session) (Joint with AP Symposium)." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 147-147.

Abstracts

A 10 Gb/s Optical Heterodyne Detection Experiment Using a 23GHz Bandwidth Balanced Receiver (1990 Vol. I [MWSYM])

N. Takachio, K.J. Washita, S. Hata, K. Katsura, K. Onodera and H. Kikuchi. "A 10 Gb/s Optical Heterodyne Detection Experiment Using a 23GHz Bandwidth Balanced Receiver (1990 Vol. I [MWSYM])." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 149-151.

A 0.5-30GHz GaAs MESFET monolithic distributed amplifier using coplanar waveguides and a wideband InGaAs twin pin photodiode are fabricated. A wideband balanced optical receiver is fabricated by connecting these devices using the solder bump flip-chip technique to reduce parasitic inductance and capacitance. A 10 Gb/s optical CPFSK heterodyne detection experiment is conducted using the receiver.

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Abstracts

A High-Gain Directly Modulated L-Band Microwave Optical Link

E. Ackerman, D. Kasemset, S. Wanuga, D. Hogue and J. Komiak. "A High-Gain Directly Modulated L-Band Microwave Optical Link." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 153-155.

A directly modulated microwave optical data link, using an efficient lossless impedance matching approach to maximize the transducer gains in the laser and detector matching networks, has yielded high gain. The free-space optical link operates at 900 MHz with a peak gain of 3.7 dB over a 3 dB bandwidth of 90 MHz. The link also exhibits a wide dynamic range of 89 dB·MHz. This optical data link is the first to function without any active amplification.

Abstracts

Low-Loss Analog Fiber-Optic Links

C.H. Cox, III, D.Z. Tsang, L.M. Johnson and G.E. Betts. "Low-Loss Analog Fiber-Optic Links." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 157-160.

Experimental and theoretical studies of high-performance fiber-optic links are reported. For the experimental directly modulated link, the measured electrical insertion gain was -4.9 dB at a bandwidth of 1500 MHz, and 0.3 dB at a bandwidth of 200 MHz. For the experimental externally modulated link operating at a bandwidth of 800 MHz, the calculated electrical insertion gain based on actual device parameters is -1.0 dB, while at 150 MHz a gain of 6.0 dB is expected. Both links have no active amplification. The directly modulated links have higher noise figures because of the high relative intensity noise of the diode laser.

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Session D -- Planar and Quasi Planar Guides

"Session D -- Planar and Quasi Planar Guides." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 161-161.

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Full-Wave Analysis of Aperture Coupled Shielded Microstrip Lines

N.L. VandenBerg and P.B. Katehi. "Full-Wave Analysis of Aperture Coupled Shielded Microstrip Lines." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 163-166.

A full-wave space-domain integral equation analysis of aperture coupled shielded microstrip lines is presented based on Pocklington's integrals and the equivalence principle. The derivation of the associated dyadic Green's functions in the form of waveguide LSE and LSM modes is described. The line currents and slot voltage are expanded in terms of subsectional basis functions and the method of moments, together with even and odd mode transmission line analysis, is applied to determine the two-port scattering parameters. A particular case is illustrated which demonstrates the behavior of the coupler as a bandpass interconnect.

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Abstracts

The Slot Line in Uniplanar MMIC's: Propagation Characteristics and Loss Analysis

W. Heinrich. "The Slot Line in Uniplanar MMIC's: Propagation Characteristics and Loss Analysis." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 167-170.

Slot-line structures as used in uniplanar MMIC's are analyzed including a full-wave description of conductor loss. It is found that such lines support a fundamental wave mode that differs basically from the conventional slot-line type. Results on propagation characteristics are presented studying also the influence of metallization thickness.

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Full-Wave Analysis of Lossy Transmission Line Incorporating the Metal Modes

S.T. Peng, C.-K.C. Tzuang and C.-D. Chen. "Full-Wave Analysis of Lossy Transmission Line Incorporating the Metal Modes." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 171-174.

A full-wave mode-matching analysis of a unilateral finline with finite conductivity, metalization thickness, and holding grooves is presented. A new class of metal modes exist in the metalized region for its most part and decay sharply in the air region. It is shown for the first time that without incorporating the metal modes presented here, the mode-matching method for tackling lossy millimeter-wave or microwave transmission lines can not produce accurate results.

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Experimental and Theoretical Characterizations of Very Thin Coplanar Waveguide and Coplanar Slow-Wave Structures

H.-Y. Lee and T. Itoh. "Experimental and Theoretical Characterizations of Very Thin Coplanar Waveguide and Coplanar Slow-Wave Structures." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 175-178.

A very thin coplanar waveguide and a slow-wave structure using a very thin coplanar strip have been characterized in a wide range of field penetration by comparing the measured transmission characteristics with the theoretical data calculated by the phenomenological loss equivalence method. The measured transmission characteristics show very good agreement with the calculated ones. It is shown that the effect of field penetration into the thin coplanar lines is significant over a wide range of frequency and must be included in the design of monolithic microwave integrated circuits.

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A Solution to Characteristics of Planar Transmission Lines Made of Finite-Thickness Metal on Multi-Layer Media

J.C. Lieu and K.M. Lau. "A Solution to Characteristics of Planar Transmission Lines Made of Finite-Thickness Metal on Multi-Layer Media." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 179-181.

When analyzing signal transmission characteristics of metal lines on semiconductor devices and circuits, the assumption that metal is perfectly conducting is not always valid. In this paper, a simple, accurate way to include metallic loss in spectral domain analysis of planar transmission lines built on multi-layer semiconducting media is presented. Applications to analyzing IC interconnection dalays, calculating FET gate electrode losses and optimizing monolithic slow-wave devices are also described.

Abstracts

Session E -- (Joint with the MMIC Symposium) Mixers and VCOs

"Session E -- (Joint with the MMIC Symposium) Mixers and VCOs." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 183-183.

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Monolithic Ka Band VCO Using Quarter Micron GaAs MESFETs and Integrated High-Q Varactors (1990 Vol. I [MWSYM])

M.G. McDermott, C. Sweeney, M. Benedek and G. Dawe. "Monolithic Ka Band VCO Using Quarter Micron GaAs MESFETs and Integrated High-Q Varactors (1990 Vol. I [MWSYM])." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 185-188.

High Q GaAs abrupt varactor diodes and 0.25µm GaAs MESFETs have been combined on a semi-insulating GaAs substrate for millimeter wave MMIC applications. Based on the measured series resistance and capacitance, the diodes have a calculated Q at -4V, 50MHz of approximately 19,000. The MESFETs have a measured gain of >6dB at 35GHz with extrapolated values for f/sub t/ and f/sub max/ of 32GHz and 78GHz respectively. A monolithic Ka band VCO using these devices has been built and tested. Output powers of 60mW with 70MHz of tuning bandwidth and 40mW with 120MHz of tuning bandwidth have been measured at 32GHz.

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K/sub u/- and K-Band GaAs MMIC Varactor-Tuned FET Oscillators Using MEV Ion-Implanted Burried-Layer Back Contacts (1990 Vol. I [MWSYM])

P.J. McNally, T. Smith, F.R. Phelleps, K.M. Hogan, B. Smith and H. Deitrich. "K/sub u/- and K-Band GaAs MMIC Varactor-Tuned FET Oscillators Using MEV Ion-Implanted Burried-Layer Back Contacts (1990 Vol. I [MWSYM])." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 189-192.

An all ion-implant, planar process has been used to fabricate high-Q, hyper-abrupt carrier profile, varactor diodes as components of GaAs MMIC VCOs with state-of-the-art performance. These GaAs varactor-tuned FET oscillators operate up to 24 GHz with a tuning bandwidth of 5 GHz in K-band. The high-Q varactors feature a buried N/sup +/ layer created by ion-implantation at up to 6 MEV. Separately masked implanted N/sup +/ areas connect the buried layer to ohmic contacts at the surface. Varactor f/sub c/ of 1600 GHz was obtained at 0.09 pF.

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A Monolithic 94 GHz Balanced Mixer (1990 Vol. I [MWSYM])

B. Adelseck, J.M. Dieudonne, K.E. Schmegner, A. Colquhoun, G. Ebert and J. Selders. "A Monolithic 94 GHz Balanced Mixer (1990 Vol. I [MWSYM])." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 193-196.

On the basis of a recently developed GaAs technology, which allows the realisation of millimeter wave Schottky mixer diodes and MESFETs on the same monolithic chip, different 94 GHz monolithic mixers have been fabricated. The Schottky diodes show cutoff frequencies of up to 2.3 THz, whereas MESFETs with typical Fmax (MAG=1) of about 90 GHz have been measured. The mixer chips show conversion losses of less than 8 dB combined with noise figures below 6 dB (DSB).

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An X-Band Monolithic Double Double-Balanced Mixer for High Dynamic Receiver Application (1990 Vol. I [MWSYM])

T.N. Ton, G.S. Dow, T.H. Chen, M. Lacon, T.S. Lin, S. Bui and D. Yang. "An X-Band Monolithic Double Double-Balanced Mixer for High Dynamic Receiver Application (1990 Vol. I [MWSYM])." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 197-200.

An X-Band monolithic double double-balanced mixer utilizing MESFET process is described. This monolithic mixer demonstrates RF performance comparable to that of a hybridized mixer. The mixer achieves a high input IP3 of 20 dBm and 1-dB compression output power of 3.6 dBm at 20 dBm LO drive. The measured conversion loss is less than 10 dB from 7 to 10 GHz with a IF output frequency of 5 GHz. We believed this represents highest IP/sub 3/ performance among the reported monolithic mixers.

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Session F -- Cavity Filters

"Session F -- Cavity Filters." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 201-201.

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Abstracts

A New Multiplexing Principle

U. Rosenberg. "A New Multiplexing Principle." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 203-206.

A newmultiplexing principle is introduced based on common multimode cavities (CMC) which resonances are excited at dedicated channel frequencies. This method provides conspicuous advantages, especially in combination with degenerate cavities. The principle is explained and experimentally verified by a diplexer design using one CMC with TE/sub 112/ and TM/sub 110/ resonances.

Abstracts

A Hexa-Mode Bandpass Filter

R.R. Bonetti and A.E. Williams. "A Hexa-Mode Bandpass Filter." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 207-210.

A 6-pole, K/sub u/-band, pseudo-elliptic bandpass filter which utilizes the sixfold degeneracy of a single rectangular cavity is presented. This design achieves significant savings in mass and volume when compared to 6-pole dual and/or triple-mode filters of equivalent performance.

Abstracts

28GHz Band Bandpass Filter Using High Q Dielectric Resonators

T. Nishikawa, H. Tanaka, K. Utsumi, Y. Ishikawa and K. Wakino. "28GHz Band Bandpass Filter Using High Q Dielectric Resonators." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 211-214.

A 28GHz band bandpass filter using high Q dielectric resonators has been developed. High Q dielectric ceramics Ba(Sn,Mg,Ta)O/sub 3/ was applied to a new configuration for symmetrically circular filter. Direct eigen mode expansion method is applied to multi-pole bandpass filter design and is effective for determination of construction parameters. The overall size of the filter is 10 x 10 x 20 mm and the volume is one fourth of dielectric resonator filters of conventional parallel structure. Insertion loss of the filter is 0.74 dB at 190 MHz bandwidth and attenuation is 33 dB at fo ± 300 MHz. The filter is suitable for K-band communication equipment.

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Asymmetric Iris Coupled Cavity Filters with Stopband Poles

F. Arndt, T. Duschak, U. Papziner and P. Rolappe. "Asymmetric Iris Coupled Cavity Filters with Stopband Poles." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 215-218.

An improved type of asymmetric iris coupled cavity filters is introduced which utilizes the dual mode resonance and interference characteristics of the fundamental mode and the next higher order odd mode in suitably optimized resonators. This design achieves additional stopband poles which may advantageously be employed to improve the edge steepness and the rejection characteristic in the second stopband. Based on the modal scattering matrix method, the rigorous design takes into account both the finite iris thickness and the higher order mode interaction at all step discontinuities. Computer-optimized design examples of asymmetric inductive and resonant iris coupled resonator filters for the waveguide Ku- (12 - 18 GHz), and W-band (75 - 110 GHz), respectively, demonstrate the improved stopband behaviour. The theory is verified by available measured results.

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A Novel Coupling Method for Dual Mode Waveguide or Dielectric Resonator Filters

S.-W. Chen and K.A. Zaki. "A Novel Coupling Method for Dual Mode Waveguide or Dielectric Resonator Filters." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 219-222.

A new method for coupling dual mode waveguide or dielectric resonator cavities is described and analyzed. The method provides a practical, flexible, economic means of replacing irises, and offers easy tunability of the coupling over a wide range of coupling values. Calculation of the resonator's coupling parameters using the mode matching methods yields accurate results and is verified by measurements. An experimental X-band 4-pole dual mode elliptic function waveguide cavity filter using the new coupling method was constructed and tested. The test results showed excellent agreement with theory.

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Direct Coupling Configuration Between TE/sub 01delta/ Dielectric Resonator Modes Application to the Design of an Elliptic Microwave Filter

S. Verdeyme and P. Guillon. "Direct Coupling Configuration Between TE/sub 01delta/ Dielectric Resonator Modes Application to the Design of an Elliptic Microwave Filter." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 223-226.

A technic to realize direct coupling between Dielectric Resonators (DRs) acting on their dipolar mode is presented. This new geometric configuration eliminates the need of transmission lines, metallic screws or iris generally employed in microwave filters to obtain negative coupling coefficients. An experimental 4 poles elliptic filter has been constructed to verify the theory.

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Abstracts

Session G -- Lightwave Technology for Microwave Antennas I and II (Focused Session) (Joint with AP Symposium)

"Session G -- Lightwave Technology for Microwave Antennas I and II (Focused Session) (Joint with AP Symposium)." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 227-227.

Abstracts

Optical Techniques for Microwave Generation, Transmission, and Control

L. Goldberg, R.D. Esman and K.J. Williams. "Optical Techniques for Microwave Generation, Transmission, and Control." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 229-232.

Techniques for optical generation of microwave signals to 35 GHz, including direct laser diode modulation, FM sideband injection locking of laser diodes, and offset frequency phase locking of solid state lasers will be reviewed. Optical methods for controlling microwave devices, including phased array radar and oscillators will be described together with recent advances in optical transmission of microwave signals.

Abstracts

Optical Control of a Digital Phase Shifter

W.D. Jemison, T. Berceli, A. Paolella, P.R. Herczfeld, D. Kasemset and A.W. Jacomb-Hood. "Optical Control of a Digital Phase Shifter." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 233-236.

A method for the optical control of digital phase shifters which significantly reduces the number of control lines required is described. The technique uses a simple cost effective LED source along with a MESFET detector and an A/D converter to generate the digital phase shifter command. The approach is independent of the phase shifter operating frequency and is compatible with MMIC technology and parallel optical signal processing. Experimental results are presented for the optical control of a 6-bit digital phase shifter. To provide 360° of phase shift, 310µW of optical power are required.

Abstracts

Microwave and MM Wave Photo-Conductive Three-Wave Mixers for Coherent Detection and Dowconversion of Optical Signals

J.K.A. Everard and R. Thomas. "Microwave and MM Wave Photo-Conductive Three-Wave Mixers for Coherent Detection and Dowconversion of Optical Signals." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 237-240.

Results are presented for lnP and GaAs MMIC photo-conductive 3-wave mixers. In these mixers two optical signals offset by 33 GHz are multiplied together with a microwave signal, all within the same device, to produce a low frequency IF signal of a few hundred MHz. The results are compared with the theory in which it is shown that these detectors are capable of operation up to mm wavelengths with 10% bandwidths and ideal sensitivities often better than ideal photo-diodes. These mixers can be used for coherent detection and downconversion of optical signals and as optoelectronic phase detectors.

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Distribution of Ultra-Stable Reference Frequency Signals Over Fiber Optic Cable

L. Primas, R. Logan, G. Lutes and L. Maleki. "Distribution of Ultra-Stable Reference Frequency Signals Over Fiber Optic Cable." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 241-244.

Radio telescope systems, which operate primarily at microwave frequencies, are used for radio and radar astronomy, very large baseline interferometry (VLBI), geodynamic measurements, and spacecraft navigation. Experimenters have struggled for years to overcome the deficiencies of metallic coaxial cables and waveguides which have limited the stability and accuracy of measurements made with radio telescope systems. Recent advances in fiber optic technology are on the verge of eliminating transmission lines as the major source of error in these systems. This paper describes high stability fiber optic links developed at JPL which are used to distribute reference frequencies over distances as far as 29 kilometers. Reference signals generated by hydrogen masers are: distributed over these links and maintain a stability of 1 part in 10/sup 15/ for 1000 second averaging times.

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Session H -- Discontinuity and Coupling Effects

"Session H -- Discontinuity and Coupling Effects." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 245-245.

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A Planar-Lumped Model for Coupled Microstrip Line Discontinuities

A. Sabban and K.C. Gupta. "A Planar-Lumped Model for Coupled Microstrip Line Discontinuities." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 247-250.

This paper presents a convenient model for analyzing coupled microstrip line discontinuities. Similar to the planar magnetic wall model for single microstrip lines, a planar-lumped model is developed for coupled microstrip lines. Fields underneath the two strips and those fringing at the outer edges are modeled by equivalent planar waveguides. Electric and magnetic field coupling in the gap region is modeled by a lumped network. Model parameters are evaluated such that [C] and [L] matrices of the model are identical with those of coupled lines. This modeling approach is applied to a coupled microstrip section with chamfered right-angled bends to single microstrip lines, and results are in good agreement with experimental values.

Abstracts

A Full-Wave Analysis of Shielded Microstrip Line-to-Line Transitions

T.S. Horng, H.Y. Yang and N.G. Alexopoulos. "A Full-Wave Analysis of Shielded Microstrip Line-to-Line Transitions." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 251-254.

A rigorous procedure is used to analyze several microstrip line-to-line transitions in a shielded multi-layer structure. The transitions studied include edge-coupled lines, overlay-coupled lines and coupled-to-single lines. A power conservation check based on a rigorous Poynting vector analysis is also used to determine the accuracy of the numerical convergence. The results of power distributions and coupling coefficients of the line-to-line transitions are studied parametrically to indentify the properties and applications of each transition.

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Reduction of Parasitic Coupling in Packaged MMIC's

J.J. Burke and R.W. Jackson. "Reduction of Parasitic Coupling in Packaged MMIC's." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 255-258.

Electromagnetic coupling between circuit elements within a package is often significant, or even catastrophic, at frequencies near a package resonance. In future, large, highly integrated, millimeter-wave MMICs this resonant coupling will be difficult to avoid. The addition of lossy materials to the enclosure will reduce the coupling, but not eliminate it. In this paper, two different methods of introducing this loss will be compared. Results indicate that a further reduction in the coupling of power to the resonant modes is possible by repositioning the circuit within the enclosure.

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Theory and Experiment on Rectangular Coaxial Line Discontinuities and Junctions

F. Alessandri, P. Capece and R. Sorrentino. "Theory and Experiment on Rectangular Coaxial Line Discontinuities and Junctions." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 259-262.

Step discontinuities and junctions in rectangular coaxial lines are analyzed both theoretically and experimentally. The theoretical approach is based on a modified field matching technique extended to 3-D problems for the analysis of multiaxial discontinuities. Experiments in the 2 to 6 GHz band show excellent agreement with the theoretical predictions.

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Analysis of Circular and Rectangular Apertures in a Circular Waveguide

G.B. Eastham and K. Chang. "Analysis of Circular and Rectangular Apertures in a Circular Waveguide." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 263-266.

An analysis has been carried out to determine the discontinuity susceptance of a circular or rectangular aperture in the transverse plane of a circular waveguide. A closed-form solution has been derived with good agreement as compared with experimental results. The results should have many applications in the design of circular waveguide components and cylindrical cavity-backed phased arrays.

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Session I -- Open Forum I

"Session I -- Open Forum I." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 267-267.

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Performance and Modeling of Superconducting Ring Resonators at Millimeter-Wave Frequencies

K.B. Bhasin, C.M. Chorey, J.D. Warner, R.R. Romanofsky, V.O. Heinen, K.S. Kong, H.Y. Lee and T. Itoh. "Performance and Modeling of Superconducting Ring Resonators at Millimeter-Wave Frequencies." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 269-272.

Microstrip ring resonators operating at 35 GHz have been fabricated from laser ablated YBCO thin films deposited on lanthanum aluminate substrates. They were measured over a range of temperatures and their performance compared to identical resonators made of evaporated gold. Below 60° Kelvin the superconducting strip performed better than the gold, reaching an unloaded 'Q' ~1.5 times that of gold at 25° K. A shift in the resonant frequency follows the form predicted by the London equations. The Phenomenological Loss Equivalence Method is applied to the ring resonator and the theoretically calculated Q values are compared to the experimental results.

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Preliminary Design Steps for Thin-Film Superconducting Filters

R.R. Bonetti and A.E. Williams. "Preliminary Design Steps for Thin-Film Superconducting Filters." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 273-276.

Techniques which aid in the design and development of microstrip filters on high-dielectric-constant substrates are presented. While the procedures are valid for most types of coupled-line filter structures, they are particularly useful as the initial steps in designing superconducting MIC filters. Numerical examples are given for both Chebychev and elliptical designs, and experimental results are provided for a 4-pole, modified hairpin microstnp filter built on a lanthanum galate substrate. Experimental measurements at liquid nitrogen temperatures show excellent agreement with the predicted performance.

Abstracts

Field and Energy-Density Profiles in Layered Superconductor-Dielectric Structures

J.M. Pond and P. Weaver. "Field and Energy-Density Profiles in Layered Superconductor-Dielectric Structures." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 277-280.

The electromagnetic field profiles, energy densities for some layered superconductor-dielectric structures are calculated. Of particular interest is the situation when the superconducting film is thinner than the superconducting penetration depth. In these cases the primary energy storage mechanism in the superconductor is the inertial energy stored in the superconducting current rather than the magnetic field. An understanding of the arrangement of electromagnetic fields in layered superconductor-dielectric structures will aid in the development of circuits, devices which utilize these properties.

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Abstracts

Microwave Measurement of Surface Impedance of High-Tc Superconductor

Y. Kobayashi, T. Imai and H. Kayano. "Microwave Measurement of Surface Impedance of High-Tc Superconductor." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 281-284.

Perturbation formulas for a TE/sub 011/ mode dielectric resonator and for a TE/sub 011/ mode circular cavity are derived to determine surface impedance Z/sub S/(=R/sub S/+jX/sub S/) of superconductors from measured values of resonant frequency and unloaded Q. The Z/sub S/ values for a YBCO plate with a diameter of 30 mm were measured at 8.7, 10.4, and 23.7 GHz using these formulas. The measured results are presented as functions of temperature.

Abstracts

High Frequency Characterization of High-Temperature Superconducting Thin Film Lines

T.E. van Deventer, P.B. Katehi, J.Y. Josefowicz and D.B. Rensch. "High Frequency Characterization of High-Temperature Superconducting Thin Film Lines." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 285-288.

An integral equation approach is applied to calculate the propagation characteristics of high temperature thin-film superconducting lines at high frequencies. To evaluate losses in these lines, the superconducting strips are replaced by frequency-dependent surface impedance boundaries. The values of these surface impedances are measured experimentally by a stripline resonator technique. Using this method, phase and attenuation constants as well as characteristic impedance are evaluated and presented as functions of frequency and several other parameters.

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Hybrid Mode Analysis of RF Characteristics in Integrated Optical Modulators on III-V Semiconductors

K. Wu, C.-Y.E. Tong and R. Vahldieck. "Hybrid Mode Analysis of RF Characteristics in Integrated Optical Modulators on III-V Semiconductors." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 289-292.

The method of lines has been applied to study the RF/-microwave characteristics of III-V semiconductor traveling wave electrooptic modulators. Double-rib, multilayer strip wave-guides have been investigated. It is found that Schottky barrier junction controlled structures support multi-nondispersive modes having phase velocities that closely match the optical carrier, These modes are potentially useful in ultra-fast modulators operating into the millimeter wave band.

Abstracts

Optically Controlled K-Band Oscillator

R. Saedi, T. Berceli, A.S. Daryoush and P.R. Herczfeld. "Optically Controlled K-Band Oscillator." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 293-294.

PIN photodiodes play an important role in detection of modulated light in fiberoptic links. However these devices are essentially junction devices, with bias dependent capacitance very similar to varactor diodes. Particularly under proper biasing conditions, junction capacitance of these devices can be changed by light illumination. This paper reports results of tuning and frequency modulation experiments of a 24.5GHz oscillator configured with a PIN photodiode as the tuning element. Both electrical and optical tuning were investigated, resulting in tuning range of few hundred MHz at K-band.

Abstracts

Coupling Maxwell's Equation Time-Domain Solution with Monte-Carlo Technique to Simulate Ultrafast Optically Controlled Switches

K.M. Connolly, S.M. El-Ghazaly, R.O. Grondin and R.P. Joshi. "Coupling Maxwell's Equation Time-Domain Solution with Monte-Carlo Technique to Simulate Ultrafast Optically Controlled Switches." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 295-298.

In this paper, we discuss how a combination of direct finite-difference time domain solutions of Maxwell's equations and Monte-Carlo models of photocarrier transport can be used to eliminate assumptions commonly made in developing equivalent circuit models for transmission lines. We then apply this technique to an electro-optic switch with subpicosecond risetimes.

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Field Effects on Picosecond Photoconductive Switch

Y. Lu. "Field Effects on Picosecond Photoconductive Switch." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 299-302.

A new rigorous method which successfully incorporate the ensemble Monte Carlo technique with time-domain finite difference method of solving time varying Maxwell's equations is presented. Interactions between electromagnetic fields and carrier transport properties have been studied and fields effects on picosecond photoconductive switch have been revealed.

Abstracts

Nonlinear Circuit Optimization with Dynamically Integrated Physical Device Models

J.W. Bandler, Q.J. Zhang and Q. Cai. "Nonlinear Circuit Optimization with Dynamically Integrated Physical Device Models." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 303-306.

The state of the art in FET circuit optimization is advanced. Our approach, which is directed at the next generation tools for yield optimization, dynamically integrates physics-based device models. We treat the Khatibzadeh and Trew FET model in a novel formulation of harmonic balance simulation. Adjoint sensitivity analysis allows efficient optimization of parameters such as device dimensions, material-related parameters, doping profile, channel thickness, etc. We demonstrate parameter extraction and power amplifier design.

Abstracts

Calculated Performance of S.I.S. Junctions as Frequency Multipliers

H.D. Foltz and J.H. Davis. "Calculated Performance of S.I.S. Junctions as Frequency Multipliers." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 307-310.

The harmonic balance technique is applied to examine the performance of SIS junctions as millimeter- and submillimeter-wave frequency multipliers. The effects of drive level, bias, embedding impedance, and junction parameters on harmonic generation are described. The calculations show that the output power is only a few nanowatts per junction, but that the efficiency is reasonable: in the range of 15-18% for realistic junction parameters.

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Comparison of GaAs MESFET DC Models

Z.R. Hu, J.J. McKeown, T. Brazil and J.A.C. Stewart. "Comparison of GaAs MESFET DC Models." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 311-314.

This paper describes a comparative study of ten GaAs MESFET DC models, including three new variations. The computations have been carried out using a new interactive program for nonlinear parameter extraction and sensitivity analysis (INTERSECT). The study concluded that the Curtice Cubic model, with seven parameters, provide the best fit to the two sets of MESFET DC characteristics used.

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Gate-Drain Breakdown Effects Upon the Large Signal Performance of GaAs MESFETs

T.A. Winslow, D. Fan and R.J. Trew. "Gate-Drain Breakdown Effects Upon the Large Signal Performance of GaAs MESFETs." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 315-318.

GaAs MESFETs often demonstrate a negative break-down slope characteristic. This slope can be critical in determining the RF performance of MESFET amplifiers. It is demonstrated that as the breakdown slope decreases, RF power performance is degraded. Tuning is also important because this adjusts the load line to allow maximum voltage and current swings on the drain. Reverse breakdown followed by foward gate conduction are confirmed to be the main saturation mechanisms for GaAs MESFETs.

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Computer-Aided Analysis and Optimization of Subhalf-Micron-Gate MODFET Structures

T. Shawki and G. Salmer. "Computer-Aided Analysis and Optimization of Subhalf-Micron-Gate MODFET Structures." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 319-322.

Novel optimization techniques for subhalf-micron gate MODFET structures are thoroughly investigated based on accurate 2D hydrodynamic hot-electron modeling. We emphasized some novel device design concepts to be implemented in submicron-MODFET knowledge-based systems. Device design constraints and guidelines to achieve optimum millimetric-wave performance are considered. These cover gate-length miniaturization, optimal gate-recess dimensions and optimized SQW-MODFET geometries.

Abstracts

A Non-Linear Distributed FET-Model, for Millimeter-Wave Circuit Design by Harmonic Balance Techniques

E. Ongareau, M. Aubourg, M. Gayral and J. Obregon. "A Non-Linear Distributed FET-Model, for Millimeter-Wave Circuit Design by Harmonic Balance Techniques." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 323-326.

In this paper, we propose a systematic procedure to derive a non-linear, distributed, FET model, which may be implemented in harmonic balance simulators for non-linear design at millimeter waves. The model is derived from the knowledge of the conventional lumped non-linear equivalent circuit, and the geometrical dimensions of the FET. A FET-finger is modeled by N sliced sections. Each section includes a nonlinear two-port, inserted between two linear four-part. Element-values of the non-linear two-port are derived from the lumped model, by appropriate scaling rules. Element-values of the linear four-port are derived from an electromagnetic analysis of the transverse structure of the FET, which takes into account coupling and distributed effects along the electrodes. The model has been applied to the non-linear analysis of a millimeter-wave FET, and compared to the lumped equivalent circuit.

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Modeling, Analysis and Optimization of GUNN Diode VCO

Y. Wang and K.J. Gu. "Modeling, Analysis and Optimization of GUNN Diode VCO." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 327-330.

In this paper, a new model of Gunn diode VCO is established on the basis of computation of coupling disc capacitance between Gunn diode and varactor using spectral-domain Hankle transformation. For the first time, the nonlinear analysis of Gunn diode VCO has been carried out by using harmonic balance technique. The experimental results are compared with the computed results. It is shown that the developed model and analysis program are available and effective. A special optimization procedure to find the doping power factor of varactor is proposed in order to get optimal tuning linearity.

Abstracts

A Design Technique for MESFET Mixers Based on Spice Program

M.J. Rosario and J.C. Freire. "A Design Technique for MESFET Mixers Based on Spice Program." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 331-334.

A design technique for MESFET mixers is described. This technique is based on a mixer analysis program (MIXAN) developed to obtain the value of conversion gain and optimum source and load impedances for any local oscillator power and DC bias. (MIXAN) program uses SPICE as a "subroutine" to determine large-signal current and voltage waveforms. In accordance, with MIXAN program is possible to obtain the operating conditions for maximum conversion gain. The good agreement between experimental and theoretical values for X band drain and gate mixers prove the validity of the design technique.

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Abstracts

Numerical Optimization of Broadband Nonlinear Microwave Circuits

V. Rizzoli, A. Costanzo and C. Cecchetti. "Numerical Optimization of Broadband Nonlinear Microwave Circuits." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 335-338.

The paper describes the implementation of extensive optimization capabilities in a general-purpose harmonic-balance simulator. Two different optimizers suitable for autonomous and forced circuits, respectively, are discussed in detail, and their merits and limitations are compared. The efficient numerical optimization of nonlinear microwave circuits specified over a finite frequency band is demonstrated for the first time.

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Abstracts

Computer-Aided Synthesis of Lossy Commensurate Line Network and its Application

L. Zhu and C. Sheng. "Computer-Aided Synthesis of Lossy Commensurate Line Network and its Application." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 339-342.

In this paper, a useful theorem which extends the technique introduced in [1] to even wide fields is proposed for transformation between distributed lossy and lumped lossless networks. A computer-aided approach is developed to the synthesis of lossy commensurate lne network with all lines being of frequency dependent loss. As an application, one-stage broad-band amplifier is designed for monolithic microwave integrated circuits (MMIC's) and its performance is compared with the example in [2].

Abstracts

A Simple Empirical Noise Model of Submicron-Gate GaAs MESFET for CAD Applications

S. Watanabe. "A Simple Empirical Noise Model of Submicron-Gate GaAs MESFET for CAD Applications." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 343-346.

A simple empirical noise model of GaAs MESFETs with submicron gate is presented. From noise parameter measurements on various types of GaAs MESFETs, the intrinsic noise current sources have been found to be represented in simple empirical equations. Hence the noise parameters can be determined only from its small-signal equivalent circuit, and a good agreement is obtained between the model and measurement. The model presented here does not require additional noise measurement, and is suitable especially for microwave CAD applications.

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Abstracts

Computer-Aided Design of Monolithic Distributed Amplifiers with Yield Optimization

M.-K. Vai, S. Prasad and B. Meskoob. "Computer-Aided Design of Monolithic Distributed Amplifiers with Yield Optimization." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 347-350.

A CAD procedure for monolithic distributed amplifiers with yield optimization is presented. Considering the difficulty of fabricating exact circuit parameters with the present technology, a yield optimization, which optimizes the predicted yield rate of circuits produced when circuit elements deviate from their nominal values, has been integrated into this CAD process. Comparing a distributed amplifier designed without yield optimization and one generated with yield optimization in this procedure, the predicted yield rate has been increased from 30% to 50%.

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A Method for Computing the Noise Figure in Matrix Distributed Amplifier

S. D'Agostino, G. D'Inzeo, P. Marietti and G. Panariello. "A Method for Computing the Noise Figure in Matrix Distributed Amplifier." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 351-354.

A method for the evaluation of the noise figure in matrix amplifiers has been developed. The amplifier noise figure is derived as a function of the noise characteristics of the active devices and circuit parameters. A simple expression in closed form is obtained. The results of the model are in good agreement with experimental data.

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A CAD Program for the Symbolic and Numerical Analysis of Microwave Electronic Circuits

A. Riddle. "A CAD Program for the Symbolic and Numerical Analysis of Microwave Electronic Circuits." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 355-358.

A new circuit analysis program, capable of both symbolic and numerical calculations, is described. The ability to derive equations describing a circuit's operation is a great leap forward for engineering analysis. This program, nodal, can calculate voltages, currents, S-parameters, and noise coefficients, Since nodal uses the Mathematica® engine, it takes advantage of the capabilities of Mathematica as well as its ability to run on various hardware platforms. A detailed description of this program and examples of its use is given below.

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Direct Extraction of GaAs MESFET Intrinsic Element and Parasitic Inductance Values

E. Arnold, M. Golio, M. Miller and B. Beckwith. "Direct Extraction of GaAs MESFET Intrinsic Element and Parasitic Inductance Values." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 359-362.

A simple method is described for extracting the intrinsic element and parasitic inductance values for the GaAs MESFET equivalent circuit. The intrinsic element values are extracted from low frequency y-parameter data de-embedded through previously determined parasitic resistances. Parasitic inductance values are then evaluated by comparing the resulting modeled z-parameters with the extrinsic measured z-parameters. All elements are extracted from the same set of hot FET S-parameter measurements. The method is very fast and the resulting equivalent circuit provides an excellent match to measured s-parameters through 18 GHz.

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Optimization of Gain, VSWR and Noise of the Broadband Multistage Microwave MMIC Amplifier by the Real Frequency Method. Synthesis in Lumped and Distributed Elements

A. Perennec, A.N. Olomo, P. Jarry and R. Soares. "Optimization of Gain, VSWR and Noise of the Broadband Multistage Microwave MMIC Amplifier by the Real Frequency Method. Synthesis in Lumped and Distributed Elements." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 363-366.

Up until now the simplified "real frequency" technique has been applied to the design of broadband multistage microwave amplifiers where gain and VSWR are optimized. In this paper we extend the method to the optimization of the noise figure in parallel with the gain and VSWR. The synthesis of the networks is carried out in two ways, with lumped elements and distributed elements. Then we give several examples of design; ultra wide band GaAs monolithic amplifier, transimpedance amplifier for optical receivers and low noise ultra wide band amplifier.

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Passive Stabilization of Sources Using a Dielectric Resonator and a Modified Ring Hybrid

B.E. Sigmon. "Passive Stabilization of Sources Using a Dielectric Resonator and a Modified Ring Hybrid." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 367-370.

A new approach for the frequency stabilization of sources, high power or low, vacuum tube or solid-state, is described. The method uses a high-Q dielectric resonator coupled to a three arm ring hybrid. Stabilization factors of 3 to 5 have been successfully achieved (in X- and Ku-bands) with pulsed magnetrons over an operating temperature range of -55 to +95 degrees Centigrade, and stabilization factors of 2 to 24 have been successfully achieved with X-and Ku-band pulsed IMPATT oscillators, some, but not all, operating over temperature ranges of -46 to +80 degrees Centigrade.

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Closed Form Solution of an N-Port Microstrip Planar Disk Device with an Eccentrically Located Short Circuit Post of Arbitrary Radius

S.R. Judah and M.J. Page. "Closed Form Solution of an N-Port Microstrip Planar Disk Device with an Eccentrically Located Short Circuit Post of Arbitrary Radius." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 371-374.

An analysis technique is presented allowing the performance of an N-port microstrip planar disk device with an arbitrarily located internal short circuit (S/C) post of arbitrary radius to be predicted. The approach yields analytical expressions ideal for CAD implementation. The experimental results are in very good agreement with the theoretical predictions.

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Analysis of a Waveguide-Disk Load

H.E. Bialkowski and O. Shahan. "Analysis of a Waveguide-Disk Load." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 375-378.

A theoretical analysis of a waveguide-disk load comnonly used in radar duplexers is carried out. An expression for the input reflection coefficient of the load is derived and verified experimentally. Based on computational results the operation of the load is explained.

Abstracts

W-Band Fin-Line Broad-Band Directional Couplers with Different Coupling Ratio

Y.-Y. Chen and S. Li. "W-Band Fin-Line Broad-Band Directional Couplers with Different Coupling Ratio." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 379-381.

W-band broad band couplers, having 6, 10 and 3dB coupling ratio realized bycoupled fin-line are reported. For looser coupling such as 6 and 10dB coupling we take advantage of over coupling configuration in order to lower the requirements of fin-line geometrical dimension. The experimental results of prototype couplers show a flat frequency response and low loss performance in a broad band.

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Abstracts

New Broad-Band 5-Section Microstrip-Line Directional Coupler

M. Nakajima, E. Yamashita and M. Asa. "New Broad-Band 5-Section Microstrip-Line Directional Coupler." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 383-386.

A new 2 to 18 GHz 6dB microstrip-line directional coupler has been realized using 3 semi-re-entrant tight-coupling sections implemented into 5 coupling sections formed on Teflon substrate. The measured coupling coefficient of this coupler is in good agreement with theoretical values.

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TEM Equivalent Circuits for Quasi-TEM Couplers

S. Cheng and M.L. Edwards. "TEM Equivalent Circuits for Quasi-TEM Couplers." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 387-390.

Equivalent circuits for TEM couplers (1,2), important in the design of coupled line filters, E.G. interdigital or combline, are inadequate approximations for quasi-TEM structures such as microstrip. Exact quasi-TEM coupler equivalent circuits are developed consisting of TEM line configurations suitable for CAE design and analysis applications.

Abstracts

Branchlike-Couplers with Improved Design Flexibility and Broad Bandwidth

B. Mayer and R. Knochel. "Branchlike-Couplers with Improved Design Flexibility and Broad Bandwidth." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 391-394.

Analytical formulas are derived, which allow to fully exploit the design flexibility inherent in two-arm branchlike-couplers with open stubs at the symmetry-planes in order to avoid low-impedance lines. A broad banding procedure is given also, which for example improves the operating-bandwidth of a two-arm coupler up to 40% while maintaining very flat coupling characteristic.

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Hybrid Mode Coupling of Dielectric Resonators to Microstrip Lines

X.-P. Liang and K.A. Zaki. "Hybrid Mode Coupling of Dielectric Resonators to Microstrip Lines." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 395-396.

Coupling between hybrid modes in dielectric resonators and microstrip lines is analyzed. This coupling is due to both magnetic and electric fields. These two kinds of coupling can be treated separately. Two degenerate hybrid modes with the same resonant frequency are excited by magnetic coupling and electric coupling, respectively. Computed data shows dependence of the external Q on the distance between the resonator and the line. Experimental measurements are compared with the computed data, showing very good agreement.

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Coplanar Waveguide Discontinuities for P-I-N Diode Switches and Filter Applications

N.I. Dib, P.B. Katehi, G.E. Ponchak and R.N. Simons. "Coplanar Waveguide Discontinuities for P-I-N Diode Switches and Filter Applications." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 399-402.

A full wave space domain integral equation (SDIE) analysis of coplanar waveguide (CPW) two port discontinuities is presented. An experimental setup to measure the S-parameters of such discontinuities is described. Experimental and theoretical results for CPW realizations of pass-band and stop-band filters are presented. The S-parameters of such structures are plotted in the frequency range 5-25 GHz.

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Analysis and Design of Asymmetric and Multiple Coupled Finline Couplers and Filters

A. Biswas and V.K. Tripathi. "Analysis and Design of Asymmetric and Multiple Coupled Finline Couplers and Filters." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 403-406.

The procedure to compute the scattering parameters of a general asymmetric and multiple coupled finline multiport is formulated in terms of the normal mode parameters of the structure. The normal mode parameters of the structures are computed by applying the spectral domain technique to general shielded multilayered structure. In addition, closed form expressions for the immittance parameters and characteristically terminated scattering parameters of the asymmetric coupled line and three line structure are presented. The multiport parameters of the finline structure are used to design filters, couplers and power dividers.

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Design of a Quasi-Planar Broadside End-Coupled Bandpass Filter

C.-K.C. Tzuang, Y.C. Chiang and S. Su. "Design of a Quasi-Planar Broadside End-Coupled Bandpass Filter." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 407-410.

This paper presents the design and implementation of a quasi-planar broadside end-coupled bandpass filter. It circumvents the problem of bandwidth limitation imposed on the conventional end-coupled filter realized by coplanar strips. To realize such a complicated filter in shape, an accurate tridimensional deembedding of the filter discontinuity problem based on the quasi-TEM variational spectral-domain approach (SDA) is developed. Then this approach leads to the design of a 30% bandwidth bandpass filter which agrees favorably with the measured performance.

Abstracts

Novel Microstrip Directional Band-Pass/Band-Stop Couplers and Filters

J. Watkins and S. Uysal. "Novel Microstrip Directional Band-Pass/Band-Stop Couplers and Filters." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 411-414.

A new class of microstrip band-pass/band-stop and periodic couplers and filters are described in this paper. Multi-function performance can be obtained from these components due to their directional properties. The design aspects and the predicted results of these circuits are presented. The theory is verified by an experimental band-pass coupler designed on alumina substrate.

Abstracts

A New Finite Element Method Formulation Applied to D.R. Microwave Filter Design

V. Madrangeas, M. Aubourg, P. Guillon, S. Vigneron, B. Theron and D. Parise. "A New Finite Element Method Formulation Applied to D.R. Microwave Filter Design." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 415-418.

A new 3D finite element formulation using NEDELEC polynomials has been developed to compute electromagnetic and electrical parameters of microwave devices; to prove the advantages of this new formulation which does not generate any non physical responses, we have applied it to evaluate resonant frequencies f/sub 0/, unloaded Q/sub 0/ dielectric resonator (D. R.) used in the design of L band microwave filters.

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Miniature Hybrid Microwave IC's Using a Novel Thin-Film Technology (1990 Vol. I [MWSYM])

K. Eda, T. Miwa, Y. Taguchi and T. Uwano. "Miniature Hybrid Microwave IC's Using a Novel Thin-Film Technology (1990 Vol. I [MWSYM])." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 419-422.

A novel thin-film technology for miniature hybrid microwave ICs is presented. All passive components are fully integrated on ordinary alumina ceramic substrates using the thin-film technology with very high yield. The numbers of parts and wiring processes were significantly reduced. This technology was applied to fabrication of Ku-band solid-state power amplifiers.

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Abstracts

18 GHz Reverse Channel HEMT Oscillator

F.S. Correra and E. Camargo. "18 GHz Reverse Channel HEMT Oscillator." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 423-426.

A simple analytical equation is proposed for describing the HEMT drain current, has been implemented at the SPICE simulator. It accurately modeled the HEMT transconductance compression, was applied to non-linear circuit simulation without convergence problems. Using this equation an oscillator design approach combining linear, non-linear analysis was used to design a DRO operating at 18 GHz employing a HEMT in the reverse channel configuration. The performance of the oscillator constructed confirmed the main results predicted by the simulations. The oscillator constructed generated + 11 dBm at 18 GHz, and the circuit/device interaction predicted by the simulation was experimentally confirmed.

Abstracts

Balanced V-Band DC-Biased Mixer with Wide (12-GHz) RF/IF Bandwidth

P. Meier. "Balanced V-Band DC-Biased Mixer with Wide (12-GHz) RF/IF Bandwidth." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 427-430.

This paper describes the design and performance of the first balanced dc-biased millimeter-wave mixer with a wide (12-GHz) instantaneous RF/IF bandwidth. Relative to the prior art, the new mixer requires less LO drive and yet provides the superior IM suppression provided by a balanced design.

Abstracts

44 GHz Hybrid Low Noise Amplifiers Using Ion-Implanted In/sub X/Ga/sub 1-x/As MESFETs

C.L. Lau, M. Feng, G.W. Wang, T. Lepkowski, Y. Chang, C. Ito, V. Dunn, N. Hodges and J. Schellenberg. "44 GHz Hybrid Low Noise Amplifiers Using Ion-Implanted In/sub X/Ga/sub 1-x/As MESFETs." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 431-433.

Hybrid low noise amplifiers using ion-implanted In/sub x/Ga/sub 1-x/As MESFETs with 0.25-micron T-gates have been developed at 44 GHz. The hybrid two-stage amplifier using these ion-implanted In/sub x/Ga/sub 1-x/As MESFETs achieved a noise figure of 3.6 dB with an associated gain of 14.4 dB at 44 GHz. When two of these amplifiers were cascaded, the four-stage amplifier demonstrated a gain of 30.5 dB at 44 GHz and 37 dB at 40 GHz. These results, achieved using low cost ion-implantation techniques, rival the best HEMT results.

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Measuring Complex Dielectric Constant of Dielectric Slab-Coated Conductors in Millimeter Waves by Radiating Technique

L. Guoding, S. Qing and S. Changsheng. "Measuring Complex Dielectric Constant of Dielectric Slab-Coated Conductors in Millimeter Waves by Radiating Technique." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 435-438.

This paper describes a novel method for determining complex dielectric constant of dielectric slab-coated conductors. The constant nay be found by measuring an angle Theta/sub m/ of maximun radiation and two radiation angles Theta/sub 1h/, Theta/sub 2h/ of half peak power from the leaky wave antenna. The method is specially useful for millimeter waves and can realize automatical measurement.

Abstracts

Extraction of Microwave Noise Parameters of FET Devices

F. Colombani and E. Camargo. "Extraction of Microwave Noise Parameters of FET Devices." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 439-442.

A technique is proposed for the extraction of the noise parameters of on-wafer, chip-mounted or packaged MESFETs and HEMTs. The approach includes the characterization of the device's small-signal equivalent circuit employing DC and RF measurements. A few microwave noise measurements are associated with computer fitting procedures to determine the noise coefficients P, R and C which completes the method. The procedure is used to determine the optimum source impedance of a Toshiba S8818A 0.3 µm gate length MESFET and the obtained parameters are compared with experimental results.

Abstracts

A New Multi-Harmonic Load-Pull Method for Non Linear Device Characterization and Modeling

R. Larose, F.M. Ghannouchi and R.G. Bosisio. "A New Multi-Harmonic Load-Pull Method for Non Linear Device Characterization and Modeling." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 443-446.

A new multi-harmonic load-pull system based on an active load tuning configuration is presented. The system allows independent load-tuning of an excitation signal and its harmonics. Load-pull measurements on MESFET (NEC 71083) have been performed at the fundamental (f/sub o/), second (2f/sub o/), and third (3f/sub o/) harmonics. The results show the importance of such measurements in designing and modeling non linear devices and circuits.

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A Frequency Conversion Scheme for an Advanced Portable Microwave Spectrum Analyzer

T. Hill and L. Lockwood. "A Frequency Conversion Scheme for an Advanced Portable Microwave Spectrum Analyzer." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 447-450.

A block diagram is described with an unusually high frequency IF system resulting in a high performance spectrum analyzer. The phase noise and short term frequency stability are not seriously degraded and the sensitivity is enhanced at high center frequencies. This technique also has applications in modern receivers.

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Session J -- (Joint with the MMIC Symposium) Control Circuits

"Session J -- (Joint with the MMIC Symposium) Control Circuits." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 451-451.

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A High Power 2-18 GHz T/R Switch (1990 Vol. I [MWSYM])

M.J. Schindler and T.E. Kazior. "A High Power 2-18 GHz T/R Switch (1990 Vol. I [MWSYM])." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 453-456.

A high power 2-18 GHz T/R switch MMIC has been developed for use in broadband T/R modules. This switch has power handling better than 35 dBm (3.2 watts), 8 dB higher than any previously reported broadband switch. A combination of techniques was used to yield higher power handling while preserving low loss and high isolation. These circuit techniques include: asymmetrical design of the Transmit and Receive arms; the use of dual-gate FETs for handling large voltages, and the use of large FET peripheries for handling large currents.

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A Compact Broadband, Six-Bit MMIC Phasor with Integrated Digital Drivers (1990 Vol. I [MWSYM])

C. Moye, G. Sakamoto and M. Brand. "A Compact Broadband, Six-Bit MMIC Phasor with Integrated Digital Drivers (1990 Vol. I [MWSYM])." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 457-460.

Digital and microwave technologies have been successfully combined on a single chip to realize a broadband, 6-bit MMIC phase shifter. It exhibits low insertion loss, good VSWR, and exceptional phase performance with less than 3 degrees RMS phase error for all sixty-four phase states over the entire 7.2-10.2 GHz band. Compared to previous designs, the number of required control lines has been reduced by a factor of two due to the integration of the digital driver circuitry.

Abstracts

Broad Band Monolithic Cross Point Switch Matrices (1990 Vol. I [MWSYM])

S. Powell, P. Becker, M. Dupuis and C. Nagy. "Broad Band Monolithic Cross Point Switch Matrices (1990 Vol. I [MWSYM])." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 461-464.

A series of broadband monolithic switch matrices has been fabricated. Circuits covering DC to 18 GHz are described, including a 4 to 10 GHz fully monolithic 2 by 2 matrix on a single chip with 4 dB insertion loss and greater than 40 dB isolation. The circuits utilize a high isolation microstrip crossover.

Abstracts

A 10-14 GHz Linear MMIC Vector Modulator with Less Than 0.1 dB and 0.8° Amplitude and Phase Error (1990 Vol. I [MWSYM])

F.L.M. van den Bogaart and R. Pyndiah. "A 10-14 GHz Linear MMIC Vector Modulator with Less Than 0.1 dB and 0.8° Amplitude and Phase Error (1990 Vol. I [MWSYM])." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 465-468.

The design, fabrication and performance of a GaAs monolithic linear vector modulator in the 10-14 GHz band is described. The circuit exhibits side band and carrier rejections of more than 45 dB with third order intermodulation signals at -40 dBc. Such performance has never been obtained previously in neither hybrid nor monolithic technology.

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Session K -- Passive Components I: Power Dividers and Phase Shifters

"Session K -- Passive Components I: Power Dividers and Phase Shifters." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 469-469.

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Broadband Printed Circuit 0°/180° Couplers and High Power Inphase Power Dividers

R. Knochel and B. Mayer. "Broadband Printed Circuit 0°/180° Couplers and High Power Inphase Power Dividers." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 471-474.

A broadbanding procedure ia described, which is suited for increasing the useful bandwidth of rat-race couplers and Gysel-type power dividers considerably. The circuits are easily fabricated, Relative bandwidths in excess of 40% are reached.

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Waveguide-to-Microstrip Power Splitter

Y.-S. Wu, M.V. Schneider and R. Trambarulo. "Waveguide-to-Microstrip Power Splitter." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 475-478.

We describe a novel coupling structure which permits both power combining and division. The structure divides power equally from a rectangular waveguide to two microstrip lines. The microstrips are T-shaped conductor patterns placed symmetrically in the waveguide. The splitter has a return loss of better than 20 dB from 3.3-4.6 GHz measured at the waveguide port. The power difference between the two microstrip output ports is less than 0.1 dB. The coupler is useful for power combining at microwave and millimeter-wavelengths with minimal power loss.

Abstracts

A Novel Power Combiner for MIC and MMIC Amplifiers

A.K. Ezzeddine and H.-L.A. Hung. "A Novel Power Combiner for MIC and MMIC Amplifiers." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 479-482.

A new power-combining technique using a dual-ridged structure in rectangular waveguide is described. The compactness of this combiner makes it especially suitable for high-power MIC or MMIC amplifier applications. Four-way combiner/dividers fabricated at X- and K/sub u/-bands exhibited an insertion loss of less than 0.1 dB (combining efficiency of 98 percent) and return loss of better than 20 dB. An MIC power amplifier was designed for the 14- to 14.5-GHz communications band to demonstrate a potential application for this new combiner.

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A Monolithic or Hybrid Broadband Compensated Balun

A.M. Pavio and A. Kikel. "A Monolithic or Hybrid Broadband Compensated Balun." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 483-486.

A compact microstrip balun structure, capable of multi octave performance has been devised for monolithic or hybrid circuit applications. The structure requires no suspended substrate techniques; hence, it can be easily incorporated in the design of a variety of components such as mixers, multipliers and class B amplifiers.

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Low-Loss 360° X-Band Analog Phase Shifter

J.I. Upshur and B.D. Geller. "Low-Loss 360° X-Band Analog Phase Shifter." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 487-490.

A low-loss reflection-type analog phase shifter circuit is described and experimental results are presented. The circuit incorporates several design features to produce nearly 360° of phase shift at X-band while achieving an insertion loss of only 4.8 dB with ±0.5 dB of variation over all phase states. These results improve upon previously reported X-band performance by demonstrating a large phase shift range together with low attenuation and low amplitude variation with phase state.

Abstracts

A New Rectangular Waveguide to Coplanar Waveguide Transition

G.E. Ponchak and R.N. Simons. "A New Rectangular Waveguide to Coplanar Waveguide Transition." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 491-492.

A new rectangular waveguide to coplanar waveguide transition is described. The transition uses a ridge in one of the broad walls of the waveguide and a nonradiating slot in the opposite wall to split and rotate the electromagnetic fields of the rectangular waveguide TE/sub 10/ mode into the CPW fields.

Abstracts

Session L -- Microwave Integrated Circuits

"Session L -- Microwave Integrated Circuits." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 493-493.

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Enhanced Coupled, Even Mode Terminated Baluns and Mixers Constructed Therefrom

R.G. Barber. "Enhanced Coupled, Even Mode Terminated Baluns and Mixers Constructed Therefrom." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 495-498.

A new mixer circuit technology, based upon what we call the Planar Balun, which is appropriate for microstrip or suspended-substrate mixer construction, is introduced. The multilayer Planar Balun is an even-mode-terminated structure which provides coupling in which odd-mode impedance and velocity can be controlled without greatly affecting even-mode characteristics. The Planar Balun and mixer circuitry are described, and comparisons are made with other baluns. Wideband mixer performance and balun voltage distribution are shown. A Planar Balun mixer fabricated in a 0.25-inch-square surface mount package is demonstrated.

Abstracts

A Varactor-Tuned, Active Microwave Band-Pass Filter

C.-Y. Chang and T. Itoh. "A Varactor-Tuned, Active Microwave Band-Pass Filter." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 499-502.

A new microwave tunable high-Q active band-pass filter was developed using a varactor diode for tuning, and a MESFET to provide negative resistance for increasing the tank circuit Q-value. Tuning ranges of 500 MHz for the one-pole filter and 430 MHz for the two-pole filter are achieved with the center frequency of 10 GHz, A 3-dB bandwidth of 20 MHz for the one-pole filter and 80 MHz for the two-pole filter are obtained. The pass-band insertion loss is typically 0 ± 1dB.

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Microwave Frequency Agile Active Filters for MIC and MMIC Applications

X.H. Jiao, P. Guillon, B. Jarry and B. Madrangeas. "Microwave Frequency Agile Active Filters for MIC and MMIC Applications." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 503-506.

The purpose of this paper is to present newly developed microwave frequency agile active resonators which, in a planar structure, may be realized using MIC or MMIC technologies. Consisting of a modified Hair pin resonator feedback by an amplifier and a phase shifter, these resonators offer extremely low loss and high Q value resonators. The use of varactors permits a tuning of the resonant frequency as well as the bandwidth. Using such resonator, a bandstop filter with a rejection of 45 dB and a lossless band pass filter with a return loss of 35 dB have been obtained at 3.1 GHz.

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Abstracts

Broad-Band Push-Pull Power Amplifier

S. Toyoda. "Broad-Band Push-Pull Power Amplifier." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 507-510.

This paper describes a broad-band push-pull amplifier. A new broad-band phase inverter which is necessary for constructing this amplifier is devised, The experiments on the amplifier are carried out at 5 - 18 GHz band. The bandwidth of 11 GHz and the output power of 1.85 w(32.7 dBm) are obtained.

Abstracts

A Wide-Band Push-Pull Amplifier Upgrades IP2

M.C. Tsai. "A Wide-Band Push-Pull Amplifier Upgrades IP2." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 511-514.

A novel design is described which utilizes Lange coupler baluns in a wideband push-pull amplifier to improve its second order harmonic intercept point (IP2). Better than 10 dB of IP2 improvement has been demonstrated on a breadboard unit. The approach has potential applications for wide-band high-efficiency power GaAs FET amplifiers.

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Inductorless Monolithic Microwave Amplifiers with Directly Cascaded Cells

I.E. Ho and R.L. Van Tuyl. "Inductorless Monolithic Microwave Amplifiers with Directly Cascaded Cells." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 515-518.

Design and performance of inductorless cascadable amplifier cells are described. Using an f/sub T/ = 15 GHz GaAs FET MMIC process, broadband cells employing a new "additive gain" technique are directly cascaded to form a 26 dB-gain, 80 MHz - 4.5 GHz amplifier. A multistage narrowband design exhibits 25 dB gain at 3.5 GHz with 1.6 GHz bandwidth. A compact FET synthetic inductor is compared to square spiral inductors for these designs.

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A Versatile Vector Modulator Design for MMIC

L.M. Devlin and B.J. Minnis. "A Versatile Vector Modulator Design for MMIC." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 519-522.

A single chip, MMIC vector modulator designed for use in an X band phased array radar system is described. The design principle is capable of addressing octave bandwidths and frequencies up into the mm wave region. The circuit is novel in that it is purely passive, using unpowered FETs as the control elements. It is therefore low noise and expected to be capable of handling relatively large RF signal levels of up to 1W. Analogue control of the vector extends over a range of more than 30 dB for amplitude and over 0-360 degrees for phase. Swept frequency, measured phase errors are lower than +/-10 deg for a 10% instantaneous bandwidth anywhere in X-band (8-12GHz).

Abstracts

Session M -- Biological Effects and Medical Applications

"Session M -- Biological Effects and Medical Applications." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 523-523.

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Antenna: The Critical Element in Successful Medical Technology

K.L. Carr. "Antenna: The Critical Element in Successful Medical Technology." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 525-527.

Developments in the application of microwave technology to the solution of medical problems, particularly the detection and treatment of cancer, have been very encouraging. In the development of cancer, for example, microwave hyperthermia has been accepted as an adjunctive procedure to radiation therapy in the treatment of superficial lesions. While not so widely reported, the use of microwave radiometry as a noninvasive passive technique for early detection of cancer appears very promising. Wider acceptance of these methods, however, awaits fundamental, improvements in the ability to focus energy at depth in human tissue -- an important and nontrivial antenna problem. Further developement in the areas of antennas and antenna arrays is required if microwave technology is to provide a practical solution to the detection and treatment of cancer.

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Submillimeter Diameter Interstitial Microwave Hyperthermia Applicators: Preclinical Testing

C.F. Gottlieb, F.L. Moffat, M.J. Hagmann, T.M. Babij, P.V. Houdek and J.G. Schwade. "Submillimeter Diameter Interstitial Microwave Hyperthermia Applicators: Preclinical Testing." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 529-532.

Interstitial hyperthermia applicators as small as 0.20 mm in diameter have been fabricated using ultraminiature coaxial cable. Animal studies show less local tissue trauma with equivalent heating to commercial 1.1 mm diameter applicators. Precise nonsurgical hyperthermia of deep-seated tumors may be achievable with these applicators.

Abstracts

Multi-Microstrip Applicator for Heating and Temperature Measurement

D. Kobayashi, Y. Nikawa, F. Okada and S. Mori. "Multi-Microstrip Applicator for Heating and Temperature Measurement." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 533-536.

A new applicator using multi-microstrip antenna for hyperthermia is proposed and developed. The applicator has two different functions as a heating applicator and as a coupled microstrip applicator for the temperature estimation inside the body noinvasively. In case of heating, an array applicator can heat deep region with surface cooling. In case of temperature measurement, the applicator detects the change of the transmission coefficient of electric field 0.78 dB/°C. Furthermore the depth of discontinuity (which is assumed to be the position of temperature change position) is assumed by simple geometrical investigation.

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Studies of Microwave Thermal Balloon Angioplasty in Rabbits

A. Rosen, P. Walinsky, D. Smith, Z. Kosmari, A. Martinez, F. Sterzer, A. Presser, D. Mawhinney, J.-S. Chou and P. Goth. "Studies of Microwave Thermal Balloon Angioplasty in Rabbits." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 537-540.

The study into the technique of microwave (2.45 MGz) thermal balloon angioplasty has established a correlation between recorded temperature and observed injury. In addition, a trend pointing toward an inverse relationship between intimal proliferation and medial injury has been observed. Angioplasty was performed on 30 normal New Zealand white rabbits, providing 60 iliac arteries for histopathologic analysis. The angioplasty catheter consists of a 3.0mm angioplasty ballon with an intrinsic thermocouple placed on the interior surface of the mid-portion of the balloon. A 0.023 inch coaxial cable was used to deliver the microwave power, and a slot antenna configuration was chosen for the radiating element.

Abstracts

Effects of Water-Filled Bolus on the Precision of Microwave Radiometric Measurements of Temperatures in Biological Structures

S. Mizushina, M. Matsuda, K. Matsui, Y. Hamamura and T. Sugiura. "Effects of Water-Filled Bolus on the Precision of Microwave Radiometric Measurements of Temperatures in Biological Structures." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 541-544.

An assessment is made of the degradation that is caused by a water-filled bolus in the precision of tissue temperatures measured non-invasively by a five-band microwave radiometry scheme. The precision is expressed in terms of the confidence interval of tissue temperature estimated from a set of five brightness temperatures measured with an experimental instrument operating at center frequencies, 1.2, 1.8, 2.5, 2.9, 3.6 GHz, with a 0.4-GHz bandwidth. Results show that the degradation due to a bolus having a thickness of about 1 cm is small when it is filled with the deionized or distilled water. A conclusion of the present study is that the use of water-filled bolus is permissible for the microwave radiometric measurement, which bears a practical importance when the technique is used in combination with the electromagnetic heating for hyperthermic treatment of cancer.

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Abstracts

Dielectric Loaded Lens Applicator for Microwave Hyperthermia

Y. Nikawa and F. Okada. "Dielectric Loaded Lens Applicator for Microwave Hyperthermia." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 545-548.

A new lens applicator for microwave hyperthermia which is combined with a partially dielectric-filled waveguide has been developed. The applicator can change heating pattern by changing the size of the dielectric material. The heating experiment of phantom modeling material of human muscle shows the maximum heating depth is around 70 mm and it confirms to realize deep and local heating for hyperthermia.

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Deeper-Penetrating Wave Applicator in Noninvasive Hyperthermia

L.L. Li and L.S. Taylor. "Deeper-Penetrating Wave Applicator in Noninvasive Hyperthermia." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 549-552.

The penetration depth of a electromagnetic wave into the lossy medium can be greatly enhanced in the near-field zone of a suitably designed applicator with transient excitaion. In the far field of the applicator, EM energy may also decay relatively slowly. We study the decay of EM power in a nondispersive lossy dielectric, and carry out the numerical calculations for the waves in dispersive high water content tissue. The potential for applications of this method is discussed.

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Session N -- CAD and Modeling for MMICs (Focused Session)

"Session N -- CAD and Modeling for MMICs (Focused Session)." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 553-553.

Abstracts

Computer-Aided Design Techniques for Microwave Monolithic Integrated Circuits

A.K. Sharma, H. Wang, N. Ton, M. Aust, J. Yonaki, J. Shioli, S. Dow, D. Yang and L.C.T. Liu. "Computer-Aided Design Techniques for Microwave Monolithic Integrated Circuits." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 555-558.

Thoroughly defined models of active devices that represent actual behavior, and passive structures which include parasitic effects are developed using analytical and experimental techniques. The enhanced simulations tools which incorporate them are then used in the design of MMICs. Theoretical and experimental correlation of several MMIC amplifier and mixer circuits designed to date are presented. The success of these chips is established by demonstrating a close relationship between the "designed" and "fabricated" circuits. The design techniques presented in this paper can be utilized in achieving first-pass success, and consequent 3 to 1 reduction in chip cost by minimizing the design risk.

Abstracts

Iterative, Monotonically Convergent Hybrid-Mode Simulation of Complex, Multiply-Branched (M)MIC Conductor Geometries

W. Wertgen and R.H. Jansen. "Iterative, Monotonically Convergent Hybrid-Mode Simulation of Complex, Multiply-Branched (M)MIC Conductor Geometries." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 559-562.

The unconditionally and monotonically convergent iterative full-wave simulation of multiply-branched (M)MIC shielded conductor geometries is described. The approach developed avoids segmentation and has been verified on problems with up to 50000 patch expansion functions, for example, on a bandpass filter containing 5 closely packed multi-finger interdigital capacitors.

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Abstracts

Losses in GaAs Microstrip (1990 Vol. I [MWSYM])

M.E. Goldfarb and A. Platzker. "Losses in GaAs Microstrip (1990 Vol. I [MWSYM])." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 563-565.

This paper presents newly measured data for the loss of microstrip on 4 mil GaAs from DC-40 GHz. This data was taken from transmission measurements of lightly coupled, multiple half-wavelength, resonators. A comparison of the loss data with the predicted losses from three popular CAE tools is provided.

Abstracts

Properties of FET Parameter Statistical Data Bases

J. Purviance, M. Meehan and D. Collins. "Properties of FET Parameter Statistical Data Bases." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 567-570.

Statistical data bases are often used to characterize the statistics of a FET. This paper shows that a data base containing FET model parameter marginal probability density functions and covariance matrix is not sufficient to describe the FET's S-parameter statistics. This result is important to those developing statistical data bases for GaAs FETs. The implications of this work to simulation and CAD are discussed and a solution to this problem, the Truth Model, is presented.

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Session O -- Directional Couplers

"Session O -- Directional Couplers." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 571-571.

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Abstracts

A Microstrip Re-Entrant Mode Quadrature Coupler for Hybrid and Monolithic Circuit Applications

A.M. Pavio and S.K. Sutton. "A Microstrip Re-Entrant Mode Quadrature Coupler for Hybrid and Monolithic Circuit Applications." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 573-576.

The re-entrant mode TEM coupling method allows the MMIC design engineer to fabricate low loss couplers on either GaAs or Al/sub 2/O/sub 3/ substrates without the problems encountered in fabricating long fine line structures. In addition, since the odd mode energy is mainly contained in a high dielectric region rather than in air, the even and odd mode velocities are closely matched thus enabling the coupler to exhibit excellent VSWR and differential phase performance.

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Abstracts

Rigorous Modal-S-Matrix Design of a New Class of Broadband 180-Degree Branch Guide Couplers

F. Arndt, T. Sieverding and P. Anders. "Rigorous Modal-S-Matrix Design of a New Class of Broadband 180-Degree Branch Guide Couplers." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 577-580.

A new class of 180-degree branch guide couplers is introduced which combines the advantages of the ultra-broadband potential of conventional waveguide E-plane multiple-branch couplers with the low-insertion-loss qualities of E-plane stub-loaded phase shifters. Based on the modal scattering matrix method, the rigorous design takes into account both the finite branch heights and the higher order mode interaction at all step discontinuities. Computer-optimized five-branch three-stub prototypes, designed for 3 ± 0.2 dB coupling, for the waveguide Ku- (12 - 18 GHz) and Ka-bands (26 - 40 GHz), respectively, achieve typically a 180° ± 1° differential phase shift at the output ports, within about 19 percent bandwidth, as well as more than 30 dB isolation and return loss. The theory is verified by available measured results.

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Accurate Design of Microstrip Directional Couplers with Capacitive Compensation

M. Dydyk. "Accurate Design of Microstrip Directional Couplers with Capacitive Compensation." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 581-584.

This paper presents an accurate design of microstrip directional couplers with high directivity using capacitive compensation. The method utilizes symmetry analysis and equivalency principals to develop closed form solutions of the compensating capacitance and a new odd mode characteristic impedance necessary to realize an ideal microstrip directional coupler. The design approach is valid for any degree of coupling thereby overcoming limitations of previous approaches to this design concept.

Abstracts

A Novel Branch-Line Coupler Design for Millimeter-Wave Applications

P. Meaney. "A Novel Branch-Line Coupler Design for Millimeter-Wave Applications." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 585-588.

By taking advantage of the odd function nature of the branch line coupler to increase its series line length to 3/4 wavelength, it is possible to make a microstrip three-branch coupler that works over a full millimeter waveguide band. This design also uses orthogonal inputs and minimizes discontinuities to improve the input match.

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Abstracts

Compact High Power Wide Band Coupler

H.F. Chapell. "Compact High Power Wide Band Coupler." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 589-591.

A technique is given to realize compact, broadband, high power TEM couplers. The basic approach is the summing of more than one signal to correct the 6 dB per octave slope of short TEM couplers.

Abstracts

Session P -- Millimeter-Wave Integrated Circuits

"Session P -- Millimeter-Wave Integrated Circuits." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 593-593.

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W-Band InGaAs HEMT Low Noise Amplifiers

K.H.G. Duh, P.C. Chao, P. Ho, A. Tessmer, S.M.J. Liu, M.Y. Kao, P.M. Smith and J.M. Ballingall. "W-Band InGaAs HEMT Low Noise Amplifiers." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 595-598.

0.15 µm gate length GaAs-based and InP-based lnGaAs channel HEMTs developed in our laboratory have exhibited state-of-the-art noise and gain performance well up to 100 GHz. 94 GHz noise figures of 2.4 and 1.4 dB with gains of 5.4 and 6.5 dB have been measured from GaAs and lnP based HEMTs respectively. High performance W-Band multi-stage amplifiers have been built using these devices. A two-stage GaAs-based amplifier exhibits a noise figure of 4.2 dB with gain of 9.7 dB at 93 GHz and a three-stage amplifier yields 4.5 dB noise figure with 14.8 dB gain at 94 GHz. The best two-stage amplifier built with InP-based HEMTs exhibits a minimum noise figure of 3.2 dB with gain of 11.5 ± 0.4 dB from 88 to 96 GHz. A noise figure as low as 3.3 dB with gain of 17.3 ± 0.5 dB from 88 to 96 GHz has also been demonstrated from a three-stage amplifier. The characteristics and performance of both devices will be presented in the paper.

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Monolithic 40 to 60 GHz LNA

N. Camilleri, P. Chye, A. Lee and P. Gregory. "Monolithic 40 to 60 GHz LNA." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 599-602.

Broadband monolithic GaAs MESFET LNAs have been developed to operate over the entire U-band (40 to 60 GHz). These U-band amplifiers make use of state of the art sub .2um MESFET devices. Typical performance for a two stage LNA using 75um devices is at least 7dB of gain with about 1.5dB peak-to-peak ripple and a maximum noise figure of 7.5dB across the 40 to 60GHz band.

Abstracts

A 44 GHz HEMT Doubler/Amplifier Chain

P.D. Chow, Y. Hwang, D. Garske, J. Velebir and H.C. Yen. "A 44 GHz HEMT Doubler/Amplifier Chain." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 603-606.

A 44 GHz doubler was designed and fabri-cated using 100 x 0.15 µm InGaAs HEMT and MIC circuit. The doubler shows a minimum conversion loss of 1.4 dB with 0.4 dBm output power, and 1.6 dBm maximum output power with 3.4 dB conversion loss. A 44 GHz InGaAs HEMT doubler/amplifier chain was also fabricated, demonstrating 10 dBm power, 7 dB overall gain, and 2 GHz bandwidth at the output frequency.

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Photoconductor-Based 10-110-GHz On-Chip Device Characterization Technique

C. Rauscher. "Photoconductor-Based 10-110-GHz On-Chip Device Characterization Technique." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 607-610.

Integration of reflectometer circuitry and device under test on the same semiconductor chip provides an attractive means for measuring scattering parameters at very high frequencies and over wide, uninterrupted frequency ranges. The investigated approach utilizes high-speed photoconductive circuit elements to perform sampling and incident pulse generation functions, assisted by special pulse shaping and compensation networks. Five test structures, implemented in monolithic format on a GaAs chip, experimentally demonstrate the practicability of the approach for frequencies up through W-band.

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High-Speed Millimeter-Wave Modulator/Demodulator

M.V. Schneider, R. Trambarulo, A. Gnauck and M.J. Gans. "High-Speed Millimeter-Wave Modulator/Demodulator." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 611-614.

We report for the first time on the performance of a millimeter-wave quaternary phase shift keyed (QPSK) modulator/demodulator at information rates up to 8 Gbit/s. The circuits operate in the 40 GHz range and are subharmonically pumped by local oscillators at half the carrier frequencies. The demodulated output data streams showed clean eye diagrams with corresponding bit error rates of less than 10/sup -11/ up to the highest rate measured (8 Gbit/s total information rate).

Abstracts

Session Q -- Microwave Packaging and Manufacturing

"Session Q -- Microwave Packaging and Manufacturing." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 615-615.

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MMIC Temperature Stabilization through Phase Change Energy Absorption

S.A. Dittman and M. Kumar. "MMIC Temperature Stabilization through Phase Change Energy Absorption." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 617-620.

A new temperature stabilization concept for MMIC's utilized in applications such as Decoys, Kinetic Energy Weapons, Missile Systems, and Smart Munitions is presented. The concept permits MMIC junction temperatures to be maintained within operational limits during short periods of high power dissipation. The stabilization of junction temperature is accomplished by locating the MMIC in close thermal proximity to a material which undergoes a change of state. The result of this mounting configuration is the absorption of large relative quantities of thermal energy within a minimal volume. Both theoretical and experimental data are presented which support evidence of an increase in operational period of approximately two hundred percent.

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A New Instrument for the Measurement of Resonant Field Distributions in Microwave Housings and Packages

D.W. Griffin. "A New Instrument for the Measurement of Resonant Field Distributions in Microwave Housings and Packages." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 621-624.

A special purpose two-dimensional standing wave detector for measuring resonant electric field distributions at the flat lid on microwave housings and packages is described and its use as a diagnostic and design development tool for module housings is demonstrated. Empirical and analytical relationships between measurables and the electric field are presented.

Abstracts

Low-Cost Package Technology for Advanced MMIC Applications

S. Chai, R. Kirschman, S. Ludvik, J. Bedinger, L. Harmon, R. Burkholder, M. Fallica, S. Tarbox, M. Doherty, J. Oenning and I. Clark. "Low-Cost Package Technology for Advanced MMIC Applications." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 625-628.

Availability of MMICs along with expanded applications for microwave components, places increasing demands on performance and cost of package technology. We report progress in meeting these demands with metal-injection molding (MIM) of metal-matrix composites for advanced microwave packaging technology. We present our experiences in developing this technology, including dimensional control, plating, hermeticity, and cost. Electrical performance of packaged multi-chip amplifiers operating 2-20 GHz is also described.

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A New Method to Calculate Parameters of Configurable Integrated Test Model

H. Wang, D. Yang, G. Ng and C. Sian-Tek. "A New Method to Calculate Parameters of Configurable Integrated Test Model." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 629-632.

A configurable integrated test (CIT) model has been developed for GaAs MMIC manufacturing control. The optimal process/test strategy of a MMIC in production phase can be predicted from this model. A new method using optimization concept is demonstrated to calculate parameters of the CIT model from process/test history. This method will estimate realistic screening probabilities and hence predict optimal test strategy accurately. The description of this new method and examples are presented in this paper.

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Production Results of X-Band GaAs MMIC 5-Bit Phase Shifters

F. Ali, S. Mitchell, A. Murphy, A. Adar, P. Ho and A. Podell. "Production Results of X-Band GaAs MMIC 5-Bit Phase Shifters." 1990 MTT-S International Microwave Symposium Digest 90.1 (1990 Vol. I [MWSYM]): 633-636.

The measured results of the production of high performance, highly reproducible GaAs monolithic 5-bit phase shifters for phased array system applications are presented. Very good DC (> 90%) and RF (75%-80%) yields have been achieved on an X-Band phase shifter from the test results of thousand of these ICs. The performance correlation of these phase shifters have been verified between wafer level results and assembled module level data. To our knowledge, this is the first monolithic single chip small size (96 mils x 48 mils) five-bit phase shifter in the X-band to achieve over 70% total production yield.

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Transient Analysis of Distortion and Coupling in Lossy Coupled Microstrips (1990 Vol. II [MWSYM])

J.P. Gilb and C.A. Balanis. "Transient Analysis of Distortion and Coupling in Lossy Coupled Microstrips (1990 Vol. II [MWSYM])." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 641-644.

The transient response of lossy coupled microstrips is studied using the Spectral Domain Approach (SDA) to rigorously compute the dielectric losses. Transient coupling is formulated in the frequency domain using an even/odd mode approach. Results for pulse distortion on a semiconducting substrate are presented showing how losses reduce the signal amplitude without significantly distorting the shape.

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A New Method for the Time-Domain Analysis of Lossy Coupled Transmission Lines

R. Griffith and M. Nakhla. "A New Method for the Time-Domain Analysis of Lossy Coupled Transmission Lines." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 645-648.

A new method, based on numerical inversion of the Laplace transform, is presented for the analysis of lossy coupled transmission lines with arbitrary linear terminal and interconnecting networks. The method is more reliable and efficient than previously published techniques based on the fast Fourier transform.

Abstracts

Full Wave Analysis of 94 GHz Patch Coupler

V.F. Fusco and L.N. Merugu. "Full Wave Analysis of 94 GHz Patch Coupler." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 649-652.

This paper presents a full three-dimensional wave analysis of a patch microwave coupler operating at 94 GHz. The method of solution is a matched TLM numerical simulation of the inhomogeneous wave equation. Amplitude and phase responses for the coupler are given for the frequency range 80-110 GHz. The effects of the package dimensions on coupler isolation and bandcentre are presented. The computed results are compared with published experimental results obtained for an empirically designed coupler. Field plots are presented for flux distribution on the patch. Radiation plots for the coupler are presented also.

Abstracts

S-Parameters of Microwave Components Computed with the 3D Condensed Symmetrical TLM Node

J. Uher, S. Liang and W.J.R. Hoefer. "S-Parameters of Microwave Components Computed with the 3D Condensed Symmetrical TLM Node." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 653-656.

The symmetrical condensed node TLM method is used for S-matrix computation of microwave circuits. An edge coupled microstrip bandpass filter and a discontinuous ridge waveguide are analysed as typical examples. The conditions which must be satisfied in S-parameter computation of such circuits are defined. The validity of the method is verified by comparison with results obtained by other numerical methods.

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Effects of Substrate Anisotropy on the Dispersion of Transient Signals in Microstrip Lines

G.W. Zheng, K.S. Chen and S.T. Peng. "Effects of Substrate Anisotropy on the Dispersion of Transient Signals in Microstrip Lines." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 657-660.

The analysis of dispersion characteristics of transient signal in microstrip lines with anisotropic substrate is developed here, with particular attention directed toward the effects of arbitrary orientations of the principal optical axis in anisotropic substrates. Numerical simulations are carried out for the propagation of transient signals, square or Guassian pulses, along microstrips with anisotropic substrates. It is shown that the dispersion characteristics is substantially affected by the change of the orientation angle of the principal optical axis in the substrate.

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New Procedures for 2-D and 3-D Microwave Circuit Analysis with the TLM Method

Eswarappa, P.P.M. So and W.J.R. Hoefer. "New Procedures for 2-D and 3-D Microwave Circuit Analysis with the TLM Method." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 661-664.

This paper contains four original contributions to numerical field modeling with the TLM method: 1. The formulation of a 3-D "Johns Matrix" (or Numerical Green's Function) for wideband non-TEM absorbing boundary conditions using the 3-D Condensed TLM node. 2. Use of tapered "Johns Matrix" (or Numerical Green's Function) for the improvement of the return low of frequency dispersive absorbing boundaries. 3. A recursive algorithm for wideband non-TEM absorbing boundary modeling. 4. A pseudo-parallel iteration scheme for the simultaneous processing of TLM substructures. These procedures are essential for efficient time domain modeling of 3-D waveguide discontinuities of arbitrary geometries. Their application saves considerable computer run time and memory when compared with conventional TLM analysis.

Abstracts

Basic Properties of Microstrip Circuit Elements on Nonreciprocal Substrate-Superstrate Structures

I.Y. Hsia, H.-Y. Yang and N.G. Alexopoulos. "Basic Properties of Microstrip Circuit Elements on Nonreciprocal Substrate-Superstrate Structures." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 665-668.

The spectral domain-exponential matrix method is developed to evaluate the dyadic Green's function for generalized anisotropic substrate-superstrate structures. The method of moments is employed to obtain the basic dispersive characteristics of microstrip and inverted microstrip circuit elements on such structures. A collection of results will be presented for the propagation constant and characteristic impedance of microstrip elements on generalized anisotropic layers. Emphasis will be placed on the investigation of microstrip properties on a biased ferrite-semiconductor interface. The modeling accounts for arbitrarily oriented dc bias magnetic fields. The phenomenon of forward and backward wave propagation on this type of nonreciprocal structure will be highlighted.

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Asymmetric Coupled Transmission Lines with Anisotropic Coupling

P. Weaver and J.M. Pond. "Asymmetric Coupled Transmission Lines with Anisotropic Coupling." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 669-672.

The characteristics of asymmetric coupled transmission lines are derived for the case of general anisotropic coupling special cases of which are certain geometries of anisotropic materials or from distributed active devices. In addition to deriving the terminal characteristics for the uniform coupled-line four-port case with anisotropic coupling, it is shown that alternate equivalent expressions for the mode impedances and admittances can be derived which have a simplified form. These simplified expressions are useful when examining special cases where a good approximation can be achieved by considering either a generalized anisotropic mutual impedance or a generalized anisotropic mutual admittance.

Abstracts

Asymmetrical Coplanar Waveguide with Finite Metallization Thickness Containing Anisotropic Media

T. Kitazawa and T. Itoh. "Asymmetrical Coplanar Waveguide with Finite Metallization Thickness Containing Anisotropic Media." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 673-676.

The spectral-domain approach (SDA) is extended to analyze the metallization thickness effect in the asymmetrical coplanar waveguide (ACPW) with an anisotropic substrate. Numerical computations are carried out for ACPW with a uniaxially anisotropic substrate and for a magnetized ferrite substrate. The paper demonstrates the metallization effect and the nonreciprocal properties in ACPW for the fiist time.

Abstracts

Modal Transition Phenomena in Shielded Microstrip with Anisotropic Substrates

L. Carin, G.W. Slade and K.J. Webb. "Modal Transition Phenomena in Shielded Microstrip with Anisotropic Substrates." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 677-680.

Modal transitions involving the quasi-TEM mode and higher-order modes in shielded microstrip and suspended microstrip with anisotropic substrates are studied. For the class of anisotropy studied, at higher frequencies the largest eigenvalue may not correspond to the quasi-TEM mode. It is shown that the dispersion curves of the quasi-TEM and higher order modes do not intersect, but rather pass through a transition/coupling region and interchange mode types.

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Analysis of Waveguides with Dielectric Inserts

A.S. Omar and K. Schunemann. "Analysis of Waveguides with Dielectric Inserts." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 681-684.

The method, which has been introduced in [1] for the analysis of waveguides with metal inserts, is extended to the analysis of waveguides with dielectric inserts. These include shielded dielectric guides, e.g. dielectric image guide and dielectric rod guide, and all shielded planar guiding structures. The method is based on applying the equivalence principle followed by field expansions in terms of the normal modes of the corresponding waveguide without the dielectric insert. The validity of the method is checked by analyzing a simple dielectric-slab-loaded rectangular waveguide. The method is then applied to the analysis of more implicated structures, e.g. shielded dielectric image guide and shielded dielectric rod guide.

Abstracts

Comparative Study of Homogeneously and Inhomogeneously Doped MIS Coplanar Transmission Lines

K. Wu, R. Vahldieck and P. Saguet. "Comparative Study of Homogeneously and Inhomogeneously Doped MIS Coplanar Transmission Lines." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 685-688.

This paper presents a hybrid mode analysis of slow-wave modes in microsize MIS CPW's on heavily doped thin- and thick-film semiconductor wafers. It was found that in homogeneously doped MIS CPW's a slow-wave mode can be maintained up to 40 GHz if the center conductor strip width is in the order of 0.5µm. To circumvent fabrication and interconnection problems associated with such small line dimensions, a gradually inhomogeneous doping profile has been introduced, resulting in much wider strip dimensions which are in the range of 50µm. In this case a slow-wave mode can be maintained up to 20 GHz. The study was carried out by using alternatively the spectral domain approach and the method of lines.

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Variational Solutions to E-Plane Bilateral Septum in Waveguide

T.Q. Ho, Y.C. Shih and V. Pham. "Variational Solutions to E-Plane Bilateral Septum in Waveguide." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 689-691.

The variational technique has been extended to the study of the E-plane touching and nontouching bilateral septum in waveguide. Computed data using the developad equations show good agreement with the experimental data. Closed form expressions of input admittance and equivalent circuit are obtained and can be directly used in practice to design E-plane circuits.

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Method-of-Moments Solution for the Posts in a Circular Waveguide

Z. Xiao-Hui, C. Dai-Zong and W. Shi-Jin. "Method-of-Moments Solution for the Posts in a Circular Waveguide." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 693-696.

A three-dimensional discontinuity problem of a pair of metallic posts with finite diameter in the TE/sub 11/-mode circular waveguide is solved by method of moments. Unlike the widely used multifilament representation which leads to a slowly converging series, a multi-strip representation is introduced for the post current modeling. Numerical results are compared with experimental data, including those given by the other authors.

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Electromagnetic Radiation from Printed Traces on a Circuit Board with Coated Plastic Cover

J.-F. Riang. "Electromagnetic Radiation from Printed Traces on a Circuit Board with Coated Plastic Cover." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 697-700.

A rigorous formulation in the spectral domain is used to investigate the radiation from printed traces on a circuit board in the frequency range from 30 MHz to 1 GHz. Both the coupling effect among adjacent traces and the shielding effectiveness of metallic coating on the plastic cover are analyzed. It is found that the radiation around resonant frequencies is critical to satisfy the FCC requirement, and an appropriate coating can resolve the problem.

Abstracts

Triangular Cells in an Electromagnetic Analysis of Arbitrary Microstrip Circuits

J.C. Rautio. "Triangular Cells in an Electromagnetic Analysis of Arbitrary Microstrip Circuits." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 701-704.

This paper describes an enhancement to an existing electromagnetic analysis of arbitrary microstrip circuits which allows the inclusion of triangular, as well as rectangular, cells. A relatively simple solution for this, potentially, extremely complicated problem is provided. It is also shown that triangular cells are required for accurate analysis of microstrip geometries involving diagonal edges. In addition, a simple means of applying the two-dimensional discrete Fourier transform, realizing a faster analysis, is described.

Abstracts

Full-Wave Analysis of Waveguides Involving Finite-Size Dielectric Regions

B.J. Rubin. "Full-Wave Analysis of Waveguides Involving Finite-Size Dielectric Regions." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 705-708.

A moment method is presented for handling arbitrarily shaped 2D and 3D waveguides that involve conductors, finite-size dielectric regions, or both. A novel procedure for modeling the dielectric allows 2D rooftop functions to represent both the 3D polarization current in the dielectric and the surface current on the conductors. Examples include microstrip and dielectric waveguides. Numerical convergence, consistency with physical principles, and agreement with the literature are demonstrated.

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Numerical Modelling of Chamfered Bends and Other Microstrip Junctions of General Shap in MMICs

J.X. Zheng and D.C. Chang. "Numerical Modelling of Chamfered Bends and Other Microstrip Junctions of General Shap in MMICs." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 709-712.

A full-wave analysis based upon a spatial-domain moment method, is obtained for finding two-dimensional current distributions, and hence, the scattering matrix for chamfered bends and other microstrip junctions of general shape in MMICs. The numerical simulation program can provide useful design information as well as physical insights for frequencies way up in the millimeter-wave range.

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Comparative Study of TE/sup x//sub mn/ Versus TE/sub mn/-TM/sub mn/ Mode Analysis and its Application to Waveguide Discontinuity Modeling

J. Bornemann and R. Vahldieck. "Comparative Study of TE/sup x//sub mn/ Versus TE/sub mn/-TM/sub mn/ Mode Analysis and its Application to Waveguide Discontinuity Modeling." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 713-716.

This paper presents a comparative study of alternative techniques to be used in the mode matching method as applied to electromagnetic field modeling at waveguide discontinuities. It is found that a modified TE/sub mn/-to-x mode (TE/sup x//sub mn/-or LSH/sub x/-mode) approach becomes necessary for waveguide discontinuities in which resonant effects occur. A comparison between the conventional TE/sup x//sub mn/ mode matching technique, commonly known from literature, and the generalized analysis based on a linear superposition of TE/sup z/sub mn/ and TM/sup z//sub mn/ modes, shows conflicting results. The latter one is found to be in excellent agreement with the modified TE/sup x/sub mn/ mode analysis and with measurements on waveguide iris filters.

Abstracts

Finite Element Modeling of Two-Dimensional Transmission Line Structures Using a New Asymptotic Boundary Condition

A.B. Kouki, A. Khebir and R. Mittra. "Finite Element Modeling of Two-Dimensional Transmission Line Structures Using a New Asymptotic Boundary Condition." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 717-720.

The finite element method is employed to study open, arbitrarily-configured two-dimensional transmission line structures in the quasi-TEM regime. An improved version of a previously developed asymptotic boundary condition (ABC) is used to truncate the open region. Results for two-and six-conductor configurations are presented to illustrate the superiority of this method over both the conventional approach where a perfectly conducting, enclosure is employed to truncate the FEM mesh, and the original ABC introduced previously by the authors. The results presented are of particular interest for estimating crosstalk and signal distortion in printed circuits.

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Integrated Microwave Field Simulation Using Three Dimensional Finite Elements

Z.J. Cendes, J.F. Lee and D.N. Shenton. "Integrated Microwave Field Simulation Using Three Dimensional Finite Elements." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 721-723.

A method for microwave field simulation based on three-dimensional finite elements is described. The method employs solid modeling for geometry generation, Delaunay tessellation for mesh generation. H/sub 1/(curl) tangential vector finite elements for field solution, and transfinite elements for port representation. Applications to conventional and MMIC devices are described.

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Miniature 8-18 GHz Four Channel Frequency Converter

S. Roos, P. Griffith, R. Sheehan, F. McMahon and M. Kumar. "Miniature 8-18 GHz Four Channel Frequency Converter." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 725-728.

A state-of-the-art 8-18 GHz Front End comprising four phase and amplitude matched Frequency Converters consisting of ten selectable 1 GHz wide sub-band channels has been developed. An Integrated Local Oscillator (LO) Distribution module consisting of five dielectric resonator oscillators (DRO) operating at 11, 12, 13, 14, 15 GHz provides the downconversion of the 8 - 18 GHz RF spectrum to a 2 - 3 GHz intermediate frequency range. The input noise figure of each converter module is 10 dB with an associated gain of 46 dB ± dB. The spurious-free dynamic range is greater than 47 dB. The DRO oscillator accuracy is ±5 PPM/°C over a temperature range of 0°C to 50°C. The downconverter utilizes a combination of MIC and MMIC components to obtain the state-of-the-art performance in a small volume of 1966 cubic centimeters.

Abstracts

A 900 MHz SAW Microstrip Antenna-Duplexer for Mobile Radio

K. Anemogiannis, C. Beck, A. Roth, P. Russer and R. Weigel. "A 900 MHz SAW Microstrip Antenna-Duplexer for Mobile Radio." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 729-732.

A novel SAW microstrip antenna-duplexer at 900 MHz which has been designed for the use in European mobile radio systems is presented. The duplexer consists of a transmitter SAW filter, two receiver SAW filters, a low noise receiver amplifier, and a duplexing microstrip circuit. A dual-track filter design using interdigital transducers for track coupling provides low insertion loss (5 dB), small passband ripple (± 0.5 dB), high stopband rejection (50 dB), and small chip-size (TO-39 package). The filters were fabricated on 36/sup 0/ rotated YX-LiTaO/sub 3/ substrates with a photolithographic technique. Due to the new design of the microstrip duplexer, the selectivity of the front-end is enhanced by 15 dB.

Abstracts

A Dual Mode Varible Polarization Phase Shifter

W. Ke-Zhu. "A Dual Mode Varible Polarization Phase Shifter." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 733-735.

A new type of the DMVPPS is introduced in this paper in general term. The features of the conventional DMPS is operated only linear polarised wave, while DMVPPS consists of a NRCP, a FR and a VP. A linear polarized wave entering the device is converted to vertical horizontal position and negative circular polarization or arbitrary polarized wave in modern phased array radar of the techniques are given, it is reciprocal operated. Simple microwave structure, lower insertion loss, smaller size and less weight. Its behaviour can be compared with the conventional phase shifter.

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Observation of a Doublet Ferromagnetic Resonance in Cubic and Hexagonal Ferrites at Millimeter Wavelengths

M.N. Afsar and H. Chi. "Observation of a Doublet Ferromagnetic Resonance in Cubic and Hexagonal Ferrites at Millimeter Wavelengths." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 737-738.

Ferromagnetic resonance from two individual magnetic sublattices of ferromagnetic materials has been observed for the first time in the laboratory. Separate g-factor (gyromagnetic ratio) values were then measured from the resonance experiment. A high signal to noise ratio millimeter wave broad band Fourier transform spectrometer and a high intensity field (140,000 gauss) d.c. magnet were utilized for this measurement.

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Nonlinear Design Approach of a Broadband Hybrid Integrated Ku-Band Common-Source GaAs FET VCO

R. Gratzl, J. Hausner and P. Russer. "Nonlinear Design Approach of a Broadband Hybrid Integrated Ku-Band Common-Source GaAs FET VCO." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 739-742.

The design of a hybrid integrated Ku-Band voltage controlled oscillator is described. The oscillator was designed using linear theory based upon a linear FET-model extracted from measured transistor small signal S-parameters and then optimized for output power employing a nonlinear model for the internal FET. In the nonlinear model, the nonlinear transconductance and the nonlinear input admittance, caused by the Schottky-junction of the gate, were taken into account. The oscillator power was calculated by investigation of the amplitude of the fundamental wave caused by the dominating nonlinearities. Higher harmonics were not taken into account. With the optimized circuit and layout a tuning bandwidth from 12 GHz to 17.25 GHz with a corresponding output power of 7 dBm to 13.5 dBm was measured. Output power was within 2 dB of the predicted value over the whole tuning range.

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Versatile FET Nonlinear Transfer Function Generator Elements

A. Katz and S. Moochalla. "Versatile FET Nonlinear Transfer Function Generator Elements." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 743-746.

A new means of generating nonlinear transfer functions useful in the production of limiters and linearizes has been discovered which offers both simplicity and high performance. This technique employs GaAs MESFETs in a passive configuration similar to that used for MMIC switches and attenuators. The resulting FET Non-linear Generator Elements (NLGEs) are readily adjustable over a wide range of both magnitude and phase transfer characteristics, and have displayed wide bandwidth performance and excellent thermal stability. FET NLGEs have been applied in both reflective and transmissive networks. A near perfect hard limiter has been produced using a FET NLGE which introduces less than 5 degree change in phase. Linearizes using FET NLGEs have been tested at L, C and Ku-bands and have provided a reduction in total intermodulation distortion products greater than 10 dB at the 2 and 3 dB output power back-off points over a bandwidth of up to 15 percent.

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Parameter Extraction Technique for Non-Linear MESFET Models

A. Davies and A.K. Jastrzebski. "Parameter Extraction Technique for Non-Linear MESFET Models." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 747-750.

The non-linear parameter extraction technique proposed in this paper gives both rapid convergence and consistency of the derived model. The computational aspect of the technique is divided into two processes: (i) direct extraction of intrinsic element values by a statistically based routine and (ii) optimisation of intrinsic and extrinsic element values and/or non-linear functions simultaneously at all bias points. The non-linear elements are extracted in two forms: (a) as some analytical functions of bias and (b) as bias-dependent values. The results of the modelling of both chip as well as packaged MESFET devices are presented and very good agreements between measurements and calculations are obtained.

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New Low Noise FET Structure

A. Truitt, D. Heston and J. Klein. "New Low Noise FET Structure." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 751-752.

A new monolithic FET topology has demonstrated a better minimum noise figure than a conventional Pi-gate FET. The new structure, named a Spider FET because of its gate feed configuration, has allowed an improved noise figure using the current 0.5 micron ion-implant production process.

Abstracts

A Logarithmic Distributed Amplifier

N. Nazoa-Ruiz and C.S. Aitchison. "A Logarithmic Distributed Amplifier." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 753-756.

This paper describes a logarithmic amplifier which uses the distributed amplifier as the basic amplifying element. The successive detection technique is used and leads to a logarithmic amplifier with a 65 dB dynamic range operating over the band 2 to 6 GHz with a deviation from linearity in the middle of the band of +/- 1.0 dB over the dynamic range. Over the specified band a further deviation of +/- 1.3 dB occurs. The effect of varying temperature from 0°C to 50°C increases this figure to +/- 1.7 dB. The rise and fall times (including the associated video amplifier) are 7nS and 20nS respectively.

Abstracts

Dual-Diode Limiter for High-Power/Low-Spike-Leakage Applications

R.J. Tan and R. Kaul. "Dual-Diode Limiter for High-Power/Low-Spike-Leakage Applications." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 757-760.

This paper presents procedures, confirmed by both measured data and microwave circuit analysis, for designing dual-diode passive microwave limiters with low spike leakage (less than 100 nJ) and the ability to handle high peak power (on the order of 10 mJ of incident energy). Design parameters covered are diode characteristics, polarity, package parasitic, and the spacing between the diodes. Such limiters are needed to protect sensitive electronics from high-power rf.

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Calculated and Measured Silicon PIN Limiter Short-Pulse Damage Thresholds

A.L. Ward, R.J. Tan and R. Kaul. "Calculated and Measured Silicon PIN Limiter Short-Pulse Damage Thresholds." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 761-764.

Limiters, used to protect sensitive electronics from high levels of rf radiation, are themselves subject to damage. A combined theoretical and experimental study has been made of damage thresholds of silicon PIN limiters with intrinsic region widths of 0.5 to 10 µm, using frequencies from 1.5 to 9.4 GHz and pulse lengths from 10 to 1000 ns.

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An S-Band Double Balanced Mixer with Very High LO/RF-Port and LO/IF-Port Isolation

J.J. Krantz. "An S-Band Double Balanced Mixer with Very High LO/RF-Port and LO/IF-Port Isolation." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 765-766.

A double balanced ring mixer which obtains very high LO/RF-port and LO/IF-port isolation due mainly to the orthogonal orientation of the LO- and RF-signals, is described. This mixer is constructed in stripline and provides a planar type circuit which overcomes the usual problems involved with mounting the diodes.

Abstracts

Slotline Coupled Varactor Tuning of Voltage Controlled Oscillators

J.B. De Swardt and P.W. Van der Walt. "Slotline Coupled Varactor Tuning of Voltage Controlled Oscillators." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 767-768.

A new electronic means of tuning a dielectric resonator oscillator has been developed. The varactor control element is electro-magnetically coupled to the resonator by means of a slotline. The easily manufactured circuit has a relatively wide tuning range. It is ideally suited for narrow-band VCO's.

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Optimization of the QWITT Diode Using Equivalent Circuit Models

M.J. Paulus, D.W. Whitson, C.E. Stutz, K.R. Evans, E.T. Koenig and R. Neidhard. "Optimization of the QWITT Diode Using Equivalent Circuit Models." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 769-772.

We experimentally investigate an equivalent circuit and an equivalent circuit/distributed impedance model or the QWITT diode. Both models incorporate a negative inductor to model the finite lifetime of carriers in the quantum well. For the latter model one can optimize the cut-off frequency and the negative resistance with respect to the drift region length, W. It is predicted and experimentally confirmed at low values of W that the cut-off frequency increases with W. The two models diverge as W increases and the drift angle is found to be a good predictor for this behavior.

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Large-Signal Design of MMIC High Efficient Power Amplifier

V.D. Hwang, Y.C. Shih and D.C. Wang. "Large-Signal Design of MMIC High Efficient Power Amplifier." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 773-776.

A large-signal two-stage power amplifier design approach using the Waveform-Balance method is presented. The MMIC amplifier designed by this technique is shown here to have a state-of-the-art power and efficiency performances at X-band. The amplifier has 40 percent bandwidth, 2 to 3 watt CW output power, 10 dB power gain, and greater than 30 percent power-added efficiency across most of the frequency band.

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A 2-18GHz Monolithic Variable Attenuator Using Novel Triple-Gate MESFETs

H.J. Sun and J. Ewan. "A 2-18GHz Monolithic Variable Attenuator Using Novel Triple-Gate MESFETs." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 777-780.

A monolithic variable attenuator requiring only a single positive external bias/drive voltage and capable of handling 0.4W input power has been developed using novel triple-gate MESFETs. The IC exhibits greater than 13dB attenuation and less than 2:1 VSWR from 2-18GHz with a maximum insertion loss of 2.7dB at 18GHz. It was developed from a lower power single-gate version using a unique scaling approach that preserves the circuit electrical property while enhancing the power handling almost nine-folds.

Abstracts

A Temperature-Compensated Linearizing Technique for MMIC Attenuators Utilizing GaAs MESFETs as Voltage-Variable Resistors

D.A. Fisher and D.M. Dobkin. "A Temperature-Compensated Linearizing Technique for MMIC Attenuators Utilizing GaAs MESFETs as Voltage-Variable Resistors." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 781-784.

A unique linearizing technique for MMIC attenuators utilizing GaAs MESFETs as voltage-variable resistors and an off-chip control circuit is reported. This technique produces an attenuation vs. control voltage characteristic that is linear (in dB) and inherently temperature compensated.

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Broadband GaAs Monolithic Equalizing Amplifiers for Multigigabit-Per-Second Optical Receivers

H. Kikuchi, Y. Miyagawa and T. Kimura. "Broadband GaAs Monolithic Equalizing Amplifiers for Multigigabit-Per-Second Optical Receivers." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 785-788.

A preamplifier IC, a gain controllable IC, and main amplifier lCs with and without a three-way divider for multigigabit-per-second optical receivers have been developed using a single-ended feedback circuit, two peaking techniques, and advanced GaAs process technology. These ICs have a 3-dB bandwith of more than 5 GHz and can be applied to optical receivers transmitting NRZ signals in excess of 7 Gb/s.

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A Fully Monolithic 4-18 GHz Digital Vector Modulator

G.B. Norris, D.C. Boire, G. St. Onge, C. Wutke, C. Barratt, W. Coughlin, III and J. Chickanosky. "A Fully Monolithic 4-18 GHz Digital Vector Modulator." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 789-792.

A fully monolithic vector modulator covering the entire 4-18 GHz band is presented that features independent direct digital control of amplitude and phase. The modulator output amplitude can be varied over a 25 dB range with 32 steps of resolution and the phase can be independently varied over 360° with 32 steps. The vector modulator chip set consists of a miniaturized 5 bit MMIC phase shifter and a 5 bit MMIC segmented dual gate distributed variable gain amplifier/attenuator. The chips are assembled on a carrier measuring less than 0.4" x 0.5" and require no supporting RF hybrid or DAC circuitry. The vector modulator demonstrates state-of-the-art performance with ultrawide (instantaneous) bandwidth, high uncorrected accuracy and resolution, and direct digital control with a potential transition time of a few nanoseconds. In addition, the individual MMIC chip performance is the best reported to date for ultrawide bandwidth phase and amplitude control functions.

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Abstracts

Active Endfire Antenna Elements and Power Combiners Using Notch Antennas

J.A. Navarro, Y.H. Shu and K. Chang. "Active Endfire Antenna Elements and Power Combiners Using Notch Antennas." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 793-796.

A Gunn device has been integrated with a planar, endfire notch antenna. A simple transmission-line model has been developed to optimize the passive and active circuit parameters. An electronic tuning bandwidth of 275 MHz centered at 9.33 GHz with a maximum power output of 37.5 mW was accomplished. Two active notches in a broadside array configuration were injection-locked at 9.484 GHz with a 30 MHz locking bandwidth and well over 90% power combining efficiency.

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Performance Characteristics of Phase-Correcting Fresnel Zone Plates

J.E. Garrett and J.C. Wiltse. "Performance Characteristics of Phase-Correcting Fresnel Zone Plates." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 797-800.

This paper gives specific measured and/or theoretical characteristics of phase-correcting zone plate antennas. Parameters described include off-axis performance, axial intensity dependence, efficiency, distortion and aberrations, and bandwidth. Measured data are summarized for 10, 94, and 140 GHz. This type of zone plate has advantages (compared to a lens) of reduced loss, weight, volume, cost, and planar construction, with similar diffraction-limited beamwidth and major-sidelobe performance, but lower efficiency.

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Integrated Active Antenna Module for Space Station Multiple Access Communication

R.W. Shaw, J.K. Kovitz, L. Johnson and B. Lu. "Integrated Active Antenna Module for Space Station Multiple Access Communication." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 801-804.

The development of an integrated module applicable for use on the Space Station Freedom mulitple access communication system (MACS) is presented. The innovative design of this module was found in the ability to merge the three key functions of circuitry, feed network and antenna element into a common unit capable of being mounted on a MACS user platform. The design utilizes a broadside suspended-stripline and balun to feed a balanced antenna element and still allow the active circuitry to be implemented in MMIC or hybrid MIC technology.

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Design Techniques for Compact Monopulse W-Band Antenna Feeds for Radar Systems

W.L. Storkus. "Design Techniques for Compact Monopulse W-Band Antenna Feeds for Radar Systems." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 805-808.

Radical differences between system requirements require great flexibility in the design process for the millimeter wave monopulse feed. This paper discusses design approaches used for three feed systems: a three channel multimode monopulse feed, a six channel dual linear polarized monopulse feed, and a four channel dual circular polarized monopulse feed. Each of these feeds was designed for a 94 GHz radar application. Performance levels achieved for each of these feeds include >35 dB null depth, >30 dB cross polarization, sidelobe levels >25 dB down, comparator insertion loss of <1 dB, axial ratios of 2 dB, pattern symmetry to BW/15 of <=3 degree, and boresight error of <=1 milliradian. The feed assemblies consist of brazed assemblies; package size varies from a volume of 8.0 cu. in. down to 0.32 cu. in., while cross sectional diameter ranges from 2.1 cu. in. down to 0.5 cu. in.

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Ka-Band MMIC Beam Steered Planar Array Feed

D. Rascoe, R. Crist, A.L. Riley, T. Cooley, L. Duffy, D. Antsos, V. Lubecke, W. Chew, K.S. Yngvesson and D.H. Schaubert. "Ka-Band MMIC Beam Steered Planar Array Feed." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 809-812.

A 32 GHz, twenty-one element array feed incorporating 63 MMIC devices and providing electronic beam steering using 21 VLSI silicon control chips is under development at JPL. The design improves on our earlier experience using a novel "building block" approach to construct a six element linear transmit array. The final array feed design is to be used for NASA deep space communications applications.

Abstracts

Session S -- Monolithic Integrated Circuits: 1

"Session S -- Monolithic Integrated Circuits: 1." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 813-813.

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Abstracts

GaAs MMIC Phase Locked Source

J. Andrews, A. Podell, J. Mogri, C. Karmel and K. Lee. "GaAs MMIC Phase Locked Source." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 815-818.

A phase locked source has been designed, built and tested using a GaAs MMIC sampling phase detector and a GaAs MMIC VCO achieving phase lock up to 2 GHz with a 100 MHz input frequency.

Abstracts

A Miniaturized, Broadband MMIC Frequency Doubler

T. Hiraoka, T. Tokumitsu and M. Akaike. "A Miniaturized, Broadband MMIC Frequency Doubler." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 819-822.

A miniaturized, broadband brdanced MMIC frequency doubler, which consists of a common gate FET and a common source FET directly connected to each drain elect rode, is proposed. A chip size of 0.5 mm x 0.5 mm is achieved excluding the output matching circuit with conversion loss less than 9 dB, fundamental signal suppression better than 18 dB, and input return loss better than 8 dB from 6 GHz to 16 GHz.

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An Octave-Band MMIC Active Filter

R.R. Bonetti and A.E. Williams. "An Octave-Band MMIC Active Filter." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 823-826.

The design, fabrication, and measurement of a GaAs, monolithic, active bandpass filter with a passband from 4 to 8 GHz is described. The circuit uses a set of cascaded lumped- and distributed-element L,C circuits isolated by a feedback amplifier to realize an equivalent fourth-order filter response. The final circuit was fabricated on a 3 x 2-mm GaAs substrate.

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An X-Band Low Cost GaAs Monolithic Transceiver

W. Yau, M.I. Herman, G. Mendolia, C.F. Wen and J.C. Chen. "An X-Band Low Cost GaAs Monolithic Transceiver." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 827-830.

A low cost X-band transceiver has been developed for multi-purpose applications. The transceiver, constructed using monolithic transceiver and power MMIC chips, is capable of delivering a transmitted power of greater than 23 dBm. Its bandwidth is voltage tunable to over 600 MHz. The control voltage of the VCO can be modulated and is applicable for FMCW or pulsed radar applications. The entire transceiver, including its transmit/receive microstrip patch antennas and the dc circuitry, is packaged in a housing with dimensions of 3.5 x 2.0 x 2.0 inches. Due to the high yield and low fabrication cost of the monolithic transceiver chips, this unit is highly suitable for high volume production.

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Multilayer MMIC Using a 3µm X 3-Layer Dielectric Film Structure

T. Tokumitsu, T. Hiraoka, H. Nakamoto and T. Takenaka. "Multilayer MMIC Using a 3µm X 3-Layer Dielectric Film Structure." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 831-834.

Newly developed, very small-size multilayer MMICs using miniature microstrip lines on a thin dielectric film are described. Other effective thin film transmission lines, line crossovers, and vertical connections are also discussed. 90-degree and 180-degree hybrids, multiport Wilkinson dividers, and distributed amplifiers are implemented in a very small area, less than 1mm².

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Session T -- Smith Chart (Special Session)

"Session T -- Smith Chart (Special Session)." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 835-835.

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Abstracts

Phillip Smith - A Brief Biography

T.S. Saad. "Phillip Smith - A Brief Biography." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 837-838.

In 1975, the Microwave Society of the IEEE presented to Phillip H. Smith a Special Microwave Application Award for his invention and application of the Smith Chart. The Smith Chart is perhaps the most widely used design tool in the, microwave field. Although the Smith Chart has been called by a number of different names, such as Reflection Chart, Circle Diagram, Additance Chart, etc., Phil Smith, a very modest man, reluctantly chose the name Smith Chart, because "none of the other names were in themselves sufficiently definitive to be used unambiguously when compared With similar charts."

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Session U -- Solid State Devices and Circuits

"Session U -- Solid State Devices and Circuits." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 839-839.

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X-Band Monolithic GaAs PIN Diode Variable Attenuation Limiter

D.J. Seymour, D.D. Heston, R.E. Lehmann and D. Zych. "X-Band Monolithic GaAs PIN Diode Variable Attenuation Limiter." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 841-844.

Monolithic GaAs PIN diode attenuator/limiter circuits have demonstrated 26 dB of variable attenuation at X-band while maintaining under 1.5 to 1 input and output voltage standing wave ratios (VSWRs). Insertion loss is 0.8 dB at 10 GHz in the 0 bias condition. Passive limiting provides 15 dB of isolation at RF input power of 2.0 W cw. These results are obtained using a vertical PIN diode process on metallorganic chemical vapor deposition (MOCVD) material.

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Full Monolithic Sampling Head IC

A. Miura, S. Kobayashi, T. Yakihara, S. Uchida, H. Kamada and S. Oka. "Full Monolithic Sampling Head IC." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 845-848.

In this paper we describe a full monolithic sampling head IC with a bandwidth of up to 26GHz. It consists of Resonant Tunneling Diodes [RTDs] for a sampling pulse generator and Schottky barrier diodes for a sampling bridge. The RTD is made using an InGaAs/AIAs pseudomorphic superlattice system. For this type RTD, we obtained a peak to valley ratio of 9 at 202°C with switching voltages up to 1.5Voltp-p. The Schottky barrier diode is made from an (InGaAs)/sub 0.5/(InAlAs)/sub 0.5/ mixing crystal. The RTD and Schottky barrier diodes are monolithically constructed on a Fe-doped InP substrate.

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Session V -- Microwave and Millimeter-Wave Superconductivity Technology (Focused Session)

"Session V -- Microwave and Millimeter-Wave Superconductivity Technology (Focused Session)." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 849-849.

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A Fully Integrated SIS Mixer for 75-110 GHz

A.R. Kerr, S.-K. Pan, S. Whiteley, M. Radparvar and S. Faris. "A Fully Integrated SIS Mixer for 75-110 GHz." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 851-854.

This paper describes an integrated SIS mixer with low noise over the full 75-110 GHz (WR-10) waveguide band. The mixer uses Nb/A1-A1/sub 2/O/sub 3//Nb trilayer technology on a fused quartz substrate. It has no adjustable tuning elements, and the design is suitable for integration with other planar components.

Abstracts

Effect of Finite Thickness on the Surface Impedance of High T/sub c/ Thin Films

H. Chaloupka, N. Klein and S. Orbach. "Effect of Finite Thickness on the Surface Impedance of High T/sub c/ Thin Films." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 855-858.

The effect of the finite film thickness on the microwave surface impedance is investigated both theoretically and experimentally. It was found that the surface resistance is enhanced due to the altered current density distribution in the film as well as power transmission through the film. The surface resistance of an YBa/sub 2/Cu/sub 3/O/sub 7-delta/ thin film grown epitaxially on LaAlO/sub 3/ by laser ablation has been determined from data measured at 87GHz by closed cavity method. At T=77K an effective surface resistance of (30±8) mOmega was measured resulting in a corresponding value in the limit of infinite film thickness of (15±8) mOmega.

Abstracts

Microwave Properties and Modeling of High-T/sub c/ Superconducting Thin Film Meander Line

A. Fathy, D. Kalokitis, V. Pendrick, E. Belohoubek, T. Venkatesan, L. Nazar, J.B. Barrier, A. Findikoglu, A. Inam, X.D. Wu, X.X. Xi and W.L. McLean. "Microwave Properties and Modeling of High-T/sub c/ Superconducting Thin Film Meander Line." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 859-862.

Meander lines have been utilized for the characterization of laser-deposited thin film high-T/sub c/ superconducting material. In this paper, we modeled the dispersion characteristics of the meander line and investigated the power dependence of high-T/sub c/ materials as a function of frequency and temperature. Measurements showed that magnetic fields as low as 0.1 Oe will affect the superconducting material decreasing the Q of the meander lines, The Q deterioration, is both temperature and frequency dependent and the latter is less pronounced at higher frequencies.

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Testchip for High Temperature Superconductor Passive Devices

R. Dill, J. Otto, G. Riha, P. Russer, L. Schultz, G. Solkner, A.A. Valenzuela and E. Wolfgang. "Testchip for High Temperature Superconductor Passive Devices." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 863-866.

A testchip for a full characterisation of High Temperature Superconducting (HTS) thin film properties relevant to planar passive microwave device applications is presented. The chip integrates coplanar resonators and transmission lines along with structures for process monitoring. Measurements of the quality factor of coplanar resonators as a function of temperature and input power are reported. For the coupling of the resonators to the input signals microwave probes with 40GHz bandwidth have been used within the cryo-enviroment. Quality values obtained at 5GHz and 77K are superior to that of an equivalent copper resonator by a factor of about 40.

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Superconducting Tl-Ca-Ba-Cu-O Thin Film Microstrip Resonator and its Power Handling Performance at 77k

R.B. Hammond, G.V. Negrete, M.S. Schmidt, M.J. Moskowitz, M.M. Eddy, D.D. Strother and D.L. Skoglund. "Superconducting Tl-Ca-Ba-Cu-O Thin Film Microstrip Resonator and its Power Handling Performance at 77k." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 867-870.

We report measurements of the temperature- and power-dependent surface resistance, Rs, of thin films of Tl-Ca-Ba-Cu-O at 9.55 GHz. At 77k these films are at least 20 times better than bulk OFHC Cu at the same temperature and frequency, in microwave magnetic fields up to 10 gauss. In addition, we report measurements of the power handling performance at 77K of a high-Q thin-film microstrip resonator made with these films. We measured loaded Q's up to 7300 at 2.6 GHz, >20 times higher than on identical silver resonators. At effective power levels in the resonator up to ~100 watts the Q was still at least three times higher than the silver resonator at all frequencies measured 2.6, 5.2, and 7.3 GHz.

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Session W -- MMICs in Communication Systems

"Session W -- MMICs in Communication Systems." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 871-871.

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26 GHz-Band Full MMIC Transmitters and Receivers Using a Uniplanar Technique

M. Muraguchi, T. Hirota, A. Minakawa, Y. Imai, F. Ishitsuka and H. Ogawa. "26 GHz-Band Full MMIC Transmitters and Receivers Using a Uniplanar Technique." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 873-876.

26 GHz-band full MMIC receiver and transmitter package modules have been demonstrated for the first time, using a uniplanar technique. Each module, including a PLL-stabilized local oscillator, is packed into a single package that measures one cubic centimeter. The receiver module consists of seven MMICs, which has an RF-IF conversion gain of 25 dB and a noise figure of 7.5 dB. The transmitter module consists seven MMICs, which has an IF-RF conversion gain of 8 dB and an output power of 5 dBm. A novel uniplanar MMIC power amplifier that is externally connected to the transmitter module has an output power of 20 dBm.

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Combining Prefiltering and Predistortion in a High Power Direct PSK Modulator

K. Kathiravan, S. Kumar and G. Harron. "Combining Prefiltering and Predistortion in a High Power Direct PSK Modulator." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 877-880.

Predistortion linearizes a high power...PSK modulator. A digital method of combining...predistortion for the modulator is proposed. From the...well as the demodulated eye diagram results it is observed that in addition to spreading of the filtered baseband spectrum, the modulator nonlinearities also introduce inband noise components. This technique of implementing the baseband signal processing paves the way for combining the microwave and baseband signal processing in a single MMIC chip.

Abstracts

MMICs Insertion in a K/sub u/-Band Active Phased Array for Communications Satellites

J.R. Potukuchi, R.C. Mott, A.I. Zaghloul, R.K. Gupta, F.T. Assal and R.M. Sorbello. "MMICs Insertion in a K/sub u/-Band Active Phased Array for Communications Satellites." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 881-884.

Active elements consisting of S-bit digital phase shifters, 5-bit digital attenuators, and amplifiers have been developed for insertion in a 64-element K/sub u/-band active-transmit phased array antenna for communications satellite applications. To minimize the unit-to-unit amplitude and phase variations, the phase shifters, attenuators, and amplifiers have been implemented using MMIC technology. In this paper, the performance characteristics of the 64 active elements integrated in the array, i.e., including the 64-way power distribution circuitry and the orthomode transducers are presented. Measured radiation patterns are also presented, and they show good agreement with the predictions.

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A Microwave Switch Matrix Using MMICs for Satellite Applications

R. Gupta, F. Assal and T. Hampsch. "A Microwave Switch Matrix Using MMICs for Satellite Applications." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 885-888.

This paper presents the design, packaging, and measured performance of a lightweight crossbar 4 x 4 Microwave Switch Matrix (MSM) for communications satellite applications. Miniaturization of the MSM has been achieved by integrating GaAs monolithic (MMIC) broadband switch elements with hybrid power dividers and combiners and driver/control circuits in a lightweight MSM package. The on-state insertion loss and on-to-off isolation for all MSM paths are measured to be 6.25 dB (maximum) and 50 dB (minimum), respectively, over 3.5- to 6.5-GHz frequency range. The corresponding path-to-path insertion loss and phase variations are within ±0.5 dB and ±10°.

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10.6 Gbit/s 2:1 Time Division Multiplexer Using Dual Gate GaAs MESFETs

Q.Z. Liu. "10.6 Gbit/s 2:1 Time Division Multiplexer Using Dual Gate GaAs MESFETs." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 889-892.

A 2:1 time division multiplexer (MUX) has been designed and built with dual gate GaAs MESFETs in thick film circuits. 10.6 Gbit/s NRZ pulses have been obtained. The voltage swing of MUX at 10 Gbit/s is 1V which is the largest one reported so far. The operation of MUX has been simulated by using mwSPICE and a good agreement between the measured and simulated switching waveforms has been obtained.

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Session X -- Monolithic Integrated Circuits: 2

"Session X -- Monolithic Integrated Circuits: 2." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 893-893.

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A Q-Band Monolithic Balanced Diode Mixer Using AlGaAs/GaAs HEMT and CPW Hybrid

T.H. Chen, T.N. Ton, G.S. Dow, K. Nakano, L.C.T. Liu and J. Berenz. "A Q-Band Monolithic Balanced Diode Mixer Using AlGaAs/GaAs HEMT and CPW Hybrid." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 895-898.

A Q-band balanced diode mixer has been developed using AIGaAs/GaAs HEMTs, a CPW ratrace hybrid, and a lumped-element low-pass filter. The mixer can be easily intergrated with the RF, LO, and IF HEMT amplifiers on one chip because it uses HEMT as a mixer diode. Furthermore, the mixer does not require backside and via-hole process and has small size, 1.4 X 1.5 mm. Therefore, it has good RF circuit yield. The mixer downconverts the 41- 48 GHz RF to a 0.5 - 3.5 GHz IF. Without DC bias, it shows 9.4 dB conversion loss for RF at 42 GHz, with a LO drive of 11 dBm at 44.45 GHz. The presented mixer is the first monolithic CPW mixer for operation at Q-band frequencies.

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A Monolithic Mixer IC: Design and Characteristics on N-Implant Only, Buried P- and MBE Wafers

S.S. Bharj, Y.-H. Yun and D. Hou. "A Monolithic Mixer IC: Design and Characteristics on N-Implant Only, Buried P- and MBE Wafers." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 899-902.

A monolithic high performance MESFET mixer integrated circuit has been developed for general purpose applications. In order to achieve high dynamic range, low power consumption and small size, active circuit techniques have been utilized for applications up to 4 GHz. The balanced mixer, which consists of active phase splitting networks and commutator cell was fabricated on different wafers having N-implant only, Buried P-layer and Molecular Beam Epitaxy. The monolithic integrated circuit has shown a conversion gain of 1 dB with RF and LO rejections greater than 20 dB, up to 4 GHz. A detailed comparison of the performance of the IC on different wafers is presented.

Abstracts

A W-Band Monolithic Amplifier

N. Camilleri, P. Chye, P. Gregory and A. Lee. "A W-Band Monolithic Amplifier." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 903-906.

Monolithic amplifiers at 90 GHz have been fabricated using 75µm GaAs MESFET and Pseudomorphic HEMT (PHEMT) devices. The sub .2µm gate length PHEMT devices have demonstrated an F/sub t/ of 100GHz and an F/sub max/ of 200GHz. Monolithic MESFET and PHEMT single stage amplifiers have achieved 3.5 dB and 7 dB gain respectively at 90 GHz.

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Wideband Bidirectional MMIC Amplifiers for New Generation T/R Module

T. Tsukii, S.G. Houng and M.J. Schindler. "Wideband Bidirectional MMIC Amplifiers for New Generation T/R Module." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 907-910.

Two novel bidirectional amplifier approaches have been conceived and demonstrated with MMICs. These amplifiers are needed in bidirectional transmit/receive (T/R) modules, where close gain and phase tracking are critical. Excellent gain and phase tracking are inherent in the presented bidirectional amplifier approaches, since the same gain elements are used in both the transmit and receive modes. The Bidirectional Distributed Amplifier (BDA) has exhibited better than ±0.4 dB in gain tracking and ±2.5 degrees in phase tracking between the transmit and receive modes over a 2 to 18 GHz band. The Bidirectional Balanced Amplifier (BBA) has shown better than ±0.4 dB in gain tracking and ±1.5 degrees in phase tracking over a 6 to 18 GHz band.

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A 6-18 GHz, High Dynamic Range MMIC Amplifier Using a Feedforward Technique

V. Steel, D. Scott and S. Ludvik. "A 6-18 GHz, High Dynamic Range MMIC Amplifier Using a Feedforward Technique." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 911-914.

A novel feedforward linearization technique has been developed to increase dynamic range in a broadband, microwave amplifier module. Results are reported on a 6-18 GHz amplifier that demonstrates third order intercept improvement /spl ap/7 dB and second order intercept improvement /spl ap/20 dB.

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Abstracts

A Low Loss Monolithic Five-Bit PIN Diode Phase Shifter

R. Coats, J. Klein, S.D. Pritchett and D. Zimmermann. "A Low Loss Monolithic Five-Bit PIN Diode Phase Shifter." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 915-918.

A new monolithic five-bit phase shifter topology made realizable by the use of PIN diode switching elements has demonstrated lower insertion loss than that available from more conventional configurations. The novel phase shifter features predicted insertion loss <3.0 dB and VSWR <1.6:1 over the 20 percent frequency band in the X-band region. Monolithic chips have been fabricated and evaluated. The experimental results presented indicate that these performance goals are achievable.

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Session Y -- Millimeter Wave Solid State Devices and Circuits

"Session Y -- Millimeter Wave Solid State Devices and Circuits." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 919-919.

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Abstracts

A Phase Modulator with Gain for Microwave Millimeter-Wave Systems

R.S. Robertson. "A Phase Modulator with Gain for Microwave Millimeter-Wave Systems." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 921-922.

This paper presents a method to achieve phase modulation directly at microwave and millimeter-wave frequencies with concurrent signal amplification. The modulation is achieved with a voltage controlled oscillator and circulator. The technique is demonstrated experimentally with the generation of a bi-phase coded signal at Ku-band with a signal gain of 10 dB.

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High Power Epitaxially-Stacked Varactor Diode Multipliers: Performance and Applications at W-Band

J.F. Cushman, F. Occhiuti, E.M. McDonagh, M.E. Hines and P.W. Staecker. "High Power Epitaxially-Stacked Varactor Diode Multipliers: Performance and Applications at W-Band." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 923-926.

Single diode varactor multipliers capable of providing 260 mW CW and 850 mW pulsed at 94 GHz are described. These new results have application at W-band for systems where high average power, wideband swept linear response, phase coherent transceivers, and inter- and intra-pulse phase stability are required.

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Millimeter-Wave Double-Drift Hybrid Read Profile Si IMPATT Diodes

C.K. Pao, J.C. Chen, R.K. Rolph, A.T. Igawa and M.I. Herman. "Millimeter-Wave Double-Drift Hybrid Read Profile Si IMPATT Diodes." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 927-930.

Double-drift Si IMPATT diodes with hybrid Read profiles were designed, fabricated and tested for millimeter-wave frequency operation. Vapor phase epitaxy (VPE) growth was used to achieve well controlled abrupt n-type doping transitions. We achieved 1.95 W with 11.7 percent efficiency at Q-band (40.6 GHz). At V-band, we achieved 1.05 W with 13.6 percent efficiency (61 GHz) and an injection locked amplifier achieved 20 dB gain, 800 mW and 2 GHz bandwidth with greater than 10 percent efficiency Finally, at W-band, we achieved 612 mW with 5.7 percent efficiency (93 GHz) and for long pulse operation 1.08 W peak power at 96 GHz.

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A 2 W Solid State Transmitter for Short Range Data Communication at 60 GHz

H. Barth and M. Pirkl. "A 2 W Solid State Transmitter for Short Range Data Communication at 60 GHz." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 931-933.

Three 60 GHz powercombiners are cascaded to amplify a CW input signal of 2 mW up to 2 W. The maximum bandwidth is 1 GHz. In the first stage the incoming signal is split into two equal portions which are amplified by two reflection type Gunn Diode amplifiers. The combined output power (20 mW) of this stage is used to injection lock the two Gunn oscillators of the second combiner. The output of that (180 mW) serves as locking signal of the third stage, where two GaAs IMPATT oscillators (1.2 W each) are synchronized and powercombined. In case of good balance of each combiner only one isolator between the stages is required.

Abstracts

Session Z -- Merging of Optical and Microwave Techniques

"Session Z -- Merging of Optical and Microwave Techniques." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 935-935.

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Nonlinear Circuit Analysis of Laser Diodes Under Microwave Direct Modulation

S. Iezekiel and C.M. Snowden. "Nonlinear Circuit Analysis of Laser Diodes Under Microwave Direct Modulation." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 937-940.

A microwave nonlinear circuit analysis technique which can account for all known steady-state responses has been developed and applied to the large-signal characterisation of directly modulated laser diodes. An equivalent circuit derived from the rate equations is used to model the laser diode. The proposed technique is based on a harmonic balance algorithm which represents two-tone inputs by describing frequencies. Second harmonic and third-order intermodulation distortion results for a GaAlAs diode have been compared with corresponding measured data to validate the approach taken. Aperiodic responses are detected by means of bifurcation theory.

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Optically Controlled GaAs MMIC Switch Using a MESFET as an Optical Detector

A. Paolella, A. Madjar, P.R. Herczfeld and D. Sturzebecher. "Optically Controlled GaAs MMIC Switch Using a MESFET as an Optical Detector." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 941-944.

Optical control of microwave devices, particularly MMIC, is a rapidly growing research area. The GaAs MESFET is the prime candidate as the optical detector for MMIC applications. In this paper a theoretical analysis is presented, which accurately predicts the photocurrents in MESFETs operated in the pinched off mode. The analysis includes both photovoltaic and photoconductive effects. The paper also describes the operation of an optically triggered MMIC switch using the MMIC switch as the detector.

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Microwave Modulation of Optical Signal by Electro-Optic Effect in GaAs Microstrips

M.G. Li, E.A. Chauchard, C.H. Lee and H.-L.A. Hung. "Microwave Modulation of Optical Signal by Electro-Optic Effect in GaAs Microstrips." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 945-948.

The microwave modulation of the interference generated by light beams reflected from the top and bottom surfaces of GaAs substrate and adjacent to a microstrip line has been used to directly measure the electro-optic (E-O) effect. This sampling technique of the time-domain waveform of a microwave signal based on the harmonic mixing mechanism results in a highly sensitive method for determining the E-O effect in the substrate.

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Optically-Controlled Tunable CPW Resonators

M.S. Islam, P. Cheung, C.Y. Chang, D.P. Neikirk and T. Itoh. "Optically-Controlled Tunable CPW Resonators." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 949-950.

The use of a Schottky-biased, optically-controlled coplanar waveguide (CPW) in a microwave resonator is investigated. A prototype device consisting of a CPW stop a lightly doped GaAs epi-layer on a semi-insulating GaAs substrate has been fabricated and tested. By making use of Schottky-contacted metal electrodes to reduce loss and increase optical sensitivity, tunable resonance has been achieved, with resonator Q's of approximately 8.4 for resonance near 10 GHz, with a tuning range of about 125 MHz at an optical illumination power of only 34 mW/cm2.

Abstracts

Compression and Reshaping of Picosecond Electrical Pulses Using Dispersive Microwave Transmission Lines

Y. Qian and E. Yamashita. "Compression and Reshaping of Picosecond Electrical Pulses Using Dispersive Microwave Transmission Lines." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 951-954.

In this paper we newly propose a simple and effective method for reshaping and compressing picosecond electrical pulses generated from photoconductive switches. A piece of dispersive strip transmission line can be used as a "phase equalizer" to compensate the phase distortion included in asymmetric electrical pulses, resulting in effective reshaping and compression of these ultrashort pulses. Initial design formulas of the strip transmission lines for this purpose are presented, together with some computer simulation results showing the pulse reshaping and compression effects.

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Session AA -- Microwave Systems

"Session AA -- Microwave Systems." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 955-955.

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Compact Microwave Remote with Newly Developed Recognition System SSB Modulation

T. Ohta, H. Nakano and M. Tokuda. "Compact Microwave Remote with Newly Developed Recognition System SSB Modulation." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 957-960.

A Compact Microwave Remote Recognition System (2.45GHz) with newly developed SSB modulation has been built. The system is composed of an interrogator and a responder. The interrogator is able to read and write the data which are stored in the responder by remote control. The SSB modulation makes microwave circuits simpler. By using of a microwave PLO, radio interferences to neighboring systems are eliminated. This system is widely applicable to factory automation, personnel management, security management, etc. Key technologies to construct this system are described in this paper.

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A Rapid Channel Detection System for EW Receivers

R.G. Ranson and S.G. Gibbons. "A Rapid Channel Detection System for EW Receivers." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 961-963.

A new subsystem is described that combines microwave circuits with digited processing to provide ultra fast frequency information in a form suitable for integration into more complex receiver systems.

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Design of a Miniature Solid State Feed-Thru Nuller

G.G. Raleigh and M.A. Pollack. "Design of a Miniature Solid State Feed-Thru Nuller." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 965-968.

One major disadvantage of high power CW radars is finite transmitter to receiver isolation. Transmitter feed-thru can cause receiver sensitivity degradation or compress the receiver front end if the feed-thru power level is high. A new solid state component solution for active feedback nulling of transmitter feed-thru is discussed and experimental results are presented.

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MMW Radar Acquisition System

A. Archdale. "MMW Radar Acquisition System." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 969-972.

This paper describes the hardware and system development which has been carried out in order to evaluate the use of 94GHz radar for the autonomous detection of targets in all clutter backgrounds. Several instrumentation radars, both ground-based and airborne, have been developed for use on field trials. These systems vary in complexity from simple, solid-state, IMPATT transmitter/Gunn assemblies to high power, pulsed, radars with scanning antennas, dual receiver channels and frequency agility. The radar concept of interest is one which is carried by a high-speed military vehicle, flying at low level (30-60m), which has to detect and discriminate, with high probability, groups of mobile amoured targets out to ranges of 3Km.

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A 15 Element Imaging Array for 100 GHz

N.R. Erickson, P.F. Goldsmith, C.R. Predmore and G.A. Novak. "A 15 Element Imaging Array for 100 GHz." 1990 MTT-S International Microwave Symposium Digest 90.2 (1990 Vol. II [MWSYM]): 973-976.

A focal plane imaging array receiver is described which covers the 90-115 GHz range for radio astronomical observations. The 3x5 array uses cryogenic Schottky diode mixers with integrated HEMT IF amplifiers. A cold quasi-optical filter selects the correct sideband, and terminates the image at 20 K. Polarization interleaving is used to minimize the array size on the sky.

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Workshops - Silicon, GaAs MMIC's and Beyond (1990 Vol. III [MWSYM])

"Workshops - Silicon, GaAs MMIC's and Beyond (1990 Vol. III [MWSYM])." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): vi-x.

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Session BB -- Microwave Power Transistors

"Session BB -- Microwave Power Transistors." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 980-980.

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A C-Band 25 Watt Linear Power FET

Y. Taniguchi, Y. Hasegawa, Y. Aoki and J. Fukaya. "A C-Band 25 Watt Linear Power FET." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 981-984.

A novel four-way power combiner/divider based on 1/8-wavelength transmission line consideration is applied to the design of internally matched GaAs FETs. The resultant FET delivers an output power at 1 dB gain compression point of 44 dBm (25 W) with 12 dB linear gain, 40 % power added efficiency, and -46 dBc 3rd order intermodulation distortion at an output power of 35 dBm (single carrier level), over the 4.4 to 5.0 GHz frequency range.

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5-GHz Band 30 Watt Power GaAs FETs

S. Yanagawa, K. Takagi and Y. Yamada. "5-GHz Band 30 Watt Power GaAs FETs." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 985-987.

C-band high-power and high-efficiency GaAs FETs have been developed. The active region of FET chip has been highly integrated by forming long gate fingers. Four chips are power-combined efficiently by using internal matching circuits. The FETs deliver an output power at 1dB gain-compression point of 30W with 6.8 dB gain and 28 % power-added efficiency, and a saturated output power of 33 W at 5.5 GHz. These output powers are the highest values reported so far on power GaAs FET. Moreover they exhibit an excellent linearity with a third-order intermodulation distortion intercept point of +55 dBm.

Abstracts

Harmonic Tuning of Power FETs at X-Band

M.A. Khatibzadeh and H.Q. Tserng. "Harmonic Tuning of Power FETs at X-Band." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 989-992.

We report on a study of high-efficiency, harmonic-tuned, class-B operation of power MESFETs at X-band. Hybrid, single-stage 1200µm power FET amplifiers were fabricated with the output circuit designed to provide optimum load impedance at the fundamental frequency (10 GHz) and short at the second harmonic. Power-added efficiency of 61% at an output power level of 450mW and 7dB power gain were obtained at 10GHz. The corresponding drain efficiency was 75%. The second harmonic level in the output was suppressed to less than -40 dBc level over a 4% frequency bandwidth. The improvement in the efficiency was at the expense of lower operating voltage and power density (0.4W/mm) when compared with class-A or class-AB amplifiers made from similar devices, Theoretical harmonic-balance analysis of these tuned class-B amplifiers were also performed and the results agree fairly well with the measured data.

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High-Efficiency, Class-B, S-Band Power Amplifier

M.A. Khatibzadeh and B. Bayraktaroglu. "High-Efficiency, Class-B, S-Band Power Amplifier." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 993-996.

A class-B, high-efficiency, S-band heterojunction bipolar transistor (HBT) amplifier has been developed for potential applications in phased-array radar and mobile communication systems. The amplifier achieves an output power level of 1.1 W with an associated power-added efficiency of 61% and 12.3 dB power gain at 3.0GHz (10% bandwidth). The amplifier is turned ON with the input RF signal and dissipates no DC power when idle even though it is biased at all times. This feature which is characteristic of true class-B operation is a significant requirement for high-efficiency T/R module and portable radio systems.

Abstracts

18 GHz High Gain, High Efficiency Power Operation of AlGaAs/GaAs HBT

N.L. Wang, N.H. Sheng, W.J. Ho, M.F. Chang, G.J. Sullivan, J.A. Higgins and P.M. Asbeck. "18 GHz High Gain, High Efficiency Power Operation of AlGaAs/GaAs HBT." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 997-1000.

Outstanding power performance has been achieved from an AlGaAs/GaAs HBT at 18GHz. A common emitter HBT has achieved 48.5% added efficiency, 6.2dB associated gain and 0.17W output power. Common base operation of HBT exhibits higher gain at 18GHz: 0.358W (3.58W/mm) was achieved with 11.4dB gain and 43% added efficiency; at a reduced power level of 0.174W (1.74W/mm), 15.3dB associated power gain is achieved with 40% efficiency. This performance compares favorably with the results reported for MESFETs, HEMTs, and PBTs.

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Session CC -- Ferrite Devices

"Session CC -- Ferrite Devices." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1001-1001.

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Ferrite Rotary-Field Phase Shifters with Reduced Cross-Section

C.R. Boyd, Jr. and C.M. Oness. "Ferrite Rotary-Field Phase Shifters with Reduced Cross-Section." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1003-1006.

Practical ferrite Rotary-Field phase shifters can be built for the 1.3 GHz frequency region by using a reduced-diameter circular waveguide in which disks of high dielectric constant material and ferrite-filled sections alternate. This approach permits reduction of the guide diameter to about half that needed for uniform filling with garnet material only. Experimental results for feasibility-study units at 2.5 GHz. and 1.3 GHz confirm that the reduced-diameter configuration can produce high phase setting accuracy, but with increased insertion loss.

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An Edge-Guide Mode Microstrip Isolator with Transverse Slot Discontinuity

R.C. Kane and T. Wong. "An Edge-Guide Mode Microstrip Isolator with Transverse Slot Discontinuity." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1007-1010.

A new configuration edge-guide mode isolator is described. The new device utilizes a transverse slot, located at one edge of the upper conductor, to effect the isolation function. Results are reported on a series of experiments which confirm operation of the device. Considerations for optimizing performance are detailed and supporting experimental data is included. A modified distributed lossy-termination Hines type isolator is also considered.

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Magnetically Tunable Stripline Y Circulator

T. Nagao and Z. Tanaka. "Magnetically Tunable Stripline Y Circulator." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1011-1014.

A stripline Y junction circulator loaded with TDC resonators achieved magnetically tunable operation in UHF. Its frequency band was wider than octave band, 0.4 to 1.1 GHz. Its constituent operation had a frequency band of less than 100 MHz, insertion losses were less than 1.5 dB, and isolation more than 25 dB. Experimental analysis of the magnetically tunable operation, and theoretical analysis of EM fields of resonant modes, eigenvalues, and perfect circulational modes are presented.

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High Performance Millimeter-Wave Microstrip Circulator for Deep Space Commucations

J.J. Pan, M. Shih and L. Riley. "High Performance Millimeter-Wave Microstrip Circulator for Deep Space Commucations." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1015-1017.

High performance microstrip circulators have been developed in the Ka-band utilizing new ferrite substrates and temperature stable magnets. A special resonator configuration was analyzed, modeled, and optimized. The circulators have isolation and return loss of greater than 17 dB, and an insertion loss of less than 0.6 dB. Test results indicated almost no performance variations over the temperature range of -30 to +60°C.

Abstracts

A 4-40 GHz Wide Bandwidth, Magnetically Tuned Bandpass Filter

D.L. Harris. "A 4-40 GHz Wide Bandwidth, Magnetically Tuned Bandpass Filter." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1019-1022.

In recent years, as microwave test equipment evolved, the need for a coaxial input/output bandpass filter that can tune from 4 to 40 GHz has become evident. This filter also needs a pass-band much wider than any of the previously available YIG filters. To meet these needs a special non-YIG ferrite filter was designed and built. This article discusses the key problems and solutions in the development of this new microwave filter.

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"Session DD -- Network Measurements." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1023-1023.

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A Vector Network Analyzer Integrated Into Coplanar-Waveguide Probes

J.V. Bellantoni and R.C. Compton. "A Vector Network Analyzer Integrated Into Coplanar-Waveguide Probes." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1025-1028.

A new type of vector network analyzer integrated with two coplanar-waveguide (CPW) probe tips for making on-wafer measurements is presented. The CPW configuration is capable of large bandwidths and allows measurements to be made directly at the device under test. The analyzer consists of detector diodes spaced logarithmically along two CPW probe tips to sample the signal, and uses six-port theory to calculate s-parameters. A 5-10 GHz proof of concept model was built and used to test a MMIC PIN diode switch.

Abstracts

Verification of MMIC On-Wafer Microstrip TRL Calibration

C. Woodin and M. Goff. "Verification of MMIC On-Wafer Microstrip TRL Calibration." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1029-1032.

An on-wafer calibration verification technique is presented, comparing Thru-Reflect-Line (TRL) calibrated microstrip measurements with independent resonator measurements in the 1 to 26.5 GHz band. This is believed to be the first reported independent verification of any microstrip on-wafer calibration. The improved accuracy using a verified on-wafer microstrip TRL calibration is demonstrated to improve the ability to attain first iteration MMIC design success.

Abstracts

Millimeter-Wave Deembedding Using the Extended TRL (ETRL) Approach

M.I. Herman, C.K. Pao, G.L. Lan and J.C. Chen. "Millimeter-Wave Deembedding Using the Extended TRL (ETRL) Approach." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1033-1036.

A new approach for deembedding is presented which utilizes known physical transmission line lengths instead of electrical characteristics for calibration standards. This allows one to perform millimeter-wave deembedding for waveguide based vector network analyzers. Theoretical formulation of ETRL and experimental characterization for V-band microstrip lines will be shown. Important design guidelines and selection of valid root choice of the formulation will be described.

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Millimetre-Wave Vector Measurements Using Multistate Reflectometers with Diode Detectors

M. Perkins and R.D. Pollard. "Millimetre-Wave Vector Measurements Using Multistate Reflectometers with Diode Detectors." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1037-1040.

The use of diode power detection with millimetre-wave multistate reflectometers is described. The nonlinear behaviour of the diodes has been linearised and comparisons with thermistor-based systems show that high quality vector measurements are produced at Q-band and 94.9 GHz with a significant improvement in measurement speed.

Abstracts

Reducing the Effects of Random Errors in Six-Port Network Analysers

A.S. Wright, A.J. Wilkinson and S.K. Judah. "Reducing the Effects of Random Errors in Six-Port Network Analysers." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1041-1044.

The performance of a Six-Port network analyser is degraded by the presence of noise and random error mechanisms. Experimental results demonstrate that the effects of random errors may be significantly reduced (10x) by employing a non-linear Kalman filter.

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New Time Domain Reflectometry Techniques Suitable for Testing Microwave and Millimeter Wave Circuits

Z.-Y. Shen. "New Time Domain Reflectometry Techniques Suitable for Testing Microwave and Millimeter Wave Circuits." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1045-1048.

A superconducting circuit based time domain reflectometer with deconvolution has achieved a record 2.5 ps rise time at the DUT's interface. The corresponding spatial resolution is approaching 0.1mm for high dielectric media. Examples for applications are given. The "tail effect" caused by large discontinuities is eliminated by deconvolution. An innovative "partial reflection" calibration is suggested to improve the resolution for on-chip tests.

Abstracts

Session EE -- Advanced Transmission Line Structures

"Session EE -- Advanced Transmission Line Structures." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1049-1049.

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Modeling of Radial Microstrip Bends

A. Weisshaar, S. Luo, M. Thorbum, V.K. Tripathi, M. Goldfarb, J.L. Lee and E. Reese. "Modeling of Radial Microstrip Bends." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1051-1054.

Equivalent curved waveguide and lumped circuit models are presented and used to compute the transmission characteristics of radial microstrip bend discontinuities. The calculated results are compared with both transmission and resonance measurements to validate the accuracy of the models. The conductor and radiation losses for the bend discontinuity are included in the model.

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A Generalized Method for the Distinction of Radiation and Surface-Wave Losses in Microstrip Discontinuities

T.S. Horng, S.C. Wu, H.Y. Yang and N.G. Alexopoulos. "A Generalized Method for the Distinction of Radiation and Surface-Wave Losses in Microstrip Discontinuities." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1055-1058.

A generalized method for calculating both radiation and surface-wave losses is developed for microstrip discontinuities. The losses are determined by a rigorous Poynting vector analysis where the current distribution over the entire microstrip discontinuities is a result of a full-wave moment method solution. It is found that above a certain frequency, the surface-wave loss becomes more important than the radiation loss. A self-consistency check of the results based on power conservation is also presented.

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Abstracts

Rigorous Analysis of a Longitudinal Strip on the Surface of Inset Dielectric Guide

P.D. Sewell and T. Rozzi. "Rigorous Analysis of a Longitudinal Strip on the Surface of Inset Dielectric Guide." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1059-1062.

This contribution rigorously determines the equivalent circuits of longitudinal strips of finite width on the air-dielectric interface of an Inset Dielectric Guide, (I.D.G.). These are used to design an array of dipoles forming a longitudinally polarised linear antenna, that is theoretically consistent with the properties of microstrip-loaded I.D.G.

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A New Mode-Coupling Effect on Coplanar Waveguides of Finite Width

H. Shigesawa, M. Tsuji and A.A. Oliner. "A New Mode-Coupling Effect on Coplanar Waveguides of Finite Width." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1063-1066.

A new mode-coupling effect that occurs on conventional coplanar waveguides of finite width is identified and explained here for the first time. The coupling occurs between the standard CPW dominant mode and a new dominant mode also identified here for the first time, and called here the CPW dominant surface-wave-like mode. This coupling is different from that which is known to occur when a printed-circuit waveguide is placed in a box or package; here there is no box, and the finite width by itself is sufficient to produce the coupling effect. Other new physical effects, that will be discussed in detail elsewhere, are included here in order to place the new coupling effect in perspective.

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The Transition Region Between Bound-Wave and Leaky-Wave Ranges for a Partially Dielectric-Loaded Open Guiding Structure (1990 Vol. III [MWSYM])

P. Lampariello, F. Frezza and A.A. Oliner. "The Transition Region Between Bound-Wave and Leaky-Wave Ranges for a Partially Dielectric-Loaded Open Guiding Structure (1990 Vol. III [MWSYM])." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1067-1070.

Most modes on partially dielectric-loaded open guiding structures are purely bound in some frequency range and leaky in another. The transition region between them is complicated and interesting, including a section where the dispersion curve doubles back, because it connects a complex nonspectral (leaky-wave) solution with a real spectral (boundwave or surface-wave) solution. The physical nature of this type of transition region is discussed in the context of a recently proposed novel leaky-wave antenna structure, and some anomalous features are described.

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Optimal Field Theory Design of Stepped E-Plane Finned Waveguide Transformers of Different Inner Cross-Sections

J. Bornemann and F. Arndt. "Optimal Field Theory Design of Stepped E-Plane Finned Waveguide Transformers of Different Inner Cross-Sections." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1071-1074.

This paper presents a new design of broadband double-stepped ridged and all-metal finned waveguide transformers which combines the advantage of constant ridge thickness with that of the optimum matching potential of different waveguide inner cross-section dimensions. Based on the modal scattering matrix method, the rigorous design takes into account the influences of both, the finite ridge or fin thicknesses and the higher-order mode interaction at all discontinuities. Computer optimized design data are given for compact transformers for WR112 and WR42 input waveguides achieving a return loss of more than 33dB for the whole waveguide bands. The theory is verified by measurements.

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Session FF -- FET Devices and Circuits

"Session FF -- FET Devices and Circuits." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1075-1075.

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RF Characteristics of P-Well GaAs MESFETs

P.C. Canfield and D.J. Allstot. "RF Characteristics of P-Well GaAs MESFETs." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1077-1080.

The first experimental results on the RF performance of p-well MESFETs are presented. It is shown that the small-signal equivalent circuit for the p-well MESFET must include a series RC branch between the source and drain to properly model the undepleted well and its contact. The dependence of the equivalent circuit parameter values on the doping of the p-well is presented and shown to have only a minor effect on the RF performance.

Abstracts

Pulse-Doped GaAs MESFETs with Planar Self-Aligned Gate for MMIC

S. Nakajima, K. Otobe, N. Kuwata, N. Shiga, K.-I. Matsuzaki and H. Hayashi. "Pulse-Doped GaAs MESFETs with Planar Self-Aligned Gate for MMIC." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1081-1084.

A pulse-doped GaAs MESFET with n+ self-aligned planar gate has been developed. This device shows excellent drain current linearity and minimum noise figures of 0.72dB (1.15dB) with associated gains Of 10.5dB (8.5dB) at 12GHz (18 GHz), Furthermore, excellent uniformity and reproducible device characteristics also have been realized.

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Monolithic Indium Phosphide-Based HEMT Multioctave Distributed Amplifier

E. Sovero, D. Deakin, W.J. Ho, G.D. Robinson, C.W. Farley, J.A. Higgins and M.F. Chang. "Monolithic Indium Phosphide-Based HEMT Multioctave Distributed Amplifier." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1085-1087.

The superior performance qualities of indium phosphide based High Electron Mobility Transistor (HEMT) structures has been established with discrete devices. In this paper, we report the first monolithic IC's made with this material system. Results are presented on a monolithic distributed amplifier with greater than 10 db gain from 2 to 30 GHz. At 14 GHz, the noise figure was 5.2 dB with 14 dB of associated gain. These circuits have all the necessary components for a high performance amplifier, including quarter micron EBL (Electron Beam Lithography) defined gates, MIM (Metal Insulator Metal) capacitors, air-bridge metal crossovers and plated-thru-substrate vias to the ground plane.

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Distributed and Lossy Match Active Power Splitters Using Bridged-T Low-Pass Filter Networks

Y. Ito. "Distributed and Lossy Match Active Power Splitters Using Bridged-T Low-Pass Filter Networks." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1089-1092.

Wideband active power splitters using distributed or lossy match amplification have been designed and fabricated in hybrid form. These splitters use a bridged-T low-pass filter network. It provides a variable characteristic impedance without affecting a cutoff frequency, and thus, is powerful in an application to a multi-way power splitting/combining circuit which requires high impedance characteristics. A 2-way distributed active power splitter has achieved a gain of 1.8 ± 0.8 dB and input/output VSWR's of less than 2:1 over 0.5 to 26.5 GHz. A 2-way lossy match active power splitter has shown a loss of 1.3 ± 1.1 dB and input/output VSWR's of less than 2:1 across 0.5 to 26.5 GHz.

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2-18 GHz Logarithmic Amplification Componentry

E. Gertel, D.M. Johnson and M. Kumar. "2-18 GHz Logarithmic Amplification Componentry." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1093-1096.

Two microwave logarithmic amplifier designs are described. First is a dual channel extended dynamic range Detector Logarithmic Video Amplifier (DLVA) design to cover the 2 - 18 GHz frequency band. The DLVA was developed to achieve state-of-the-art accuracy over 65 dB dynamic range, while providing excellent amplitude and phase tracking between the two channels. Amplitude and phase tracking of ±1 dB and ±5 degrees have been achieved, respectively. Second is a Successive Detection Logarithmic Amplifier (SDLA) design to cover the 2 - 6 GHz frequency range. The SDLA was developed to achieve state-of-the-art pulse processing capability. Rise time of 8 ns and recovery time of 30 nsec have been achieved over 70 dB of dynamic range.

Abstracts

Session GG -- (Focused Session)

"Session GG -- (Focused Session)." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1097-1097.

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The Advent of the Signal Microprocessor

B.J. Hunsinger. "The Advent of the Signal Microprocessor." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1099-1102.

The signal Microprocessor [SMP] is a software controlled processor for analog RF and microwave signals which makes the implementation of new signal based systems practical much like the digital microprocessor did for data-based systems. The SMP is programmed using digital commands and processes analog RF and microwave signals without analog to digital conversion. The SMP, enabled by the ACT technology, is less complex and uses less power because it has the processing power of a multimillion transistor ASIC, but is implemented with less than 3000 transistors. The SMP is operated by a natural language software system.

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Current and Voltage Sensing in Act 'Block NDS' Transversal Filters

R.L. Miller and D.S. Bailey. "Current and Voltage Sensing in Act 'Block NDS' Transversal Filters." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1103-1106.

Fixed ACT transversal filters look like apodized SAW transducers, but because they capacitively sense charge packets directly below the surface, the individual lines can be smeared together into two plates separated by a wavy boundary. In the conventional "voltage sense" approach, the shape of the gap is made to be the desired impulse response, and each side is loaded by an RC network. We describe a "current sense" approach, in which the shape of the gap is the integral of the desired impulse response, and the current which must oscillate from one Non-Destructive Sense (NDS) plate to the other is taken to be the output. Unlike voltage sensing, current sensing does not have a "DC pedestal" in its impulse response to create an undesired passband at low frequencies.

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Heterostructure Acoustic Charge Transport Technology for Programmable Transversal Filters

W.J. Tanski, S.W. Merritt, D.E. Cullen, R.D. Carroll, E.J. Branciforte, R.N. Sacks and W.D. Hunt. "Heterostructure Acoustic Charge Transport Technology for Programmable Transversal Filters." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1107-1110.

Significant progress has been made recently in the development of heterostructure acoustic charge transport (HACT) technology. In this paper the HACT device concept is reviewed, details of the layer structure, monolithic integration, and acoustic performance are discussed, and the performance of transversal filters is presented. A transversal filter 3.35 µsec long (1 cm) with 480 taps and charge transfer efficiency in excess of 0.9999 is described. This is the longest acoustic charge transport device reported to date. Measurements show the thermal dynamic range of the device to be 80 dB, and the spurious free dynamic range is 62 dB, over the 300 kHz bandwidth of the filter.

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Acoustic Charge Transport Digitally Programmable Transversal Filter Development

R.W. Miller and R.J. Kansy. "Acoustic Charge Transport Digitally Programmable Transversal Filter Development." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1111-1114.

A monolithic 128-tap digitally programmable analog transversal filter is described that uses an acoustic charge transport tapped delay line and integrated GaAs MESFET circuits for coefficient storage and tap weighting. The device has 5-bit tap weights, an input sampling rate of 360 MHz, and an output tap spacing corresponding to an output sampling rate of 180 MHz. The device is mounted on a ceramic thick film substrate along with RF input and output amplifiers and the entire assembly is housed in a 1.25 inch-square 44-pin kovar flatpack.

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Development of a Monolithic, Programmable SAW Filter in Silicon

J.C. Haartsen. "Development of a Monolithic, Programmable SAW Filter in Silicon." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1115-1118.

In this paper the development of a monolithic, programmable Surface-Acoustic-Wave (SAW) filter in a ZnO-SiO/sub 2/-Si layered structure is presented. Two programmable taps with integrated detection-control capabilities are discussed, producing efficiencies of 40-50 dB with a control range of 15-20 dB at 100 MHz. They consist of implanted pn junction electrodes at the silicon surface and have a smooth surface for an unperturbed SAW propagation. A new SAW generating transducer is proposed with a combined junction-metal interdigital pattern. A large dielectric medium under the transducer is created by the depletion regions of the reverse-biased junction pattern. In this way optimal efficiency of SAW transducer and taps can be obtained. Experimental results are given for a 16-tap, full silicon programmable filter operating at 100 MHz.

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Session HH -- Measurement of Material Properties

"Session HH -- Measurement of Material Properties." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1119-1119.

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High Spatial Resolution Dielectric Constant Uniformity Measurements Using Microstrip Resonant Probes

M.S. Wang, S. Bothra, J.M. Borrego and K.W. Kristal. "High Spatial Resolution Dielectric Constant Uniformity Measurements Using Microstrip Resonant Probes." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1121-1124.

In this paper we present the use of evanescent fields of apertures in microstrip resonant probes for measuring dielectric constant uniformity with high spatial resolution. The accuracy we have achieved in dielectric constant measurement at 10 GHz is better than 2% using apertures as small as 0.030" X 0.010" in size.

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An Automated 60 GHz Open Resonator System for Precision Dielectric Measurement (1990 Vol. III [MWSYM])

M.N. Afsar, X. Li and H. Chi. "An Automated 60 GHz Open Resonator System for Precision Dielectric Measurement (1990 Vol. III [MWSYM])." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1125-1128.

An automated open resonator system is designed and constructed for precision measurement of loss tangent and dielectric permittivity of low absorbing materials at 60 GHz. The use of high Q hemispherical Fabry-Perot cavity together with highly stabilized synthesized phase locked Gunn oscillator sources and the super heterodyne receiver enabled us to measure loss tangent value as low as 10 micro-radians.

Abstracts

Characterization of Conductor-Backed Coplanar Waveguide Using Accurate On-Wafer Measurement Techniques

Y.-C. Shih and M. Maher. "Characterization of Conductor-Backed Coplanar Waveguide Using Accurate On-Wafer Measurement Techniques." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1129-1132.

The conductor-backed coplanar waveguide has been experimentally characterized using accurate on-wafer S-parameter measurement techniques. An uncertainty analysis was conducted to quantify the measurement errors. Measured characteristic impedance, effective dielectric constant, and attenuation constant are in good agreement with the theory.

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Dual-Mode Stripline Resonator Array for Fast Error Compensated Moisture Mapping of Paper Web

M. Fischer, P. Vainikainen and E. Nyfors. "Dual-Mode Stripline Resonator Array for Fast Error Compensated Moisture Mapping of Paper Web." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1133-1136.

A mechanically simple and therefore inexpensive sensor array for fast mapping of the water content of wet paper has been developed. The sensors are UHF strip-line resonators, which have two degenerate resonance modes, even and odd. By using the difference of these two frequencies a high accuracy can be achieved, because the resonance frequency of the odd mode is not affected by moisture changes in the wet paper, and can therefore be used for error compensation. Because of the electronic scanning the measurement is very fast and it makes almost real-time water content profiling possible.

Abstracts

Characterization of GaAs Devices by a Versatile Pulsed I-V Measurement System

A. Platzker, A. Palevsky, S. Nash, W. Struble and Y. Tajima. "Characterization of GaAs Devices by a Versatile Pulsed I-V Measurement System." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1137-1140.

We have built and utilized a pulsed I-V system which is capable of reaching any current-voltage point of three-terminal devices from any arbitrarily chosen DC bias point. The system, which can be used on wafer, serves as an invaluable tool for device modeling and process diagnostics. Direct dependence of the pulsed I-V curves on the DC bias was found in GaAs MESFETs and HEMTs.

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Session II -- Field Theory of Integrated Circuit Discontinuities

"Session II -- Field Theory of Integrated Circuit Discontinuities." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1141-1141.

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A Three-Dimensional Finite-Difference Calculation of Equivalent Capacitances of Coplanar Waveguide Discontinuities

M. Naghed and I. Wolff. "A Three-Dimensional Finite-Difference Calculation of Equivalent Capacitances of Coplanar Waveguide Discontinuities." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1143-1146.

A finite difference method is applied to three-dimensional multilayered shielded structures containing planar waveguide discontinuities. The electric field distribution inside the shielded structure is computed and the equivalent capacitances of the discontinuities are determined. Open-ends and gaps in various coplanar waveguides with one and two layer substrates as well as more complicated structures like interdigitated capacitors are examined. The calculated results are in good agreement with accurate measurements and results from other methods.

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Abstracts

Analysis of Complex Passive (M)MIC-Components Using the Finite Difference Time-Domain Approach

M. Rittweger and I. Wolff. "Analysis of Complex Passive (M)MIC-Components Using the Finite Difference Time-Domain Approach." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1147-1150.

The analysis of a number of complicated microstrip components containing coupled discontinuities and line structures using the finite difference time-domain (FDTD) method is presented. The time-domain data are plotted and the frequency-domain response in form of S-parameters is compared with accurate measurements. Advantages and disadvantages of the applied technique are discussed and modifications of the available algorithms for increased efficiency and stability of the solutions are described.

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A Rigorous Dispersive Characterization of Microstrip Cross and Tee Junctions

S.-C. Wu, H.-Y. Yang and N.G. Alexopoulos. "A Rigorous Dispersive Characterization of Microstrip Cross and Tee Junctions." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1151-1154.

A full-wave spectral-domain analysis is applied to the characterization of multi-port microstrip discontinuities. This approach employs the moment method to find the currents in the microstrip circuits and subsequently, the scattering parameters of the junctions. In this approach, all the physical effects are considered, including radiation and surface waves. The numerical results for a tee and a cross junction are presented and agree well with the quasistatic values at low frequencies. The S parameters of a tee junction are further compared against the measured results with excellent agreement. The utilization of a shaped T-junction as a broad-band equal-power divider is also discussed.

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Full Wave Modeling of Electrically Wide Microstrip Open End Discontinuities via a Deterministic Spectral Domain Method

J. McLean, H. Ling and T. Itoh. "Full Wave Modeling of Electrically Wide Microstrip Open End Discontinuities via a Deterministic Spectral Domain Method." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1155-1158.

A fullwave analysis of microstrip open-end discontinuities in an open environment is presented. The analysis differs from previous work in that it includes the effects of both longitudinal and transverse current on the strip and mode conversion near the open end. The effects of space, wave and surface wave radiation are included by making use of the exact spectral domain Green's function. The inclusion of transverse current in the analysis allows the analysis to be extended to electrically wide strips. Results of the calculation of the complex reflection coefficient are presented for both narrow and wide strips.

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An Efficient Finite Element Approach for the Analysis of Three-Dimensional Transmission Line Discontinuities Using an Asymptotic Boundary Condition

A. Khebir, A.B. Kouki and R. Mittra. "An Efficient Finite Element Approach for the Analysis of Three-Dimensional Transmission Line Discontinuities Using an Asymptotic Boundary Condition." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1159-1162.

In this paper, a novel technique is developed for efficient finite element solution of open region three-dimensional transmission line structures in the quasi-TEM regime. Starting with the general form of the solution to the three-dimensional Laplace's equation in spherical coordinates, a set of asymptotic boundary condition (ABC) operators is derived. The second-order ABC is then applied on a conformable outer boundary for the purpose of truncating the FEM mesh in an efficient manner. To illustrate its application, the method is used to compute the capacitance of a rectangular microstrip patch and the results are found to be in good agreement with data published elsewhere.

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Session JJ -- European Session

"Session JJ -- European Session." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1163-1163.

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Microwave Communications Activity in Eastern Europe

T. Berceli. "Microwave Communications Activity in Eastern Europe." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1165-1168.

The paper presents a survey on the microwave activity in Eastern Europe. It concentrates on the achievements in microwave communications, and in their related fields. First, a survey on the microwave communication equipment developed in these countries is presented. Then, the research activity in the field of circuits and their nonlinear simulation is presented. Finally, the trend of future activities is outlined.

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Short Range Microwave Links for Traffic and Transport Applications

B. Hane and P. Weissglas. "Short Range Microwave Links for Traffic and Transport Applications." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1169-1172.

Short range microwave communication links in traffic and transport may be used for automatic debiting, navigational aid, collision avoidance and traffic flow improvements. Some examples of existing systems are presented. A review of the future requirements is also given illustrated by presentations of some experimental systems in the frequency range 2.4 - 60 GHz which are being studied in Europe.

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Session KK -- CAD Techniques for Microwave Applications

"Session KK -- CAD Techniques for Microwave Applications." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1173-1173.

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Abstracts

Efficient CAD of E-Plane Steps in Rectangular Waveguide

M. Mongiardo and T. Rozzi. "Efficient CAD of E-Plane Steps in Rectangular Waveguide." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1175-1178.

Cascaded E-plane steps in weveguide still find a variety of uses in microwave components for power applications and in millimetrics. Wideband synthesis requires efficient field analysis, leading to simple equivalent circuits with frequency independent elements, so as to avoid repeating the field analysis at each frequency. We present the results of an analytical approach in a form suitable for CAD on a desktop computer.

Abstracts

An Accurate CAD Algorithm for E-Plane Type Bandpass Filters Using a New Passband Correction Method Combined with the Synthesis Procedures

J.-B. Lim, C.-W. Lee and T. Itoh. "An Accurate CAD Algorithm for E-Plane Type Bandpass Filters Using a New Passband Correction Method Combined with the Synthesis Procedures." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1179-1182.

A CAD algorithm using a new passband correction method combined with the synthesis procedures is presented for an accurate design of E-plane type bandpass filters. The proposed method gives a solution for the passband deviation problems associated with the conventional synthesis method. The passband correction factors are derived from the actual insertion losses of a pre-designed filter at the band-edge frequencies. Validity of the new method was confirmed by computer simulations and experimental measurements of the filters designed by this method.

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Abstracts

Expert System for Microwave Filter Design

A.H. Nakamura, K. Hibino, F. Yamamoto and S. Kamihashi. "Expert System for Microwave Filter Design." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1183-1186.

An expert system for microwave filter design, "fire" (Filter Designer), has been developed to make a straightforward optimum design of edge-coupled microstrip-line bandpass filters. The system incorporates the design expertise and knowledge of experienced microwave-circuit design engineers as a knowledge data base, necessary design data as a microwave data base, and commercially available microwave circuit simulators. It can also generate MIC pattern layout data on MT (magnetic tape). Thus the system makes it possible even for inexperienced engineers to design bandpass filters with experienced engineers design quality in much shorter time than conventional design procedures.

Abstracts

New Microwave Network Identities for CAD Modeling

D. Neuf. "New Microwave Network Identities for CAD Modeling." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1187-1190.

Network identities are allow one to model homogeneous two, three, presented which symmetric and or four coupled lines by using ideal 180 degree hybrids and separate uncoupled transmission lines representing each characteristic mode. These identities are helpful to intuitively understand the performance of these couplers as well as analyze them using commercially available CAD programs.

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Abstracts

Time Domain Simulation of Uniform and Nonuniform Multiconductor Lossy Lines by the Method of Characteristics

N. Orhanovic, V.K. Tripathi and P. Wang. "Time Domain Simulation of Uniform and Nonuniform Multiconductor Lossy Lines by the Method of Characteristics." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1191-1194.

A numerical technique to compute the time domain response of multiconductor lossy uniform and nonuniform lines terminated in general nonlinear elements is presented. The technique is based on the generalized method of characteristics and is used to study signal delay, distortion and crosstalk in interconnections in integrated circuits and chip carriers.

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A Series of CAD Techniques for Designing Microwave Feedback Amplifiers and Simplifying the Design of Reactively Matched Single-Ended Amplifiers

P.L.D. Abrie. "A Series of CAD Techniques for Designing Microwave Feedback Amplifiers and Simplifying the Design of Reactively Matched Single-Ended Amplifiers." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1195-1198.

A series of CAD techniques is introduced which is useful for modifying the characteristics of transistors for use in microwave amplifiers. Two applications are presented: In the first, some of these techniques are applied to the design of feedback amplifiers and in the second two transistors are modified for easier matching and a flat transducer power gain versus frequency response in a single-stage amplifier configuration.

Abstracts

Session LL -- Focused Session on Active Quasi-Optical Techniques

"Session LL -- Focused Session on Active Quasi-Optical Techniques." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1199-1199.

Abstracts

Quasi-Optical Power-Combining Arrays

D.B. Rutledge, Z.B. Popovic, R.M. Weikle, II, M. Kim, K.A. Potter, R.C. Compton and R.A. York. "Quasi-Optical Power-Combining Arrays." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1201-1204.

Semiconductor devices have limited power handling capabilities at high frequencies, particularly at millimeter-wave frequencies. In this paper, we present a method for overcoming this problem by combining the outputs of several devices quasi-optically in a resonator cavity. This method has been applied to a number of solid-state devices, including Gunn diodes and MESFETs. The devices do not require an external locking signal because they lock to a mode of the resonator cavity. Effective radiated powers of 22 watts for a 4x4 array of Gunn diodes and 25 watts for a 10x10 array of MESFETs have been achieved.

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Abstracts

Recent Efforts on Planar Components for Active Quasi-Optical Applications

K.D. Stephan and T. Itoh. "Recent Efforts on Planar Components for Active Quasi-Optical Applications." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1205-1208.

Quasi-optical components are coming to the aid of microwave circuit designers who are seeking smaller size, fewer parts, and higher efficiency. Several novel sources and receiving mixers using both diodes and FETs have been developed, and are discussed in the framework of isotropic conversion loss or gain, quantities that were developed to measure the unique properties of these components.

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Millimeter and Submillimeter Wave Quasi-Optical Oscillator with Multi-Elements (1990 Vol. III [MWSYM])

M. Nakayama, M. Hieda, T. Tanaka and K. Mizuno. "Millimeter and Submillimeter Wave Quasi-Optical Oscillator with Multi-Elements (1990 Vol. III [MWSYM])." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1209-1212.

Multi-elements oscillator with quasi-optical resonator is reported. The resonator consists of a Fabry-Perot cavity with a grooved mirror. It has capability for power-combing of solid-state sources in the millimeter wave region. X-band models consisting of Gunn diodes or GaAs MESFET's are demonstrated. Power combining and frequency-locking of 18 diodes and 6 FET's have been successfully observed. 50 GHz-band Gunn diode oscillator with the resonator is also reported.

Abstracts

A Periodic Second Harmonic Spatial Power Combining Oscillator

A. Mortazawi and T. Itoh. "A Periodic Second Harmonic Spatial Power Combining Oscillator." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1213-1215.

A periodic second harmonic spatial power combining oscillator is designed and fabricated. This circuit does not require an external resonator. It is planar, and therefore it makes the design of monolithic circuits easier. In this work, four X-band Gunn diodes are used. The effective radiated power is 370 mW at 18.6 GHz. The isotropic conversion efficiency is 10.2%.

Abstracts

Spatial Power Combining Using Push-Pull FET Oscillators with Microstrip Patch Resonators

J. Birkeland and T. Itoh. "Spatial Power Combining Using Push-Pull FET Oscillators with Microstrip Patch Resonators." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1217-1220.

We describe the design and performance of spatial power combining arrays of FET oscillators. The individual oscillators consist of single rnicrostrip patches driven by two FETs oscillating in the push-pull mode. Arrays formed from these elements show nearly perfect power combination in prototype modules operating at 6 GHz. Maximum ERP for a 4 patch array combining the power of 8 FETs is 32.8 dBm. Results for an oscillator using four FETs combining in a single patch are also discussed.

Abstracts

Session MM -- Phased Array Techniques

"Session MM -- Phased Array Techniques." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1221-1221.

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A New Approach to Active Phased Arrays Through RF-Wafer Scale Integration

L.R. Whicker, J.J. Zingaro, M.C. Driver and R.C. Clarke. "A New Approach to Active Phased Arrays Through RF-Wafer Scale Integration." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1223-1226.

This paper describes a new approach to active phased array technology. Here, several modules are fabricated at the same time and placed in a layered structure. The layers include the RF modules, cooling manifold, dc bias distribution, RF manifold, and radiating elements. In this configuration, 16 or more T/R modules are fabricated on a single 3-inch GaAs wafer. The realization of multiple modules on a wafer is made possible by redundancy of circuit elements and novel mechanical switches. Preliminary results on these efforts are presented.

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Transmit/Receive Modules for 6 to 18 GHz Multifunction Arrays

M. Priolo, G. St. Onge, W. Coughlin, III, J. Bugeau and D. Meharry. "Transmit/Receive Modules for 6 to 18 GHz Multifunction Arrays." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1227-1230.

A high density, complex MMIC Transmit/Receive module is presented with applications for 6 to 18 GHz multifunction phased arrays. It features a dual polarization, high dynamic range architecture, a state-of-the-art family of MMIC chips (269 mm² total GaAs area), and advanced MMIC packaging techniques. Modules will be demonstrated in a broadband subarray.

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Abstracts

Q-Band Monolithic Phase and Amplitude Weights

J.A. Lester, K. Nakano and Y.C. Ngan. "Q-Band Monolithic Phase and Amplitude Weights." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1231-1234.

Monolithic variable amplitude and phase weight components have been developed for applications at Q-band. The amplitude weight consists of a three-stage variable gain amplifier using 0.25 µm HEMT devices. Variable gain was acheived by adjustment of the bias voltages. The variable phase shifter is based on the I/Q design and utilizes two of the variable gain amplifiers in quadrature. Continually variable phase shift between 0 and 90 degrees was achieved with 2 dB insertion loss.

Abstracts

A Single Chip C-Band GaAs Monolithic Five Bit Phase Shifter with on Chip Digital Decoder

F. Ali, S. Mitchell, J. Mogri and A. Podell. "A Single Chip C-Band GaAs Monolithic Five Bit Phase Shifter with on Chip Digital Decoder." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1235-1237.

A single chip C-band GaAs monolithic five bit phase shifter with on-chip digital decode circuitry measuring 96mils x 48mils has been developed. This phase shifter has an RMS phase error of less than five degrees across 5.5-8.5 GHz band with greater than 60% RF yield. An application of this phase shifter as a serrodyne frequency translator is also presented.

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Composite Stripline Phase Shifter with Low Loss and Minimum Weight

P.M. Esker, A.W. Morse, J.W. Gipprich, Z.A. Diaz and S.R. Kramer. "Composite Stripline Phase Shifter with Low Loss and Minimum Weight." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1239-1242.

An S-Sand phase shifter is described using lightweight composite construction for low cost manufacture with batch processing. Couplers and phase shift networks are grouped together on an unusual printed air stripline medium. Lumped elements and critical ground paths are contained in a mass producible, individually testable hybrid circuit. The low loss, lightweight phase shifter is readily integrable with distribution manifolding and printed radiator arrays.

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Abstracts

An Efficient Mode Launcher for Arrays of Longitudinal Dipoles in IDG

T. Rozzi and L. Ma. "An Efficient Mode Launcher for Arrays of Longitudinal Dipoles in IDG." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1243-1246.

IDG (Inset Dielectric Guide) has proved an excellent antenna medium featuring pure polarization broadband matching and high efficiency. Antenna characteristics, however, are affected by the feeding system. We present a new effective feed arrangement suitable for appication to multiple arrays in IDG.

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Abstracts

Phase Control of Optically Injection Locked Oscillators for Phased Arrays

A.S. Daryoush, M. Francisco, R. Saedi, D. Polifko and R. Kunath. "Phase Control of Optically Injection Locked Oscillators for Phased Arrays." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1247-1250.

Future generation of space-based communications systems are envisioned to employ high-speed fiberoptic links for distribution of control and communication signals. The most suitable architecture for millimeter wave frequencies are based on the T/R level data mixing architecture, where a frequency reference is provided to local oscillators in the subarrays to have them frequency and phase synchronized. The indirect subharmonic optical injection locking has benefit of high degree of frequency synchronization up to millimeter wave frequencies, however they suffer from phase inaccuracy over the locking range, first formulated by Adler. In this paper we propose a scheme to measure this phase error and correct for by adjusting the free-running oscillation frequency of a VCO. Experiments supporting this approach are reported for two optically injection locked oscillators at 18GHz, where controlled phase shifts over -90° to 78° are achieved by adjusting the bias current to a YIG tuned VCO.

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Session NN -- Low Noise Technique

"Session NN -- Low Noise Technique." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1251-1251.

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Broadband, Low-Noise, Cryogenically-Coolable Amplifiers in 1 to 40 GHz Range

M.W. Pospieszalski, J.D. Gallego and W.J. Lakatosh. "Broadband, Low-Noise, Cryogenically-Coolable Amplifiers in 1 to 40 GHz Range." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1253-1256.

A design technique for very broadband, low-noise amplifiers is described. It is based on a wideband noise model of a MODFET. The computer-aided design and realization of L-, K-, K/sub a/-band and wideband 8-18 GHz cryogenically-coolable amplifiers with optimal noise performance are described. A uniqueness of results presented in this paper rest in the demonstration that a single frequency measurement of noise parameters provides sufficient information for a design of a number of wideband amplifiers in the 1-40 GHz range.

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Super Low-Noise Self-Aligned Gate GaAs MESFET with Noise Figure of 0.87dB at 12GHz

K. Hosogi, N. Ayaki, T. Kato, T. Oku, Y. Kohno, H. Nakano, T. Shimura, H. Takano and K. Nishitani. "Super Low-Noise Self-Aligned Gate GaAs MESFET with Noise Figure of 0.87dB at 12GHz." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1257-1260.

Advanced Self-aligned multi-layer gate FET (SAMFET) is developed for super low-noise MMIC amplifiers. Reduction of gate resistance by adopting a novel T-shaped multi-layer gate results in improvement of minimum noise figure by 0.2dB compared with conventional SAMFET. At 12GHz, advanced SAMFET gives a minimum noise figure of 0.87dB with associated gain of 10.62dB. Excellent uniformity of performances and high reliability are confirmed. They are owing to complete planer structure and refractory WSi gate contact. This technology is considered to be promising for high performance and low cost MMICs.

Abstracts

Measurement of the Cross Correlation Between Baseband and Transposed Flicker Noises in a GaAs MESFET

P.A. Dallas and J.K.A. Everard. "Measurement of the Cross Correlation Between Baseband and Transposed Flicker Noises in a GaAs MESFET." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1261-1264.

When an R.F. carrier is amplified by a GaAs MESFET, amplitude modulation (A. M.) and phase modulation (P. M.) noises are imposed on the carrier. This is generally believed to be caused by transposition to the carrier frequency of the low frequency flicker noise generated by the FET. The cross correlation between the A.M. and P.M. noises and the low frequency (L.F.) noise observed on the drain of the FET is measured. While the A.M. noise and the low frequency noise on the drain of the FET exhibit a high degree of correlation, the P.M. noise and the low frequency drain noise are not highly correlated. The latter result may explain the limited success of oscillator phase noise reduction methods which rely on the existence of a large cross correlation between the P.M. and low frequency noises.

Abstracts

Figures of Merit for Characterizing FET Oscillators

O.A.A. Elnor, A. Jacob and K. Schunemann. "Figures of Merit for Characterizing FET Oscillators." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1265-1268.

Simple expressions characterizing FET oscillator performance are presented. A stability criterion has been derived in a fairly general way. New expressions for the loaded quality factor for both fundamental and harmonic-mode operation are given with expressions for the output PM noise. The results presented in this paper extend the well established analysis of one-port oscillators to two-port oscillators.

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Phase Noise Characterization of SAW Oscillators Based on a Newton Minimization Procedure (1990 Vol. III [MWSYM])

D.P. Klemer, E.E. Clark, III and K.-M. Shih. "Phase Noise Characterization of SAW Oscillators Based on a Newton Minimization Procedure (1990 Vol. III [MWSYM])." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1269-1272.

A Newton-Raphson iterative technique is used to optimize the values of circuit parameters which characterize a voltage-controlled SAW-stabilized oscillator (VCSO). An expression given by Parker is used to calculate double-sideband phase-noise-to-carrier ratio; good agreement between calculations and phase noise measurements is achieved by minimizing the squared-error through the use of a Newton-Raphson minimization scheme. Less accurately known circuit parameters are thus optimized in an iterative fashion using exact expressions for the elements of the Hessian matrix. This technique is useful for the accurate determination of circuit parameter values; alternatively it can be used in the design of low-phase-noise oscillators by using desired (rather than measured) phase-noise values in the objective function to be minimized.

Abstracts

Simple Noise Analysis Applied to Power Combiners

A.S. Morris and R.J. Trew. "Simple Noise Analysis Applied to Power Combiners." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1273-1275.

The advent of ultra-low-noise amplification has shifted the emphasis of low-noise design towards passive circuitry. This paper derives simple expressions for the noise parameters for a passive two-port in terms of the scattering matrix and applies them to the problem of design of power combining circuits. Simple guidelines for low-noise combiner design are presented.

Abstracts

Session OO -- Nonlinear CAD

"Session OO -- Nonlinear CAD." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1277-1277.

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Choosing an Optimum Large Signal Model for GaAs MESFETs and HEMTs

M. Miller, M. Golio, B. Beckwith, E. Arnold, D. Halchin, S. Ageno and S. Dorn. "Choosing an Optimum Large Signal Model for GaAs MESFETs and HEMTs." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1279-1282.

Seven large signal MESFET models and three newly developed HEMT models have been compared, providing the microwave circuit designer with a practical benchmark. The error for each model is quantified and minimized using a modified Newton's method with the restricted step technique of Levenberg and Marquardt. This minimum obtainable error is used as a basis for comparing the models. The validity of this approach is confirmed by comparing predicted to measured large-signal performance made on a Triquint 0.5 µm gate length MESFET. The model comparison tool has also been utilized to develop a general approach to large signal HEMT modeling for circuit simulation applications. A 0.7 µm gate length pseudomorphic HEMT device was used for this portion of the study.

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A New and Efficient Approach to the Analysis and Design of GaAs MESFET Microwave Oscillators

K.K.M. Cheng and J.K.A. Everard. "A New and Efficient Approach to the Analysis and Design of GaAs MESFET Microwave Oscillators." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1283-1286.

A new technique for the analysis and design of oscillators is presented. The solution is based on Volterra series and the resulting nonlinear system is solved by an efficient algorithm. The novel feature here is the way in which the oscillator circuit is decomposed so that the determination of the nonlinear kernels can be evaluated much more easily. This method is fast, requires no initial guess, has good convergence properties and can be implemented on a computer in a straightforward manner. Measurements performed on a microwave GaAs oscillator show close agreement with the predicted results.

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A General Program for Steady State, Stability, and FM Noise Analysis of Microwave Oscillators

J.M. Paillot, J.C. Nallatamby, M. Hessane, R. Quere, M. Prigent and J. Rousset. "A General Program for Steady State, Stability, and FM Noise Analysis of Microwave Oscillators." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1287-1290.

This paper presents two new algorithms for nonlinear autonomous circuits CAD. In the first, a symbolic simulator is used to calculate the possible oscillations frequencies of the circuit, then the high level behaviour of the oscillator is determined by the harmonic balance method extended to autonomous circuits. The second algorithm is based on the conversion matrix method, which allows simulation of nonlinear microwave oscillators phase and amplitude noise spectra with linear and nonlinear correlated noise sources.

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Modeling MESFETs for Intermodulation Analysis of Mixers and Amplifiers (1990 Vol. III [MWSYM])

S.A. Maas and D. Neilson. "Modeling MESFETs for Intermodulation Analysis of Mixers and Amplifiers (1990 Vol. III [MWSYM])." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1291-1294.

This paper examines the problem of modeling GaAs MESFETs for calculations of intermodulation and spurious responses. We show that an adequate model must express not only the absolute I/V characteristics of the device, but also the derivatives of those characteristics. Finally, we propose a large-signal FET model that models those derivatives more realistically than do existing models.

Abstracts

The Exploitation of Sparse-Matrix Techniques in Conjunction with the Piecewise Harmonic-Balance Method for Nonlinear Microwave Circuit Analysis

V. Rizzoli, F. Mastri, F. Sgallari and V. Frontini. "The Exploitation of Sparse-Matrix Techniques in Conjunction with the Piecewise Harmonic-Balance Method for Nonlinear Microwave Circuit Analysis." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1295-1298.

The paper describes a novel sparse-matrix approach to the simulation of nonlinear microwave circuits by the Newton-iteration-based piecewise harmonic-balance technique. Selected elements of the Jacobian matrix are set to zero according to some physical criterion, which leads to a sparse Jacobian with a preselected the pattern of nonzeros. This allows the use of specialized sparse-matrix solvers, with an effective optimization of both memory storage and CPU time. The code has been developed in both a scalar and a vectorized version optimized for the Cray Y-MP supercomputer.

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Session PP -- Submillimeter and Wave Techniques Devices

"Session PP -- Submillimeter and Wave Techniques Devices." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1299-1299.

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Abstracts

High Efficiency Submillimeter Frequency Multipliers

N. Erickson. "High Efficiency Submillimeter Frequency Multipliers." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1301-1304.

Solid state sources have been developed for 330 and 500 GHz using cascaded varactor multipliers driven by a Gunn oscillator. The 330 GHz source uses a cascade of two balanced doublers achieving very high efficiency, and produces an output of 4mW. The 500 GHz source uses a cascade of a balanced doubler and single diode tripler and produces 0.7 mW.

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A Micron-Thickness, Planar Schottky Diode Chip for Terahertz Applications with Theoretical Minimum Parasitic Capacitance

W.L. Bishop, E.R. Meiburg, R.J. Mattauch, T.W. Crowe and L. Poll. "A Micron-Thickness, Planar Schottky Diode Chip for Terahertz Applications with Theoretical Minimum Parasitic Capacitance." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1305-1308.

The design and fabrication of a novel planar Schottky diode with greatly reduced shunt capacitance for millimeter and submillimeter wave applications is described. The dominant pad-to-pad shunt capacitance is minimized by replacing the substrate GaAs with a low-dielectric substitute. This replacement substrate can be easily removed by the user after the device is soldered into the mixer circuit. This will yield minimum possible pad-to-pad shunt capacitance.

Abstracts

Far-Infrared Composite Microbolometers

S.M. Wentworth and D.P. Neikirk. "Far-Infrared Composite Microbolometers." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1309-1310.

Composite microbolometers for use as broad band far-infrared radiation detectors have been constructed. These novel devices utilize nichrome load elements which can be impedance-matched to a planar antenna. The load elements are thermally coupled to tellurium detectors. We achieved room temperature responsivities of 120 V/W, and noise equivalent powers of 6.7 x 10/sup -9/ W//spl radic/Hz.

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A Technique for Fabricating Free Standing Electrically Thick Metallic Mesh and Parallel Wire Grids for Use as Submillimeter Wavelength Filters and Polarizers

P.H. Siegel and J.A. Lichtenberger. "A Technique for Fabricating Free Standing Electrically Thick Metallic Mesh and Parallel Wire Grids for Use as Submillimeter Wavelength Filters and Polarizers." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1311-1314.

The electrically thick dichroic plate has been used widely as a frequency selective surface at infrared wavelengths since the early 1960's. At these high frequencies plates formed of metal mesh with a thickness and mesh size in the range of several microns can make excellent high pass filters. These dimensions are compatible with standard optical photolithographic processing techniques and the resulting filters can be either free standing or dielectrically backed.

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A Wideband Monolithic Submillimeter-Wave Quasi-Optical Power Meter

C.C. Ling and G.M. Rebeiz. "A Wideband Monolithic Submillimeter-Wave Quasi-Optical Power Meter." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1315-1318.

A novel monolithic power meter has been developed for submillimeter-wave applications (100GHz to 10THz). The detector is a 4x4 mm Bismuth bolometer integrated on a 1.2 µm thick dielectric membrane. This approach results in a wideband high-responsivity detector. The power meter is simple to fabricate, inexpensive, and can be easily calibrated using a low-frequency network. Quasi-optical measurements at 185GHz show that the bolometer is polarization independent, acts as a lambertian surface, and could be modelled by a simple transmission line model. The measured low-frequency responsivity for a 70Omega bolometer, at a bias of 1V. and a video modulation of 300Hz, is around 1V/W. The NEP of the detector is around 3nWHz/sup -1/2/. Potential application areas are antenna coupling efficiency measurements and absolute power measurements at submillimeter wavelengths.

Abstracts

Session QQ -- High Power Devices

"Session QQ -- High Power Devices." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1319-1319.

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The Reverse Bias Requirement for PIN Diodes in High Power Switches and Phase Shifters

G. Hiller and R.H. Caverly. "The Reverse Bias Requirement for PIN Diodes in High Power Switches and Phase Shifters." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1321-1324.

A key design and cost parameter in a high power PIN diode application is the selection of the applied DC reverse bias voltage. Up to now, this voltage has been chosen either by conservatively using the magnitude of the peak RF voltage or by empirical trials to determine a possible lower value. This paper explores the reverse bias requirement for a PIN diode operating in a high power RF and microwave environment. It demonstrates that the minimum reverse bias voltage is equivalent to the PIN diode's self generated DC voltage under similar RF conditions. An expression for this voltage was developed and experimentally verified that will assist the design engineer in more accurately selecting an appropriate minimum value for the applied reverse bias voltage setting.

Abstracts

Thermal Considerations in High Average Power Microwave PIN Diode Switches

J.C. Hill and H.S. Maddix. "Thermal Considerations in High Average Power Microwave PIN Diode Switches." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1325-1328.

The temperature sensitivity of PIN diode chip parameters responsible for the absorption and removal of heat in high average power switches is discussed. The absorption of heat is controlled by the temperature sensitive forward and reverse bias resistances. The removal of heat is dominated by the variation in thermal impedance as a function of temperature. These variables combine in high power PIN diode switches to produce a phenomenon commonly called thermal runaway. Using an empirical relationship derived from the data presented, a nonlinear model for temperature rise as a function of input power is generated. Reasonable correspondence between the empirical model and measured junction temperature was observed using a 1 KW CW SPDT waveguide switch. Part of this work was performed as part of an Air Force contract.

Abstracts

High Power Four - Way Power Divider/Combiner

K. Chang, M. Li, K.A. Hummer and R.A. Speciale. "High Power Four - Way Power Divider/Combiner." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1329-1332.

A new 4-way waveguide power divider/combiner has been developed using a radial waveguide. The divider has an insertion loss of less than 0.5 dB and a power balance of ± 0.2 dB over a bandwidth of 2.5 GHz at X-band. A power combiner using this circuit and four Gunn oscillators has been demonstrated with over 70 percent combining efficiency. The circuit should have applications in millimeter-wave power combining and high power microwave systems.

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High CW Power with Multi-Octave Bandwidth from Power-Combined Mini-TWTs

R. Mallavarpu and M.P. Puri. "High CW Power with Multi-Octave Bandwidth from Power-Combined Mini-TWTs." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1333-1336.

Several mini-TWTs were recently power-combined in the band 2.0 to 8.0 GHz to achieve 250 W of CW power at better than 90 percent combining efficiency. Graceful degradation was demonstrated by successively turning off each of the TWTs, The combining device, known as the spatial field power combiner, is especially suited for high average power applications. This approach has the potential for achieving CW powers in excess of 1 kW over multi-octave frequency bands up to 20 GHz. This paper focuses on a four-way combiner and discusses the results obtained in combining mini-TWTs.

Abstracts

A 12.5 GHz-Band 50W Solid-State Power Amplifier for Future Broadcasting Satellites

H. Mizuno, H. Mitsumoto and N. Yazawa. "A 12.5 GHz-Band 50W Solid-State Power Amplifier for Future Broadcasting Satellites." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1337-1340.

We designed and fabricated a 50W solid-state power amplifier (SSPA) utilizing a cylindrical cavity type power combiner with low-insertion loss and a corporate type power divider. The isolation between the input ports of the combiner is studied, The output power of the SSPA is more than 50W over a bandwidth of 12.625±0.125GHz, its efficiency is more than 21.6% including electronic power conditioners (EPCs) (more than 26% excluding the EPCs). The gain is more than 37dB. A thermal vacuum test was put into operation, resulting in satisfactory performance.

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Late Papers (1990 Vol. III [MWSYM])

"Late Papers (1990 Vol. III [MWSYM])." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1341-1341.

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Optical Control of Phased Array Antennas: A European Perspective (Late Paper)

A.J. Seeds, W.I. McMillan, C.R. Pescod, M.J. Wale and W.S. Birkmayer. "Optical Control of Phased Array Antennas: A European Perspective (Late Paper)." 1990 MTT-S International Microwave Symposium Digest 90.3 (1990 Vol. III [MWSYM]): 1343-1346.

The savings in mass and bulk in phased array antennas resulting from the replacement of microwave element feeds with optical fibre feeds are now widely recognised. However, the technological difficulties in implementing such systems are only now beginning to be addressed. In this paper we review current European work on optical feeds, ranging from systems demonstrator work on optical signal distribution networks to research studies on phased array beam formers using coherent optical techniques.

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Committees, Awards, Distinguished Lecturers, MIT Radiation Laboratory, Historical Exhibit, Panel Sessions, Workshops, Technical Program (1991 Vol. I [MWSYM])

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Abstracts

Commercial GaAs MMIC Applications (1991 Vol. I [MWSYM])

R. Rosenzweig. "Commercial GaAs MMIC Applications (1991 Vol. I [MWSYM])." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 71-72.

The future of the GaAs MMIC commercial sector. There industry is in the is a cornucopia of high volume applications, such as DBS cellular telephone, PCM, fiber optics and GPS that are targets for cost effective GaAs MMIC solutions. The key to success is the ability to produce functional circuits in high volume at low cost. To be successful takes a shift in emphasis from low volume, high selling price "jewelry" applications, to the rigors and discipline of high volume manufacture.

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Abstracts

A 2 GHz Enhancement Mode GaAs Down for Satellite TV Tuner Converter IC

P. Philippe and M. Pevtus. "A 2 GHz Enhancement Mode GaAs Down for Satellite TV Tuner Converter IC." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 73-76.

A fully integrated 2 GHz down-converter IC has been designed and fabricated for satellite TV application using an enhancement mode GaAs foundry process. Its internal oscillator covers a 1.2 GHz bandwidth that allows to receive the extended satellite TV band from 950 MHz to 2 GHz. The LO power leakage is greatly reduced as compared to a discrete circuit: it is about -40 dBm at the RF input and less than -30 dBm at the IF output. This IC operates under a single 5 V supply voltage and its performance is an outstanding trade-off between noise, linearity, power consumption and simplicity of implementation. It is encapsulated in a standard low cost plastic package and is already available for sampling.

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X-Band MMIC Amplifier with Pulse-Doped GaAs MESFETs (1991 Vol. I [MWSYM])

N. Shiga, S. Nakajima, K. Otobe, T. Sekiguchi, N. Kuwata, K.-I. Matsuzaki and H. Hayashi. "X-Band MMIC Amplifier with Pulse-Doped GaAs MESFETs (1991 Vol. I [MWSYM])." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 77-80.

An X-band monolithic low noise amplifier (LNA) with 0.5µm-gate pulse-doped GaAs MESFETs was successfully demonstrated for a direct broadcast satellite (DBS) converter. This LNA shows excellent VSWR matches of under 1.4 as well as a noise figure of 1.67dB and a gain of 24dB at 12GHz. The yield of chips within microwave specifications is 62.5%.

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A New Planar Double-Double Balanced MMIC Mixer Structure (1991 Vol. I [MWSYM])

J. Eisenberg, J. Panelli and W. Ou. "A New Planar Double-Double Balanced MMIC Mixer Structure (1991 Vol. I [MWSYM])." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 81-84.

Coplanar waveguides, slot lines and coplanar strips are combined to realize a MMIC double-double balanced mixer (DDBM) in which ail circuitry is on the top side of the substrate and no via holes are required. The DDBM exhibits RF, LO, and IF bandwidths of 6-20 GHz, 8-18 GHz and 2-7 GHz respectively with conversion loss ranging between 6.2 and 9.8 dB, and RF to IF, LO to IF and LO to RF isolations all greater than 20 dB. The mixer was designed analytically using the harmonic balance method to assess key performance parameters. It is believed to be the first planar diode MMIC DDBM to be reported.

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Session B -- Non Linear Modeling and Analysis

"Session B -- Non Linear Modeling and Analysis." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 85-85.

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Statistical Modeling of GaAs MESFETs

J.W. Bandler, R.M. Biernacki, S.H. Chen, J. Song, S. Ye and Q.J. Zhang. "Statistical Modeling of GaAs MESFETs." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 87-90.

This paper contrasts the statistical extraction of GaAs MESFET equivalent circuit model parameters and physical model parameters from wafer measurements. We observe that the Materka and Kacprzak model based on equivalent circuit parameters provides a better match for individual devices, but the Ladbrooke model based on physical parameters provides a better estimate of device statistics.

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Intermodulation in Heterojunction Bipolar Transistors

S.A. Maas, B. Nelson and D. Tait. "Intermodulation in Heterojunction Bipolar Transistors." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 91-93.

This paper examines the modeling of small-signal intermodulation distortion (IM) in heterojunction bipolar transistors (HBTs). We show that IM current generated in the exponential junction is partially cancelled by IM current generated in the junction capacitance, and that this phenomenon is largely responsible for the unusually good IM performance of these devices, Finally we propose a nonlinear IHBT model suitable for IM calculations, show how to measure its parameters, and verify its accuracy experimentally.

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Accurate Nonlinear Transistor Modeling Using Pulsed S Parameters Measurements Under Pulsed Bias Conditions

J.F. Vidalou, J.F. Grossier, M. Chaumas, M. Camiade, P. Roux and J. Oregon. "Accurate Nonlinear Transistor Modeling Using Pulsed S Parameters Measurements Under Pulsed Bias Conditions." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 95-98.

Accurate design of non-linear MICs and MMICs needs accurate modeling of transistors. Two methods are available today, which suffer from several drawbacks: In the first method, S parameters are measured at different DC bias points and a small signal model is extracted with elements depending on bias variables. This method ignores temperature effects due to DC dissipation and cannot be applied to high power transistors. Moreover, it does not allow measurements near the breakdown region. In the second method, the non-linear current sources are extracted from pulsed measurements, and the linear elements from S parameters. However, this method does not allow accurate extraction of the differential elements (such as gm and gd for a FET), moreover this elements cannot be extracted in the pinched region where the pulsed drain current is zero. To overpass all the former drawbacks a new method is proposed which has been applied to FETs modeling: The device is characterized by pulsed S parameters measurements under pulsed bias voltages, in the whole plane of Vgs, Vds, including the breakdown and pinched regions. The resulting transistor model is accurate for all classes of operation: A, AB, B, C; the method may be applied to very high power bipolar transistors used in pulsed class C-radars.

Abstracts

An Accurate HEMT Large Signal Model Usable in SPICE Simulators

J. Staudinger, M. Miller, M. Golio, B. Beckwith and D. Halchin. "An Accurate HEMT Large Signal Model Usable in SPICE Simulators." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 99-102.

An empirical large signal model which describes HEMT characteristics has been developed, implemented and compared to measured performance. When compared to existing MESFET models, better accuracy is obtained in predicting HEMT transconductance. The validity of the model has been examined by comparing harmonic content predicted by SPICE to measured results.

Abstracts

Voltage-Frequency Update for Nonlinear Analysis of Free-Running and Injection-Locked Multiple Device Oscillators

H.D. Foltz, J.H. Davis and T. Itoh. "Voltage-Frequency Update for Nonlinear Analysis of Free-Running and Injection-Locked Multiple Device Oscillators." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 103-106.

The standard voltage update algorithm is modified for use in oscillator problems in which the frequency may be unknown and the embedding circuit is a high-impedance resonant circuit. The method is then applied to large-signal steady-state analysis of strongly coupled power combining oscillator circuits under free-running and externally injection-locked conditions. Tunability, power output, locking, and sensitivity to device parameters are examined.

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Harmonic-Balance Analysis of Multitone Autonomous Nonlinear Microwave Circuits

V. Rizzoli and A. Neri. "Harmonic-Balance Analysis of Multitone Autonomous Nonlinear Microwave Circuits." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 107-110.

The paper introduces a Newton-iteration based algorithm for the harmonic-balance analysis of autonomous microwave circuits operating in quasi-periodic conditions. The autonomy concept for quasi-periodic regimes is first discussed in detail, and a solution strategy of the harmonic-balance equations based on a mixed-mode Newton iteration is outlined. A method for the exact computation of the Jacobian matrix, including the exact derivatives with respect to the unknown fundamental frequencies, is presented, Finally, the excellent numerical performance of the new simulation tool is demonstrated by the analysis of a DR-tuned self-oscillating mixer.

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Session C -- MIT Radiation Laboratory (Special Session)

"Session C -- MIT Radiation Laboratory (Special Session)." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 111-111.

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Abstracts

Recollections on Microwave Theory

N. Marcuvitz. "Recollections on Microwave Theory." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 113-114.

The following is a somewhat personal retrospective and anecdotal recollection of just a small part of MIT Radiation Laboratory World War 2 activities, namely that facet which contributed to the development of the theory of the ropagation of microwaves in waveguides. In 1941 had been doing graduate work with my advisor Dr. Ernst Weber at the Bklyn Polytechnic Institute on some perplexing aspects of the Sommerfeld problem of electromagnetic propagation over the earth. One Saturday shortly after Pearl Harbor, F. W. Loomis and I. Rabi visited the Polytechnic to inspect Dr. Weber's laboratory and to discuss the possibility of a cooperative program between the Rad Lab program and Poly; on Sunday with only a few clothes I was on a train heading for Cambridge and the Radiation laboratory. On Monday I was sent to Ed Purcell's group and he soon assigned me the task of understanding the effects of discontinuities in waveguides. This was then a minor effort of the group members who were concerned with understanding and designing 3 cm systems using magnetron sources, TR boxes, waveguide structures, and parabolic antennas. Many who worked in Purcell's group stayed for a short time to become familiar with microwave techniques and then passed on to groups more directly concerned with real radar systems.

Abstracts

Microwave Systems - Then and Now - Examples at the 50th Reunion of the M.I.T. Radiation Laboratory (1991 Vol. I [MWSYM])

I.A. Getting. "Microwave Systems - Then and Now - Examples at the 50th Reunion of the M.I.T. Radiation Laboratory (1991 Vol. I [MWSYM])." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 115-115.

The delivery by the British in 1940 of a cavity magnetron operating at S-band (10cm) sparked an intensive effort in the US in response to three urgent war-time system requests. The MIT Radiation Laboratory was established by NDRC; and from this sprang an intense and successful program in microwave components and systems. Because of space restraints, this paper briefly describes the successes attained in two of the three projects; "firecontrol" and "navigation". The paper then skips to the current situation, the impact of advances in technology, both in the microwave field and in complementary fields essential to the design of modern "microwave systems". Three examples are briefly reviewed: the Army Patriot, the Navy Aegis and the AF Navstar or GPS navigation system.

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Abstracts

Microwave Components

R.V. Pound. "Microwave Components." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 117-120.

This paper describes the development of some of the microwave components by the R-f Group at the Radiation Laboratory MIT. The examples are drawn mainly from the author's limited experience. Among them are the intro-duction of "broad-banding" and "preplumbing," the problem of crystal burnout, the design of crystal mixers, and devices using the Magic-Tee. Among latter were the frequency stabilization of klystrons and a related proposal for a narrow band duplex microwave communication system. With the war's successful conclusion, much of the experience was carried over into fundamental research, with microwave spectroscopy, radio astronomy, and nuclear and electronic magnetic resonance as relatively direct beneficiaries.

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Session D -- Student Papers Competition I (Special Session)

"Session D -- Student Papers Competition I (Special Session)." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 121-121.

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Maximum Efficiency Tuning of Microwave Amplifiers

L.C. Hall and R.J. Trew. "Maximum Efficiency Tuning of Microwave Amplifiers." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 123-126.

Maximum efficiency tuning conditions for a microwave power amplifier are determined by a statistical impedance matching method. A physics-based MESFET simulator is used to predict optimum device performance. Sensitivity of efficiency to variations in source harmonic impedance matching is described and shown to be significant.

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Large-Signal Modeling and Study of Power Saturation Mechanisms in Heterojunction Bipolar Transistors

M.Y. Frankel and D. Pavlidis. "Large-Signal Modeling and Study of Power Saturation Mechanisms in Heterojunction Bipolar Transistors." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 127-130.

A harmonic balance based large-signal model of the heterojunction bipolar transistor suitable for microwave circuit design and simulation has been developed. The excellent agreement between modeled and measured power characteristics, including the saturation behavior, validates its accuracy. The model has been used to investigate the device power saturation mechanisms.

Abstracts

Submicron Gate Indium Gallium Arsenide Microwave Power Transistors

G.A. Johnson and V.J. Kapoor. "Submicron Gate Indium Gallium Arsenide Microwave Power Transistors." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 131-133.

Depletion mode InGaAs microwave power MISFETS with 0.7 µm gate lengths and 0.2 mm gate widths have been fabricated using an epitaxial process. The devices employed a plasma deposited silicon dioxide gate insulator. The rf power performance at 18 GHz is presented. An output power density of 0.92 W/mm with a corresponding power gain and power- added efficiency of 3.2 dB and 29%, respectively, was obtained. This is the highest output power density obtained for an InGaAs based transistor on InP at K-band.

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Analysis of Microstrip Structures on and near Dielectric Ridges Using an Integral Equation-Mode Matching Technique

A.G. Engel, Jr. and L.P.B. Katehi. "Analysis of Microstrip Structures on and near Dielectric Ridges Using an Integral Equation-Mode Matching Technique." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 135-138.

A full-wave technique which uniquely synthesizes well-known integral equation and mode-matching methods is shown to be applicable to the study of propagation in microstrip structures which are on and near dielectric ridges. Coupled microstrips on dielectric ridges and a microstrip near a chip edge are examined to demonstrate the accuracy and utility of this method.

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Full-Wave Analysis of Aperture Coupled Microstriplines

N. Herscovici and D.M. Pozar. "Full-Wave Analysis of Aperture Coupled Microstriplines." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 139-142.

Two methods are presented for the analysis of aperture coupled microstrip lines. Assuming a quasi-TEM traveling wave incident on the feeding line, an expression for the wave on the coupled line is derived. First the moment method is used and the current on the coupled line is represented by a traveling wave propagating away from the slot. In the second method, coupled and the results the reciprocity theorem is applied to the line. An equivalent circuit is derived S parameters are computed. Theoretical are verified with measurements.

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Resonant Frequencies of Higher Order Modes in Cylindrical Anisotropic Dielectric Resonators (1991 Vol. I [MWSYM])

M.E. Tobar and A.G. Mann. "Resonant Frequencies of Higher Order Modes in Cylindrical Anisotropic Dielectric Resonators (1991 Vol. I [MWSYM])." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 143-146.

An improved method is developed which allows the determination of mode frequencies to high accuracy in cylindrical anisotropic dielectric resonators. This is an extension of Garault and Guillon's method from isotropic to anisotropic dielectrics, applied to four different classes of field patterns. Application to high Q sapphire crystal resonators is discussed.

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Session OF-I -- Open Forum I

"Session OF-I -- Open Forum I." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 147-147.

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How to Model Intermodulation Distortion

S.A. Maas. "How to Model Intermodulation Distortion." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 149-151.

This paper examines the problem of calculating intermodulation levels and mixer spurious responses in nonlinear microwave circuits. We examine the effects of device models analytical methods, dynamic range, and linear elements cm accuracy. We also describe ways to obtain accurate analyses af these phenomena using available harmonic-balance and Volterra-series circuit simulators.

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Experimental 9 GBit/S Transmitter and Receiver for Optical Transmission Systems

G. Hanke. "Experimental 9 GBit/S Transmitter and Receiver for Optical Transmission Systems." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 153-156.

In the trunk network of Deutsche Bundespost Telekom (DBP) optical transmission systems working at 2.4 Gbit/s have been implemented last year. This bitrate could be processed with commercial monolithic integrated GaAs-circuits. For higher bitrates, such as 4.5 Gbit/s or even 9 Gbit/s, monohthic integrated Si-ICs must be applied at the time being. In this paper it is shown that with only a few different types of special Si-ICs all the components for transmission systems working at bitrates of up to 10 Gbit/s can be built up using a sophisticated circuitry.

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A Millimeter-Wave Integrated-Circuit Antenna Based on the Fresnel Zone Plate

M.A. Gouker and G.S. Smith. "A Millimeter-Wave Integrated-Circuit Antenna Based on the Fresnel Zone Plate." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 157-160.

A new type of millimeter-wave integrated-circuit antenna is investigated. The antenna is based on a quasi-optical design, with a Fresnel zone plate on one side of a dielectric substrate and a resonant strip dipole antenna at the focus of the zone plate on the opposite side of the substrate, Figure 1. The unique feature of this design is that all of the components are made using simple IC fabrication techniques: simple metal depositions on dielectric layers. Another unusual feature of this design is the short focal length of the zone plate; the f/d of the zone plate ranges from 0.1 to 0.5.

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Current Distribution in Superconducting Strip Transmission Lines

D.M. Sheen, S.M. Ali, D.E. Oates, R.S. Withers and J.A. Kong. "Current Distribution in Superconducting Strip Transmission Lines." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 161-164.

A method for the calculation of the current distribution, resistance, and inductance for superconducting strip transmission lines is presented. These calculations allow accurate characterization of both high-T/sub c/ and low-T/sub c/ superconducting strip transmission lines. For a stripline geometry the current distribution, resistance, and inductance are calculated as a function of the penetration depth for various film thicknesses. These calculations are then used to determine the penetration depth for a Y Ba/sub 2/ Cu/sub 3/O/sub 7-X/ superconducting thin film from the measured temperature dependence of the resonant frequency of a stripline resonator. The power dependence of the YBa/sub 2/Cu/sub 3/O/sub 7-X/ surface resistance is shown plotted against the RF magnetic field which is determined from the calculated current distribution.

Abstracts

10 GHz High Temperature Superconductor Phase Shifter

C.M. Jackson and D.J. Durand. "10 GHz High Temperature Superconductor Phase Shifter." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 165-168.

An HTS phase shifter with a single SQUID device has been developed and tested at 10 GHz. Circuit parameters have been determined, and the performance has been modeled. This HTS single-SQUID phase shifter is the first step toward a multiple device circuit with broadband true-time delay phase shifter performance.

Abstracts

A New Method for On-Wafer High Frequency Noise Measurement of FET's

G. Dambrine, A. Cappy and E. Delos. "A New Method for On-Wafer High Frequency Noise Measurement of FET's." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 169-172.

A new method for determining the equivalent noise resistance Rn and the magnitude of the optimum generator admittance |Yopt| is described. This method is based on the fact that the real part of the correlation admittance can be neglected. A new method for determining the other noise parameters Gamma opt and Fmin without automatic input tuner is then proposed.

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Characterization of Diodes in a Coaxial Measurement System

M.B. Steer and R.G. Hicks. "Characterization of Diodes in a Coaxial Measurement System." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 173-176.

A method is reported for experimentally characterizing packaged microwave diodes with respect to their outer cylindrical surface. The diode is mounted coaxial with the center conductor of a coaxial line and radial transmission line theory is used to determine the impedance of dummy diode packages used in calibration. The diode equivalent circuit thus developed is suited to the modeling of a diode mounted in a post-in-waveguide mount, Experimental characterization of a varactor diode and of a mixer diode are reported.

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High-Power Second-Harmonic Gyrotron Oscillator

I.P. Spassovsky, N.A. Nikolov, K.G. Kostov, V.A. Spassov and I.G. Yovchev. "High-Power Second-Harmonic Gyrotron Oscillator." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 177-180.

This paper reports on experimental results from study of nonadiabatic pumped second-harmonic gyrotron oscillator. A steady second-harmonic cavity emission has been observed at 28 GHz and waveguide mode TE/sub 2/. A peak power of ~ 25MW has been reached with ~ 9 percent efficiency. Magnetic field in region is modeled pumping is simulated.

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An Accurate, Field Matching Analysis of Waveguides of Complex Cross-Sectional Geometry Loaded with Magnetized Ferrite Rods

M. Okoniewski and J. Mazur. "An Accurate, Field Matching Analysis of Waveguides of Complex Cross-Sectional Geometry Loaded with Magnetized Ferrite Rods." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 181-184.

In this contribution we present developments to our technique of analysis of complex waveguides. We may now analyze waveguides having complicated cross-sectional geometry and comprising circularly--cylindrical ferrite-dielectric rods magnetized in a longitudinal direction. This class of waveguides includes rectangular waveguides loaded with ferrite rods, which have not, to the best knowledge of authors, been rigorously analyzed yet, despite their wide spread usage in devices. We also present experimental data validating our theory, and examples of potentially useful structures which can be treated by our method (e.g. ferrite loaded waveguides of crossed-rectangular and finned - circular cross sections). The inner products encountered in the method are computed via FFT which resulted in 3-fold increase of computational speed and 2-fold reduction of computer storage.

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Abstracts

An Efficient Technique for the Time Domain Analysis of Multi-Conductor Transmission Lines Using the Hilbert Transform

T.R. Arabi, A.T. Murphy and T.K. Sarkar. "An Efficient Technique for the Time Domain Analysis of Multi-Conductor Transmission Lines Using the Hilbert Transform." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 185-188.

Most models that appeared in the literature for the transient time domain analysis of lossy multi-conductor, multi-dielectric transmission line systems are non causal and fail to accurately predict the pulse distortion resulting from the losses in a multi-conductor transmission line for very fast digital signals. The reason has been found in the modeling of the frequency dependent material characteristics, particularly the complex dielectric constant epsilon(omega). In this paper, a causal model, based on the Hilbert Transform, is presented.

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Ceramic Dry-Phantom and its Application to SAR Estimation

T. Nojima, T. Kobayashi, K. Yamada and S. Uebayashi. "Ceramic Dry-Phantom and its Application to SAR Estimation." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 189-192.

A dry-phantom material having the same microwave properties as biological tissues is developed. The new phantom composed of ceramics has overcome various problems incidental to the conventional jelly-phantom. Experiments are performed to estimate specific energy absorption rates of human heads exposed to microwave sources by using the thermography method.

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Abstracts

Modeling and Performance of a Sub-Nanosecond High Isolation DC-18 GHz Monolithic SPST with Driver

A. Mallet-Guy, D. Ariel, J.L. LaCombe, D. Levy, P. Marsot and T. Thibout. "Modeling and Performance of a Sub-Nanosecond High Isolation DC-18 GHz Monolithic SPST with Driver." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 193-196.

The design, computed performance using linear and non linear modeling and experimental results of a DC-18 GHz high-isolation ultra-fast monolithic SPST switch with driver are presented. A non linear modeling of the SPST and of the driver was carried out in order to predict the switching time of the overall circuit. The monolithic SPST design uses GaAs FETs and the driver uses GaAs devices in order to reach a very short switching time. Insertion loss less than 2.4 dB, a typical isolation of 50 dB and a switching time less tlhan 1 ns, driver included, were obtained. The validity of the non linear-models used were demonstrated by the good agreement obtained between the simulated and the measured performance.

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Abstracts

An Experimental Low Power Rectenna Density

W.C. Brown. "An Experimental Low Power Rectenna Density." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 197-200.

The paper describes the design and performance of a 2.45 GHz rectenna that absorbs small amounts (milliwatts) of microwave power at incident power density levels that are 10,000 times lower than those normally used, and then, after a microwave impedance step up of 50, converts it into DC power at useful voltage levels. Several useful applications are discussed.

Abstracts

Statistical Interpolation of FET Data Base Measurements

L. Campbell, J. Purviance and C. Potratz. "Statistical Interpolation of FET Data Base Measurements." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 201-204.

This work is the result of research into valid and compact statistical FET models. This paper presents a statistical interpolation technique which extends the Truth Model proposed by Purviance and Meehan in [6]. The Truth Model proposes to simply use samples from a FET measurement data base when performing statistical analysis and design of circuits. The statistical interpolation technique presented here multiplies the number of points within a statistical data base by interpolating among the measurements in a statistically valid manner. It lends itself easily to software implementation, and gives results better than other simulation models now available. We have developed and validated the statistical interpolation technique using 179 Galium Arsenide FETs supplied by TriQuint Semiconductor Inc.. We show that the marginal statistics and the correlation matrix are preserved for the simulated samples.

Abstracts

Eleven Octave MMIC Based Stimulus Module for Lightweight Systems

D.P. Glynn, Ill, T.O. Perkins and Ill. "Eleven Octave MMIC Based Stimulus Module for Lightweight Systems." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 205-208.

A compact RF and microwave stimulus module for broadband applications has been developed. The module covers a frequency bandwidth of 1800:1, slightly less than 11 octaves. The unit exhibits excellent rejection of unwanted signals, while providing leveled power output, automatic gain control, amplitude and square-wave modulation, and self-test features. This lightweight integrated multi-function package is efficient, reliable, and reproducible.

Abstracts

18-40 GHz 13 dBm Low Noise GaAs FET YIG Tuned Oscillator

A.P.S. Khanna and J. Hauptman. "18-40 GHz 13 dBm Low Noise GaAs FET YIG Tuned Oscillator." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 209-212.

A fundamental YIG-tuned oscillator has been devel-oped using a submicron GaAs FET to cover 18 to 40 GHz. Power output of +13 dBm and phase noise of better than -100 dBc/Hz at 100 kHz from the carrier has been achieved. The approach used to design the oscillator circuit and the magnet for the oscillator will be discussed and test data will be presented.

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A Planar Wideband Millimeter-Wave Subharmonic Receiver

B.K. Kormanyos, C.C. Ling, G.M. Rebeiz, P.H. Ostdiek, W.L. Bishop and T.W. Crowe. "A Planar Wideband Millimeter-Wave Subharmonic Receiver." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 213-216.

A wideband planar subharmonic mixer has been designed for millimeter-wave operation. The receiver consists of a back-to-back Schottky-diode pair integrated at the base of a wideband log-periodic antenna. The antenna is backed by a hyperhemispherical lens and tested at 178.5GHz with a 90GHz local oscillator. The results indicate a single-sideband conversion-loss of -12.8dB without any RF or IF matching networks. The subharmonic monolithic approach results in an inexpensive wideband receiver and the design can be easily extended to receiver arrays.

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Dispersive Properties of Grounded Slotlines and Edge Coupled Microstrip Lines on Biaxial Substrates

T.Q. Ho and B. Beker. "Dispersive Properties of Grounded Slotlines and Edge Coupled Microstrip Lines on Biaxial Substrates." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 217-220.

The spectral domain analysis is applied to study the propagation characteristics of grounded slotlines and edge coupled mlcrostrip lines on biaxial substrates. The formulation derives an expression for the Green's function which is valid for substrates simultaneously specified by both their permittivity and permeability tensors. The behavior of the normalized wavelength, index of refraction, and propagation constant are examined in detail with respect to different line width/substrate thickness ratios as well as the material parameters. Some of the numerically calculated data describing propagation characteristics of these structures are presented here for the first time.

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Dispersion Analysis of Square Pulse with Finite Rise Time in Single, Tapered and Coupled Microstrip Lines

P. Pramanick and R.R. Mansour. "Dispersion Analysis of Square Pulse with Finite Rise Time in Single, Tapered and Coupled Microstrip Lines." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 221-224.

Distortion of an electrical pulse, with finite rise time (quadratic-linear-quadratic transition) caused by dispersion as it propagates along a uniform microstrip a tapered microstrip and a coupled pair of microstrips is investigated. Closed form analysis equations for single and coupled microstrips and an algorithm for numerical quadrature technique for evaluation of inverse Fourier transform have been used. The results will be useful in the time domain analysis of many circuit components where such microstrips are used.

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An 18-40 GHz Phase Locked Downconverter Subsystem

A. Stajcer. "An 18-40 GHz Phase Locked Downconverter Subsystem." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 225-228.

A high performance frequency conversion module (FCM) has been developed for ground based EW system applications. The FCM unit is built using integrated finline and hybrid MIC techniques to achieve a low noise high performance millimetre-wave front-end without the use of a mm-wave LNA. The FCM unit chanellizes the 18 to 40 GHz into three bands and downconverts each band to a common 8-18 GHz IF. The FCM design includes a novel wideband mm-wave limiter and mm-wave L.O. for each of the bands. A noise figure of <13 dB was achieved in all three bands with a 50 dB dynamic range.

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Spectral Domain Technique for the Analysis of Waveguide Junction with Anisotropic Media

Y.Y. Tsai and A.S. Omar. "Spectral Domain Technique for the Analysis of Waveguide Junction with Anisotropic Media." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 229-232.

A rigorous analysis of a waveguide junction with lossy arbitrarily shaped anisotropic media is proposed. The analysis is based on the equivalence principle and the spectral domain technique and being dependent on neither the geometrical symmetry of the junction nor the number of ports. To demonstrate the validity of the method, H- and E-plane Y-junction circulators are considered. The influences of the magnetic and dielectric losses on the performance of the circulators are examined.

Abstracts

A Physically Based with Self Heating Large Signal HBT Model and Transit Time Effects

P.C. Grossman. "A Physically Based with Self Heating Large Signal HBT Model and Transit Time Effects." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 233-236.

A physically based, time dependent, large signal HBT model is presented which accounts for the time dependence of base, collector, and emitter charging, and includes self heating effects. The model tracks device performance over eight decades of current. The model can be used as the basis of SPICE model approximations. A thesis for the divergence of high frequency large signal SPICE simulations from measured data is presented. A new empirical equation for base-collector capacitance is included.

Abstracts

Requirements for Noise Parameter Measurements in Superconducting Electronic Systems

J.M. O'Callaghan and J.B. Beyer. "Requirements for Noise Parameter Measurements in Superconducting Electronic Systems." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 237-240.

General considerations for the measurement of noise parameters in highly mismatched systems are discussed. In particular, the problem of noise characterization of active superconducting microwave devices is addressed. A measurement technique including an error analysis is presented along with current data for a Superconducting Flux Flow Transistor.

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Accurate Experimental Characterization of Three-Ports

S.B. Goldberg, M.B. Steer and P.D. Franzon. "Accurate Experimental Characterization of Three-Ports." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 241-244.

An accurate procedure is reported for experimentally characterizing microwave devices using two-port measurements. Reflection measurements only are used to determine three-port reflection parameters and primarily transmission measurements to determine three-port transmission parameters, thus considerably reducing the sensitivity of the procedure. No assumptions about the three-port device is made for the procedure. The results are compared to Woods' renormalization method.

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Session E -- (Joint with MMWMC) Receiver Circuits II

"Session E -- (Joint with MMWMC) Receiver Circuits II." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 245-245.

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An HBT MMIC Wideband VCO (1991 Vol. I [MWSYM])

A. Adar and R. Ramachandran. "An HBT MMIC Wideband VCO (1991 Vol. I [MWSYM])." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 247-250.

A wideband MMIC Voltage Controlled Oscillator (VCO) has been developed using AIGaAs/GaAs Heterojunction Bipolar Transistors (HBTs). Test results indicate a very wide tuning range of 7 to 15GHz, with a minimum output power of 9 dBm. This MMIC also exhibits low power dissipation (5 V and 25 mA) and excellent phase noise (75 dBc/Hz @ 100 KHz) for a broadband VCO. In addition to the basic oscillator this MMIC also includes a buffer amplifier to provide better load isolation and power output stability. All the required biasing and matching circuitry except for the resonator is contained within the chip that measures 30 X 40 mils (0.8 mm X 1 mm).

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A Class of Monolithic HBT Multipliers (1991 Vol. I [MWSYM])

C.B. Perry, K.T. Ip, K.Z. Claxton, B.R. Allen and A.E. Farris. "A Class of Monolithic HBT Multipliers (1991 Vol. I [MWSYM])." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 251-254.

Two types of monolithic multipliers have been developed using current AlGaAs HBT technology. Both circuits have an intended input frequency range of 10 MHz to 1.0 GHz. Preliminary wafer probe measurements indicate the even order multiplier achieves 45 dB of fundamental rejection and 22 dB conversion loss at 2.5 GHz (10th harmonic), consuming 175 mW. The odd order multiplier exhibited 21 dB of conversion loss at 10 GHz (10th harmonic) and 35 dB at 21 GHz (21st harmonic), dissipating 315 mW. These circuits offer significant improvement in bandwidth, output power and lower implementation cost compared to existing diode-based MIC or MMIC MESFET frequency multipliers.

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Abstracts

Monolithic Ultra-Broadband Transimpedance Amplifiers Using AiGaAs/GaAs HBTs (1991 Vol. I [MWSYM])

N. Nagano, T. Suzaki, A. Okamoto and K. Honjo. "Monolithic Ultra-Broadband Transimpedance Amplifiers Using AiGaAs/GaAs HBTs (1991 Vol. I [MWSYM])." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 255-258.

Monolithic ultra-broadband transimpedance amplifiers have been developed using AIGaAs/GaAs HBTs. The amplifiers have exhibited DC to 13.4-GHz bandwidth, with an 18.1-dB gain, and a 49.8-dB Omega transimpedance. These results have been brought about by optimized circuit design considering large signal operation and an affordable HBT fabrication process using a self-aligned method.

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GaAs HBT Wideband and Low Power Consumption Amplifiers to 24 GHz (1991 Vol. I [MWSYM])

K.W. Kobayashi, R. Esfandiari, M.E. Hafizi, D.C. Streit, A.K. Oki and M.E. Kim. "GaAs HBT Wideband and Low Power Consumption Amplifiers to 24 GHz (1991 Vol. I [MWSYM])." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 259-262.

This paper reports on the design and performance of a 2-24 GHz distributed matrix amplifier and a 1-20 GHz 2-stage Darlington coupled amplifier based on an advanced HBT MBE profile which increases the bandwidth response of the distributed and Darlington amplifiers by providing lower base-emitter and collector-base capacitances. The matrix amplifier has a 9.5 dB nominal gain and a 3-dB bandwidth to 24 GHz. It is the highest bandwidth reported for an HBT distributed amplifier. The input and output VSWRs are less than 1.5:1 and 2.0:1, respectively. The total power consumed is less than 60 mW. The chip size measures 2.5x2.6 mm². The 2-stage Darlington amplifier has 7 dB gain and 3-dB bandwidth to 20 GHz. The input and output VSWRs are less than 1.5:1 and 2.3:1, respectively. This amplifier consumes 380 mW of power and has a chip size of 1.66x1.05 mm².

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Session F -- Microwave Integrated Circuits (1991 Vol. I [MWSYM])

"Session F -- Microwave Integrated Circuits (1991 Vol. I [MWSYM])." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 263-263.

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Broadband Switched-Bit Phase Shifter Using All-Pass Networks

D. Adler and R. Popovich. "Broadband Switched-Bit Phase Shifter Using All-Pass Networks." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 265-268.

A method of broadband phase shifting, utilizing an unbalanced all-pass network topology, has been developed. By taking advantage of the intrinsically matched characteristics of these networks, it is shown that multi-octave response can be achieved by cascading of two or more similar networks. Utiliziig this approach, an octave band 4-bit phase shifter has been realized, having less than 18° total phase error and better than -30 dBc carrier suppression when operated as a frequency translator.

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Novel MIC Bipolar Frequency Doublers Having High Gain, Wide Bandwidth and Good Spectral Performance (1991 Vol. I [MWSYM])

M. Borg and G.R. Branner. "Novel MIC Bipolar Frequency Doublers Having High Gain, Wide Bandwidth and Good Spectral Performance (1991 Vol. I [MWSYM])." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 269-272.

New high efficiency Bipolar microwave frequency multipliers have been developed having wideband performance, high conversion gain and good spectral properties. Experimental conversion gains of up to 7 dB have been attained for narrow band designs (/spl ap/12% BW) and greater than 0dB for wide-band designs (>= 40%) at C band. Corresponding fundamental and 3rd harmonic rejections are greater than 45 dBc and 30 dBc respectively. Extensive modeling and computer-oriented design has been employed utilizing harmonic balance.

Abstracts

Planar Broadband MIC Balanced Frequency Doublers

R. Bitzer. "Planar Broadband MIC Balanced Frequency Doublers." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 273-276.

Broadband microwave frequency doublers employing beam-lead Schottky barrier diodes in a new planar balun configuration are presented. Measurement results for output frequencies up to the K-band show good agreement with analytical results. A minimal conversion loss of 8.4 dB and an output frequency ratio exceeding 1:3 were achieved. The low-cost, small-sized multipliers are useful to generate the wideband local oscillator signals required in broadband measuring instruments.

Abstracts

A HEMT Harmonic Oscillator Stabilized by an X-Band Dielectric Resonator

R. Tupynamba, E. Camargo and F.S. Correra. "A HEMT Harmonic Oscillator Stabilized by an X-Band Dielectric Resonator." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 277-280.

A simple design method for harmonic oscillators using HEMT devices is presented. The method employs non-linear analysis to derive the harmonic components of the drain current of a low frequency transistor model. The resulting harmonics components are then used to linearize a high frequency model and to synthezise the microwave circuit. The performance of a second harmonic oscillator that uses an X -Band dielectric resonator and a packaged HEMT device is +6.0 dBm output power at 18 GHz with 6.5 % RF/DC efficiency.

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FET DROs at V-Band

W. Yau, E.T. Watkins and Y.C. Shih. "FET DROs at V-Band." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 281-284.

MESFET DROs have been demonstrated at V-band. The first unit operates at 51.2 GHz with an output power as high as 9 dBm. The second unit operates at 65.6 GHz with an output power of 7.6 dBm. Dc to RF efficiencies were 18 percent and 14 percent, respectively. Power variation is less than ±0.25 dB over a temperature from 0 to 50° C. The high output power associated with the dc-to-RF efficiency is believed to be the highest ever reported.

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A New Concept: An Electronically Tunable MMIC Flatness Corrector

F. Labarre, J.L. Cazaux, C. Goldztejn, N. Pichon and M. Soulard. "A New Concept: An Electronically Tunable MMIC Flatness Corrector." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 285-288.

A novel concept resulting in a good insertion gain flatness in receiver applications is reported. The idea is based on inserting into a chain a device with an attenuation characteristic equal and opposite to the gain variation of the rest of the chain.

Abstracts

A 0.5-12 GHz Hybrid Matrix Distributed Amplifier Using Commercially Available FETs

S. D'Agostino, G. D'Inzeo, G. Grifoni, P. Marietti and G. Panariello. "A 0.5-12 GHz Hybrid Matrix Distributed Amplifier Using Commercially Available FETs." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 289-292.

In this work we present a matrix distributed amplifier for a coherent high bit-rate optical receiver front-end. A gain of 20 dB in the 0.5-12 GHz with a noise figure between 5-8 dB over the whole frequency range has been obtained together with a low VSWR as the experimental results prove. The layout is very simple in comparison to other hybrid realizations reported in literature and is fully related with the lumped elements of the circuit schematic. The computed results obtained using a small signal model for each FET fit rather well with measurements.

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Session G -- Multi-GHz Lightwave Transmission Systems (Special Session)

"Session G -- Multi-GHz Lightwave Transmission Systems (Special Session)." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 293-293.

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Activities in the European Optical Communications Field

M.J. O'Mahoney. "Activities in the European Optical Communications Field." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 295-296.

The optical communication areas reviewed in the paper mainly relate to system and network based activities. A supporting European optical component program exists, of course, but this is not covered in detail in this review.

Abstracts

Interfaces for High-Speed Fiberoptic Links

A.S. Daryoush, N. Samant, E. Ackerman, S. Wanuga and D. Kasemset. "Interfaces for High-Speed Fiberoptic Links." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 297-300.

An analysis of directly and externally modulated fiberoptic links is presented here. The theoretical analysis is based on the signal flow graph of the interface circuits to laser diode, Mach-Zehnder electro-optic modulator, and pin photodiode. The system parameters, such as gain, noise figure, two-tone intermodulation distortion, and dynamic range, are expressed as a function of frequency. Furthermore, fiberoptic link analytical models are compared with the experimental results obtained on custom designed directly modulated FO link at 12GHz and externally modulated FO link at 900MHz.

Abstracts

Component Technology for 40 GHz Fibre Optic Systems

I. Bennion, A. Carter, A. Moseley, M. Wale and R. Walker. "Component Technology for 40 GHz Fibre Optic Systems." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 301-302.

We describe the design, manufacture and performance of integrated optical modulators and InGaAs photodetectors for microwave optical systems operating up to 40 GHz. Critical design issues are examined and the achievements of current research are discussed.

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Ultrahigh Speed Optical Transmission Systems in Japan

K. Nakagawa, K. Hohkawa and K. Hagimoto. "Ultrahigh Speed Optical Transmission Systems in Japan." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 303-306.

This paper presents an overview of the current state of ultrahigh speed transmission systems in Japan. Recent progress in optical fiber transmission systems developed in NTT are reviewed. Transmission experiments and key technologies required for constructing ultrahigh speed transmission systems are also discussed.

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Performance Improvements in Fiber-Optic Links for Multi-Carrier TV Transmission

T. Berceli, I. Frigyes, P. Gottwald, P.R. Herczfeld and F. Mernyei. "Performance Improvements in Fiber-Optic Links for Multi-Carrier TV Transmission." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 307-310.

In broadband networks, there is an increasing need for the transmission of more and more television channels. For this purpose the fibre-optic link proved to be one of the best solutions. However, when the number of TV channels is very high a significant intermodulation distortion will arise. The intermodulation distortion can be reduced by improving the modulation linearity of the laser or by applying a more appropriate modulation method. In this paper both solutions will be discussed in detail. The linearity has been significantly improved by applying an active matching technique. The sensitivity of QPSK TV transmission to disturbing intermodulation has been investigated. A new "group modulation" method offers a better approach for optical multi-carrier TV transmission.

Abstracts

Session H -- Student Papers Competition II (Special Session)

"Session H -- Student Papers Competition II (Special Session)." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 311-311.

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Low-Loss Quasi-Optical Open Resonator Filters

J.C. McCleary and K. Chang. "Low-Loss Quasi-Optical Open Resonator Filters." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 313-316.

A novel and efficient coupling method has been devised for the design of a low-loss quasi-optical open resonator filter. The method uses a narrow slot opening in the coupling waveguide. An insertion loss of less than 1 dB was achieved for the passband, The filters should have applications in many millimeter-wave and submillimeter-wave systems.

Abstracts

Comparison of Two Architectures for Fiber Optic Distribution Inside Ka-Band Communication Satellites

D.M. Polifko and A.S. Daryoush. "Comparison of Two Architectures for Fiber Optic Distribution Inside Ka-Band Communication Satellites." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 317-320.

A comparison between two high speed fiber optic (FO) link architectures is presented. Experiments were performed on two reactively matched links, one operating from 18.5 to 19.0 GHz and the other at 0.5 to 1 GHz and then subsequently unconverted to 18.0 GHz. Both links were fully characterized analytically and experimentally. It will be demonstrated that for high frequency operation, the best configuration occurs from the separation of the data and carrier signals. When these signals are sent over separate links, this architecture is called T/R level data mixing. Improvements are seen in gain (>30dB), noise figure (>30dB) and dynamic range (>40dB) when this architecture implemented.

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Session I -- (Joint with MMWMC) Power Amplifiers

"Session I -- (Joint with MMWMC) Power Amplifiers." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 321-321.

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Abstracts

An X-Band High-Efficiency Ion-Implanted MMIC Power Amplifier (1991 Vol. I [MWSYM])

H. Le, Y.C. Shih, Y. Hwang, T. Chi, K. Kasel and D.C. Wang. "An X-Band High-Efficiency Ion-Implanted MMIC Power Amplifier (1991 Vol. I [MWSYM])." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 323-325.

A state-of-the-art X-band high efficiency monolithic power amplifier has been demonstrated. An average output power of 3.6 Watts at an average 41% power-added efficiency over a 40% bandwidth from 7.0 to 10.5 GHz has been achieved. An excellent average power density of 500 mW/mm and peak power density of 550 mW/mm has been measured across this bandwidth.

Abstracts

A 4.0 Watt High Efficiency 15-18 GHz Power MMIC (1991 Vol. I [MWSYM])

M. Gat, D.S. Day and J.R. Basset. "A 4.0 Watt High Efficiency 15-18 GHz Power MMIC (1991 Vol. I [MWSYM])." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 327-330.

A two-stage Ku-band monolithic power amplifier is reported. The MMIC incorporates a full interstage matching network and partial input matching network on the chip. The amplifier delivers 4 watts of power, 10 to 13 dB of gain and more than 20% power added efficiency at 2 dB gain compression. This amplifier can be tuned for a 1 GHz instantaneous bandwidth anywhere in the 15-18 GHz band. To the best of our knowledge, the combination of output power, power-added efficiency and gain are the best published results for a power MMIC operating at 18 GHz to date.

Abstracts

C-Band GaAs MMIC Limiting Power Amplifier with Small Insertion Phase Variation (1991 Vol. I [MWSYM])

J. Ozaki, K. Arai, M. Miyauchi, S. Watanabe and S. Kamihashi. "C-Band GaAs MMIC Limiting Power Amplifier with Small Insertion Phase Variation (1991 Vol. I [MWSYM])." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 331-334.

A C-band GaAs MMIC limiting power amplifier has been developed by cascading three kinds of MMIC chips (a limiting amplifier, a gain-control amplifier and a power amplifier) in a single package. It provides an output power of 33.2 ± 0.2 dBm with an insertion phase variation of less than 2.3 degrees over an input power range of from 13.5 dBm to 18.5 dBm. The output power can be controlled between 17.8 dBm and 33.2 dBm with an insertion phase variation less than 22.5 degrees.

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35 GHz Pseudomorphic HEMT MMIC Power Amplifier (1991 Vol. I [MWSYM])

D.W. Ferguson, S.A. Allen, M.Y. Kao, P.M. Smith, P.C. Chao, M.A.G. Upton and J.M. Ballingall. "35 GHz Pseudomorphic HEMT MMIC Power Amplifier (1991 Vol. I [MWSYM])." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 335-338.

0.25µm gate-length double-heterojunction InGaAs Pseudomorphic HEMTs developed at the GE Electronics Laboratory have been integrated into a 3-stage power amplifier MMIC designed for the 34-36 GHz band. This first pass design exhibited a peak small-signal gain of 30 dB, minimum output power of 200 mW with 20 dB associated gain, power-added efficiency of greater than 18% and a return loss of greater than 14 dB over the entire band. This performance was measured with the MMIC operating from a single 6 Volt DC supply.

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Session J -- Advanced Techniques of Numerical Electromagnetics

"Session J -- Advanced Techniques of Numerical Electromagnetics." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 339-339.

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Abstracts

Full-Wave Loss Analysis of Normal- and Superconducting Transmission Lines by Hybrid-Mode Boundary Integral Equation Method

W. Schroeder and I. Wolff. "Full-Wave Loss Analysis of Normal- and Superconducting Transmission Lines by Hybrid-Mode Boundary Integral Equation Method." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 341-344.

The Hybrid-Mode Boundary Integral Equation Method ia extended to full-wave analysis of arbitrary MMIC transmission limes that incorporate superconductors and/or normal (imperfect) conductors and lossy dielectrics. The method is demonstrated for thin film microstrip line of small width. Attenuation and effective permittivity results of several configurations with Au and YBCO strips separated by medium and high permittivity films are compared.

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Fullwave Analysis of Microstrip In-Line and Offset Gaps in Fully and Laterally Open Environments Using a Deterministic Spectral Domain Approach

J.S. McLean, H. Ling and T. Itoh. "Fullwave Analysis of Microstrip In-Line and Offset Gaps in Fully and Laterally Open Environments Using a Deterministic Spectral Domain Approach." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 345-348.

Microstrip in-line and offset gap discontinnities in both laterally open and fully open environments are, for the first time, analyzed using a deterministic spectral domain method. The analysis includes the effects of space wave and surface wave radiation and coupling in the case of fully open environments and includes the effects of LSM and LSE wave radiation and coupling in the case of laterally open environments. In the case of laterally open environments, the effect of cover height is investigated. The analysis includes the effects of two-dimensional, two-component current flow on the conductors.

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Network Folding Strategies for Concurrent Electromagnetic Field Mapping

L.N. Merugu, V.F. Fusco and J.A.C. Stewart. "Network Folding Strategies for Concurrent Electromagnetic Field Mapping." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 349-352.

A number of concurrent algorithms for dynamic field mapping based on the two-dimensional lumped circuit analogies of Maxwell's equations are presented. Large networks of lumped equivalent circuits are mapped onto arrays of transputers to provide a computational advantage over classical sequential techniques. Different network folding and unfolding strategies are proposed to solve these large networks. Diakoptic methodologies in concurrent form are used throughout. The method presented is general and can be applied to any orthogonal coordinate system with non uniform elemental quantization and boundary conditions placed at infinity. Results are presented for a rectangular waveguide problem.

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Abstracts

Efficient S-Parameter Calculation of Multiport Planar Structures with the Spectral Domain Analysis Method

T. Becks, G. Gronau and I. Wolff. "Efficient S-Parameter Calculation of Multiport Planar Structures with the Spectral Domain Analysis Method." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 353-356.

An iterative method based on a Lanczos-like algorithm for the solution of large systems of linear equations having multiple right-hand sides is presented. In connection with a new S-pararneter extraction technique the method allows an efficient handling of multiport planar structures with the spectral domain analysis method. Measured and calculated results for closely coupled microstrip branchline couplers and patch couplers are presented.

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Abstracts

A Modified MoL Algorithm with Faster Convergence and Improved Computational Efficiency

S. Xiao, R. Vahldieck, H. Jin and Z. Cai. "A Modified MoL Algorithm with Faster Convergence and Improved Computational Efficiency." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 357-360.

This paper presents an improved algorithm for the method of lines (MoL) which converges much faster than the conventional method. While the error in the MoL is typically o(h^2), the error in the modified MoL is reduced to o(h/sup 4/). Therefore, accuracy can be maintained with a much smaller number of lines leading to reduced matrix sizes and thus accelerating the algorithm considerably. Numerical results obtained for a microstrip line illustrate the advantages of this new idea.

Abstracts

A New Finite-Difference Time-Domain Formulation Equivalent to the TLM Symmetrical Condensed Node

Z. Chen, W.J.R. Hoefer and M.M. Ney. "A New Finite-Difference Time-Domain Formulation Equivalent to the TLM Symmetrical Condensed Node." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 361-364.

A new Finite-Difference Time-Domain (FD-TD) formulation is proposed. It is shown to be exactly equivalent to the symmetrical condensed node model used in the Transmission Line Matrix (TLM) Method. Due to a better field resolution and fulfillment of continuity conditions, the new FD-TD formulation or its TLM equivalent model have less dispersion and better accuracy than the traditional FD-TD method based on Yee's scheme.

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Session K -- High Power Optical Switching for Ultra Wide-Band Applications (Special Session)

"Session K -- High Power Optical Switching for Ultra Wide-Band Applications (Special Session)." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 365-365.

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Ultrawideband Radar

J.D. Taylor. "Ultrawideband Radar." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 367-370.

Ultrawideband radars use signal bandwidths greater than 25 percent of center frequency. Conventional radio and radar signal bandwidths are generally less than 1 percent of center frequency. Using ultrawideband signals gives a range resolution smaller than most military targets. Ultrawideband impulse signals can provide a capability for target imaging and identification through resonance characteristics. The added capabilities gained through ultrawideband signals are balanced by needs for complex receivers and signal processing. This paper discusses ultrawideband radar and makes qualitative comparisons with narrowband systems.

Abstracts

Ultra-Wideband Radar--Potential and Limitations

R.S. Vickers. "Ultra-Wideband Radar--Potential and Limitations." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 371-374.

There has been a recent awakening of interest in defense applications for ultra-wideband radar (UWB) systems. Work is in progress at a number of laboratories to establish the performance potential and limitations of such systems for target detection and identification. UWB radars differ from more conventional systems in that their bandwidth is a significant fraction of the carrier frequency. This can result in a design that gives the technique potential for identifying targets, reducing the effectiveness of low-observable treatments, and performing detection tasks that are now considered to be difficult. The primary limitation on such systems is the lack of peak output power. Up to now, the pulse sources for these experimental radars have been either transistor impulse generators or spark gaps; both of these sources have severe limitations. With the development of OASS devices, new possibilities for extending the performance of UWB radars become available. In particular, the repeatability and fast rise time of OASS devices, while operating at high power levels, are of extreme importance to this newly emerging radar technology. In this paper, some of the more obvious uses of a UWB radar are discussed, together with some of the problems (arising from limited source capabilities) in implementing adequate designs.

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Abstracts

Generation of High Power Ultra-Wideband Electrical Impulse by Optoelectronic Technique

C.H. Lee. "Generation of High Power Ultra-Wideband Electrical Impulse by Optoelectronic Technique." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 375-376.

Progress in the application of ultrafast optics and photoconductive switchhg for the generation of high power ultra-wideband electrical impulses is reviewed. Several techniques are described. Megawatt pulses with picosecond rise-and falltimes and variable pulse duration have been obtained. Using photoconductive switch both as a closing and opening switch in an inductive energy storage system the electrical pulse power enhancement of a factor of 50 has been demonstrated for the first time.

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High Power Light Activated Semiconductor Switches with Sub-Nanosecond Rise Times

F.J. Zutavern, G.M. Loubriel, M.T. Buttram, M.W. O'Malley, W.D. Helgeson and D.L. McLaughlin. "High Power Light Activated Semiconductor Switches with Sub-Nanosecond Rise Times." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 377-380.

This paper presents a summary of results from experiments with large GaAs, InP, and silicon photoconductive semiconductor switches (PCSS). Linear and high gain (lock-on) switching modes will be described. We have used individual PCSS to switch voltages as high as 120 kV and currents as high as 4.2 kA and have produced rise times as fast as 200 ps in the linear mode and 600 ps in the initiation of lock-on. The high gain switching mode is important to applications which must be compact or operate at high repetition rates. The highest power which we have switched to date with a pulsed semiconductor laser diode array (100 W) is 40 MW. The potential development of these switches for future applications will also be discussed.

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Session L -- Microwave Radiometers (Special Session)

"Session L -- Microwave Radiometers (Special Session)." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 381-381.

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Earth Sensing with Large Aperture Radiometers

W.J. Wilson. "Earth Sensing with Large Aperture Radiometers." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 383-386.

Three microwave radiometer instruments built by JPL for NASA for remote sensing of the Earth's atmosphere and surface are described. The three instruments are the Microwave Sounder Unit, the Scanning Multichannel Microwave Radiometer and the Microwave Limb Sounder.

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Terrestrial Sensing with Synthetic Aperture Radiometers

C.T. Swift and D.M. LeVine. "Terrestrial Sensing with Synthetic Aperture Radiometers." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 387-388.

Aperture synthesis concepts have been used for many years in Radio Astronomy to achieve high image resolution at a reasonable cost. The time is approaching for earth remote sensing technology to borrow some of these techniques to meet the cost challenges of large antennas in space.

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Millimeter Radiometric Sensing of the Lower Atmosphere

D.H. Staelin. "Millimeter Radiometric Sensing of the Lower Atmosphere." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 389-390.

One of the most rewarding results of the mid-century development of high-sensitivity passive microwave spectrometers, of which the Dicke radionneter was a key enabling element, has been the advent of scientific and operational sounding of the lower atmosphere by passive microwave techniques on both local and global scales. Strong microwave spectral features of oxygen and water vapor permtt ground and space-based sensors to determine the altitude profiles of atmospheric temperature and humidity with an accuracy not obtainable by comparable infrared sensors. Clouds and precipitation, as well as numerous stratospheric and mesospheric constituents, can also be measured.

Abstracts

Submillimeter Heterodyne Spectroscopy and Remote Sensing of the Upper Atmosphere

J.W. Waters. "Submillimeter Heterodyne Spectroscopy and Remote Sensing of the Upper Atmosphere." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 391-394.

The submillimeter region is rich with spectral lines of atmospheric molecules. Remote sensing by submillimeter heterodyne spectroscopy can provide measurements for studying global change and processes in Earth's atmosphere.

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The Submillimeter Wave Astronomy Satellite

P.F. Goldsmith, A. Dalgarnot, N.R. Erickson, G.G. Fazio, M. Harwit, D.J. Hollenbach, D.G. Koch, G.J. Melnick, D.A. Neufeld, R. Schieder, R.L. Snell, J. Stauffer, P. Thaddeus and G.F. Winnewisser. "The Submillimeter Wave Astronomy Satellite." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 395-398.

The Submillimeter Wave Astronomy Satellite (SWAS) was selected for development and flight by NASA in 1989 as one of the initial payloads in the Small Explorer program. SWAS is the first instrument designed to carry out submillimeter astronomical observations of spectral lines from space. Spectral lines of H/sub 2/, O/sub 2/, /sup 13/CO, and atomic carbon, which are extremely difficult to observe from the ground but which are potentially important tracers of the structure of dense clouds in the interstellar medium, will be simultaneously observed with high spectral resolution. Incoming radiation is collected by a 55 x 71-cm offset Cassegrain antenna, with an aggregate surface error <= 9 µm rms. The receiver front end consists of two independent cooled Schottky diode harmonic mixers, each pumped by frequency-tripled phaselocked Gunn oscillator. Spectral analysis is performed on the 4 lines from the two mixers simultaneously by an acousto-optical spectrometer having a bandwidth of 1.4 GHz, and a frequency resolution of 1 MHz.

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The Dicke Radiometer and Cosmic Radiation

D. Wilkinson. "The Dicke Radiometer and Cosmic Radiation." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 399-402.

R. H. Dicke initiated microwave radiometry in 1946 by inventing the instrument that still bears his name. Eighteen years later he initiated an important sub-field of cosmology by proposing that the universe is filled with microwave blackbody radiation left over from the Big Bang. The Dicke radiometer is widely used to check his idea and to learn new things about the early universe.

Abstracts

Radiometer Programs in Europe

K.F. Kunzi. "Radiometer Programs in Europe." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 403-404.

There are many groups in Europe actively engaged in microwave radiometry. Large progress has recently been made in applications related to atmospheric physics, meteorology and in developing new receivers at sub-mm wave length. The review will briefly consider groundbase and airborne sensors and then concentrate on European space programs for the nineties.

Abstracts

Monolithic Integrated Circuit Imaging Radiometers

S. Weinreb. "Monolithic Integrated Circuit Imaging Radiometers." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 405-408.

The application of arrays of integrated circuit receiver to imaging of microwave and millimeter wave radiation is presented. Overall system concepts and both focal-plane and aperture-plane types of systems are discussed. Several functional block diagrams of the sensors are suggested and some examples of state-of-the-art units are presented.

Abstracts

Millimeter Wave Superconducting Receivers

Q. Hu, CA. Mears and P.L. Richards. "Millimeter Wave Superconducting Receivers." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 409-412.

We review the recent work done at Berkeley on the development of millimeter wave heterodyne mixers using superconductor-insulator-superconductor (SIS) junctions. Two types of mixers have been developed: a conventional waveguide system using a resonant cavity and a open-structure quasioptical system using planar antennas and lenses. Using the waveguide system, we have achieved the lowest mixer noise level yet achieved (within 25% of the quantum limit) at 95 GHz. The quasioptical system has achieved a good mixer performance up to 200 GHz, and it has shown great promise to be used at submillimeter wavelengths.

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Index of Authors (1991 Vol. I [MWSYM])

"Index of Authors (1991 Vol. I [MWSYM])." 1991 MTT-S International Microwave Symposium Digest 91.1 (1991 Vol. I [MWSYM]): 413-416.

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Session M -- Monolithic Microwave Integrated Circuits (MMIC) I

"Session M -- Monolithic Microwave Integrated Circuits (MMIC) I." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 419-419.

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Ku-Band Monolithic 2.5-Watt Power Amplifier for High Volume Applications

D.T. Bryant. "Ku-Band Monolithic 2.5-Watt Power Amplifier for High Volume Applications." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 421-424.

The design, tuning, and performance of a 2.5-watt Ku-band power amplifier will be presented. The circuit, which was designed to cover the 16-to 17-GHz band, was modified with some on-chip tuning to correct for unmodeled coupling because of the dense circuit layout and a cross model error in the computer aided design (CAD) program. The on-chip tuning flexibility was then used to achieve 2.5-watt performance in the 14.5-to 16-GHz band for a second amplifier design.

Abstracts

New Broadband Balun Structures for Monolithic Microwave Integrated Circuits

B.J. Minnis and M. Healy. "New Broadband Balun Structures for Monolithic Microwave Integrated Circuits." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 425-428.

Two new passive balun structures, are described for use in MMICs. They are especially relevant to wideband push-pull power amplifiers, being capable of handling several watts of power. They operate over bandwidths of up to 3:1 and can provide large impedance level transformations. Exact network synthesis procedures are used to generate prototypes and a 3 dimensional field simulator is used to verify the corresponding physical circuits. A family of designs for 6-18 GHz and 6.5-13.5 GHz bands has been established.

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100 MHz to 20 GHz Monolithic Single-Pole, Two-, Three-, and Four-Throw GaAs PIN Diode Switches

D.D. Heston, D.J. Seymour and D. Zych. "100 MHz to 20 GHz Monolithic Single-Pole, Two-, Three-, and Four-Throw GaAs PIN Diode Switches." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 429-432.

Monolithic GaAs PIN diode single-pole, two-, three-, and four-throw switch circuits provide low noise figure and insertion loss performance over a 2-decade + 1-octave bandwidth. From 100 MHz to 20 GHz, the measured noise figure and insertion loss for the three switch types are less than 1 dB in the through path, with greater than 45 dB of isolation in the off paths. These state-of-the-art results are obtained using a vertical PIN diode process on metallorganic chemical vapor deposition (MOCVD) material. Each of the three PIN diode switch types has been designed with and without on-chip bias networks. This paper compares the performance demonstrated by this family of six single-pole, two-, three-, and four-throw switch circuits.

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High Performance MMIC 20 GHz LNA and 44 GHz Power Amplifier Using Planar-Doped InGaAs HEMTs

J.A. Lester, W.L. Jones and P.D. Chow. "High Performance MMIC 20 GHz LNA and 44 GHz Power Amplifier Using Planar-Doped InGaAs HEMTs." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 433-436.

GaAs-based lnGaAs Psuedomorphic High Electron Mobility Transistors (HEMT) have demonstrated superior low-noise and high power capabilities at microwave and millimeter wave frequencies. This paper presents a pair of 3-stage amplifiers fabricated with the same process demonstrating excellent noise and power performance. A K-Band fully monolithic LNA has demonstrated greater than 33 dB gain over a 4 GHz bandwidth with a noise figure of less than 2 dB over 2 GHz. The Q-Band power amplifier has demonstrated an output power of 13.3 dBm at 1 dB compression with 25.3 dB of gain and a saturated output power of 16.1 dBm at 40 GHz. These amplifiers are designed for insertion into future EHF satellite communication ground terminals.

Abstracts

A Stable GaAs 6-20 GHz High Gain and Power TWA

M.M. Oda. "A Stable GaAs 6-20 GHz High Gain and Power TWA." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 437-440.

A stable power cascode distributed amplifier is demonstrated over the 6 to 20 GHz band. This monolithic GaAs traveling wave amplifier exhibits a minimum gain above 11 dB with +/- 0.5 dB of gain flatness over the band. The output power at the 1 dB gain compression point is over 24 dBm @ 20 GHz. The input/output return loss is better than 12 dB over the band. This chip was fabricated using a 0.4µm MESFET process and measures 3.02mm x 0.89mm (area of 2.7 mm^2). This power wideband amplifier employs 7 cascode stages. The excellent performance is achieved with the specially chosen transmission lines connecting the second gates and vias of each stage. This technique yields stability along with higher gain and power by eliminating the need for damping networks.

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Session N -- High Q Filters

"Session N -- High Q Filters." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 441-441.

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Abstracts

Miniature Dual Mode Microstrip Filters

J.A. Curtis and S.J. Fiedziuszko. "Miniature Dual Mode Microstrip Filters." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 443-446.

Dual mode cavity and dielectric resonator filters are the mainstay of satellite communications. In this paper, a new generation of planar dual mode filters is introduced which offers significant size, weight, and cost advantages over these previous designs. All currently used elliptic function, self equalized, etc. filter designs can be implemented in microstrip using this new concept. The proposed filter structures are ideally suited for implementation using the recently discovered high temperature superconductors. Basic dual mode resonator and filter structures are discussed, and experimental data for proof of concept filters implemented using both normal and superconducting microstrip are presented.

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Hybrid Dielectric/HTS Resonators and Their Applications

J.A. Curtis, S.J. Fiedziuszko and S.C. Holme. "Hybrid Dielectric/HTS Resonators and Their Applications." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 447-450.

Interest in HTS material applications has exploded in the past few years fueled by continuing progress in superconductor fabrication techniques. However, in typical microwave structures utilizing these materials in the form of thin films, HTS compatible dielectric substrates and their dielectric losses are a performance limiting factor. This paper presents a novel concept of using dielectric resonators in conjunction with HTS materials. This hybrid approach offers several advantages: dielectric resonator materials have extremely low losses at cryogenic temperatures, reduced size in comparison to traditional dielectric resonators, exceptional temperature stability, tunability, and versatility (any HTS material can be easily substituted in the proposed filter structures). Basic dielectric /HKS resonator structures are shown. Novel filter configurations utilizing these resonators and experimental results are presented.

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A Novel 2-4 GHz Multi-Passband Tunable and Gain Controlled Miniature Active Equalizer/Filter

A. Madjar, B. Even-Or and E. Gertel. "A Novel 2-4 GHz Multi-Passband Tunable and Gain Controlled Miniature Active Equalizer/Filter." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 451-454.

This paper presents the design and performance of a novel tunable active equalizer/filter intended for use in wide band systems such as EW. The proposed circuit operates in the range 2-4 GHz, it has a simple circuit topology, low cost in manufacturing, narrow instantaneous bandwidth (100-200 MHz), has a gain control of more than 20 db and has an instantaneous multi-band capability.

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The Simplified Real Frequency Method Applied to the Active Filters Synthesis

E.E. Hen Daoui, A. Perennec and P. Jarry. "The Simplified Real Frequency Method Applied to the Active Filters Synthesis." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 455-457.

In this paper, we present a direct method for the design of active filters using the simplified real frequency technique. This method bypasses the analytic theory and yields the maximum flat transducer power gain (T.P.G.) possible. An example for low-pass filters is given at the end.

Abstracts

Finite Element Simulation for Microwave Devices Applications to Microwave D.R. Filters

J.P. Cousty, S. Verdeyme, M. Aubourg and P. Guillon. "Finite Element Simulation for Microwave Devices Applications to Microwave D.R. Filters." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 459-462.

Rigorous numerical analysis of an axis symmetrical TM/sub 0,1,delta/ dielectric resonators mode filter is presented. Two dimensional (2D) and three dimensional (3D) finite element method (F.E.M.) is applied to compute the exact scattering matrix parameters (Taking into account the excitation probes) of this device. A sensitivity analysis is also performed and permits easier filter tuning. Experimental results are given and are in good agreement with theoretical ones.

Abstracts

Session O -- CPW and Other Discontinuities

"Session O -- CPW and Other Discontinuities." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 463-463.

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Abstracts

Full-Wave Analysis of Coplanar Discontinuities Considering Three-Dimensional Bond Wires

M. Rittweger, M. Abdo and I. Wolff. "Full-Wave Analysis of Coplanar Discontinuities Considering Three-Dimensional Bond Wires." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 465-468.

The analysis of a simple coplanar band-reject filter based on open ended stubs using the finite difference time-domain (FDTD) method is presented. The influence of bond wires for grounding the side conductors of the coplanar lines is investigated. A comparison of the obtained results with accurate measurements is shown. Results are used for the discussion of the effect on coplanar circuit design.

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Analysis of Shielded CPW Discontinuities with Air-Bridges

N.I. Dib, P.B. Katehi and G.E. Ponchak. "Analysis of Shielded CPW Discontinuities with Air-Bridges." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 469-472.

The effect of air-bridges on the performance of various coplanar waveguide (CPW) discontinuities is studied. Specifically, the coupled open-end CPWs and the short-end shunt CPW stub discontinuities are considered. The high frequency effect of the air-bridge is evaluated using a hybrid technique. At first, the frequency dependent equivalent circuit of the planar discontinuity without the air-bridge is derived using the Space Domain Integral Equation (SDIE) method. Then, the circuit is modified by incorporating the air-bridge's parasitic inductance and capacitance which are evaluated using a simple quasi-static model. The frequency response of each discontinuity with and without the air-bridge is studied and the scattering parameters are plotted in the frequency range 30-50 GHz for typical CPW dimensions.

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Analysis of Shielded Coplanar Waveguide Step Discontinuity Considering the Finite Metallization Thickness Effect

C.-W. Kuo, T. Kitazawa and T. Itoh. "Analysis of Shielded Coplanar Waveguide Step Discontinuity Considering the Finite Metallization Thickness Effect." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 473-475.

The mode-matching technique is applied to analyze the shielded coplanar waveguide (CPW) step discontinuity. Effect of the finite thickness of the CPW center strip and ground planes is also considered. Results of the frequency-dependent scattering parameters of the shielded CPW step discontinuity incorporating the finite metallization thickness effect are presented for the first time.

Abstracts

Capacitive Discontinuities: Rigorous Multimode Equivalent Network Representation

M. Guglielmi. "Capacitive Discontinuities: Rigorous Multimode Equivalent Network Representation." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 477-480.

In this paper we present novel, rigorous, multi-mode equivalent network representations for a variety of zero-thickness capacitive windows and obstacles in a parallel plate waveguide. A key feature of these representations is that the coupling between all of the modes excited is described by a matrix whose elements do not depend on frequency. The value of the results presented is in that the networks developed can be used to analyze rigorously a large variety of single and coupled planar transmission line structures including radiation effects.

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Application of Microwave Techniques in the Analysis of Quantum Waveguide Structures and Devices

A. Weisshaar, J. Lary, S.M. Goodnick and V.K. Tripathi. "Application of Microwave Techniques in the Analysis of Quantum Waveguide Structures and Devices." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 481-484.

An extension of the generalized scattering matrix (GSM) technique is formulated to compute the GSM of nonuniform quantum waveguide structures with two-dimensional quantum confinement of electronic states. Low temperature I-V characteristics for a double constriction are presented, exhibiting a region of negative differential resistance (NDR). A simple design procedure for increasing the temperature range with achievable NDR is introduced.

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Session P -- Microwave/Optical Devices and Circuits

"Session P -- Microwave/Optical Devices and Circuits." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 485-485.

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Optical Response of the GaAs MESFET at Microwave Frequencies and Applications

A. Paolella, P.R. Herczfeld, A. Madjar and T. Higgins. "Optical Response of the GaAs MESFET at Microwave Frequencies and Applications." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 487-490.

This paper concerns the MESFET as an optical port on MMICs. It has three principal themes: to show quan-titatively how better optical coupling improves the photoresponse of the MESFET, to point out that by modest redesign its frequency response can be significantly extended up to 10 GHz, and finally to demonstrate how these can be converted to better optical control of MMIC circuits. A direct optical injection locking of a MESFET oscillator was performed.The measured optical injection locking bandwidth was 43.8 MHz.

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Multigigahertz Monolithic GaAs Optoelectronic Receivers Using 0.2 µm Gate-Length MESFETs

R.H. Walden, W.W. Hooper, C.S. Chou, C. Ngo, R. WongQuen, R.A. Metzger, F. Williams, L.E. Larson and R. Blumgold. "Multigigahertz Monolithic GaAs Optoelectronic Receivers Using 0.2 µm Gate-Length MESFETs." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 491-494.

Two GaAs optical receiver front-ends are reported. Each consists of an MSM photodetector and a tranaresistance amplifier that drives a 50 Omega load. One amplifier has a measured analog bandwidth of 6.5 GHz and the other 4.5 GHz. The transresistance-bandwidth product for both is a very high 2.1 THz-Omega.

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Theory and Experiment for the HEMTs Under Optical Illumination

M.A. Romero, A.L.A. Cunha and A.A.A. de Salles. "Theory and Experiment for the HEMTs Under Optical Illumination." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 495-498.

Theoretical and experimental work for the DC and RF performance of depletion mode AI/sub 0.3/ Ga/sub 0.7/ As/GaAs HEMTs under optical illumination is presented. Photoconductive effect increasing the 2-DEG channel electron concentration and photovoltaic effect in the gate junction are considered. Optical tuning of a 2 GHz HEMT oscillator and optical control of gain of a 2 to 6 GHz HEMT amplifier are presented and potential applications are described.

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A Direct Optical Injection Locked 8 GHz MMIC Oscillator

A. Bangert and M. Ludwig. "A Direct Optical Injection Locked 8 GHz MMIC Oscillator." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 499-502.

For the first time the optical injection locking behavior of a monolithic integrated HFET-oscillator has been investigated. The monolithic integration is an important step towards the implementation of optically controlled oscillators in phased array antenna systems. The oscillator was designed to operate at 8 GHz. The gate and source terminals of the HFET were biased at 0 volt through coplanar lines, which also served as a feedback and resonator circuit. The active region of the device was illuminated by a pigtailed laser diode modulated at about 8 GHz that the oscillator circuit could be optically injection locked. The experimental results show the optical locking behavior of the oscillator. A direct comparison between optical and electrical injection locking is possible.

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Generation of Subpicosecond Optical Pulses by Mode-Locking Semiconductor Lasers with Millimeter-Wave Sources

Y.K. Chen, M.C. Wu, T. Tanbun-Ek, R.A. Logan and M.A. Chin. "Generation of Subpicosecond Optical Pulses by Mode-Locking Semiconductor Lasers with Millimeter-Wave Sources." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 503-505.

Subpicosecond transform-limited optical pulses are generated from monolithic colliding pulse mode-locked multiple quantum well lasers at 1.5-um wavelength. The 0.95 ps optical pulses are synchronized with a millimeter-wave oscillator up to 40 GHz and have a modulation depth greater than 95%. Using a passive mode-locking technique, 610 femtosecond optical pulses are also generated at a repetition rate as high as 350 GHz without any synchronization sources. This is the highest pulse repetition rate ever reported by semiconductor optoelectronic sources.

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Characterization of Microwave Integrated Circuits Using an Optical Phase-Locking and Sampling System

H.-L.A. Hung, M.G. Li, S.-L.L. Huang and C.H. Lee. "Characterization of Microwave Integrated Circuits Using an Optical Phase-Locking and Sampling System." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 507-510.

Using an optical technique, phase-locked microwave signals of up to 15 GHz from voltage-controlled oscillators (VCOs) have been achieved. Combining this technique with a photoconductive switch, a new microwave waveform sampling system that displays the characteristics of oscillators and amplifiers has been demonstrated. The approach has potential applications for optically phase-locked microwave subsystems and monolithic integrated circuit characterizations.

Abstracts

Session Q -- Monolithic Microwave Integrated Circuits (MMIC) II

"Session Q -- Monolithic Microwave Integrated Circuits (MMIC) II." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 511-511.

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A 0.2 µm GaAs MESFET Technology for 10 Gb/s Digital and Analog IC's

Y. Yamane, M. Ohhata, H. Kikuchi, K. Asai and Y. Imai. "A 0.2 µm GaAs MESFET Technology for 10 Gb/s Digital and Analog IC's." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 513-516.

A 0.2 µm gate length GaAs IC technology is reported. This technology enables the fabrication of both digital and analog K's using the same process. A 10 Gb/s decision circuit with a 130 mV sensitivity and 215 degree phase margin, and an amplifier with a 20 dB gain and 13 GHz bandwidth were successfully fabricated using this untied process technology.

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Single Chip Ka-Band Transceiver

J. Berenz, M. Lacon and M. Luong. "Single Chip Ka-Band Transceiver." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 517-520.

This paper presents the first monolithic single chip FM-CW radar transceiver operating at 40 GHz. The chip is the largest multifunction MMIC demonstrated operating at millimeter-wave frequencies. The design implements transmitter receiver, and duplexer functions using a single process InGaAs HEMT technology. The transmitter operates in the frequency range from 37 to 40 GHz and has greater than 12.0 dBm output power. The receiver converts the signals in the same frequency range to an IF frequency of 10 to 100 MHz with 0 dB conversion loss. When integrated with an antenna, the chip is a fully functional FM-CW radar which detects the doppler frequency shift from reflected objects. The paper will describe the design, fabrication, and performance of the chip.

Abstracts

A K-Band HEMT Low Noise Receive MMIC for Phased Array Applications

R. Carandang, J. Yonaki, W.L. Jones, R.E. Kasody, W. Lam and L.C.T. Liu. "A K-Band HEMT Low Noise Receive MMIC for Phased Array Applications." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 521-524.

A state-of-the-art InGaAs HEMT receive MMIC consisting of a low noise amplifier and a novel 3-bit phase shifter has been fabricated and evaluated for receive phased-array development at 20 GHz. The low noise amplifier employs series and shunt feedback to provide high gain and low noise performance while the 3-bit phase shifter utilizes a novel switched-allpass approach to minimize circuit size. The monolithic receive chip has demonstrated noise figures of less than 2.75 dB and gains between 11.8 and 14.1 dB for the 8 phase-shift states across the 20.2-21.2 GHz frequency range.

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A Linear Limiter: A 11-GHz Monolithic Low Distortion Variable Gain Amplifier

M. Muraguchi and M. Aikawa. "A Linear Limiter: A 11-GHz Monolithic Low Distortion Variable Gain Amplifier." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 525-528.

A new 11-GHz monolithic low distortion variable gain amplifier is proposed. The amplifier maintains high lineality up to the high input power level using variable negative feedback. The third-order intermodulation distortion ratio of this amplifier is improved more than 40 dB compared with conventional variable gain amplifiers under compressed gain conditions.

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A Highly Compact, Wideband GaAs MESFET X - Ku Band Receiver MMIC

M.V. Aust, T.N. Ton, J. Yonaki, G.S. Dow, T.S. Lin, D.C. Yang and S.S. Andrews. "A Highly Compact, Wideband GaAs MESFET X - Ku Band Receiver MMIC." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 529-532.

A fully integrated MMIC receiver was designed and fabricated using the ion-implanted GaAs MESFET 0.5 µm process. This MMIC receiver incorporates a two-stage RF amplifier, a two-stage LO amplifier, an IF amplifier and a singly balanced diode mixer to form this highly compact monolithic IC receiver. Better than 10 dB conversion gain is achieved from 9 to 20 GHz. The LO to IF isolation is better than 30 dB. This chip operates from a single + 5 Vdc and draws 175 mA. Total chip size is 3.5 mm x 3.0 mm.

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Session R -- Filters and Multiplexers

"Session R -- Filters and Multiplexers." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 533-533.

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Modal-S-Matrix Design of Microwave Filters Composed of Rectangular and Circular Waveguide Elements

F. Arndt and U. Papziner. "Modal-S-Matrix Design of Microwave Filters Composed of Rectangular and Circular Waveguide Elements." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 535-538.

The rigorous CAD of a class of cavity filters is introduced which are composed of rectangular circular waveguide structures. Based on the rectangular-to-circular and circular-to-circular waveguide junction key-building block modal S-matrices, the design takes rigorously into account both the finite iris thickness and the higher order mode interaction at all step discontinuities, as well as asymmetric irises. This allows the stopband characteristic to be included in the filter design, and dual-mode resonance effects may be utilized to achieve improved edge steepness and rejection characteristics. The theory is verified by measurements.

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Narrow Bandstop Filters (1991 Vol. II [MWSYM])

H.C. Bell. "Narrow Bandstop Filters (1991 Vol. II [MWSYM])." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 539-542.

The synthesis of narrow bandstop filters with arbitrary atopband and equiripple passband responses is demonstrated. A new transformed frequency variable is used for iterative approximation with automatic bandwidth adjustment and prototype circuit realization.

Abstracts

Synthesis of Non-Contiguous Diplexers Using Broadband Matching Theory

R. Levy. "Synthesis of Non-Contiguous Diplexers Using Broadband Matching Theory." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 543-546.

An approximate but highly accurate simple closed form solution for the element values of non-contiguous lowpass/highpass diplexers has been obtained using broadband matching theory. Excellent results are demonstrated by analysis of several diplexers of degree 10 having return loss of 26 dB. Suggestions are made for extending the method to other types of non-contiguous multiplexers.

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A Two-Step Synthesis of Broadband Ridged Waveguide Bandpass Filters with Improved Performances (1991 Vol. II [MWSYM])

J.-C. Nanan, J.W. Tao, H. Baudrand, B. Theron and S. Vigneron. "A Two-Step Synthesis of Broadband Ridged Waveguide Bandpass Filters with Improved Performances (1991 Vol. II [MWSYM])." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 547-550.

A quarter-wave broadband ridged waveguide bandpass filter with improved stopband attenuation has been designed and realized. A two step design procedure associating Tchebychev's formulas with a rigorous optimization routine is also presented. The predicted filter performances, including the rectangular to ridged waveguide transformer, agree well with the measurements, showing improved stopband attenuation and reduced filter dimension in the Ku band.

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A Broadband Dielectric Diplexer Using a Snaked Strip-Line

M. Miyazaki, H. Asao and O. Ishida. "A Broadband Dielectric Diplexer Using a Snaked Strip-Line." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 551-554.

A diplexer comprised of a snaked strip-line low-pass filter and a dielectric band-pass filter was developed. Sharper cutoff characteristics of the low-pass filter permit reduction of the element number. In addition, the filters are miniaturized by use of high-permittivity dielectric. A 1GHz-band diplexer with dimensions 12mmx50mmx50mm was fabricated.

Abstracts

High-Dielectric Constant Stripline Band-Pass Filters

F. Winter, J. Taub and M. Marcelli. "High-Dielectric Constant Stripline Band-Pass Filters." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 555-556.

High-dielectric constant (K=38) stripline was employed to realize selective band-pass filters. Seven-pole, gap-coupled filters centered at 6.0 and 8.0 GHz were designed for 140 MHz 3-dB bandwidths. The data shows excellent agreement without the need for tuners. Miniaturization of high-performance filters has been demonstrated. This technique is applicable to MMIC-based microwave systems.

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Session S -- New Guided-Wave Leakage Effects

"Session S -- New Guided-Wave Leakage Effects." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 557-557.

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Abstracts

Leakage Effects in Broadside-Coupled Microstrip

L. Carin. "Leakage Effects in Broadside-Coupled Microstrip." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 559-562.

Broadside-coupled microstrip with and without conducting side walls are studied using a full-wave spectral-domain analysis. Special attention is directed towards possible leakage to the parallel plate mode and its potential effects in practical integrated circuits. It is asserted that for appropriate geometrical parameters, broadside-coupled microstrip can be leaky at all frequencies. Instructive comparisons between the modes on broadside-coupled microstrip with and without side walls are made by means of dispersion curves.

Abstracts

New Interesting Leakage Behavior on Coplanar Waveguides of Finite and Infinite Widths (1991 Vol. II [MWSYM])

M. Tsuji, H. Shigesawa and A.A. Oliner. "New Interesting Leakage Behavior on Coplanar Waveguides of Finite and Infinite Widths (1991 Vol. II [MWSYM])." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 563-566.

Last year we showed that coplanar waveguide leaks power in the form of a surface wave above some critical frequency, and that this leakage can cause undesirable cross talk and package effects, Further studies now reveal several new interesting behavioral features, including unexpected sharp minima and dimensional dependence.

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Proper and Improper Modal Solutions Inhomogeneous Stripline

D. Nghiem, J.T. Williams and D.R. Jackson. "Proper and Improper Modal Solutions Inhomogeneous Stripline." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 567-570.

A rigorous procedure is developed to determine the propagation constant for an inhomogeneous stripline, which consists of a perfectly conducting strip of infinitesimal thickness and finite width embedded in multiple dielectric layers between two perfectly conduct ing ground planes. An integral equation, formulated in terms of an electric field Green's function, is obtained by enforcing the boundary conditions on the strip. The current distribution and propagation constant are determined by solving the integral equation using a method of moments procedure. For several inhomogeneous stripline structures, both proper and improper dominant modal solutions are obtained. One of the most important practical cases, studied in detail, is that of the conventional stripline with an air-gap above the strip. This work represents the first reporting of improper modal solutions for such a stripline.

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Mode-Coupling Formation of Complex Modes in a Shielded Nonreciprocal Finline

C.-K.C. Tzuang and J.-M. Lin. "Mode-Coupling Formation of Complex Modes in a Shielded Nonreciprocal Finline." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 571-574.

The use of coupled-mode theory explains qualitatively and quantitatively the kinetic formation of the complex modes, which are explicitly shown to be the result of mode-coupling between a forward wave and a backward wave in a shielded lossless nonreciprocal finline. The unique properties of the complex modes in the nonreciprocal fineline are discussed in detail for the first time. Based on the coupled-mode theory, the amount of coupling between the forward wave and the backward wave can be related to the complex propagation constants of the complex modes, of which the data are obtained by the full-wave spectral-domain approach.

Abstracts

Session T -- Microwave/Optical Circuits and Applications

"Session T -- Microwave/Optical Circuits and Applications." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 575-575.

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Abstracts

A 3-6 GHz Lightwave/Microwave Transceiver Module for Microwave Fiber-Optic Communications

E. Ackerman, S. Wanuga, J. Komiak, D. Kasemset, R. Scotti, W. MacDonald and J. Gates. "A 3-6 GHz Lightwave/Microwave Transceiver Module for Microwave Fiber-Optic Communications." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 577-579.

A novel 3-6 GHz lightwave/microwave transceiver module has been demonstrated which combines an advanced lightwave component packaging technology with MMIC module technology. The module is compact and low profile, measuring 0.1x1.0X0.9 in., and exhibits greater than 16 dB RF-to-RF gain. This transceiver module marks the first significant step in the integration of fiber-optic interfaces into microwave subsystems.

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Abstracts

Recirculating Fiberoptic Link for Memory Loop

R. Saedi, X. Zhou, S. Malone, A. Daryoush, P. Herczfeld and B. Even-Or. "Recirculating Fiberoptic Link for Memory Loop." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 581-584.

Fiberoptic links can be used as delay elements in microwave frequency memory loops. This paper presents the analysis and experimental results of a recirculating memory loop operating over 2-4GHz leading to a 100µsec delay. The reactively matched optical transmitter and actively matched optical receiver are designed to achieve optimum loop performance. New gain equalization techniques are discused permitting along time delay in the range of milliseconds.

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A 7-13 GHz Low-Noise Tuned Optical Front-End Amplifier for Heterodyne Transmission System Application

F. Ebskamp, G. Sehiellerup and M. Hogdal. "A 7-13 GHz Low-Noise Tuned Optical Front-End Amplifier for Heterodyne Transmission System Application." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 585-588.

We present a 7-13 GHz low-noise bandpass tuned optical front-end amplifier, showing 46 ± 1 dBOmega transimpedance, and a noise spectral density around 12 pA//spl radic/Hz. This is the first time such a flat response and low noise were obtained simultaneously at these frequencies, without any further equalization. The front-end was used in an optical 2.5 Gbit/s coherent CPFSK system experiment, resulting in a sensitivity of -41.7 dBm at BER = 10/sup -9.

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Resistive Mixing and Parametric Up-Conversion of Microwave Optoelectronic Signals in a Microstrip Ring Resonator

G.K. Gopalakrishnan, B.W. Fairchild, C.L. Yeh, C.S. Park, K. Chang, M.H. Weichold and H.F. Taylor. "Resistive Mixing and Parametric Up-Conversion of Microwave Optoelectronic Signals in a Microstrip Ring Resonator." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 589-592.

A novel microwave optoelectronic mixer is fabricated on semi-insulating GaAs by monolithically integrating Schottky diode photodetectors into a microstrip ring resonator. Resistive mixing occurs when the conductance of the detector is modulated, and parametric amplification occurs when the capacitive reactance of the detector is modulated. The results should impact future fiber-optic communication systems.

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Fiber Optic Microwave Transmission Using Harmonic Modulation and Optoelectronic Mixing/Optically Pumped Mixing (1991 Vol. II [MWSYM])

H. Ogawa and Y. Kamiya. "Fiber Optic Microwave Transmission Using Harmonic Modulation and Optoelectronic Mixing/Optically Pumped Mixing (1991 Vol. II [MWSYM])." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 593-596.

This paper proposes two configurations of fiber optic links for use in microwave and millimeter-wave transmissions. Harmonic generation and the optoelectronic mixing/optically pumped mixing are successfully utilized in the fiber optic links. The performance of laser diodes as a harmonic modulator is experimentally investigated in the 10-GHz band. The pin photodiode is used as an optoelectronic microwave mixer and an optically pumped microwave mixer, and the microwave characteristics of the mixers are demonstrated. The two fiber optic links are promising to transmit microwave and millimeter-wave frequencies.

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"Session OF-II -- Open Forum II." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 597-597.

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Simulation of Nonlinear Microwave Circuits - An Historical Perspective and Comparisons

M.B. Steer. "Simulation of Nonlinear Microwave Circuits - An Historical Perspective and Comparisons." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 599-602.

The nonlinear analysis of microwave circuits has seen considerable development over the last decade. By assuming that only a finite number sinusoids are present in a nonlinear circuit, the computational burden of computing the transient response of the circuit is avoided and only the steady state response, given by the amplitudes and phases of the sinusoids, is required. This paper focuses on methods for computing this response. An historical perspective is presented. Quantitative comparisons of limitations, errors and dynamic ranges of the various methods are made for the simulation of single-tone and two-tone excitation of microwave amplifiers.

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A New Approach in CAD of MM-Wave IMPATT Oscillators

V. Stoiljkovic, M.J. Howes and V. Postoyalko. "A New Approach in CAD of MM-Wave IMPATT Oscillators." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 603-605.

A computer synthesis of a waveguide CW IMPATT oscillator is presented. The oscillator design is treated as an impedance-matching problem, using a non-isothermal drift-diffusion model for the IMPATT diode. An optimum design of a passive circuit is described, together with a new technique for calculating the output power-oscillating frequency dependence. Comparison with experimental results gives good agreement at W-band frequencies (75-110 GHz).

Abstracts

Pulsed-RF and Transient Analysis of Nonlinear Microwave Circuits by Harmonic-Balance Techniques

V. Rizzoli, A. Lipparini, P. Ghigi, F. Mastri and C. Cecchetti. "Pulsed-RF and Transient Analysis of Nonlinear Microwave Circuits by Harmonic-Balance Techniques." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 607-610.

The paper introduces a harmonic-balance approach to the simulation of nonlinear microwave circuits excited by pulsed RF and/or DC sources. The same technique also provides a transient analysis capability for circuits including passive components that can only be characterized in the frequency domain. Making use of Fourier expansions of the modulating signals, the problem is reduced to the analysis of the nonlinear circuit under multitone excitation. The resulting job is very demanding from the numerical viewpoint, and requires the harmonic-balance simulator to possess a number of advanced capabilities, which are discussed in detail. The pulsed-RF analysis of a rnicrostrip power amplifier matched by radial stubs is presented as an example of application.

Abstracts

Effect of Distributed Gate Diode on MESFET Power Performance Evaluated by Harmonic Balance Simulation

P.M. White. "Effect of Distributed Gate Diode on MESFET Power Performance Evaluated by Harmonic Balance Simulation." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 611-614.

A mechanism for power limitation in GaAs MESFETs which arises from the distributed conduction properties of the resistive gate diode is evaluated using harmonic balance simulation in conjunction with a distributed diode model. It is shown that 1 dB compressed power output and peak efficiency depend on unit gate finger width which has significance for device layout and choice of gate technology in high-power applications. The simulation results are supported by experimental data.

Abstracts

Propagation Properties of Multilayer Thin-Film Polarization-Maintaining Optical 3-D Waveguide

H. Jui-Pang, T. Anada, S. Nakamura and T. Kobayashi. "Propagation Properties of Multilayer Thin-Film Polarization-Maintaining Optical 3-D Waveguide." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 615-618.

We propose a new single-mode and polarization-maintaining three-dimensional optical waveguide. The structure of the optical waveguide proposed here consists of lamination of very thin-films of two optical materials with different refractive indices and the rib-type waveguide for the confinement of the optical field in the vertical and horizontal direction respectively. The method of analysis is fundamentally based on the equivalent multi-mode transmission line model and the transverse resonance condition. By this method, the propagation properties of the guided wave for various structure parameters are investigated. Some new numerical and useful results are obtained.

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Abstracts

Accurate Characterization of Cross-Over and Other Junction Discontinuities in Two-Layer Microstrip Circuits

A. Hoorfar, J.X. Zheng and D.C. Chang. "Accurate Characterization of Cross-Over and Other Junction Discontinuities in Two-Layer Microstrip Circuits." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 619-621.

A mixed-potential spatial-domain integral equation approach is used to model the coupling and junction effects when microstrip structures in two different layers of a common substrate are crossing each other. In particular, some canonical four port and three port junctions are characterized by applying a Galerkin method with linear basis functions for the currents.

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Abstracts

Study of a Novel Planar Transmission Line

N.I. Dib, WP. Harokopus, Jr., P.B. Katehi, C.C. Ling and G.M. Rebeiz. "Study of a Novel Planar Transmission Line." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 623-626.

A new type of monolithic planar transmission line is proposed. This line can operate without the need for via-holes or the use of air-bridges for ground equalization. Furthermore, it has shown the tendency to radiate less than the conventional microstrip or coplanar waveguide (CPW) and can provide a wide range of impedances due to the many available parameters for design. The space domain integral equation method is used to analyze four different discontinuities of the proposed type. A comparison to conventional CPW with respect to radiation shows very good performance.

Abstracts

HELENA: A New Software for the Design of MMICs

H. Happy, O. Piubetich, G. Dambrine, J. Alamkan, Y. Cordier and A. Cappy. "HELENA: A New Software for the Design of MMICs." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 627-630.

HELENA, a new software for device optimization and circuit design is presented. This software provides for any kind of HEMT the DC, AC and noise properties in the cm and mm wave range. It is very fast, easy to use and needs only personal computer.

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3-D TLM Time Domain Electromagnetic Wave Simulator for Microwave Circuit Modeling

P.P.M. So and W.J.R. Hoefer. "3-D TLM Time Domain Electromagnetic Wave Simulator for Microwave Circuit Modeling." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 631-634.

A novel 3-D TLM time domain simulator for electromagnetic waves in structures of arbitrary geometry is described. It computes their response to arbitrary excitation in 3-D space and time, and extracts their frequency characteristics via discrete Fourier transform. It also visualizes the field propagation in a generated-solution mode (field animation). Furthermore it permits time reversal for inverse problem simulation. It has been implemented on RISC workstations and 386 micro-computers.

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Mixed Lumped and Distributed Network Applied to Superconducting Thin-Film Broadband Impedance Transforming

L. Zhu and L.J.P. Linner. "Mixed Lumped and Distributed Network Applied to Superconducting Thin-Film Broadband Impedance Transforming." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 635-638.

In this paper, a detailed analysis of properties of mixed lumped and distributed (MLD) lossless network is first carried out, from which the reason why the MLD network can be used as an extreme impedance transformer between source and load impedances without using extreme impedance values in the network is found. Then, the lossy transformation technique, which can be employed for the transformation between MLD lossy or lossless network and lumped lossless one, is discussed and compared with the method developed by Carlin. Finally, as an example, one quarter-wave and two MLD lossless broadband impedance transformers are synthesized for transforming extremely low input or output impedance of a superconducting device to 500 microwave system and the lossy performance of one of the MLD transformers is estimated by means of the lossy transformation technique.

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Experimental Determination of High-Speed GaAs Digital Circuit Interconnect Parameters

K. Kiziloglu, N. Dagli, G.L. Matthaei and S.I. Long. "Experimental Determination of High-Speed GaAs Digital Circuit Interconnect Parameters." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 639-642.

Coplanar strips that are representative of on-chip high-speed digital circuit interconnects have been fabricated on GaAs and characterized up to 18 GHz. Strip widths of 4, 6, and 8 µm with strip spacings of 4 and 8 µm and conductor thicknesses of 2500Å and 5000Å were used in the experiments. Line parameters such as resistance, capacitance, inductance per unit length, propagation constant, etc. were extracted from these measurements. Measurement results confirm the quasi-TEM properties of such interconnects.

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A 1.57 W/mm GaAs-Based MISFET for High-Power and Microwave-Switching Applications

F.W. Smith, C.L. Chen, L.J. Mahoney, M.J. Manfra, D.H. Temme, B.J. Clifton and A.R. Calawa. "A 1.57 W/mm GaAs-Based MISFET for High-Power and Microwave-Switching Applications." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 643-646.

A GaAs-based MISFET delivered a record output power density of 1.57 W/mm at 1.1 GHz. An RF switch based upon this device has a figure of merit (R/sub on/C/sub off/) better than that of the best commercial MESFET we have tested.

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A Planar Integral Equation Method for the Analysis of Dielectric Ridge Structures Using Generalized Boundary Conditions

T.E. van Deventer and P.B. Katehi. "A Planar Integral Equation Method for the Analysis of Dielectric Ridge Structures Using Generalized Boundary Conditions." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 647-650.

A novel method is developed to calculate the propagation characteristics of dielectric ridge structures in high frequency monolithic integrated circuits. First, the electric field in the dielectric ridge is expressed in terms of a polarization current from which an equivalent surface current density is defined. Further, genezalized boundary conditions are enforced in order to provide a simple integral equation. Results derived by this modified integral equation approach give excellent agreement with other numerical methods. The main advantage of this techniques that it simplifies greatly the analysis of three-dimensional complex structures.

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Abstracts

Large Signal Characterization and Numerical Modeling of the GaAs/AlGaAs HBT

D.A. Teeter, J.R. East, R.K. Mains and G.I. Haddad. "Large Signal Characterization and Numerical Modeling of the GaAs/AlGaAs HBT." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 651-654.

A numerical, model for GaAs/AlGaAs HBT's which includes velocity overshoot effects has been developed. Good agreement between measured and modeled small signal characteristics has been obtaimed. To understand the large signal performance of the HBT, the model has been, used to parameterize several typical device structures. At low frequencies, the parametrization method describes the large signal behavior of the HBT reasonably well up to moderate power levels. At higher frequencies, the accuracy of the method degrades. High frequency simulation results have been compared with measurements made with a 26.5 to 40 GHz active load pull system. Details of the measurement system, sources of error, and methods to reduce the error are discussed.

Abstracts

Optical Control of Microwave Active Band-Pass Filter Using MESFETs

Y. Yamamoto, K.-I. Kawasaki and T. Itoh. "Optical Control of Microwave Active Band-Pass Filter Using MESFETs." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 655-658.

A semiconductor laser tuned active band-pass filter is developed using a gate-to-source capacitance ofatwqmsed MESFET for tuning. Another MESFET is used in the circuit to provide a negative resistance to increase the tank-circuit Q-value. Tuning range of 257 MHz was obtained for a two-pole filter in X-band.

Abstracts

Design of Millimeter-Wave Extracted-Pole Filters with Asymmetrical Frequency Characteristics

R.R. Mansour and G. Woods. "Design of Millimeter-Wave Extracted-Pole Filters with Asymmetrical Frequency Characteristics." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 659-662.

In this paper, we present a rigorous field theory analysis, for iris-type extracted-pole filters. The design and performance of two extracted-pole filters with asymmetrical frequency characteristics designed at 60 GHz are described. The accuracy of the computed results is checked by comparison with the measured data.

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Abstracts

Asymmetric, Multi-Conductor Low-Coupling Structures for High-Speed, High-Density Digital Interconnects (1991 Vol. II [MWSYM])

J.P.K. Gilb and C.A. Balanis. "Asymmetric, Multi-Conductor Low-Coupling Structures for High-Speed, High-Density Digital Interconnects (1991 Vol. II [MWSYM])." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 663-666.

Small inter-line spacings and ultra-fast switching speeds emphasize the problems of crosstalk and coupling distortion in high-speed, high-density digital interconnects. However, the use of substrate compensation allows the design of structures where crosstalk and coupling can be essentially eliminated, even for inter-line spacings of less than one center conductor width. Some of the characteristics of this novel method are presented for asymmetric multi-conductor transmission lines. The study shows that it is possible to choose a substrate combination which significantly reduces coupling and crosstalk for wide range of conductor configurations.

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Analysis of Quasi Complex Modes on Lossy Substrate Boxed Microstrip Lines

F. Huret, P. Pribetich and P. Kennis. "Analysis of Quasi Complex Modes on Lossy Substrate Boxed Microstrip Lines." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 667-670.

In this communication, by using spectral domain approach improved by asymptotic expansions, we show by means of coupling integral values that the notion of quasi complex modes can be introduced for lightly lossy substrates. The quasi complex modes are particular modes with similar behaviour than lossless structure complex modes.

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Novel Type of Electrically-Controlled Phase Shifter for Millimeter-Wave Use: Theory and Experiment

J.W. Tao, B. Chan, H. Baudrand and J. Atechian. "Novel Type of Electrically-Controlled Phase Shifter for Millimeter-Wave Use: Theory and Experiment." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 671-674.

A novel type of electrically controlled phase shifter has been designed and realized at 35 GHz, by using a piezoelectric bimorph actuator. A figure of merit as high as 270°/0.35 dB has been obtained in the Ka band, as well as an insertion loss less than 0.5 dB including the mismatch of rectangular to dielectric waveguide transition. Good agreement has been observed between predicted and measured results.

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An Improved TLM Full-Wave Analysis Using a Two Dimensional Mesh

H. Jin, R. Vahldieck and S. Xiao. "An Improved TLM Full-Wave Analysis Using a Two Dimensional Mesh." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 675-677.

An improved TLM full-wave analysis method based on a novel TLM node is described. Compared to the conventional TLM full-wave analysis, which requires a three dimensional mesh, this method utilizes only a two dimensional transmission line mesh to fully characterize dispersive guided structures. This leads to a significant reduction in CPU time and memory space, and makes the TLM method an even more attractive tool in the analysis of arbitrarily shaped guided structures. Numerical results are given for shielded and suspended coupled didectric waveguides.

Abstracts

Statistical Design for Microwave Systems

R. Cooke and J. Purviance. "Statistical Design for Microwave Systems." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 679-682.

This paper presents, for the first time, a proposed methodology for statistical system design using the commercial simulator OMNISYS(TM). Using two examples, a simple amplifier chain and filter, and a complete satellite receiver system, the application and benefits of statistical system design are demonstrated. The nonlinear characteristics of the system amplifiers and mixers are accounted for in this work. The specification of group delay, signal to noise ratio, and power out are all considered in these statistical designs.

Abstracts

A New Effective Approach for High Yield Microwave Matching Network and Amplifier Design

C. Sheng and Y. Wang. "A New Effective Approach for High Yield Microwave Matching Network and Amplifier Design." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 683-686.

In this paper, orthogonal array experiment of statistics is at the first time introduced to design high yield matching networks and select high yield topologies of matching networks for the load impedances located at the different regions on the Smith Chart. The circuit designed by this new approach always has a high yield. Also with this new approach, an FET amplifier is designed. Its performances are similar to those of the amplifier of [5], but its yield is much higher than that of the latter.

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Triple-Mode Dielectric Resonator Loaded Cavity

Z.-M. Gan, Y.-Q. Li, C.-D. Feng and S.-G. Yang. "Triple-Mode Dielectric Resonator Loaded Cavity." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 687-690.

With dual HE/sub 11/ and single TM/sub 01delta/ in dielectric loaded cavities, six-pole elliptic function bandpass filter was realized, and the measured result was given.

Abstracts

Millimeterwave Coplanar Transmission Lines on Gallium Arsenide, Indium Phosphide and Quartz with Finite Metalization Thickness

W.H. Haydl, T. Kitazawa, J. Braunstein, R. Bosch and M. Schlechtweg. "Millimeterwave Coplanar Transmission Lines on Gallium Arsenide, Indium Phosphide and Quartz with Finite Metalization Thickness." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 691-694.

Coplanar lines for the millimeterwave frequency range are required to be of small dimensions, typically 25-50 µm (ground to ground spacing) for the W- and V-band respectively. The thickness of the metalization, typically 0.5 to several µm, cannot be neglected. The effect of the metalization on the impedance, propagation constant and attenuation is presented theoretically and experimentally for millimeterwave coplanar lines on gallium arsenide (GaAs), indiurn phosphide (InP) and quartz.

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Abstracts

A Scattering-Type Transverse Resonance Formulation and its Application to Open, Conductor-Backed and Shielded Slotline (M)MIC Structures

J. Bornemann. "A Scattering-Type Transverse Resonance Formulation and its Application to Open, Conductor-Backed and Shielded Slotline (M)MIC Structures." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 695-698.

A new formulation of the transverse resonance technique is introduced and applied to the propagation characteristics calculation of MIC and MMIC slot line configurations. By utilizing a scattering-type representation of the transverse discontinuities involved, the influences of different boundary conditions as required for conductor-backed, shielded or even open structures can be easily incorporated. The computed results obtained with this method are found to be in excellent agreement with measurements as well as with previously published theoretical data on fundamental and higher-order mode characteristics. The software is operational on 386-compatible workstations.

Abstracts

Conductor Loss in Hollow Waveguides Using a Surface Integral Formulation (1991 Vol. II [MWSYM])

M. Swaminathan, T.K. Sarkar and P. Petre. "Conductor Loss in Hollow Waveguides Using a Surface Integral Formulation (1991 Vol. II [MWSYM])." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 699-702.

The power-loss method along with a surface integral formulation has been used to compute the attenuation constant in hollow waveguides of arbitrary cross-section. An E-field integral equation has been developed for the surface electric currents which has been transformed into a matrix equation using method of moments. An iterative technique, i.e. Muller's method has been used to obtain the relation between the propagation constant and frequency. The attenuation constants have been calculated and formulated for various waveguides and are in good agreement with published data.

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Session U -- Field Effect Transistors

"Session U -- Field Effect Transistors." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 703-703.

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Abstracts

Ku-Band Super Low-Noise Pseudomorphic Heterojunction Field-Effect Transistors (HJFET) with High Producibility and High Reliability

T. Tokue, Y. Nashimoto, T. Hirokawa, A. Mese, S. Ichikawa, H. Negishi, T. Toda, T. Kimura, M. Fujita, I. Nagasako and T. Itoh. "Ku-Band Super Low-Noise Pseudomorphic Heterojunction Field-Effect Transistors (HJFET) with High Producibility and High Reliability." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 705-708.

This paper reports newly developed Ku-band super low-noise pseudomorphic heterojunction FETs (HJFET) with high producibility and high reliability, utilizing a novel electron beam lithography technique. The developed HJFETs with 0.25µm long and 200µm wide gate FETs showed average noise figure of 0.6 dB with 11.3 dB average associated gain at 12GHz, and exhibited high reliable operation with MTTF (mean time to failure) of 3x10/sup 9/ hours at 100° C.

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Enhancement-Mode Pseudomorphic Inverted HEMT for Low Noise Amplifier (1991 Vol. II [MWSYM])

K. Ohmuro, H.I. Fujishiro, M. Itoh, H. Nakamura and S. Nishi. "Enhancement-Mode Pseudomorphic Inverted HEMT for Low Noise Amplifier (1991 Vol. II [MWSYM])." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 709-712.

The noise characteristics of pseudomorphic inverted HEMT (P-I-HEMT) were reported for the first time in this paper. The P-I-HEMTs were fabricated in enhancement-mode. Compared with pseudomorphic HEMT, P-I-HEMT shows a lower noise figure, especially at small drain voltage and small drain current. It was concluded that the P-I-HEMT structure is suitable for fine gate low noise FETs.

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An AlGaAs/InGaAs Pseudomorphic High Electron Mobility Transistor (PHEMT) for X- and Ku-Band Power Applications

J.C. Huang, G. Jackson, S. Shanfield, W. Hoke, P. Lyman, D. Atwood, P. Saledas, M. Schindler, Y. Tajima, A. Platzker, D. Masse and H. Statz. "An AlGaAs/InGaAs Pseudomorphic High Electron Mobility Transistor (PHEMT) for X- and Ku-Band Power Applications." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 713-716.

A PHEMT with simultaneous record-high output power, gain and power-added efficiency at 10 and 18 GHz has been achieved due to the use of a new method to improve the gate-drain reverse breakdown voltage. A critical surface problem was uncovered and resolved. Silicon nitride was deposited as surface passivation.

Abstracts

A High Power, High Efficiency Millimeter-Wave Pseudomorphic HEMT

P.M. Smith, D.W. Ferguson, W.F. Kopp, P.C. Chao, W. Hu, P. Ho and J.M. Ballingall. "A High Power, High Efficiency Millimeter-Wave Pseudomorphic HEMT." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 717-720.

We have developed a pseudomorphic HEMT with record output power and high efficiency at 44 GHz. The 0.15µm gate-length, 900µm gate-width device generates 500 to 700 mW of output power with power-added efficiencies ranging from 22 to 30%. Moreover, the devices are producible DC yields for these large gate-width HEMTs are 50-80% and uniformity of electrical characteristics is excellent. Reliability aspects of the device are discussed and the results of high-temperature DC life testing of pseudomorphic power HEMTs are reported for the first time.

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High Power and High Efficiency AlInAs/GaInAs on InP HEMTs

M. Matloubian, L.D. Nguyen, A.S. Brown, L.E. Larson, M.A. Melendes and M.A. Thompson. "High Power and High Efficiency AlInAs/GaInAs on InP HEMTs." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 721-724.

In this paper we report on the development of AlInAs/ GaInAs on InP power HEMTs. Output power densities of more than 730 mW/mm and 960 mW/mm with power-added efficiencies (PAE) of 50% and 40% respectively were achieved at 12 GHz. When biased for maximum efficiency, PAE of 59% and output power of 470 mW/mm with 11.3 dB gain were obtained. These results are the first reported power performance of InP-based HEMTs and demonstrate the viability of these HEMTs for power amplification.

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A Highly Linear MESFET

S.L.G. Chu, J. Huang, W. Struble, G. Jackson, N. Pan, M.J. Schindler and Y. Tajima. "A Highly Linear MESFET." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 725-728.

A highly linear MESFET has been developed. This device incorporates a spike profile in its active channel, and was designed specifically for linearity. A third-order intercept (IP3) and a 1 dB compression power of 43 dBm and 19 dBm, respectively, have been measured on a 400 µm device at 10 GHz. The difference between these two numbers, 24 dB, is the largest yet reported for a MESFET. This device also dissipates only 400 mw of dc power, yielding a linearity Figure-of-Merit (FOM) (IP3/P/sub dc/) of 50.

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Session V -- Passive Components I

"Session V -- Passive Components I." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 729-729.

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A Rigorous Analysis of Dielectric Ring Resonators Loaded in Waveguide or Microstrip Line Structure

S.-W. Chen and K.A. Zaki. "A Rigorous Analysis of Dielectric Ring Resonators Loaded in Waveguide or Microstrip Line Structure." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 731-734.

A rigorous mode matching technique is used to analyze the dielectric ring resonators loaded in waveguide or microstrip line structure. Variations of the resonant frequencies for several lowest order modes with the structures' parameters are presented. Analysis shows that increasing the inner concentric hole's diameter of a dielectric ring resonator up to 25% of its outside diameter changes the TE/sub 01/ mode resonant frequency by less than 1%, however, increases the spurious mode free region by greater than 80% compared with the dielectric rod resonator. Two-dimensional electric and magnetic field line patterns and three-dimensional field intensity dktributions of the ring resonator are plotted, which provide valuable information on mode excitation, coupling, and suppression. Coupling between two dielectric ring resonators loaded in a metallic cavity are analyzed for application in the filter design. Experimental results are presented and shows excellent agreement with the analysis solutions within 1%.

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Dielectric Ring-Gap Resonator for Application in MMIC's (1991 Vol. II [MWSYM])

W.K. Hui and I. Wolff. "Dielectric Ring-Gap Resonator for Application in MMIC's (1991 Vol. II [MWSYM])." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 735-738.

A new dielectric resonator -- the dielectric ring-gap resonator -- is introduced and analysed. The resonant frequency and unloaded Q factor of the fundamental quasi-TE/sub 011/ mode have been calculated by a numerical field analysis and an appropriate equivalent circuit. The calculated resonant frequencies show an accuracy of <1% compared with the experimental results.

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A Broadband Tunable Distributed Feedback Resonator

J. Hausner and P. Russer. "A Broadband Tunable Distributed Feedback Resonator." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 739-742.

A tunable Bragg type distributed feedback microwave resonator is presented. The resonator is formed by a transmission line periodically loaded with varactor diodes. A tunable periodic superstructure is superimposed on the transmission line by periodically dc biasing the varactor diodes. Two resonators of this type were fabricated, one on an alumina substrate in coplanar hybrid integrated technology and the second in microstrip on RT-Duroid substrate. With this resonator configuration we achieved a tuning bandwidth from 400 MHz to 4 GHz and 200 MHz to 2 GHz, respectively.

Abstracts

Radiation Loss from Open Coplanar Waveguide Discontinuities

W.P. Harokopus, Jr. and P.B. Katehi. "Radiation Loss from Open Coplanar Waveguide Discontinuities." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 743-744.

Coplanar waveguide is becoming the dominant planar transmission line structure at millimeter-wave frequencies. In this paper, radiation losses are investigated for open coplanar waveguide discontinuities by the Space Domain Integral Equation Technique. Results are presented for CPW open-end and stub discontinuities.

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A New Method for the Calculation of the Equivalent Inductances of Coplanar Waveguide Discontinuities

M. Naghed, M. Rittweger and I. Wolff. "A New Method for the Calculation of the Equivalent Inductances of Coplanar Waveguide Discontinuities." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 747-750.

Capacitive and inductive model parameters of coplanar waveguide discontinuities are calculated using the quasistatic three-dimensional finite difference method (3D-FDM). The equivalent inductances are derived from the magnetic field distribution in the coplanar slots, which is determined by solving the Laplacian equation for the inverse structure (i.e. replacing the conductors with slots and vice versa). The method is applied to coplanar air bridge T-junctions and the results are compared with measurements. The influence of different types of air bridges are also investigated.

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Coupled Slot-Strip Coupler in Finline

M. Schoenberger, A. Biswas, A. Mortazawi and V.K. Tripathi. "Coupled Slot-Strip Coupler in Finline." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 751-753.

Dispersion characteristics and impedances of stripslot coupled lines in a shielded structure has been computed, using rigorous spectral domain technique. Using this data four port couplers in finline configuration are realized. The coupler represents a complementary structure to that, studied by Hoffman and Siegl. The analysis and design procedure for coupler presented in this paper should be useful in millimeter-wave finline circuits.

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Analysis and Design of Slot-Coupled Directional Couplers Between Double-Sided Substrate Microstrip Lines (1991 Vol. II [MWSYM])

M.F. Wong, V.F. Hanna, O. Picon and H. Bauorand. "Analysis and Design of Slot-Coupled Directional Couplers Between Double-Sided Substrate Microstrip Lines (1991 Vol. II [MWSYM])." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 755-758.

This paper proposes to study the characteristics of a slot-coupled directional coupler between two microstrip lines coupled through a rectangular slot in the common ground plane. Firstly, conformal mapping techniques are used to obtain analytic closed-form expressions for the coupler even and odd-mode impedances and propagation constants for any coupler configuration. Secondly, a full-wave analysis is performed using the spectral domain approach to determine the dispersion properties of coupler parameters. Theoretical and experimental results for a 10 dB coupler at 10 GHz are presented.

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Session W -- Novel Concepts and Characteristics of Planar Transmission Lines

"Session W -- Novel Concepts and Characteristics of Planar Transmission Lines." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 759-759.

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Abstracts

A New Definition of Characteristic Impedance

J.C. Rautio. "A New Definition of Characteristic Impedance." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 761-764.

Existing two-dimensional definitions of characteristic impedance can result in a wide range of values for the characteristic impedance of a given transmission line in inhomogeneous media. This paper suggests a three-dimensional definition, the "TEM Equivalent" characteristic impedance, which is unique for any given transmission line geometry and is appropriate for use in circuit theory applications. Comparisons with two-dimensional results and comparisons with measurements are presented. The TEM equivalent characteristic impedance also shows a non-monotonic dispersion which is not seen in the usual two-dimensional definitions but is seen in experimentally.

Abstracts

Determination of the Characteristic Impedance of Single and Coupled Lines in Layered Dielectric Media

A. Janhsen and V. Hansen. "Determination of the Characteristic Impedance of Single and Coupled Lines in Layered Dielectric Media." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 765-768.

A method is presented by which the characteristic impedances of lines in layered dielectric media can be calculated in a new way. Lines of semi-infinite extend (e.g. microstrip lines or a coupled line system) which are connected by picewise sinusodial basisfunctions are fed by Delta - gap sources. Spectral domain analysis is used to solve the eigenvalue problem of the lines and to determine the transverse current distribution. The characteristic impedance is defined as the quotient of voltage of the Delta - gap source and the total current on the lines which is calculated using the method of moments. Thus, neither the voltage between a line and the ground nor the power transported by the coupled line system is used. Results for single lines, asymmetric coupled lines and coplanar lines are given.

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Planar Transmission Lines with Finitely Thick Conductors and Lossy Substrates

Z. Kitazawa, C.W. Kao, K.-S. Kong and T. Itoh. "Planar Transmission Lines with Finitely Thick Conductors and Lossy Substrates." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 769-772.

Various types of lossy planar transmission lines are analyzed by extending the spectral domain approach. Introduction of the finite metallization model and choice of the proper basis functions for the model does not only overcome the computational difficulty, but also reduce drastically the computation labor for the calculation of the conductor loss. This procedure preserves the versatility of SDA, and it can be applied to various types of planar transmission lines. Numerical results include the effective dielectric constants, characteristic impedances and total losses (conductor and dielectric losses) for slot lines, coplanar waveguides, and strip Iines. Numerical computations show that the currents on the side walls of the metal conductors make the considerable contributions to the conductor loss and cannot be neglected, and that the quasistatic approximation gives reasonable results for the loss calculation of CPW if the metallization thickness effect is taken into consideration properly.

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Skin-Effect Current Distribution of a Unilateral Finline with Finite Conductivity

C.-D. Chen, C.-K.C. Tzuang and S.T. Peng. "Skin-Effect Current Distribution of a Unilateral Finline with Finite Conductivity." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 773-776.

This paper presents an accurate full-wave approach to the analyses of current distribution on a unilateral finline containing finite metal conductivity and thickness. The electromagnetic fields are rigorously represented in terms of a complete set of modes, and this allows the classification of the current distributions as edge currents and surface currents contributed by the air modes and the metal modes, respectively. Such an approach provides a clear physical picture for understanding of the cross-sectional current distributions throughout the metal strips, whereby the skin-effect in every direction can be explained. Finally the full-wave analysis establishes a solid basis on which the applicability of the perturbation method can be judged.

Abstracts

Characteristics of Modified Slotline Configurations

N.K. Das. "Characteristics of Modified Slotline Configurations." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 777-780.

Studies on the performances of modified slotline configurations: 1) a dual slotline and 2) a dielectric loaded conductor-backed slotline, are presented based on a full-wave spectral-domain analysis. The spectral moment method analysis is outlined, and results on propagation constant and characteristic impedance of example geometries are discussed. It is shown, that unlike an unloaded conductor-backed slotline, a conductor-backed slotline with a suitable dielectric loading on top or an even mode dual-slotline can be safely used without power leakage to the parallel plate mode.

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Analysis of Stitch Line for Monolithic Microwave Integrated Circuits

K. Kawasaki and T. Itoh. "Analysis of Stitch Line for Monolithic Microwave Integrated Circuits." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 781-784.

A new type of transmission line, called the stitch line, is introduced for possible applications in monolithic microwave integrated circuits. A simple approximate analysis method under the assumption of a quasi-TEM propagation is presented which includes the conductor loss. The s-parameters of a two-port circuit constructed with these stitch lines are computed based on the analysis. The results agree well with measured characterizations.

Abstracts

Session X -- Biological Effects and Medical Applications

"Session X -- Biological Effects and Medical Applications." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 785-785.

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Microwaves in Surgery: Method and Results

L.S. Taylor and W.P. Reed. "Microwaves in Surgery: Method and Results." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 787-790.

The design of new devices using 2.45 GHz radiation to produce thick eschars for coagulation in surgery of highly vascular organs is described. Twenty-two patients have been treated to date in FDA clinical trials; results in ten cases at Baystate Medical Center are detailed.

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Techniques for Heating Brain Tumors with Implanted Microwave Antennas

T.P. Ryan. "Techniques for Heating Brain Tumors with Implanted Microwave Antennas." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 791-794.

Microwave antennas are inserted into an array of nylon catheters implanted in brain tumors and apply a localized heat treatment to raise the tumor to 43°C. Flexible antennas of various designs have been used such as dipole, choke dipole, modified dipole and helical designs. Phase shifting and phase rotation techniques have been incorporated into the treatment system to steer power in the tumor, as predicted by computer rnodelling. Choke antennas counter the sensitivity of dipole antennas to insertion length. Clinical results are discussed with the different antenna designs.

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The Efficacy of Transurethral Interstitial Microwave Hyperthermia in the Management of Benign Prostatic Hyperplasia

H. Arastu, P. Ginsberg, M. Hightower, H. Nisenbaum, D. Plunkett and S. Jayaraman. "The Efficacy of Transurethral Interstitial Microwave Hyperthermia in the Management of Benign Prostatic Hyperplasia." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 795-795.

Fifteen patients received transurethral interstitial microwave hyperthermia for Benign Prostatic Hyperplasia according to an FDA IDE Study. At thirty and sixty day evaluations, patients reported subjective improvement in voiding pattern, urinary flow rates were increased and residual volume decreased. Thermal mapping indicates adequate heating of the central zone of the prostate. No significant adverse effects related to basic hyperthermia treatments were noted.

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Microwave Balloon Angioplasty

P. Walinsky, A. Rosen, D. Smith, D. Nardone, A. Martinez-Hernandez and Z. Kosman. "Microwave Balloon Angioplasty." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 797-800.

Angioplasty of the coronary and peripheral arteries has become standard treatment for obstructive atherosclerotic vascular disease. The major acute problems which are encountered are acute closure of the vessel due to elastic recoil, dissection of the vessel or thrombus. The major long term problem is restenosis. We have evaluated the utility of microwave thermal energy in resolving these problems. In normal and atherosclerotic rabbit models we have demonstrated the feasibility and efficacy of a microwave system to enhance the result of the primary angioplasty procedure. The result at four weeks was also enhanced by microwave energy. Clinical trials are planned to explore the clinical utility of this modality.

Abstracts

Variations of Pain Threshold and Norepinephrine Release in Rabbits Due to Microwave Stimulation

J. Teng, H. Yan, D. Vanhoenacker and A. Vander Vorst. "Variations of Pain Threshold and Norepinephrine Release in Rabbits Due to Microwave Stimulation." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 801-804.

Microwave irradiation can disturb the equilibrium between the processes of excitation and inhibition in the nervous system. Applying microwaves to stimulate some acupuncture points, analgesic effects are obtained on rabbits: microwave stimulation can increase the pain threshold and decrease the concentration of norepinephrine in the hypothalamic preoptic area at the same time.

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Analysis of Microwave Effects on Isolated Hearts

C.C. Tamburello, L. Zanforlin, G. Tine and A.E. Tamburello. "Analysis of Microwave Effects on Isolated Hearts." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 805-808.

Heartbeat stimulation and regularization effects of microwaves on the electrical activity of isolated chick embryo hearts are analyzed. The hearts were exposed to low-power pulsed modulated electromagnetic waves at 2.45 GHz. The results can be explained by studying the correlation between the cardiac and the modulation waveforms.

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New Applicators for Microwave Hyperthermia

Y. Nikawa, D. Kobayashi, S. Mori and F. Okada. "New Applicators for Microwave Hyperthermia." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 809-812.

Two types of applicators using microstrip for microwave hyperthermia are proposed. One is a microstrip patch applicator using a dielectric substrate made of silicone rubber with flowing water (Type I). The other is a microstrip array applicator using flowing water substrate (Type II). The applicators are flexible and can avoid the surface overheat of the heating medium. The heating experiments at 430 MHz show that the applicator can be in contact well with the uneven surface of the body and can heat relatively wide and deep portion inside simulated human muscle.

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Session Y -- FET and HEMT Circuits

"Session Y -- FET and HEMT Circuits." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 813-813.

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AlInAs/GaInAs on InP HEMT Low Noise MMIC Amplifiers

S.E. Rosenbaum, K. Litvin, C.S. Chou, L.E. Larson, L.D. Nguyen, C. Ngo, M. Lui, J. Henige, M.A. Thompson, U. Mishra and D. Pierson. "AlInAs/GaInAs on InP HEMT Low Noise MMIC Amplifiers." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 815-817.

We have developed AlInAs/GaInAs on InP HEMT single-stage low-noise MMIC amplifiers for operation at 12 GHz, 35 GHz, and 60 GHz. A noise figure of 0.78 dB with associated gain of 15 dB was achieved at 12 GHz. This is the lowest noise figure yet reported for a monolithic amplifier at 12 GHz. A noise figure of 1.2 dB with gain greater than 12 dB was obtained from 10 to 14 GHz. At 35.5 GHz, we have obtained 13 dB gain with 17 dB input return loss. At 55 GHz, we have obtained 8 dB gain with more than 12 dB input return loss.

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Ku-Band Power Amplifier Using Pseudomorphic HEMT Devices for Improved Efficiency

D. Helms, J.J. Komiak, W.F. Kopp, P. Ho, P.M. Smith, R.P. Smith and D. Hogue. "Ku-Band Power Amplifier Using Pseudomorphic HEMT Devices for Improved Efficiency." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 819-821.

A two-stage Ku-band power amplifier demonstrating state-of-the-art power-gain and efficiency has been developed using 0.25µm gate-length, 1600µm gate-width double-heterojunction pseudomorphic HEMT devices. At 12 GHz, output power of 2.2 and 2.7 watts has been achieved, with power-added efficiency of 39% and 36% respectively. Associated gain of 14 dB has been demonstrated.

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30-V MMIC Power Amplifier with Novel Bias Circuitry

K.E. Peterson, H.-L.A. Hung, F.R. Phelleps, E.Y. Chang, J.L. Singer, H.E. Carlson and A.B. Cornfeld. "30-V MMIC Power Amplifier with Novel Bias Circuitry." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 823-826.

High-voltage power amplifiers allow more efficient DC power conditioning and distribution than is possible with low-voltage systems. Results are presented for the first fully monolithic High-Voltage FET amplifier, with on-chip power combining and novel bias circuitry. Output power greater than 2 W was obtained with 30-V drain bias at 11 GHz. A power-added efficiency of 34 percent was also achieved, which is believed to be the best reported for such amplifiers.

Abstracts

A Compact Ka-Band MIMIC Voltage Controlled Oscillator Comparison of MESFET and HEMT Implementations

D. Bosch, M. Gawronski, S. Swirhun, J. Geddes, J. Beyer and R. Cravens. "A Compact Ka-Band MIMIC Voltage Controlled Oscillator Comparison of MESFET and HEMT Implementations." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 827-830.

A novel, compact Ka-band MMIC voltage controlled oscillator (VCO) has been designed, fabricated, and tested. The VCO design is a "ring" configuration using two FETs with two isolated control terminals which provides increased tuning bandwidth. This design uses an active feedback topology resulting in greater device size for higher output power and circuit Q. This VCO was fabricated with both 0.25µm gate length MESFET and HEMT processes designed to have similar RF equivalent circuits by engineering the device doping. To our knowledge, this is the fiist report of a monolithic millimeter-wave HEMT VCO. The measured MESFET VCO demonstrated a tuning bandwidth of 740MHz centered at 35GHz and output power of 8.3 dBm. Chip size is 30 x 34 mils. The measured HEMT VCO tuning bandwidth is greater, but phase noise is worse than the MESFET implementation. This limits HEMTs in the application of low phase noise millimeter wave oscillators.

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Monolithic 38GHz Dielectric Resonator Oscillator

P.G. Wilson. "Monolithic 38GHz Dielectric Resonator Oscillator." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 831-834.

A 38GHz monolithic DRO incorporating a 0.3micron HEMT has been designed, using a small-signal design procedure. Following fabrication in-house, ten DROs have been tested, seven of which were found to be fully working at RF and gave ouput powers up to 0dBm. The temperature coefficient of the frequency of oscillation was -2.1ppm/°C and the phase noise was -68dBc/Hz @ 100kHz from carrier. The DRO is potentially inexpensive in high volume and suitable for a local oscillator in a broadband telecommunications system.

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Low Noise Microwave Oscillator Using Ultra High Q Dielectric Resonator

K. Uzawa and K. Matsumoto. "Low Noise Microwave Oscillator Using Ultra High Q Dielectric Resonator." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 835-838.

Dielectric resonator oscillator (DRO) with excellent low single side band (SSB) noise was developed at 16 GHz. BMT (Ba(Mg/sub 1/3/Ta/sub 2/3/)0/sub 3/) ceramics with low dielectric loss (tan delta = 3.3*10/sup -5/ at 10 GHz) was used as a dielectric resonator. A conventional GaAs MESFET was used as an active component, SSB noise at 10 kHz from the carrier of -102 dBc/Hz was obtained. This is one of the lowest SSB noise level that has ever reported for a Ku-band DRO. This result implies that the low loss BMT ceramics as a high Q dielectric resonator fairly contribute to the low noise performance of the oscillators.

Abstracts

Novel High Performance SPDT Power Switches Using Multi-Gate FET's

F. McGrath, C. Varmazis, C. Kermarrec and R. Pratt. "Novel High Performance SPDT Power Switches Using Multi-Gate FET's." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 839-842.

The development of a 16 watt SPDT MESFET based switch is presented. The switch is unique in its use of a multi-gate FET device which can be fabricated on a standard production switch process. The power handling is 9 times that of a single FET while occupying only 30% more die area. The device's bandwidth is comparable to a single FET while insertion loss is minimized using a novel N-plus (N+) intergate layer. A switch using the multi-gate device has achieved 0.4dB insertion loss and 40dB of isolation at L-Band.

Abstracts

Double Balanced, Coplanar, Image Rejection Mixer Uses Monolithic MESFET Quad

D. Neuf and S. Spohrer. "Double Balanced, Coplanar, Image Rejection Mixer Uses Monolithic MESFET Quad." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 843-846.

A coplanar double balanced image rejection mixer with an input 1 dB compression level of +10 dBm uses two MESFET ring quads with only +10 dBm LO power. This is considerably more efficient in terms of LO power when compared to Schottky diodes. Eigen-circuits are used to model the balun performance.

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Session Z -- Passive Components II

"Session Z -- Passive Components II." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 847-847.

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Characterizing Waveguide T-Junctions by Three Plane Mode-Matching Techniques

X.-P. Liang and K.A. Zaki. "Characterizing Waveguide T-Junctions by Three Plane Mode-Matching Techniques." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 849-852.

A rigorous method for the solution of rectangular waveguide T-junction problems is presented. The method characterizes the waveguide discontinuity three times when the side-arm of the T-junction is terminated in a short circuit with three different lengths, and hence is called the Three Plane Mode-Matching Technique (TPMMT). Computed and measured data on both E-plane and H-plane T-junctions are compared, showing an excellent agreement, of both magnitudes and phases of the scattering matrix elements.

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Optimised Design of Eight-Port Branch-Waveguide Directional Couplers

P. Carle. "Optimised Design of Eight-Port Branch-Waveguide Directional Couplers." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 853-856.

An optimised design method for eight-port branch-waveguide directional couplers with arbitrary output power distribution is presented. This component is suitable for beam forming networks (BFN's) applications. In fact the proposed device yields a more compact design of BFN's. An eight-port coupler prototype in WR75 waveguide has been manufactured. Comparing scattering parameter measurements with the computed frequency performance shows that the design procedure is verified very satisfactorily. Moreover these couplers can be used as multiport power dividers with four input and four output ports. An example of 4-way power divider suitable for multiport amplifier applications is presented.

Abstracts

A 900MHz 90 Degrees Hybrid for QPSK Modulator

S. Arai, A. Kato, K. Minami and T. Nishikawa. "A 900MHz 90 Degrees Hybrid for QPSK Modulator." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 857-860.

A miniaturized surface mounting 90 degrees hybrid using a meandered thin film microstrip line directional coupler has been developed for the QPSK modulator. The coupling level of the narrow spacing parallel lines on a high dielectric constant (K) ceramics was calculated using Finite Element Method (FEM) and a circuit simulator. Balanced outputs and quadrature phase difference in the frequency range of 950 MHz ± 10 MHz were obtained experimentally at the size of 1.7 (H) x 4.8 (W) x 6.2 (D) mm.

Abstracts

Broadband Monolithic Passive Baluns and Monolithic Double-Balanced Mixer

T.H. Chen, K.W. Chang, H. Wang, G.S. Dow, L.C.T. Liu, S.B.T. Bui and T.S. Lin. "Broadband Monolithic Passive Baluns and Monolithic Double-Balanced Mixer." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 861-864.

This paper presents the design and fabrication of four broadband monolithic passive baluns including CPW Marchand, multilayer MS Marchand, planar-transformer, and broadside-coupled line baluns. Operational frequencies range from 1.5 GHz to 24 GHz. Maximum relative bandwidths in excess of 3:1 are achieved. Simulated performances using full wave electromagnetic (EM) analysis are in good agreement with the measured results. The design of a monolithic double-balanced diode mixer using two planar-transformer baluns are also presented. Without dc bias, the mixer shows a minimum conversion loss of 6 dB with the RF at 5 GHz and a LO drive of 15 dBm at 4 GHz. The measured input IP/sub 3/ of this mixer is better than 15 dBm over the 4 to 5.75 GHz frequency band.

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A 6 to 20 GHz Planar Balun Using a Wilkinson Divider and Lange Couplers

J. Rogers and R. Bhatia. "A 6 to 20 GHz Planar Balun Using a Wilkinson Divider and Lange Couplers." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 865-868.

A simple broadband microstrip balun has been developed using a Wilkinson divider for power splitting followed by Lange couplers for phase shifting. This planar balun structure can be easily fabricated on alumina substrate using conventional MIC process without the need for multi-layer or suspended substrate techniques. The inherent wideband characteristics of the Wilkinson divider and Lange couplers and symmetry of the structure has resulted in good broadband amplitude and phase balance performance. The balun fabricated on 10 mil alumina measures an amplitude imbalance of +/- 0.6dB average phase imbalance of 7 degrees and total insertion loss of 1.2 dB max. from 6 to 20 GHz.

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A Branch-Line-Type Eight-Port Comparator Circuit

T. Kawai, K. Iio and T. Kaneko. "A Branch-Line-Type Eight-Port Comparator Circuit." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 869-872.

A novel method of constructing an eight-port comparator with four branch-line 3 dB quadrature hybrids is described theoretically and experimentally. A relative bandwidth of up to 20 percent (for return loss and isolation better than 20 dB) is obtained by addition of simple external circuits. A strong point of the present comparator is to be manufactured on the same face of a substrate using a planar transmission line such as a stripline or a microstrip line.

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Session AA -- Receiver Components

"Session AA -- Receiver Components." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 873-873.

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A Subharmonically Pumped Resistive Dual-HEMT-Mixer

H. Zirath. "A Subharmonically Pumped Resistive Dual-HEMT-Mixer." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 875-878.

A new subharmonically pumped High Electron Mobility Transistor (HEMT)-based resistive mixer is described. The mixer is based on a paralleled HEMT-configuration where the LO is applied to the gates with the same amplitude but with opposite phase. A mixer prototype was constructed at X-band. A conversion loss of 6.5 dB was measured at an LO-power level of 12 dB/sub m/. A high LO-IF and LO-RF isolation is obtained intrinsically due to LO-cancellation. HEMT-devices were fabricated and characterized, and a nonlinear device model was developed and used in Harmonic Balance simulations.

Abstracts

A 40GHz Band Monolithic Even Harmonic Mixer with an Antiparallel Diode Pair

K. Itoh, A. Iida, Y. Sasaki and S. Urasaki. "A 40GHz Band Monolithic Even Harmonic Mixer with an Antiparallel Diode Pair." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 879-882.

A monolithic even harmonic mixer with a new simplified circuit configuration is described. The mixer employs an antiparallel diode pair, open and short circuited stubs as filters for separating RF output signal, IF input signal and LO power from each other. The circuit configuration is suitable for MMIC. A 40GHz band even harmonic mixer is fabricated on a 1.7mmx2.2mm GaAs substrate, and a conversion loss of 9.5dB and a suppression of the virtual LO leakage of 75dB are achieved.

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An Integrated GPS Receiver with Synthesizer and Downconversion Functions

R.M. Herman, A. Chao, C.H. Mason and J.R. Pulver. "An Integrated GPS Receiver with Synthesizer and Downconversion Functions." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 883-886.

An integrated circuit for GPS (Global Positioning System) receivers has been developed which includes, on one chip, an L-band downconversion function, and an LO synthesizer function with a phased-locked loop. The downconversion function contains an L-Band amplifier, active mixer, and IF amplifier. The synthesizer function is comprised of a VCO, a prescaler, a phase/frequency detector, and loop amplifier. The chip also contains output buffers for three frequencies generated by the synthesizer, and on-chip power regulation. This IC advances the level of integration for IC's operating at the L-band frequencies used by GPS. This paper will report on the design, performance, packaging, and testing techniques.

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Improved Millimeter-Wave Mixer Performance Analysis Using a Drift Diffusion Capacitance Model

I. Mehdi, P.H. Siegel and J. East. "Improved Millimeter-Wave Mixer Performance Analysis Using a Drift Diffusion Capacitance Model." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 887-890.

The capacitance-voltage characteristic of a Schottky diode as derived from Poisson's equation predicts erroneously high values of capacitance for large forward bias. The use of this capacitance model predicts temperature dependent mixer noise performance in contradiction with experimentally measured trends. It is shown that by using a drift-diffusion model for the diode capacitance the computed mixer performance is in better agreement with experiments. The need for better diode models to accurately predict high frequency temperature dependent mixer noise performance is also emphasized.

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Extremely Low-Phase Noise X-Band Field Effect Transistor Dielectric Resonator Oscillator

M. Mizan and R.C. McGowan. "Extremely Low-Phase Noise X-Band Field Effect Transistor Dielectric Resonator Oscillator." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 891-894.

The 9 GHz Field Effect Transistor (FET) Dielectric Resonator Oscillator (DRO) presented in this paper represents the best X-band DRO reported to date. The merit of the oscillator was determined by measuring the loaded quality factor, single sideband phase noise and frequency stability of the device. Additionally, the residual phase noise of the dielectric resonator and the FET amplifier were measured to determine the limiting element in the oscillator. The 9 GHz FET DRO displays a single sideband phase noise which is 3 dBc/Hz better than the previous state-of-the-art, while it exhibits a frequency stability of 0.65 ppm/K.

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50 GHz Sampler Hybrid Utilizing a Small Shockline and an Internal SRD

W.C. Whiteley, W.E. Kunz and W.J. Anklam. "50 GHz Sampler Hybrid Utilizing a Small Shockline and an Internal SRD." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 895-898.

A 50 GHz sampler whose performance is a result of the addition of a small GaAs nonlinear transmission line is described. The compact hybrid microcircuit also features a step recovery diode (SRD), a microstrip-to-slotline balun and a GaAs integrated sampling bridge to form a complete sampling subsystem.

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Abstracts

A New Design Method for Maximum Gain Formulation of a Microwave Amplifier Subject to Noise Figure and Input VSWR

M. Gunes and F. Gunes. "A New Design Method for Maximum Gain Formulation of a Microwave Amplifier Subject to Noise Figure and Input VSWR." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 899-902.

This paper presents a graphic design method for the low-noise, low input VSWR amplifiers, where all necessary design information is placed in the input impedance plane. As a consequence of the bilinear tranformations involved, all parameters can be represented by circles which centers and radii are in the input impedance plane. For a given set of the noise figure and input VSWR the maximum achievable gain and corresponding terminations can be determined by inspection of the graph. Furthermore not only the analytic expressions make the calculations very fast but the results of changes in the noise figure, input VSWR and gain can be viewed directly.

Abstracts

Session BB -- Time-Resolved Spectroscopy and Imaging of Tissues (Special Session)

"Session BB -- Time-Resolved Spectroscopy and Imaging of Tissues (Special Session)." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 903-903.

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Abstracts

Diffusion Equation Representation of Photon Migration in Tissue

M.S. Patterson, S.J. Madsen, J.D. Moulton and B.C. Wilson. "Diffusion Equation Representation of Photon Migration in Tissue." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 905-908.

A time dependent diffusion model of photon migration in tissue is used to develop analytic expansions for the diffusely reflected pulse detected some distance from a delta function input. Particular attention is paid to the nature of the boundary between the tissue and the surrounding non-scattering medium, and it is shown that the pulse shape is relatively insensitive to the nature of this boundary. Monte Carlo simulation and experimental results arc presented which confirm the accuracy of the diffision model.

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Abstracts

Simulations of Photon Migration and Image Formation in Highly Scattering Media

J.C. Haselgrove. "Simulations of Photon Migration and Image Formation in Highly Scattering Media." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 909-912.

A computer model has been used to simulate transillummation imaging of a sharp edge in the center of a highly scattering object. It is shown that R the width of the edge-spread-function of an infinitely absorbing edge increases with the migration time of the photon in a non-linear fashion. Furthermore, the spread - function is offset with respect to the edge: the offset is linearly related to the migration time. The effect is explained in terms of the non-linear nature of the imaging process.

Abstracts

Optical Ranging of Muscle and Brain

B. Chance, J. Haselgrove, J.S. Leigh, M. Patterson and E. Sevick. "Optical Ranging of Muscle and Brain." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 913-916.

Radar and optical ranging under conditions of poor propagation through scattering media have similarities in detection and imaging of brain biochemistry. In the intensely scattering properties of the brain, chemical identification of altered states of hemoglobin oxygenation are described and approaches to localization of brain bleeding are outlined. Both time domain and frequency domain employ similar technology. In brain study, a pulse time resolution of 400 ps and in phase modulation frequencies in the vicinity of 200 MHz can be employed. In both systems, global or localized data acquisition detects or images brain hypoxia or localized bleeding.

Abstracts

Experimental Study of the Diffraction of Photon Density Waves by an Absorbing Edge in Highly Scattering Media

J.B. Fishkin, B.A. Feddersen and E. Gratton. "Experimental Study of the Diffraction of Photon Density Waves by an Absorbing Edge in Highly Scattering Media." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 917-920.

Near-infrared imaging of bodily tissues is of prime importance in medicine. This study makes further inroads into the understanding of the physical principles behind the optical processes occurringin these highly scattering media. Using frequency-domain methods, we have studied the diffraction of transmitted intensity-modulated light waves on an absorbing edge which could be carried in position relative to the illumination and detection fiber optics. The medium was highly scattering and had a variable, adjustable absorption. We report the experimental conditions for which the highest spatial resolution is obtained and discuss the influence of the various photon paths. This work was funded by the National Institutes of Health, grant RR03155.

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"Index of Authors (1991 Vol. II [MWSYM])." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 921-924.

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"Exhibitors (1991 Vol. II [MWSYM])." 1991 MTT-S International Microwave Symposium Digest 91.2 (1991 Vol. II [MWSYM]): 925-926.

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"Panel Sessions (1991 Vol. III [MWSYM])." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): iii-viii.

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Session CC -- Millimeter-Wave Integrated Circuits and Technology I

"Session CC -- Millimeter-Wave Integrated Circuits and Technology I." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 927-927.

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Abstracts

W Band Whispering Gallery Dielectric Resonator Mode Oscillator

D. Cros, C. Tronche, P. Guillon and B. Theron. "W Band Whispering Gallery Dielectric Resonator Mode Oscillator." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 929-932.

This paper presents the utilisation of planar millimeter wavelength whispering gallery dielectric resonator modes for designing a W band Gunn diode oscillator. An oscillator has been realised in W band, the performances of which are better than those obtained by using conventional metallic resonator.

Abstracts

A W-Band Double/Amplifier Chain Using a MMIC Varactor Doubler and a MMIC Power MESFET Amplifier

G. Hegazi, E. Chang, J. Singer, F. Phelleps, P. McNally, K. Pande, P. Rice and P. Pages. "A W-Band Double/Amplifier Chain Using a MMIC Varactor Doubler and a MMIC Power MESFET Amplifier." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 933-936.

A monolithic microwave integrated circuit (MMIC) W-band varactor doubler has been developed that delivers 30 mW of output power at 93 GHz with 12 percent conversion efficiency. U-band MMIC MESFET power amplifier chips were also developed that exhibit 0.23 W of output power with 13 dB of gain from 45.5 to 46.5 GHz. A doubler/amplifier chain has been integrated to deliver 30 mW of output power at 93 GHz with an overall gain of 7 dB.

Abstracts

A Millimeter-Wave, Third-Harmonic, Gunn VCO with Ultra-Wideband Tuning

L.D. Cohen. "A Millimeter-Wave, Third-Harmonic, Gunn VCO with Ultra-Wideband Tuning." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 937-938.

State-of-the-art ultra-wideband tuning (69 to 91 GHz) has been demonstrated with a third-harmonic, varactor-tuned, GaAs Gunn oscillator. The 22-GHz wide tuning band was obtained by tuning the voltage controlled oscillator (VCO) at fundamental frequency and using the in-situ generated Gunn-diode third harmonic for output. This is the first reported operation of a third-harmonic Gunn VCO.

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Abstracts

43.5 to 45.5 GHz Active Times-4 Frequency Multiplier with 1.4 Watt Output Power

C. Creamer, P. Chye and B. Sinclair. "43.5 to 45.5 GHz Active Times-4 Frequency Multiplier with 1.4 Watt Output Power." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 939-942.

The active multiplier/amplifier described in this paper produces a minimum 1.41 W output power in a 2 GHz band centered at 44.5 GHz. Total dc power consumption is 18.7 W. The entire unit, including drive amplifier, quadruple, EHF power amplifier and high-speed bias control circuitry, is housed in a hermetic 3.8-x1.3-x0.45-inch package weighing 3.7 oz. This represents an order-of-magnitude reduction in size and weight compared to existing IMPATT-based EHF transmitters. The results we present were achieved by using 0.2-µm GaAs PHEMT MMICs coupled with a low-loss planar combining scheme.

Abstracts

A High Performance W-Band Monolithic Pseudomorphic InGaAs HEMT LNA

H. Wang, G.S. Dow, K. Tan, J. Berenz, T.N. Ton, T.S. Lin, P. Liu, D. Streit, P.D. Chow and B. Allen. "A High Performance W-Band Monolithic Pseudomorphic InGaAs HEMT LNA." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 943-946.

A high performance W-band monolithic two-stage LNA based on pseudomorphic InGaAs/GaAs HEMT devices has been developed. This amplifier has a measured small signal gain of 13.3 dB at 94 GHz and 17 dB at 89 GHz. The noise figure is 5.5 dB from 91 to 95 GHz. This is the best reported performance of a W-band monolithic LNA. The measured results of this MMIC LNA even rival some of the recently reported hybrid LNAs. A rigorous analysis procedure was incorporated in the design, including accurate active device modeling and full-wave EM analysis of passive structures. The first pass success of this LNA chip design indicates the importance of a rigorous analysis/design methodology in the millimeter wave monolithic IC development.

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Session DD -- Ferrites and Acoustics

"Session DD -- Ferrites and Acoustics." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 947-947.

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Abstracts

Application of Perturbation Theory to Toroidal Phase Shifters

B. Lax and J. Pehowich. "Application of Perturbation Theory to Toroidal Phase Shifters." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 949-951.

A perturbation treatment provides a quantitative solution for inhomogeneous ferrite waveguides structures. Theory and experiments for the differential phase shift in single and double toroidal phase shifters agree within 5% over a broadband. Treatment of higher order modes, impedances and extension to other devices are outlined.

Abstracts

Slot Line Between Oppositely-Magnetized Ferrite Layers for Broadband, High-Nonreciprocity Phase Shifters

C.J. Koza and E.-B. El-Sharawy. "Slot Line Between Oppositely-Magnetized Ferrite Layers for Broadband, High-Nonreciprocity Phase Shifters." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 953-956.

A novel phase shifting structure that exhibits both broadband operation and high nonreciprocity is presented. This structure is comprised of a slot line between two oppositely-magnetized ferrite substrates. A full-wave, spectral-domain analysis is used, where Green's functions are formulated using a transmission matrix approach. By eliminating the use of relatively thick high-dielectric substrates, a bandwidth of 3:1 and a differential phase of 50°/cm are feasible. The addition of thin layers of high-dielectric material is shown to increase the differential phase to over 100°/cm without significantly reducing the bandwidth.

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Tunable Band-Stop Filter Based on Epitaxial Fe Film on GaAs

V.S. Liau, T. Wong, W. Stacey, S. Ali and E. Schloemann. "Tunable Band-Stop Filter Based on Epitaxial Fe Film on GaAs." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 957-960.

Theoretical and experimental work on tunable band-stop filters based on single-crystal Fe films is reported. The filters can be tuned over a broad frequency range with a relatively small magnetic field. Theoretical predictions based on a parallel plate transmission line model agree qualitatively with the observations, but the measured attenuation per unit length is about 2.5 times smaller than predicted.

Abstracts

Computer - Aided Design and Optimisation of Broadband Stripline Circulators for 18-30 GHz and 18-40 GHz

M.T. Hickson, L.E. Davis, D.K. Paul and D.B. Sillers. "Computer - Aided Design and Optimisation of Broadband Stripline Circulators for 18-30 GHz and 18-40 GHz." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 961-964.

Computer programs have been written for the design and optimisation of tracking stripline circulators, and used to predict the performance of broadband designs, 18 - 30 GHz and 18 - 40 GHz, using ferrites with 4piM/sub s/ /spl ap/ 5000G. Initial results show promising agreement between predicted and experimental performance and an undesirable insertion-loss spike has been identified as due to an inherent mismatch associated with circulator modes. The design and location of matching transformers are discussed, and the programs can be used with a commercial design software.

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Temperature Compensated Permanent Magnet YIG Tuned Oscillators

Y. Ataiiyan and D. Hejmanowski. "Temperature Compensated Permanent Magnet YIG Tuned Oscillators." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 965-968.

Advantages, disadvantages and areas of concern regarding the use of a permanent magnet as a means of providing the magnetic bias field for the YIG tuned oscillators are discussed. Two different types of permanent magnet YIG tuned oscillators with the temperature variation of less than 15 PPM/°c are constructed. The measured characteristics of some of these devices are presented.

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A 2 - 5 GHz Tunable Magnetostatic Wave Oscillator

I. Aoki. "A 2 - 5 GHz Tunable Magnetostatic Wave Oscillator." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 969-972.

We developed a prototype 2 - 5 GHz tunable magnetostatic wave (MSW) delayline oscillator. A continuous frequency sweep range is between 1.8 GHz and 5.6 GHz. SSB phase noise characteristics at 10 kHz offset frequency are better than -111 dBc/Hz. We have carefully controlled an oscillation power level because a saturation of a MSW delayline degrades inherent SSB phase noise of the delayline by 40 dB at 10 kHz offset frequency. The degradation of the the inherent SSB phase noise directly affect to an output signal. The frequency drift rate changes from 6.8 MHz/K to 2.8 MHz/K for 2-5 GHz almost linearly. We stabilized the drift within ±20 MHz for the temperature range from 270 K to 340 K by sensing YIG film temperature and adjusting tuning coil current.

Abstracts

SAW Microstrip Front-End for Mobile Communication Systems in the GHz Range

K. Anemogiannis, P. Russer, R. Weigel and C. Zimmerman. "SAW Microstrip Front-End for Mobile Communication Systems in the GHz Range." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 973-976.

Design, fabrication and performance of a SAW microstrip front-end circuit in the low GHz range for applications in time division multiple access (TDMA) systems are reported. The front-end consists of a transmitter part (containing a SAW filter for noise suppression, and amplifiers), a receiver part (containing a stripline filter for preelection, a SAW filter, and a low noise amplifier), and a duplexing circuit. Both the transmitter SAW filter and the receiver SAW filter are low-loss filters with a center frequency of 1.684 GHz, a fractional 3 dB-bandwidth of 3.5 %, and an insertion loss of 6 dB. Pin-diode switching is used in the duplexer. The front-end operates at 1.684 GHz and has a 1 dB-bandwidth of 30 MHz. The output power at the antenna port is 23 dBm. The transmitter-receiver isolation is better than 50 dB. The present work arose from a requirement of a minature low-cost front-end for the digital European cordless telephone. The paper also presents some new design techniques for low-loss SAW filters in the upper UHF band.

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Session EE -- CAD Modeling for Transmission Structures

"Session EE -- CAD Modeling for Transmission Structures." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 977-977.

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Sensitivity Analysis of Lossy Coupled Transmission Lines (1991 Vol. III [MWSYM])

S. Lum and M. Nakhla. "Sensitivity Analysis of Lossy Coupled Transmission Lines (1991 Vol. III [MWSYM])." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 979-982.

An analysis method, based on the numerical inversion of the Laplace transform, is described for the evaluation of the time domain sensitivity of networks which include lossy coupled transmission lines. The sensitivity can be calculated with respect to network components and parameters of the transmission lines. Examples and comparisons with sensitivity determined by perturbation are presented.

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Abstracts

Analysis of Lossy Multiconductor Transmission Lines Using the Asymptotic Waveform Evaluation Technique (1991 Vol. III [MWSYM])

T. Tang, M. Nakhla and R. Griffith. "Analysis of Lossy Multiconductor Transmission Lines Using the Asymptotic Waveform Evaluation Technique (1991 Vol. III [MWSYM])." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 983-986.

A new method is described for the transient analysis of lossy coupled transmission line networks with linear or nonlinear terminations. This method is based on an asymptotic waveform evaluation technique which offers two to three orders of magnitude speedup when compared to previously published methods with comparable accuracy. The method is useful for delay and crosstalk simulation of high speed VLSI interconnects.

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Abstracts

High Speed Digital System Simulation Using Frequency Dependent Transmission Line Network Modeling

M.S. Basel, M.B. Steer, P.D. Franzon and D. Winkelstein. "High Speed Digital System Simulation Using Frequency Dependent Transmission Line Network Modeling." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 987-990.

A robust and accurate method for the analysis of high speed digital circuits with a lossy, frequency-dependent transmission line network is presented. Implementation in an analog circuit simulator, using convolution and time-domain scattering parameters, in combination with a linear microwave circuit simulator is discussed.

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Abstracts

An Universal Model for Lossy and Dispersive Transmission Lines for Time Domain CAD of Circuits

J.I. Alonso, J. Borja and F. Perez. "An Universal Model for Lossy and Dispersive Transmission Lines for Time Domain CAD of Circuits." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 991-994.

An universal equivalent circuit for lossy and dispersive transmission lines is presented. Existing CAD packages, such as SPICE, can be used for its implementation. The starting point for obtaining the model are the analog filters which approximate the forward impulse response and characteristic impedance. The equivalent circuit is used to simulate the effects for pulse propagation on microstrip transmission lines. An examination of the validity of the model is carried out analyzing the response for an example case in the time and frequency domains.

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Field Distribution and Dispersion Characteristics of Fundamental and Higher-Order Modes in Miniature Hybrid MIC (MHMIC) Considering Finite Conductor Thickness and Conductivity

K. Wu and R. Vahldieck. "Field Distribution and Dispersion Characteristics of Fundamental and Higher-Order Modes in Miniature Hybrid MIC (MHMIC) Considering Finite Conductor Thickness and Conductivity." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 995-998.

A hybrid-mode analysis of coplanar transmission lines on 10mils alumina substrate with lossy back metallization is presented. A self-consistent approach is used together with the method of lines (MoL) to determine the propagation constant, losses and field distribution considering finite metallization thickness and conductor losses. Results are given for the fundamental and first two higher-order modes. It is demonstrated that the onset of higher order modes limits the frequency range of conductor backed CPW's.The method presented is general and can be used in the analysis of Miniature Hybrid MIC's (MHMIC) and MMIC's and can include also semiconductor losses.

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Abstracts

A Combination of FD-TD and Prony's Methods for Analyzing Microwave Integrated Circuits (1991 Vol. III [MWSYM])

W.L. Ko and R. Mittra. "A Combination of FD-TD and Prony's Methods for Analyzing Microwave Integrated Circuits (1991 Vol. III [MWSYM])." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 999-1002.

It is demonstrated in this paper that in applying the FD-TD technique to analyze microwave integrated circuits, the long FD-TD time record required for generating accurate frequency domain scattering parameters can be extrapolated from a relatively short FD-TD time record by using Prony's method. As shown by comparison with the direct FD-TD generated results, the new approach using the combination of FD-TD and Prony's methods achieves the same type of accuracy with a time record computed over a much shorter time.

Abstracts

Full Wave Analysis of Propagation Characteristics of a through Hole Using the Finite-Difference Time-Domain Method (1991 Vol. III [MWSYM])

S. Maeda, T. Kashiwa and I. Fukai. "Full Wave Analysis of Propagation Characteristics of a through Hole Using the Finite-Difference Time-Domain Method (1991 Vol. III [MWSYM])." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1003-1006.

A full wave analysis of the propagation characteristics of a through hole was carried out using the finite-difference time-domain (FD-TD) method. The results were compared with measured values. Agreement between computed results and measured ones was excellent from DC to high frequencies. As a result, it is shown that at high frequencies, radiation is at a significant level. The frequency characteristics of radiation depend on the structure of the through hole, especially its rod diameter and microstrip connecting angle.

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Session FF -- Applications of Measurement Technology

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Abstracts

Industrial Microwave Sensors

E. Nyfors and P. Vainikainen. "Industrial Microwave Sensors." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1009-1012.

Microwave sensors are used for a variety of applications in the industry, in medicine, and for research purposes. This paper gives a survey of the different types of sensors and rewieves the latest developements reported by European institutes and companies.

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Range Measurement of Nonreflecting and Reflecting Targets Using Interaction of Ultrasound and Microwaves

M. Daas and R. Knochel. "Range Measurement of Nonreflecting and Reflecting Targets Using Interaction of Ultrasound and Microwaves." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1013-1016.

A new measurement technique for simultaneous remote range and temperature determination is reported, which utilizes the microwave (10.0 GHz) back-scatter from a traveling ultrasound wave (about 22 KHz) /1/. For the first time, such a system is operated in a closed environment which suffers from clutter echoes. Maximum range in the order of 30 m can be measured with an accuracy of better than 1%. Multiple targets are detectable with a resolution of at least 2%. The air temperature profile along the path can be determined with the same local resolution and with an accuracy of better than ± 0.10° C.

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Highly Sensitive Measurements with a Lens-Focussed Reflectometer (1991 Vol. III [MWSYM])

D.R. Gagnon. "Highly Sensitive Measurements with a Lens-Focussed Reflectometer (1991 Vol. III [MWSYM])." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1017-1018.

A lens-focussed microwave reflectometer is described which offers exceptional sensitivity and very wide bandwidth. The system produces a well confined spot focus and, with the prescribed calibration procedure, gives effective directivity approaching 70 dB. Precision of ±1dB is demonstrated for measurements, in X-band, at the -50 dB level.

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Novel Truncated Cone Cavity for Surface Resistance Measurements of High T/sub c/ Superconducting Thin Films

B. Mayer, R. Knochel and A. Reccius. "Novel Truncated Cone Cavity for Surface Resistance Measurements of High T/sub c/ Superconducting Thin Films." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1019-1022.

A new truncated cone cavity is described which avoids degeneration between the TE/sub o1n/ and TM/sub 11n/ modes occuring in the most often used circular cylindrical cavities for material measurements. Analytical expressions for the field components are given. An error analysis is carried out which yields a sensitivity of 2.3 mOmega for surface resistance measurements at 18 GHz using samples with a diameter of 9 mm. One cavity was built and measurement results are given for the surface resistance of various YBa/sub 2/Cu/sub 3/ O/sub x/ thin films on MgO substrates. The samples were manufactured by means of laser ablation and magnetron sputtering.

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A Highly Sensitive Millimetre Wave Quasi-Optical F.M. Noise Measurement System (1991 Vol. III [MWSYM])

G.M. Smith and J.C.G. Lesurf. "A Highly Sensitive Millimetre Wave Quasi-Optical F.M. Noise Measurement System (1991 Vol. III [MWSYM])." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1023-1026.

A highly sensitive, tuneable, low loss quasi-optical millimetre wave F.M. noise measurement system has been constructed, with state of the art performance. It utilises a novel matched, easily tuneable quasi-optical cavity in reflection, to act as a carrier suppression filter. This can operate with matched cavity Q's of several hundred thousand with almost zero insertion loss to provide an extremely high discriminator slope at low power levels. The F.M. noise measurement system can allow direct measurement of phase locked sources at low input power levels over ultra-wideband frequency ranges.

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A Multistate Reflectometer in Dielectric Guide for the Frequency Range 75-140GHz

R.J. Collier and M.F. D'Souza. "A Multistate Reflectometer in Dielectric Guide for the Frequency Range 75-140GHz." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1027-1030.

In the paper an implementation of a four-port Multistate Reflectometer using dielectric guide for the frequency band 75-140GHz is presented along with all its necessary components. The paper focuses on the realisation of a phase shifter as this, the key component, does not till now have an equivalent for use with dielectric waveguides. The characteristics of the final instrument are then measured at intermediate frequencies and a calibration performed at 94GHz. Measurements were performed at the National Standards Division at R.S.R.E. in Malvern U.K., and subsequent results are in good agreement with theory.

Abstracts

A Computer Controlled Noise Parameter Measurement System

B. Albinsson, H. Guo, M. Schoon and H.-O. Vickes. "A Computer Controlled Noise Parameter Measurement System." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1031-1034.

A novel, computer controlled, noise parameter measurement system utilizing a new programmable load, is presented. Both signal and noise measurements are possible using only two transfer switches. A thorough mathematical treatment and accuracy calculations are presented. The performance of the system is verified by measurements (4-8GHz).

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Session GG -- Millimeter-Wave Integrated Circuits and Technology II

"Session GG -- Millimeter-Wave Integrated Circuits and Technology II." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1035-1035.

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94 GHz Subharmonically Pumped MMIC Mixer

D. Blackwell, H.G. Henry, J.E. Degenford and M. Cohn. "94 GHz Subharmonically Pumped MMIC Mixer." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1037-1039.

A 94 GHz subharmonically pumped antiparallel diode pair MMIC mixer with a short circuit sum frequency termination is described. Advantages of the mixer configuration include: 1) reduced conversion loss, 2) elimination of the need for an area consuming hybrid junction while retaining the separation of LO, RF and IF ports, 3) inherent LO noise sideband suppression, and 4) very small size and cost.

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Ultra Low Noise High Gain W-Band InP-Based HEMT Downconverter

P.D. Chow, K. Tan, D. Streit, D. Garske, P. Liu and H.C. Yen. "Ultra Low Noise High Gain W-Band InP-Based HEMT Downconverter." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1041-1044.

State-of-the-art performance have been achieved at W-band on a two-stage LNA and on a single-ended active mixer fabricated using 0.15 micron T-gate lnP HEMT devices. The LNA showed 3 dB noise figure and 16.5 dB associated gain at the waveguide interface at 93 GHz. The active HEMT mixer has 2.4 dB conversion gain and 7.3 dB noise figure at 94 GHz RF and 85 GHz LO. At the same RF and LO frequencies, the complete downconverter showed 3.6 dB noise figure and 17.8 dB conversion gain at the waveguide input and output.

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A Millimeter Wave Passive FET Mixer with Low 1/F Noise

J. Geddes, P. Bauhahn and S. Swirhun. "A Millimeter Wave Passive FET Mixer with Low 1/F Noise." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1045-1047.

A unique millimeter wave resistive FET mixer design provides down conversion to low IF frequencies with low l/f noise. The single FET unbalanced mixer has a double sideband noise figure of 7.5 dB with a conversion loss of 9dB at an LO drive level of 9dBm. An RF to LO isolation of 15 dB is achieved through use of a resonant loop from drain to gate. The design allows downconconversion to low IF frequencies using a FET compatible process with a small chip size. A comparison of MESFET snf HEMT versions of the mixer shows that the l/f noise level is higher in the HEMT mixer.

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Q- and V-Band Planar Combiners

D.I. Stones and P.D. Chow. "Q- and V-Band Planar Combiners." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1049-1052.

Millimeter-wave planar power combiners have been developed at frequencies of 44 GHz and 60 GHz. These combiners are 3-way and 5-way and are of tapered line construction. They show transmission loss of 0.6 dB, VSWR of 1.5:1 and isolation of greater than 15 dB.

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Nearly Dispersionless Microstrip for 100 GHz Pulses Utilizing a Buried Silicide Groundplane

K.W. Goossen, H. Roskos, M.C. Nuss, D.W. Kisker, B. Tell, A.E. White, K.T. Short, D.C. Jacobson and J.M. Poate. "Nearly Dispersionless Microstrip for 100 GHz Pulses Utilizing a Buried Silicide Groundplane." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1053-1056.

Measurements of pulse propagation on microstrip lines on silicon that use a buried highly conducting CoSi/sub 2/ groundplane are presented. These lines show significant reductions in dispersion compared to lines using a standard groundplane on the back of the substrate, due to the much smaller conductor separation. Rise times of 100 GHz pulses increase only from 2.5 ps to 3.7 ps on the buried groundplane microstrip after 5 mm propation, compared to 2.7 ps to 11.3 ps on a conventional microstrip. The CoSi/sub 2/ layer is formed by an ion-implant and alloy technique that results in a crystalline silicon overlayer allowing device fabrication.

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Session HH -- Microwave and Millimeter-Wave Packaging

"Session HH -- Microwave and Millimeter-Wave Packaging." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1057-1057.

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Packaging and System Integration of Microwave and Digital Monolithic IC's

G.L. Holz, J.L. Bugeau and M.A. Priolo. "Packaging and System Integration of Microwave and Digital Monolithic IC's." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1059-1062.

Multilayer microwave substrates offer numerous advantages for today's high density packaging requirements. A single firing, multilayer process which uses a combination of thick and thin film metallization on hardened ceramic has been developed. This technology promotes the integration of digital, analog, and microwave circuit designs onto a single multilayer substrate. It provides an increase in interconnect density, a reduction in the number of parts and a decrease in assembly operations. This represents a novel packaging approach which provides greater design flexibility and superior electrical performance for microwave products such as couplers, filters, MMIC modules, delay lines, and millimeter-wave packages.

Abstracts

A High Performance Quartz Package for Millimeter-Wave Applications

Y.C. Shih, K. Li, K. Kasel, L. Fong, G. Holz and K. Shalkhauser. "A High Performance Quartz Package for Millimeter-Wave Applications." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1063-1066.

A high performance quartz package has been developed for millimeterwave applications. When integrated with a 50-ohm through-line, the 0.25-inch long package was measured with an insertion loss less than 1.2 dB and a return loss better than 15 dB up to 35 GHz.

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MMIC Transmission Lines for Multi-Layered MMICs

H. Ogawa, T. Hasegawa, S. Banba and H. Nakamoto. "MMIC Transmission Lines for Multi-Layered MMICs." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1067-1070.

Multi-layered MMIC transmission line configurations have been proposed, their performance experimentally investigated. Four transmission line structures have been fabricated using polyimide films. Four transmission lines discussed in this paper are: (1) Microstrip line with overlay, (2) Inverted microstrip line, (3) Trapezoid microstrip line, (4) Valley microstrip line.

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Optimum Microstrip Interconnects

S. Nelson, M. Youngblood, J. Pavio, B. Larson and R. Kottman. "Optimum Microstrip Interconnects." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1071-1074.

A simple, automated assembly technique has been developed which solves the high VSWR and insertion loss problems associated with variable wire inductance in microwave assemblies. The following paper discusses theory, design and fabrication of optimum microstrip interconnects from 2 to 20 GHz. Microstrip interconnects, modeled and measured, are shown to achieve VSWRs of 1.2:1 through 20 GHz, even when several intercomects are cascaded. The technique is tolerant of gap variations between substrates and of misalignment of the microstrip conductors.

Abstracts

Effects of Coefficient of Thermal Expansion Mismatch on Solder Attached GaAs MMICs

J. Pavio and D. Hyde. "Effects of Coefficient of Thermal Expansion Mismatch on Solder Attached GaAs MMICs." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1075-1078.

An evaluation/qualification was undertaken to examine reliability effects of GaAs solder attachment to a variety of different materials with a diverse range of coefficients of thermal expansion (CTE). Failure mechanisms included fractures or cracks through the devices as well as cracking of the corners. GaAs devices placed under tensile stress with materials such as Kovar (CTE 5.1 ppm/°C) experienced severe cracking and corner fracture through long term reliability screening. Devices placed under compressive stress, on the other hand, did not degrade through life testing unless the CTE mismatch was greater than or equal to 16.5 ppm/°C. From this evaluation, a coefficient of thermal expansion range was defined at which GaAs can be reliably attached and expected to operate without failures through 1000 cycles of MIL-STD thermal cycling.

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Session II -- 3-D Field Theory-Based CAD

"Session II -- 3-D Field Theory-Based CAD." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1079-1079.

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Abstracts

Systematic Investigation of Coplanar Waveguide MIC/MMIC Structures Using a Unified Strip/Slot 3D Electromagnetic Simulator

R. Bromme and R.H. Jansen. "Systematic Investigation of Coplanar Waveguide MIC/MMIC Structures Using a Unified Strip/Slot 3D Electromagnetic Simulator." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1081-1084.

The electrical properties of coplanar waveguide MIC/MMIC structures like open and short end, gap, step, bend, tee and capacitor have been studied using an efficient, unified strip/slot 3D electromagnetic simulator. Parasitic slot mode excitation, the effects of air bridges and equivalent circuit representations are discussed for frequencies to 60 GHz and higher.

Abstracts

A Computationally Efficient Method for Improving the Speed of Full Wave Analysis CAD Programs for Microstrip Circuits

L.C. Howard and J.M. Dunn. "A Computationally Efficient Method for Improving the Speed of Full Wave Analysis CAD Programs for Microstrip Circuits." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1085-1086.

Moment method analysis of microstrip structures is becoming increasingly popular because of its ability to model very general structures. One drawback is the amount of computer time required. A new, and highly efficient, approximation to the Green's function used in many formulations is presented here.

Abstracts

High-Speed 3D Electromagnetic Simulation for MIC/MMIC CAD Using the Spectral Operator Expansion (SOE) Technique

R.H. Jansen and J. Sauer. "High-Speed 3D Electromagnetic Simulation for MIC/MMIC CAD Using the Spectral Operator Expansion (SOE) Technique." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1087-1090.

A layout-oriented 3D electromagnetic simulation tool for the CAD of MICs/MMICs with several new features is described. It exhibits higher speed in multifrequency analyses than the known standard algorithms by using spectral operator expansion (SOE) with non-regular expansion functions. Its use in the context of CAD is outlined by examples.

Abstracts

Analysis of Multiple Coupled Microstrip Discontinuities for Microwave and Millimeter Wave Integrated Circuits

A. Hill. "Analysis of Multiple Coupled Microstrip Discontinuities for Microwave and Millimeter Wave Integrated Circuits." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1091-1094.

A novel technique is introduced which allows the analysis of multiple coupled microstrip discontinuities including those structures that are embedded by multiple coupled transmission line sections such as coupled right angle bends. The method, based on the fullwave 3D moment method, is verified by comparing the simulated results of a microstrip coupler to those obtained from an experimentally verified 2D spectral domain technique. In addition, the effect of the coupled line spacing on the S parameters of typically encountered coupled microstrip discontinuities is demonstrated.

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Abstracts

A High Level Compiler for the Electromagnetic Modeling of Complex Circuits by Geometrical Partitioning

G.E. Howard and Y.L. Chow. "A High Level Compiler for the Electromagnetic Modeling of Complex Circuits by Geometrical Partitioning." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1095-1098.

An electromagnetic geometrical compiler k introduced. The compiler takes the structure being investigated and breaks it down into blocks via many levels of structural decomposition. The structure once thus decomposed is then analyzed from the bottom up using the method of moments. By using this procedure, large and complex structures can be analyzed quickly and with little computer memory.

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Abstracts

A Modified Dynamic Model for Planar Microwave Circuits (1991 Vol. III [MWSYM])

T. Rozzi, A. Morini, A. Pallotta and F. Moglie. "A Modified Dynamic Model for Planar Microwave Circuits (1991 Vol. III [MWSYM])." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1099-1102.

The present work is aimed at enhancing the effectiveness of the moments method in solving planar microwave circuits problems. It stems from the same analytical model as [1,2]. Its novelty consists in introducing a technique, of fundamental mode sampling, that substantially reduces the complexity of the analysis and the computation time involved in the characterization of all practical discontinuities. Moreover, the numerical results are in very good agreement with experimental data.

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The Rigorous CAD of Aperture Coupled T-Junction Bandstop-Filters, E-Plane Circuit Elliptic-Function Filters, and Diplexers

F. Arndt and T. Sieverding. "The Rigorous CAD of Aperture Coupled T-Junction Bandstop-Filters, E-Plane Circuit Elliptic-Function Filters, and Diplexers." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1103-1106.

The rigorous CAD of waveguide bandstop-filters, of elliptic-function E-plane integrated circuit filters with additional bandstop cavities, and of high return loss E-plane T-junction diplexers with iris matching elements is introduced. Based on the general rectangular waveguide T-junction key-building block modal S-matrix, the design takes into account both the finite thickness of all coupling elements and the higher order mode interaction at all step discontinuities. The theory is verified by measurements.

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Finite Element Analysis of Resonant Cavities and Waveguides Using a Vector Potential Formulation

B.E. MacNeal, L.A. Larkin and J.R. Brauer. "Finite Element Analysis of Resonant Cavities and Waveguides Using a Vector Potential Formulation." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1107-1110.

A general, finite element formulation of resonant field behavior is presented. The formulation uses the magnetic vector potential /spl rarr over A/ and time-integrated electric scalar potential Psi as solutions variables. Two types of physical modes are found. "Microwave" modes with nonzero /spl rarr over A/ and Psi components represent ordinary, high-frequency resonant behavior in the presence of inhomogeneous, anisotropic dielectrics. Because the time-integral of the scalar potential is used, "electrostatic" modes are found at zero frequency with only Psi components. Unphysical "spurious" modes are eliminated using a modal transformation method- in a way that does not affect physical solutions. The capability is demonstrated with two examples.

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Session JJ -- On-Wafer and Noise Measurements

"Session JJ -- On-Wafer and Noise Measurements." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1111-1111.

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Extraction of FET Model Noise-Parameters from Measurement

A. Riddle. "Extraction of FET Model Noise-Parameters from Measurement." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1113-1116.

A rigorous noise-parameter extraction technique for MESFETs and HEMTs is presented. This technique analytically extracts the FET current noise-parameters (P,R, and C) from the measured S- and noise-parameters. This procedure does not require curve fitting, optimization, or simplified noise models. The matrix-based extraction method is derived and shown to be reasonably robust. The sensitivity of this technique to experimental error is also discussed.

Abstracts

FET Noise Model and On-Wafer Measurement of Noise Parameters

M.W. Pospieszalski and A.C. Niedzwiecki. "FET Noise Model and On-Wafer Measurement of Noise Parameters." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1117-1120.

The recently published noise model of a microwave FET is verified for the first time with on-wafer S-parameters and noise parameters measurement data. An excellent agreement between the model prediction and measurement results is obtained for a wide range of FET bias. It is shown that the equivalent drain temperature ia a very strong function of the drain current, while the equivalent gate temperature is a very weak function of the drain current and, within the measurement error, it is equal to the ambient temperature for small drain currents.

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Anomalies Observed in Wafer Level Microwave Testing

T.H. Miers, A. Cangellaris, D. Williams and R. Marks. "Anomalies Observed in Wafer Level Microwave Testing." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1121-1124.

Wafer level testing of GaAs MMICs is fast, reliable and can be very accurate. However, two anomalies have been observed in the course of developing planar wafer level standards. The first involves a low frequency characteristic impedance change of microstrip and coplanar waveguide transmission lines. This effect, which is due to conductor loss of the transmission media, can result in improper/inaccurate calibrations and measurements. The second anomaly results from resonant coupling of the microwave probe itself into adjacent structures on the wafer. This can occur during calibration or measurement and results in extreme inaccuracies at the resonant frequencies.

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16-Term Error Model and Calibration Procedure for on Wafer Network Analysis Measurements (1991 Vol. III [MWSYM])

J.V. Butler, D. Rytting, M.F. Iskander, R. Pollard and M.V. Bossche. "16-Term Error Model and Calibration Procedure for on Wafer Network Analysis Measurements (1991 Vol. III [MWSYM])." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1125-1127.

Vector network measurements are enhanced by calibrating the measurement system at the device under test interface. Many measurement systems such as MMIC wafer probes contain leakage and coupling error terms not modeled in current calibration systems. In this paper, all possible error terms are included in a new 16-term error model and calibration procedure. Corrected measurements using the new 16-term calibration procedure are compared with TRL calibration measurements and excellent agreement was observed.

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A V-Band Wafer Probe Using Ridge-Trough Waveguide (1991 Vol. III [MWSYM])

E.M. Godshalk. "A V-Band Wafer Probe Using Ridge-Trough Waveguide (1991 Vol. III [MWSYM])." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1129-1132.

A V-band (50-75 GHz) wafer probe is presented. The probe features a new type of waveguide developed to allow transition from rectangular waveguide to coplanar waveguide. This new waveguide consists of a ridge extending from the upper waveguide wall into a trough in the lower waveguide wall, and is known as ridge-trough waveguide.

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Measurement of Phase and Amplitude Response of a GaAs MMIC by Electrooptic Sampling

M.S. Heutmaker, G.T. Harvey, T.B. Cook and J.S. Perino. "Measurement of Phase and Amplitude Response of a GaAs MMIC by Electrooptic Sampling." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1133-1135.

Electrooptic sampling with a gain-switched semiconductor laser is used to measure the voltage gain and phase shift of a GaAs monolithic microwave integrated circuit (MMIC) low-noise amplifier over the 5-15 GHz frequency range. A new synchronization technique enables the phase response to be measured accurately.

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Sheet Resistance Measurements of Implanted Layers on Silicon Wafers Using a Microwave Resistivity Probe

M.S. Wang, H. Bhimnathwala, S.S. Yao and J.M. Borrego. "Sheet Resistance Measurements of Implanted Layers on Silicon Wafers Using a Microwave Resistivity Probe." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1137-1140.

In this paper we present the use of microwave radiation at 35 GHz from an open ended waveguide for measuring the sheet resistance of implanted layers on high resistivity silicon with dynamic range and spatial resolution comparable to the one of four point probes. The technique is capable of measuring implanted layers with doses in the range of 10/sup 12/ ions/cm² to 10/sup 16/ ions/cm².

Abstracts

Session KK -- Microwave System Applications

"Session KK -- Microwave System Applications." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1141-1141.

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The Use of Microwaves in Europe to Detect, Classify and Communicate with Vehicles

H. Roe. "The Use of Microwaves in Europe to Detect, Classify and Communicate with Vehicles." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1143-1146.

Microwave techniques have an important role to play in developing the communication infrastructure for control and management of road traffic. They are also used in stand alone systems to improve driver safety and for speed enforcement. Road traffic engineers could use a portable microwave system to obtain traffic statistics to help plan new roads. The paper below briefly describes some of these applications.

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94 GHz FMCW Radar for Low Visibility Aircraft Landing System

L.Q. Bui, Y. Alon and T. Morton. "94 GHz FMCW Radar for Low Visibility Aircraft Landing System." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1147-1150.

This paper describes a 94 GHz bistatic FMCW radar currently under development for an aircraft landing system. Using a narrow vertical fan beam antenna, the system scans the runway rapidly in azimuth, processes the radar returns, and obtains a realistic real-time runway image with sufficient information and resolution to enable a pilot to operate in and out of the airport in conditions with visibility as low as zero without dependence on today's auto-land systems. This system may use an airport's glide slope indicator to approach the landing area. The range performance requirements of the landing system are illustrated in Fig. 1.

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RF Electronics Digital Chirp for the Spaceborne Imaging Radar-C Instrument

B.L. Huneycutt. "RF Electronics Digital Chirp for the Spaceborne Imaging Radar-C Instrument." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1151-1152.

The SIR-C RF electronics subsystem generates the multifrequency RF signals to drive the antenna distributed array high power amplifiers. The digital frequency step chirp signals are designed to allow flexibility in the selection of radar parameters such as range bandwidth to improve resolution, and pulsewidth to reduce dc power usage.

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Design of a Geostationary Microwave Precipitation Radiometer

W.J. Wilson, C.S. Ruf, C.M. Satter and Y. Rahmat-Samii. "Design of a Geostationary Microwave Precipitation Radiometer." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1153-1156.

The Geostationary Microwave Precipitation Radiometer will be a passive microwave radiometer system to be flown on the NASA Geostationary Earth Observatory. This instrument will provide microwave images for meteorology. It will measure radiation from the Earth and its atmosphere in seven frequency bands from 37 to 220 GHz. The instrument will have a 4.4x4.0 m offset parabolic antenna which will be mechanically scanned to provide images of the Earth in /spl ap/ 2 hours. The radiometer system uses a low-loss quasi-optical frequency multiplexer. This multiplexer divides the input signal into four separate focal planes for the different radiometers. Conventional low-noise heterodyne mixer systems were used for most of the radiometers. However, because of the narrow bandwidths required in the 54 and 118 GHz radiometers, new low noise mm-wave amplifiers were used in the first stage of these radiometers. Also in the 54 and 118 GHz radiometers, multi-channel filterbanks were used to provide the required spectral information for atmospheric sounding.

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Miniaturized Multistage Power Amplifiers for the 10.95- to 12.75-GHz Communications Satellite Band

P.E. Goettle, B.D. Geller, F.R. Phelleps, A.I. Zaghloul, R.M. Sorbello and F.T. Assal. "Miniaturized Multistage Power Amplifiers for the 10.95- to 12.75-GHz Communications Satellite Band." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1157-1160.

This paper describes the design and performance of three prototype power amplifiers that use a combination of MMICs and "quasi-monolithic" circuits, and which are intended for use in a satellite multibeam phased-array antenna. The amplifiers are designed to maximize DC-to-RF conversion efficiency and linearity while satisfying additional requirements for output power and minimum size. The four-stage, 30-dB gain modules deliver an output power of 2 W at 2-dB compression, with an efficiency of 25 percent and a two-tone, carrier-to-third-order intermodulation distortion (C/I/sub 3/) level of 16 dB.

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The Differential Reference Frequency Synthesizer

Z. Galani, M.J. Bianchini and J.A. Chiesa. "The Differential Reference Frequency Synthesizer." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1161-1163.

Indirect digital frequency synthesizers cannot achieve fast frequency switching with closely spaced frequencies because of limitations imposed by the requisite narrow loop bandwidth. A novel dual-loop digital frequency synthesizer is presented which satisfies these conflicting requirements and, in most cases, exhibits improved phase noise performance.

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An Ultraminiature 2 to 18 GHz MMIC RF Converter for EW Applications

S.M. Weiner, J.L. Merenda and J.A. Pierro. "An Ultraminiature 2 to 18 GHz MMIC RF Converter for EW Applications." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1165-1168.

Advances in gallium-arsenide (GsAs) monolithic microwave integrated circuits (MMIC's), miniature microwave filter technology, and planar microwave interconnection technology have made possible dramatic reductions in the size and weight of complex radio frequency (RF) modules. These technologies have been utilized in the design and implementation of a 2 to 18 GHz miniature, MMIC-based, RF converter line replaceable module (LRM) for EW applications. The converter, packaged in a etandard electronic module (SEM-E) housingmeasuring only 5.88 in. x 6.68 in. x 0.685 in., represents an approximate 5:1 reduction in size compared to an equivalent MIC version. A detailed discussion of the RF converter design is presented, along with measured performance data. The results are believed to be the first reported for a MMIC-based converter of this type, packaged in SEM-E format.

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Session LL -- Solid State Devices and Circuits (Non-FET) I

"Session LL -- Solid State Devices and Circuits (Non-FET) I." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1169-1169.

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High Peak Power Dielectric Resonator Oscillator Combiner

B.E. Sigmon. "High Peak Power Dielectric Resonator Oscillator Combiner." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1171-1174.

Traditional approaches to achieving significant amounts of power from a dielectric resonator oscillator (DRO) center using a cascade of amplifier chains cumulating with combined output stage. Described herein is an approach which achieves significant amounts of peak power from an oscillator, dielectrically stabilized, and power combined, in one stage. The active elements used were "stacked" Gunn diodes operating in X- and Ku-bands. Forty watts and one hundred and twelve watts of peak power was measured from a two-diode and four-diode DRO/combiner respectively, operating in X-band (9.3 GHz), and 13.5 watts of peak power was measured from a two-diode DRO/combiner in Ku-band (16.3 GHz).

Abstracts

Voltage Controlled Push-Push Oscillators Using Miniaturized Hairpin Resonators

H. Yabuki, M. Sagawa and M. Makimoto. "Voltage Controlled Push-Push Oscillators Using Miniaturized Hairpin Resonators." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1175-1178.

This paper describes the fundamental characteristics of newly developed compact stepped impedance hairpin resonators having parallel coupled lines and shows their application to voltage controlled push-push oscillators for UHF band operation, The experimental push-push oscillators which were built using these resonators made it clear that they have the advantage of providing compact size, low phase noise and wide tuning operation.

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Abstracts

Performance and Applications of Novel Tunable Oscillators Utilizing Focused-Ion-Beam-Implanted Gunn-Effect Devices

A. Chu, L. Chu, W. Macropoulos, K. Khair, R. Patel, M.H. Cordaro, L.J. Mahoney, H. Lezec and J. Melngailis. "Performance and Applications of Novel Tunable Oscillators Utilizing Focused-Ion-Beam-Implanted Gunn-Effect Devices." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1179-1182.

The RF performance of novel tunable voltage-controlled, injection-locked and dielectric resonator oscillators utilizing focused-ion-beam-implanted (FIBI) Gunn-effect devices is reported for the first time. By varying the bias voltage across the device a frequency tuning range from 5 to 25 GHz was achieved, which is the widest band exhibited to date by a single FIBI Gunn oscillator.

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Abstracts

Temperature Stable, Low-Phase Noise 2 GHz Dielectric Resonator Oscillator

M. Mizan, R.C. McGowan, T. Lukaszek and A. Ballato. "Temperature Stable, Low-Phase Noise 2 GHz Dielectric Resonator Oscillator." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1183-1186.

The results of a rigorous analysis of a state-of-the-art 2 GHz dielectric resonator oscillator (DRO) are presented in this paper. The performance of the DRO was determined by measuring the phase noise, loaded quality factor and frequency versus temperature response of the oscillator. These test results represent the lowest reported phase noise for a 2 GHz DRO, with the oscillator exhibiting single sideband phase noise levels of -100 dBc/Hz and -126 dBc/Hz at carrier offset frequencies of 100 Hz and 1 kHz respectively. A superb frequency vs. temperature response is also shown. The DRO exhibits a frequency stability of 1.31 ppm/K over the temperature range +55°C to -45°C.

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A Novel Varactor Tunable Coplanar Waveguide-Slotline Gunn VCO

J.A. Navarro, Y.-H. Shu and K. Chang. "A Novel Varactor Tunable Coplanar Waveguide-Slotline Gunn VCO." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1187-1190.

A novel varactor tunable CPW-slotline Gunn VCO has been developed. The oscillator provides 16.3±0.45 dBm throughout a 300 MHz tuning range centered at 10.40 GHz. The signal quality and stability are very good throughout the tuning range. The circuit is small and lightweight and offers low cost, good reproducibility and excellent performance.

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A Better Biasing Technique for IMPATT Diodes

R.L. Eisenhart. "A Better Biasing Technique for IMPATT Diodes." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1191-1194.

A new biasing technique is introduced which increases power, bandwidth, and reliability in IMPATT circuits while also eliminating thermal runaway and reducing cold startup times, all done with simpler biasing electronics than before.

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Session MM -- CAD for Yield and Noise Characterization

"Session MM -- CAD for Yield and Noise Characterization." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1195-1195.

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Gradient Quadratic Approximation Scheme for Yield-Driven Design

J.W. Bandler, R.M. Biernacki, S.H. Chen, J. Song, S. Ye and Q.J. Zhang. "Gradient Quadratic Approximation Scheme for Yield-Driven Design." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1197-1200.

A new approach to modeling of circuit responses and gradients is proposed. We exploit multidimensional quadratic approximation and take full advantage of available gradient information. Efficiency and accuracy are demonstrated by gradient-based yield optimization of a filter and an MMIC amplifier.

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Accurate Design Centering and Yield Prediction Using the "Truth Model"

M.D. Meehan, T. Wandinger and D.A. Fisher. "Accurate Design Centering and Yield Prediction Using the "Truth Model"." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1201-1204.

The "Truth Model" is introduced as the first implementation of a statistically validated GaAs FET simulation model. In this paper we examine the power and accuracy of the Truth Model by comparing the predicted and measured statistical response of a GaAs MMIC 0.5 -2.5 GHz amplifier. By design centering a small-signal amplifier both with and without the use of the Truth Model, we show that not only yield estimates are affected by the accuracy of the device statistical model, but also the design center.

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Yield Optimization of a MMIC Distributed Amplifier Using Physically-Based Device Models

R.J. Gilmore, M. Eron and T. Zhang. "Yield Optimization of a MMIC Distributed Amplifier Using Physically-Based Device Models." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1205-1208.

Using a physical model to generate correlated parameters, and response modelling to overcome long response times, even complex circuits can be optimized for maximum yield. In this paper, a MMIC distributed amplifier was simulated and optimized for maximum design yield.

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Statistical Techniques for Objective Characterization of Microwave Device Statistical Data

M.D. Meehan and L. Campbell. "Statistical Techniques for Objective Characterization of Microwave Device Statistical Data." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1209-1212.

A comprehensive treatment of statistical metrics for the characterization of microwave device statistical data is presented. The primary aim is to investigate the power of these tests in their ability to faithfully delhteate between like and unlike Joint Probability Density Functions (JPDF). This paper shows that adequate techniques are available to solve this problem, and illustrates a novel application of these techniques by distinguishing the statistical difference between two GaAs FET data bases that have identical means, standard deviations, kurtosis, skewness and correlations. Finally, we verify our characterization approach by design centering a small-signal amplifier, both with and without the use of statistically characterized device data.

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Abstracts

Acceleration of Simulated Annealing and its Application to Microwave Device and Circuit Optimization

M.-K. Vai, J.-S. Lin and S. Prasad. "Acceleration of Simulated Annealing and its Application to Microwave Device and Circuit Optimization." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1213-1216.

Simulated annealing (SA), while being successful as a general optimization technique applicable to many modeling and design problems of microwave devices and circuits, is very time consuming. To alleviate this problem, we propose the creation of a hardware-implemented SA accelerator. The design and evaluation of this SA accelerator, as well as its application to the microwave CAD area, are presented. This accelerator features a highly parallel pipeline structure with a programmable characteristic function. Acceptance prediction is used to further improve the performance. It is evident from simulation results that this accelerator has a significant (several orders of magnitude) speed advantage over an ordinary software implementation.

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Abstracts

A Unified Framework for Computer-Aided Noise Analysis of Linear and Nonlinear Microwave Circuits (1991 Vol. III [MWSYM])

S. Heinen, J. Kunisch and I. Wolff. "A Unified Framework for Computer-Aided Noise Analysis of Linear and Nonlinear Microwave Circuits (1991 Vol. III [MWSYM])." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1217-1220.

This paper introduces a new unified theoretical concept for noise analysis in analog and microwave circuits. Based on the adjoint system approach an analysis technique for general purpose CAD-applications is presented. The algorithm is easy to be implemented into existing CAD-tools. Moreover. it exploits the advantages of sparse matrix techniques.

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Abstracts

A Simple Circuit Model for Resonant Mode Coupling in Packaged MMICs

J.J. Burke and R.W. Jackson. "A Simple Circuit Model for Resonant Mode Coupling in Packaged MMICs." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1221-1224.

Neglecting the effect of enclosing an MMIC circuit in a resonant conducting package can have undesirable consequences such as power loss, poor isolation, and circuit instabilities. In principle these effects can be predicted by currently available full-wave CAD programs. In practice, however, such programs are difficult to implement for a complex circuit and are very CPU intensive when realistic box/circuit sizes are used. A simpler approach would be useful. In this paper we will develop a simple circuit model which will predict coupling effects between various circuit components due to a package resonance. It is easily implemented on commercially available CAD packages and requires several orders of magnitude less CPU time than a full-wave technique.

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Session NN -- Superconducting Microwave Components

"Session NN -- Superconducting Microwave Components." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1225-1225.

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High-Temperature Superconductive Passive Microwave Devices

W.G. Lyons, R.S. Withers, J.M. Harem, A.C. Anderson, P.M. Mankiewich, M.L. O'Malley, R.E. Howard, R.R. Bonetti, A.E. Williams and N. Newman. "High-Temperature Superconductive Passive Microwave Devices." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1227-1230.

Two important classes of passive superconductive microwave devices are described that have been recently demonstrated using thin films of the high-temperature superconductor YBa/sub 2/Cu/sub 3/O/sub 7-x/. The devices include tapped-delay-line transversal filters with multigigahertz bandwidths, with time-bandwidth products as large as 30, and narrowband (less than three-percent bandwidth) microstrip filters. These devices illustrate the potential performance advantages superconductive thin films offer to the designer of a high-frequency, wide-bandwidth analog signal processing system.

Abstracts

S-Parameter Measurements and Applications of Superconducting Flux Flow Transistors

J.S. Martens, V.M. Hietala, T.E. Zipperian, D.S. Ginley, C.P. Tigges and J.M. Phillips. "S-Parameter Measurements and Applications of Superconducting Flux Flow Transistors." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1231-1234.

We have performed microwave two-port S-parameter measurements and modelling on Superconducting Flux Flow Transistors (SFFTs). These transistors, based on the magnetic control of flux flow in an array of High Temperature Superconducting (HTS) weak links, can exhibit significant available power gain at microwave frequencies (over 20 dB at 7-10 GHz in some devices). The input impedance is largely inductive while the output impedance is resistive and inductive. The characteristics are such that these devices are potentially useful in numerous applications including matched amplifiers.

Abstracts

High T/sub c/ Superconducting Coplanar Delay Line with Long Delay and Low Insertion Loss

Z.-Y. Shen, P.S.W. Pang, W.L. Holstein, C. Wilker, S. Dunn, D.W. Face and D.B. Laubacher. "High T/sub c/ Superconducting Coplanar Delay Line with Long Delay and Low Insertion Loss." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1235-1238.

11-nanosecond coplanar delay lines have been fabricated from TIBaCaCuO (2212) and YBaCuO (123) high Tc superconducting thin films on l"x1" LaAlO/sub 3/ substrate. This device exhibits the unique combination of long delay (11 ns), low insertion loss (<0.25 dB/ns up to 8 GHz), and low cross talk (< -50 dB). In terms of total delay and delay per unit area, to our knowledge, it is a record for high T/sub c/ superconductor delay lines. Test data are compared with theoretical values. Potential applications are discussed.

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Abstracts

Low Phase Noise Superconducting Oscillators

A.P.S. Khanna and M. Schmidt. "Low Phase Noise Superconducting Oscillators." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1239-1242.

Microstrip resonators fabricated from thallium high temperature superconducting thin films have loaded Q values in the 8,000 to 20,000 range at frequencies up to X band. The resonators are used as the stabilizing elements in low phase noise microwave oscillators. These superconducting oscillators (SCO's) demonstrate improved performance over conventional dielectric resonator oscillators (DRO's) operating at the same frequencies.

Abstracts

Radiation Efficiency Measurements of a Thin-Film Y-Ba-Cu-O Superconducting Half-Loop Antenna at 500 MHz

R.J. Dinger, D.R. Bowling, A.M. Martin and J. Talvacchio. "Radiation Efficiency Measurements of a Thin-Film Y-Ba-Cu-O Superconducting Half-Loop Antenna at 500 MHz." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1243-1246.

A 500 MHz half-loop antenna and matching network has been fabricated from a 2-cm by 2-cm thin film of the: high temperature superconductor YBaCuO. The antenna demonstrates a radiation efficiency of 20 percent, compared to 7 percent fox a comparable copper antenna.

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Session OO -- Phased and Active Array Techniques

"Session OO -- Phased and Active Array Techniques." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1247-1247.

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Microwave and Millimetre-Wave Staring Array Technology

C.J. Alder, C.R. Brewitt-Taylor, R.J. Davis, M. Dixon, R.D. Hodges, L.D. Irving, H.D. Rees, J. Warner and A.R. Webb. "Microwave and Millimetre-Wave Staring Array Technology." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1249-1252.

Microwave receivers are described incorporating lens-fed planar antennas with semiconductor components integrated on a common substrate, in an area small enough for packing into monolithic two-dimensional arrays. Such receivers have been built to operate at 10 and 35 GHz, including a monolithic silicon 4 x 4 array for 35 GHz. A radar demonstrator has also been built, using a hybrid array, and has shown direction-finding accuracy comparable to monopulse, in a staring array with no moving parts.

Abstracts

An EHF Backplate Design for Airborne Active Phased Array Antennas

H. Wong, S.S. Chang, D.C.D. Chang, G.S. Bretana, G.A. Hill, T.Q. Ho and M.N. Wong. "An EHF Backplate Design for Airborne Active Phased Array Antennas." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1253-1256.

An array backplate is an essential part of millimeter-wave active phased array antennas. It is the key system that distributes DC, command logic, and EHF signals to the thousands of radiating elements. This paper describes an EHF array backplate design for use in airborne active phased array antennas. The backplate utilizes a multilayer substrate and reduced waveguide for signal routing while a counterflow air cooling technique is used to cool the GaAs MMIC active devices. The integrated design is characterized by temperature coefficient matched materials to insure a rigid, thermally stable structure.

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Wideband Integrated Varactor - Tunable Active Notch Antennas and Power Combiners

J.A. Navarro, Y.-H. Shu and K. Chang. "Wideband Integrated Varactor - Tunable Active Notch Antennas and Power Combiners." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1257-1260.

A Gunn device in a varactor tuned slotline-coplanar waveguide (CPW) resonator has been integrated with a planar, end re notch antenna. The varactor provides more than 14 percent tuning bandwidth centered at 9.6 GHz with a power output of 14.5 ± 0.8 dBm. Wideband tunable quasi-optical power combiners have also been developed using these active elements.

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A Layered Negative Resistance Amplifier and Oscillator Using a FET and a Slot Antenna

S. Kawasaki and T. Itoh. "A Layered Negative Resistance Amplifier and Oscillator Using a FET and a Slot Antenna." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1261-1264.

Prototypes of quasi-optical transmitter components (oscillator and amplifier) using FET's as 1-port devices are reported. By using a slot antenna and microstrip to slotline transition, the circuit portion and the antenna are separated on different interfaces. The oscillator exhibited 1% eclectically tuned range and the amplifier had a 2% locking range. The radiation patterns are also reported.

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A Circularly Polarized FET Oscillator Active Radiating Element

J. Birkeland and T. Itoh. "A Circularly Polarized FET Oscillator Active Radiating Element." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1265-1268.

We present an FET oscillator which combines the power from three devices and directly generates circularly polarized radiation using a novel feedback arrangement. The radiated field exhibits a minimum axial ratio of 1.04. This oscillator is suitable for use in spatial power combining systems or as an active antenna when injection locked from an external source.

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Millimeter-Wave Integrated Phased Arrays with Ferrite Control

E.F. Zaitsev, Y.P. Yavon, Y.A. Komarov and A.Y. Kanivets. "Millimeter-Wave Integrated Phased Arrays with Ferrite Control." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1269-1269.

A new class of scanning arrays will be described. The antenna is of a traveling wave type and consists of a waveguide with a magnetogyrotropic medium. The radiating discontinuities are placed periodically along the waveguide. The waveguide may consist of an open three-layer structure made up of ferrite-dielectric-ferrite materials. A set of microstrip dipoles is placed on top of the outer ferrite layer, spaced equidistantly (one half wavelength apart), perpendicular to the direction of wave propagation. The opposite side of the structure is covered with a metal screen and the ferrite plates are transversely magnetized using wires. The inner dielectric layer with a high dielectric constant consists of a number of rods, each of which is placed under a row of microstrip dipoles. Each dielectric rod with its row of dipoles forms a line-source antenna with negligible electromagnetic coupling to its nearest neighbors. This structure forms the planar scanning array.

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Session PP -- Solid State Devices and Circuits (Non FET) II

"Session PP -- Solid State Devices and Circuits (Non FET) II." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1273-1273.

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Abstracts

A Limiting Filter

R.J. Tan. "A Limiting Filter." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1275-1278.

A limiting filter is a new type of microwave circuit device, combining the nonlinear properties of a limiter with those of conventional filter designs. A limiting filter whose design is based on standard filter design theory is modified by the addition of PIN diodes or other nonlinear devices, which give the filter limiting properties at high power levels.

Abstracts

Low Noise HEMTs with Multi - Feed Gate Configurations

K. Hosogi, T. Katoh, T. Kashiwa, H. Matsuoka, H. Minami, K. Kosaki, K. Nagahama, K. Nishitani and M. Otsubo. "Low Noise HEMTs with Multi - Feed Gate Configurations." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1279-1282.

A novel multi-feed gate configuration using air-bridge metallization is demonstrated for low noise HEMTs. The configuration is designed according to the detailed analysis of parasitic gate capacitances. Very low noise figures of 0.55 and 1.6dB have been achieved at 12 and 40GHz for 0.25µm gate AlGaAs/InGaAs pseudomorphic HEMT, respectively. The noise figure of 4.1dB and the gain of 12.2dB at 40GHz are also obtained for the 2-stage HEMT MMICs.

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A Si Wide-Band MMIC Amplifier Family for L-S Band Consumer Product Applications

H. Takeuchi, M. Muraoka, T. Hatakeyama, A. Matsuoka, M. Honjou, S. Miyazaki, K. Tanaka and T. Nakata. "A Si Wide-Band MMIC Amplifier Family for L-S Band Consumer Product Applications." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1283-1284.

By using a novel Si bipolar process technology, medium power, low noise and low power consumption amplifiers have been successfully realized, For the low power consumption amplifier, as little as 4mA of total supply current is required with 3.4V supply voltage, 2.3GHz 3dB-bandwidth, and 10.8dB gain at 1GHz.

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20-GHz 5-dB-Gain Analog Multipliers with AlGaAs/GaAs HBTs

K. Osafune and Y. Yamauchi. "20-GHz 5-dB-Gain Analog Multipliers with AlGaAs/GaAs HBTs." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1285-1288.

From-DC-to-above-20-GHz monolithic Gilbert cell analog multipliers have been developed using AlGaAs/GaAs HBT technology. As a double balanced active mixer, it exhibits very high conversion gain of above +5 dB with extremely high LO-IF isolation of 33 dB for RF/LO inputs up to 20 GHz. As a detection mixer in coherent optical heterodyne receivers, it can operate for RF/LO inputs up to 15 GHz under a less than -7.5 dBm LO input condition.

Abstracts

Miniaturized Reverse Modulation Loop for a CQPSK 120-Mbit/s Modem

K.K. Ralston, R.K. Gupta, F.T. Assal and R.T. Kroll. "Miniaturized Reverse Modulation Loop for a CQPSK 120-Mbit/s Modem." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1289-1292.

The design and performance of a miniaturized reverse modulation loop (RML) for carrier recovery in a 120-Mbit/s coherent quadrature phase shift keying (CQPSK) modem for on-board satellite applications are presented. The RML circuit, consisting of a modulator, demodulator, and comparator circuit, has been fabricated using quasi-monolithic techniques with dimensions of 1.65 x 4 cm. The relative phase for all four states of the modulator is in close agreement with design values of 90° ± 1° over a 200-MHz bandwidth at 3.95 GHz. The demodulator and comparator circuits of the RML have successfully recovered a 120-Mbit/s bit stream.

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A Submillimeter-Wave Planar Diode Mixer - Design and Evaluation

T. Newman and K.T. Ng. "A Submillimeter-Wave Planar Diode Mixer - Design and Evaluation." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1293-1296.

A novel 345 GHz mixer employing a planar GaAs Schottky diode has been designed and tested at the University of Virginia. The design process used nonlinear and linear numerical mixer analysis as well as scale model impedance measurements. Using a planar diode eliminates the disadvantages of mechanical instability and labor-intensive assembly associated with the whisker in conventional whisker-contacted diodes. To the best of our knowledge, this represents the first attempt at using a planar diode in a submillimeter-wave mixer, and test results indicate performance on the same level as the best whisker-contacted room temperature mixers for submillimeter wavelengths.

Abstracts

Session QQ -- High Power Devices and Systems

"Session QQ -- High Power Devices and Systems." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1297-1297.

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Eight Watt Ku-Band Module

M. Gat, D.S. Day and J.R. Basset. "Eight Watt Ku-Band Module." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1299-1302.

A Ku-band MBE monolithic power amplifier is reported. In the design, two pairs of MMICs combined in parallel are balanced between Lange couplers and driven by a fifth identical MMIC. Each MMIC is a two-stage power amplifier which incorporates a full interstage matching network and a partial input matching network. Individually, the MMICs deliver more than 3 watts of power, 11 dB gain and more than 20% power-added efficiency (PAE) from 15 to 18 GHz. To our knowledge, these are the best published results for a power MMIC operating at 18 GHz. The full power module has 8 watts of P/sub out/, 20 dB gain and 14% PAE at 18 GHz. The module could be tuned for a 1 GHz instantaneous bandwidth anywhere in the 15-18 GHz band.

Abstracts

Development of 20 GHz-Band On-Board Power Amplifiers

H. Makishima and N. Mita. "Development of 20 GHz-Band On-Board Power Amplifiers." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1303-1306.

A high-efficiency and light-weight SSPA and TWTA for use in a 20 GHz-band satellite transponder is developed. The SSPA features a compact, highly efficient output power combiner. The output power of the SSPA is 3.3 W with an efficiency of 21% at 18.365 GHz and it weighs only 750 g. The TWTA features a high-efficiency, compact size 3-stage collector and high-switching frequency power supply. The TWTA delivers an output power of 31% efficiency at 20.645 GHz and weighs only 1430 g.

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A PIN Diode Switch that Operates at 100 Watts CW at C-Band

J. Sherman. "A PIN Diode Switch that Operates at 100 Watts CW at C-Band." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1307-1310.

Measured data on a packaged 6 port matrix switch yields an insertion loss of 1.2 dB maximum and isolation of 60 dB minimum from 4.2 to 5.2 GHz. The phase balanced switch handles 100 watts CW in the frequency band at temperatures of -30 to +95C.

Abstracts

Pulse Generation and Measurement of Radiated Waveforms from an Optically Activated Impulse Generator

A. Kim, R. Zeto, R. Youmans, M. Weiner, J. Fishback and B. Lalevic. "Pulse Generation and Measurement of Radiated Waveforms from an Optically Activated Impulse Generator." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1311-1314.

The generation of extremely narrow, high peak power pulses using an optically activated impulse generator has been demonstrated. Radiative measurements at 1 Hz PRF have been conducted by pulse biasing this device up to 15 kV and subsequently triggering the device with an optical pulse from a Nd:YAG laser. The measured pulse from a wide-band antenna had a pulsewidth of 1.5 ns with a risetime of 900 ps. The frequency spectrum of this radiated waveform ranged from 50 MHz to 1 GHz.

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Generation of Highly Tunable Microwave Radiation via a Relativistic Ionization Front

R.L. Savage, Jr., C. Joshi and W.B. Mori. "Generation of Highly Tunable Microwave Radiation via a Relativistic Ionization Front." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1315-1318.

This paper reports the experimental demonstration of frequency upshifting of microwave radiation by a relativistic ionization front. Source radiation at 34.8 GHz has been upshifted to greater than 116 GHz in a continuously tunable fashion. It is a new technique for generating high-power, tunable radiation in short pulses, and has potential applications in plasma diagnostics, time-resolved microwave spectroscopy and ultra-wideband impulse radar.

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Abstracts

A New Generation of Power Klystrons on the Base of Multiple-Beam Design

E.A. Gelvich, E.V. Zhary, L.M. Borissov, A.D. Zakurdayevg, A.S. Pobedonostsev and V.I. Poognin. *"A New Generation of Power Klystrons on the Base of Multiple-Beam Design." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1319-1320.*

The advantages of multibeam klystrons over single-beam klystrons regarding the reduction of supply voltages, weight and the amplification band expansion, are shown. Some parameters of industrial samples of multiple-beam klystrons (supply voltages, output powers and amplification band) are given.

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MM-Wave Power Amplifiers

M.I. Iopin, B.A. Belyavsky, K.G. Simonov and V.A. Cherepenin. "MM-Wave Power Amplifiers." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1321-1322.

The report displays the advantages of amplifying TWT-chains in the 8 mm - wavelength range based on power output "transparent" TWT, packetized in permanent magnets for providing power levels of tens of kW. To obtain pulsed power levels of hundreds of kW to units of MW the hybrid "orotron-TWT" type design-based microwave device version is represented. First experimental results are given.

Abstracts

Session RR -- Superconducting Filters

"Session RR -- Superconducting Filters." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1323-1323.

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Present and Projected Performance of High-Temperature Superconducting Filters

S.H. Talisa, M.A. Janocko, J. Talvacchio and C. Moskowitz. "Present and Projected Performance of High-Temperature Superconducting Filters." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1325-1328.

Microwave planar high-temperature superconducting (HTS) filterbanks will find application in radar and communications. Because of difficulties of growing HTS films on both sides of a substrate, it is convenient to use normal-conducting ground planes to fabricate HTS microstrip filters. The insertion losses in a filter have been estimated from a calculation of the effect of a normal-conducting ground plane on the losses of an HTS microstrip line. It is shown that, even with a gold ground plane, the performance of current filters could be limited by mismatch losses rather than conductor losses, and that, above Ka-band, the benefits of using an HTS ground plane are only marginal.

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Critical Design Issues in Implementing a YBCO Superconductor X-Band Narrow Bandpass Filter Operating at 77 K

A. Fathy, D. Kalokitis and E. Belohoubek. "Critical Design Issues in Implementing a YBCO Superconductor X-Band Narrow Bandpass Filter Operating at 77 K." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1329-1332.

New design parameters were considered in the successful implementation of a narrow band (0.5%) high-T/sub c/ filter operating at X-band and 77K. This article addresses the effects of HTS film thickness on the loss performance; kinetic and mutual inductance contributions to the center frequency drift with temperature; and nonlinearities associated with the generation of intermodulation distortion.

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A Coplanar Waveguide Filter Using Thin-Film High Temperature Superconductor

W. Chew, L.J. Bajuk, T.W. Cooley, M.C. Foote, B.D. Hunt, D.L. Rascoe and A.L. Riley. "A Coplanar Waveguide Filter Using Thin-Film High Temperature Superconductor." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1333-1336.

The design of a coplanar waveguide low-pass filter made of high critical temperature superconducting YBa/sub 2/Cu/sub 3/O/sub 7-delta/ (YBCO) film on a LaAIO/sub 3/ substrate is described. The patterned and packaged coplanar waveguide low pass filter of YBCO exhibited measured insertion losses in liquid nitrogen superior to the loss of a similar thin-film copper filter throughout the 0 to 9.5 GHz passband. Coplanar waveguide models for use with thin film normal metal (with thickness either greater or less than the skin depth) and YBCO are discussed and used to compare the losses of the measured YBCO and copper circuits.

Abstracts

High-T/sub c/ Superconducting High-Q Coplanar Resonator Made on MgO

T. Konaka, M. Sato, H. Asano, S. Kubo and Y. Nagai. "High-T/sub c/ Superconducting High-Q Coplanar Resonator Made on MgO." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1337-1340.

Coplanar 2-port transmission line resonators were made using high-T/sub c/ superconducting EuBa/sub 2/Cu/sub 3/O/sub x/ film on MgO. The EuBa/sub 2/Cu/sub 3/O/sub x/ films were prepared by magnetron sputtering, and patterned by photolithography and Ar ion milling. We measured the resonator characteristics as a function of temperature and power. The highest unloaded Q value obtained was 12500 at 28 K and at 3.9 GHz and the surface resistance of the film was estimated at about 40 µOmega. No change in Q values was not observed at input power levels less than -20 dBm.

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Characterization of Microstrip Discontinuities on LaAlO/sub 3/

P.A. Macdonald, D. Rensch, J.Y. Josefowicz, F. Williams and W. Hoefer. "Characterization of Microstrip Discontinuities on LaAlO/sub 3/." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1341-1344.

The difference between microstrip coupled line filter designs using quasi-static and full-wave analyses on LaAlO/sub 3/ is discussed. Comparative data for CAD predictions and direct measurement for selected microstrip discontinuities on LaAlO/sub 3/ substrates is presented, as well as measured and predicted filter performance.

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Low-Loss Bandpass Filter Using Dielectric Rod Resonators Oriented Axially in a High-T/sub c/ Superconductor Cylinder

Y. Kogami, Y. Kobayashi, T. Konaka and M. Sato. "Low-Loss Bandpass Filter Using Dielectric Rod Resonators Oriented Axially in a High-T/sub c/ Superconductor Cylinder." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1345-1348.

A maximally flat type bandpass filter using two TM/sub 01delta/-mode dielectric rod resonators oriented axially in a high-Tc superconductor cylinder is designed with 3dB bandwidth 36MHz at 11.958GHz. For this filter the insertion loss below 0.1dB and the frequency temperature coefficient of -2.7ppm/K are realized in the range 20 to 50K.

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"Index of Authors (1991 Vol. III [MWSYM])." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1349-1352.

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"Exhibition Guide (1991 Vol. III [MWSYM])." 1991 MTT-S International Microwave Symposium Digest 91.3 (1991 Vol. III [MWSYM]): 1355-1370.

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Message from the MMWMC Chairman (1991 [MCS])

"Message from the MMWMC Chairman (1991 [MCS])." 1991 Microwave and Millimeter-Wave Monolithic Circuits Symposium Digest 91.1 (1991 [MCS]): f4-f4.

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"Message from the MMWMC Technical Program Chairman (1991 [MCS])." 1991 Microwave and Millimeter-Wave Monolithic Circuits Symposium Digest 91.1 (1991 [MCS]): f6-f6.

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"Committees (1991 [MCS])." 1991 Microwave and Millimeter-Wave Monolithic Circuits Symposium Digest 91.1 (1991 [MCS]): f7-f7.

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Panel Sessions (1991 [MCS])

"Panel Sessions (1991 [MCS])." 1991 Microwave and Millimeter-Wave Monolithic Circuits Symposium Digest 91.1 (1991 [MCS]): f12-f12.

Abstracts

Microwave and Millimeter-Wave Monolithic Circuit Technology, its History and Future

R.W. Sudbury. "Microwave and Millimeter-Wave Monolithic Circuit Technology, its History and Future." 1991 Microwave and Millimeter-Wave Monolithic Circuits Symposium Digest 91.1 (1991 [MCS]): 1-2.

On the tenth Anniversary of the Microwave and Millimeter-Wave Monolithic Circuits (MMWMC) Symposium, it is appropriate to review the history of the symposium and in particular how it has reflected significant technological progress over the past decade. Work reported at past MMWMC symposia will be utilized to highlight the technology advances. Emphasis at previous symposia has been on demonstrated circuit data from research performance results through early integrated component production.

Abstracts

FM-CW Radar on a Single GaAs/AlGaAs HBT MMIC Chip

B. Maoz, L.R. Reynolds and A. Oki. "FM-CW Radar on a Single GaAs/AlGaAs HBT MMIC Chip." 1991 Microwave and Millimeter-Wave Monolithic Circuits Symposium Digest 91.1 (1991 [MCS]): 3-6.

A novel low power FM-CW radar on a single chip has been implemented for the first time using GaAs/AlGaAs HBT technology developed at TRW. An innovative electronic circulator allows operation with a single antenna at C band. In addition, the chip contains a VCO, transmitter amplifier, and receiver mixer with proper filtering. The chip measures 1 x 2 x 0.25 mm and operates from a single +5 Volt supply. In order to minimize cost we used a process featuring a relaxed 3 µm emitter size, achieving f/sub t/ of 24 GHz. We also did not use via holes. Potential applications for the chip include range and velocity discriminating fuzes, sensors and altimeter functions.

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Single-Chip FM-CW Radar Low-Cost Production Test

L.D. Reynolds and M.S. Wang. "Single-Chip FM-CW Radar Low-Cost Production Test." 1991 Microwave and Millimeter-Wave Monolithic Circuits Symposium Digest 91.1 (1991 [MCS]): 7-10.

In order to realize the low product cost potential of a single-chip FM-CW radar MMIC, an innovative production testing concept is developed in which the complete transmit/receive transfer function is verified in under one minute using the self-generated microwave signal in a simulated radar range environment. The test acceptance criteria are related to fundamental radar module specifications.

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A K/sub a/-Band MMIC Array Feed Transmitter for Deep Space Applications

A.L. Riley, D.L. Rascoe, T. Cooley, L. Duffy, V. Jamnejad and R. Thomas. "A K/sub a/-Band MMIC Array Feed Transmitter for Deep Space Applications." 1991 Microwave and Millimeter-Wave Monolithic Circuits Symposium Digest 91.1 (1991 [MCS]): 11-14.

A K-band solid state transmitter capable of power greater than 5 W is being developed. The transmitter consists of an array of 21 elements each driven by a single stage MMIC power amplifier three stage MMIC preamplifier and four bit phase MMIC phase shifter. The design of the array and measurements of the antenna pattern of the full array and an electronically beam steered sub-array are reported.

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A High Power K/Ka-Band Monolithic T/R Switch

P. Bemkopf, M. Schindler and A. Bertrand. "A High Power K/Ka-Band Monolithic T/R Switch." 1991 Microwave and Millimeter-Wave Monolithic Circuits Symposium Digest 91.1 (1991 [MCS]): 15-18.

A high power K/Ka-band MESFET switch MMIC has been developed for use in Transmit/Receive (T/R) modules. The switch demonstrates 0.2 dB insertion loss compression with 30 dBm input power, 12 dB higher than previously reported for K/Ka-band MESFET switches. Also no isolation degradation was apparent with up to 28 dBm input power, a 13 dB improvement over the same previously demonstrated switches. A combination of techniques was used to yield higher power handling while preserving low loss and high isolation. These circuit techniques include the use of stacked MESFETs with large peripheries to improve power handling and transmission line transformers to minimize loss and maintain high isolation.

Abstracts

A Compact, Monolithic Radiofrequency Demodulator - Modulator for 64-QAM Digital Radio Links

I. Telliez, A.M. Couturier, C. Rumelhard, C. Versnaeyen, P. Champion and D. Fayol. "A Compact, Monolithic Radiofrequency Demodulator - Modulator for 64-QAM Digital Radio Links." 1991 Microwave and Millimeter-Wave Monolithic Circuits Symposium Digest 91.1 (1991 [MCS]): 19-22.

The design, fabrication and performance of a GaAs monolithic radiofrequency demodulator with phase and amplitude trimming in the quadrature coupler and balanced mixers, in the 5.9-8.5 GHz range is described. This circuit includes amplitude and phase trimming circuits, two single balanced mixers, couplers, and a quadrature phase comparator. The design is such that the same chip can be used either as a direct 64 QAM demodulator or a modulator. The small chip size is 2.7 mm x 3.65 mm.

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A 10-14 GHz Quenchable MMIC Oscillator

G. Dietz, R. Becker, R. Haubenstricker, S. Moghe and G. Giacomino. "A 10-14 GHz Quenchable MMIC Oscillator." 1991 Microwave and Millimeter-Wave Monolithic Circuits Symposium Digest 91.1 (1991 [MCS]): 23-26.

A wideband negative resistance MMIC oscillator chip has been designed and tested for fast switching DRO and VCO applications. This MMIC has an on-chip quench circuit which allows for very fast switching of the oscillator without affecting the active device bias. The MMIC which also has an on-chip resistive heater section located in close proximity to the active device minimizes frequency drift due to temperature variations. The switching performance was measured with the chip configured as a DRO; its frequency settled within 0.6 MHz of the final frequency in only 0.5 us. This MMIC configured as a VCO achieved wideband tuning from 10 to 14 GHz.

Abstracts

Micromachined Microwave Actuator (MIMAC) Technology - A New Tuning Approach for Microwave Integrated Circuits

L.E. Larson, R.H. Hackett, M.A. Melendes and R.F. Lohr. "Micromachined Microwave Actuator (MIMAC) Technology - A New Tuning Approach for Microwave Integrated Circuits." 1991 Microwave and Millimeter-Wave Monolithic Circuits Symposium Digest 91.1 (1991 [MCS]): 27-30.

This paper describes a new approach for the realization of tunable/variable III-V planar microwave integrated circuits, which employs micromachined electrostatically controlled actuator technology. This technology is potentially compatible with conventional MMIC fabrication techniques, and allows precise positioning and re-positioning of metal conductors (tuning stubs, switches, capacitor plates, etc.) on an insulating substrate after fabrication is complete. A variety of structures have been fabricated, including electrostatic micro-motors, rotating microwave switches, and variable interdigitated capacitors. A rotating microwave transmission line switch exhibited less than 0.5 dB insertion loss and greater than 35 dB isolation from dc to 45 GHz. A variable interdigitated capacitor exhibited a variation from 35 fF to 100 fF. A number of aspects of the technology require further research, including improvement in starting voltages, repeatability of contacts, and microwave design.

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Abstracts

Military Applications of MMICs

E.D. Cohen. "Military Applications of MMICs." 1991 Microwave and Millimeter-Wave Monolithic Circuits Symposium Digest 91.1 (1991 [MCS]): 31-34.

This paper will serve as a progress report on the Microwave and Millimeter Wave Monolithic Integrated Circuits (MIMIC) program by describing some of its current and planned insertions into Department of Defense (DoD) systems. Some of the products of the MIMIC program have already found application in DoD systems that are currently deployed. Many others are slated for increasingly wide scale use in future DoD systems. In addition, most of the new hardware and software products will be readily adaptable for commercial applications by the microwave/millimeter wave community.

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Octave S/C-Band MMIC T/R Modules for Multi-Function Phased Arrays

J.J. Komiak and A.K. Agrawal. "Octave S/C-Band MMIC T/R Modules for Multi-Function Phased Arrays." 1991 Microwave and Millimeter-Wave Monolithic Circuits Symposium Digest 91.1 (1991 [MCS]): 35-38.

A complex wideband Transmit/ReceiveModule that has achieved performance levels superior to any MMIC module will be described. Performance across an octave 3.0 to 6.0 GHz band includes a power output of 21 Watts at S-Band and 19 at C-Band, a noise figure of 3.9 to 5.0 dB, 30 to 38 of receive gain, 25 to 26 dBm IP/sub 3/, 40 dB of gain control in 256 steps, dual receive channels with independent amplitude and phase control, and an bit phase shifter with less than 1 degree calibrated RMS phase error. Total GaAs area is 146 mm² with 170 mm of total gate periphery. The module incorporates a compact digital interface, requires only three supply voltages, and utilizes advanced packaging techniques, resulting in a size compatible with a grating lobe free grid spacing.

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Integrated Digitally Controlled 6-Bit Phase Shifter, 4-Bit Attenuator, and T/R Switch Using Multifunction Self Aligned Gate Process

H. Singh, D. Willems, I. Bahl, J. Naber, T. Kelly, V. Sadhir, J. Jorgenson, G. Studtmann, R. Sadler, M. Drinkwine, A. Geissberger, J. Grzyb, E. Griffin and C. Andricos. "Integrated Digitally Controlled 6-Bit Phase Shifter, 4-Bit Attenuator, and T/R Switch Using Multifunction Self Aligned Gate Process." 1991 Microwave and Millimeter-Wave Monolithic Circuits Symposium Digest 91.1 (1991 [MCS]): 39-42.

A monolithic microwave and digital integrated circuit (MMDIC) consisting of a 12-bit serial-to-parallel converter, 6-bit phase shifter, 4-bit attenuator, and SPDT switch has been designed and fabricated using the standard Multifunction Self-Aligned Gate (MSAG) process, with a full functional yield of over 27%. By combining digital circuitry with these microwave control circuits, the number of control lines is reduced from 16 to 3, allowing simplification of the subsystem architecture.

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A Monolithic K/sub A/-Band Sub-Harmonically Pumped Frequency Converter

P. Bernkopf and Y. Tajima. "A Monolithic K/sub A/-Band Sub-Harmonically Pumped Frequency Converter." 1991 Microwave and Millimeter-Wave Monolithic Circuits Symposium Digest 91.1 (1991 [MCS]): 43-46.

A GaAs monolithic Sub-harmonically Pumped (SHP) Ka-band frequency converter has been developed. The complete frequency converter Monolithic Millimeter-wave Integrated Circuit (MMIC), having six microwave ports, consists of an SP2T RF switch, LO buffer amplifier, anti-parallel diode mixer, 3-stage IF amplifier, and SP3T IF switch. To minimize circuit cost, the converter was fabricated with conventional MMIC material and processing. The frequency converter exhibited a conversion gain of 8 dB and a single sideband noise figure of 20dB. This Integrated Circuit (IC) is the first demonstrated monolithic Ka-band SHP frequency converter and has a higher level of integration than previous MMIC SHP mixers.

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35 GHz InGaAs HEMT MMIC Downconverter

J. Yonaki, R. Carandang, B.A. Allen, M. Hoppe, W.L. Jones, D.C. Yang and C.L. Brunnenmeyer. "35 GHz InGaAs HEMT MMIC Downconverter." 1991 Microwave and Millimeter-Wave Monolithic Circuits Symposium Digest 91.1 (1991 [MCS]): 47-50.

The design and development of a 35 GHz HEMT MMIC downconverter is reported. This completely monolithic chip consists of a balanced two-stage low noise amplifier cascaded with a singly balanced (HEMT compatible) diode mixer. Conversion gain of 5 dB over a 20 to 100 MHz IF output with an RF frequency of 35 GHz and an LO frequency = RF + IF has been measured. In addition to the downconverter macrocell, the LNA and mixer designs were fabricated as individual microcells. The LNA has demonstrated state-of -the-art performance: measured noise figure (NF) from 34 to 40 GHz is less than 2.8 dB. Associated gain is 14.0 +/- 0.4 dB over a 30 to 40 GHz bandwidth. Input and output VSWR is better than 1.2:1. The singly balanced mixer exhibited conversion loss of less than 5 dB. The design and test results of these circuits are presented.

Abstracts

MM-Wave MIMIC Receiver Components

M.W. Trippe, S. Weinreb, S.W. Duncan, A. Eskandarian, B.A. Golja, D.C. Martel, G. Mendenilla, B. Power, H.B. Sequeira, S.B. Southwick, S.P. Svensson, D.-W. Tu and N.E. Byer. "MM-Wave MIMIC Receiver Components." 1991 Microwave and Millimeter-Wave Monolithic Circuits Symposium Digest 91.1 (1991 [MCS]): 51-54.

Monolithic W-band amplifiers and a new W-band mixer fabricated using a pseudomorphic 0.1-µm MODFET technology are presented. Single-stage W-band amplifiers delivered 8.5-dB gain; four-stage units showed 23-dB maximum gain or 4.5-dB noise figure, 21.7-dB associated gain. Monolithic W-band mixers have shown 11.8 dB conversion loss.

Abstracts

A W-Band Monolithic Pseudomorphic InGaAs HEMT Downconverter

K.W. Chang, H. Wang, T.H. Chen, K. Tan, J. Berenz, G.S. Dow, A.C. Han, D. Garske and L.C.T. Liu. "A W-Band Monolithic Pseudomorphic InGaAs HEMT Downconverter." 1991 Microwave and Millimeter-Wave Monolithic Circuits Symposium Digest 91.1 (1991 [MCS]): 55-58.

This paper presents the design, fabrication, and evaluation of a fully integrated W-band monolitic downconverter based on InGaAs pseudomorphic HEMT (PHEMT). The downconverter consists of a two-stage low-noise amplifier (LNA) and a singly balanced HEMT gate diode mixer. Measured results of the complete downconverter show a conversion gain of 5.3 dB and a noise figure of 6.8 dB at 94 GHz. The whole downconverter is a first pass design and has a high circuit yield. Furthermore, this is first reported monolithic downconverter in the W-band frequency range, and represents the state-of-the-art in monolithic millimeter-wave technology.

Abstracts

Commercial GaAs MMIC Applications (1991 [MCS])

R. Rosenzweig. "Commercial GaAs MMIC Applications (1991 [MCS])." 1991 Microwave and Millimeter-Wave Monolithic Circuits Symposium Digest 91.1 (1991 [MCS]): 59-60.

The future of the GaAs MMIC industry is in the commercial sector. There is a cornucopia of high volume applications, such as DBS cellular telephone, PCM, fiber optics and GPS that are targets for cost effective GaAs MMIC solutions. The key to success is the ability to produce functional circuits in high volume at low cost. To be successful takes a shift in emphasis from low volume, high selling price "jewelry" applications, to the rigors and discipline of high volume manufacture.

Abstracts

A 2 GHz Enhancement Mode GaAs Down Converter IC for Satellite TV Tuner

P. Philippe and M. Pertus. "A 2 GHz Enhancement Mode GaAs Down Converter IC for Satellite TV Tuner." 1991 Microwave and Millimeter-Wave Monolithic Circuits Symposium Digest 91.1 (1991 [MCS]): 61-64.

A fully integrated 2 GHz down-converter IC has been designed and fabricated for satellite TV application using an enhancement mode GaAs foundry process. Its internal oscillator covers a 1.2 GHz bandwidth that allows to receive the extended satellite TV band from 950 MHz to 2 GHz. The LO power leakage is greatly reduced as compared to a discrete circuit: it is about -40 dBm at the RF input and less than -30 dBm at the IF output. This IC operates under a single 5 V supply voltage and its performance is an outstanding trade-off between noise, linearity, power consumption and simplicity of implementation. It is encapsulated in a standard low cost, plastic package and is already available for sampling.

Abstracts

X-Band MMIC Amplifier with Pulse-Doped GaAs MESFETs (1991 [MCS])

N. Shiga, S. Nakajima, K. Otobe, T. Sekiguchi, N. Kuwata, K.-I. Matsuzaki and H. Hayashi. "X-Band MMIC Amplifier with Pulse-Doped GaAs MESFETs (1991 [MCS])." 1991 Microwave and Millimeter-Wave Monolithic Circuits Symposium Digest 91.1 (1991 [MCS]): 65-68.

An X-band monolithic low noise amplifier (LNA) with 0.5µm-gate pulse-doped GaAs MESFETs was successfully demonstrated for a direct broadcast satellite (DBS) converter. This LNA shows excellent VSWR matches of under 1.4 as well as a noise figure of 1.67dB and a gain of 24dB at 12GHz. The yield of chips within microwave specifications is 62.5%.

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A New Planar Double-Double Balanced MMIC Mixer Structure (1991 [MCS])

J. Eisenberg, J. Panelli and W. Ou. "A New Planar Double-Double Balanced MMIC Mixer Structure (1991 [MCS])." 1991 Microwave and Millimeter-Wave Monolithic Circuits Symposium Digest 91.1 (1991 [MCS]): 69-72.

Coplanar waveguides, slot lines and coplanar strips are combined to realize a MMIC double-double balanced mixer (DDBM) in which all circuitry is on the top side of the substrate and no via holes are required. The DDBM exhibits RF, LO, and IF bandwidths of 6-20 GHz, 8-18 GHz and 2-7 GHz respectively with conversion loss ranging between 6.2 and 9.8 dB, and RF to IF, LO to IF and LO to RF isolations all greater than 20 dB. The mixer was designed analytically using the harmonic balance method to assess key performance parameters. It is believed to be the first planar diode MMIC DDBM to be reported.

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An HBT MMIC Wideband VCO (1991 [MCS])

A. Adar and R. Ramachandran. "An HBT MMIC Wideband VCO (1991 [MCS])." 1991 Microwave and Millimeter-Wave Monolithic Circuits Symposium Digest 91.1 (1991 [MCS]): 73-76.

A wideband MMIC Voltage Controlled Oscillator (VCO) has been developed using AlGaAs/GaAs Heterojunction Bipolar Transistors (HBTs). Test results indicate a very wide tuning range of 7 to 15GHz, with a minimum output power of 9 dBm. This MMIC also exhibits low power dissipation (5 V and 25 mA) and excellent phase noise (75 dBc/Hz @ 100 KHz) for a broadband VCO. In addition to the basic oscillator this MMIC also includes a buffer amplifier to provide better load isolation and power output stability. All the required biasing and matching circuitry except for the resonator is contained within the chip that measures 30 X 40 mils (0.8 mm X 1 mm).

Abstracts

A Class of Monolithic HBT Multipliers (1991 [MCS])

C.B. Perry, K.T. Ip, K.Z. Claxton, B.R. Allen and A.E. Farris. "A Class of Monolithic HBT Multipliers (1991 [MCS])." 1991 Microwave and Millimeter-Wave Monolithic Circuits Symposium Digest 91.1 (1991 [MCS]): 77-80.

Two types of monolithic multipliers have been developed using current AlGaAs HBT technology. Both circuits have an intended input frequency range of 10 MHz to 1.0 GHz. Preliminary wafer probe measurements indicate the even order multiplier achieves 45 dB of fundamental rejection and 22 dB conversion loss at 2.5 GHz (10th harmonic), consuming 175 mW. The odd order multiplier exhibited 21 dB of conversion loss at 10 GHz (10th harmonic) and 35 dB at 21 GHz (21st harmonic), dissipating 315 mW. These circuits offer significant improvement in bandwidth, output power and lower implementation cost compared to existing diode-based MIC or MMIC MESFET frequency multipliers.

Abstracts

Monolithic Ultra-Broadband Transimpedance Amplifiers Using AlGaAs/GaAs HBTs (1991 [MCS])

N. Nagano, T. Suzaki, A. Okamoto and K. Honjo. "Monolithic Ultra-Broadband Transimpedance Amplifiers Using AlGaAs/GaAs HBTs (1991 [MCS])." 1991 Microwave and Millimeter-Wave Monolithic Circuits Symposium Digest 91.1 (1991 [MCS]): 81-84.

Monolithic ultra-broadband transimpedance amplifiers have been developed using AIGaAs/GaAs HBTs. The amplifiers have exhibited DC to 13.4-GHz bandwidth, with an 18.1-dB gain, and a 49.8-dB Omega transimpedance. These results have been brought about by optimized circuit design considering large signal operation and an affordable HBT fabrication process using a self-aligned method.

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GaAs HBT Wideband and Low Power Consumption Amplifiers to 24 GHz (1991 [MCS])

K.W. Kobayashi, R. Esfandiari, M.E. Hafizi, D.C. Streit, A.K. Oki and M.E. Kim. "GaAs HBT Wideband and Low Power Consumption Amplifiers to 24 GHz (1991 [MCS])." 1991 Microwave and Millimeter-Wave Monolithic Circuits Symposium Digest 91.1 (1991 [MCS]): 85-88.

This paper reports on the design and performance of a 2-24 GHz distributed matrix amplifier and a 1-20 GHz 2-stage Darlington coupled amplifier based on an advanced HBT MBE profile which increases the bandwidth response of the distributed and Darlington amplifiers by providing lower base-emitter and collector-base capacitances. The matrix amplifier has a 9.5 dB nominal gain and a 3-dB bandwidth to 24 GHz. It is the highest bandwidth reported for an HBT distributed amplifier. The input and output VSWRs are less than 1.5:1 and 2.0:1, respectively. The total power consumed is less than 60 mW. The chip size measures 2.5x2.6 mm². The 2-stage Darlington amplifier has 7 dB gain and 3-dB bandwidth to 20 GHz. The input and output VSWRs are less than 1.5:1 and 2.3:1, respectively. This amplifier consumes 380 mW of power and has a chip size of 1.66x1.05 mm².

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An X-Band High-Efficiency Ion-Implanted MMIC Power Amplifier (1991 [MCS])

H. Le, Y.C. Shih, V. Hwang, T. Chi, K. Kasel and D.C. Wang. "An X-Band High-Efficiency Ion-Implanted MMIC Power Amplifier (1991 [MCS])." 1991 Microwave and Millimeter-Wave Monolithic Circuits Symposium Digest 91.1 (1991 [MCS]): 89-91.

A state-of-the-art X-band high efficiency monolithic power amplifier has been demonstrated. An average output power of 3.6 Watts at an average 41% power-added efficiency over a 40% bandwidth from 7.0 to 10.5 GHz has been achieved. An excellent average power density of 500 mW/mm and peak power density of 550 mW/mm has been measured across this bandwidth.

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A 4.0 Watt High Efficiency 15-18 GHz Power MMIC (1991 [MCS])

M. Gat, D.S. Day and J.R. Basset. "A 4.0 Watt High Efficiency 15-18 GHz Power MMIC (1991 [MCS])." 1991 Microwave and Millimeter-Wave Monolithic Circuits Symposium Digest 91.1 (1991 [MCS]): 93-96.

A two-stage Ku-band monolithic power amplifier is reported. The MMIC incorporates a full interstage matching network and partial input matching network on the chip. The amplifier delivers 4 watts of power, 10 to 13 dB of gain and more than 20% power added efficiency at 2 dB gain compression. This amplifier can be tuned for a 1 GHz instantaneous bandwidth anywhere in the 15-18 GHz band. To the best of our knowledge, the combination of output power, power-added efficiency and gain are the best published results for a power MMIC operating at 18 GHz to date.

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C-Band GaAs MMIC Limiting Power Amplifier with Small Insertion Phase Variation

J. Ozaki, K. Arai, M. Miyauchi, S. Watanabe and S. Kamihashi. "C-Band GaAs MMIC Limiting Power Amplifier with Small Insertion Phase Variation." 1991 Microwave and Millimeter-Wave Monolithic Circuits Symposium Digest 91.1 (1991 [MCS]): 97-100.

A C-band GaAs MMIC limiting power amplifier has been developed by cascading three kinds of MMIC chips (a limiting amplifier, a gain-control amplifier and a power amplifier) in a single package. It provides an output power of 33.2 ± 0.2 dBm with an insertion phase variation of less than 2.3 degrees over an input power range of from 13.5 dBm to 18.5 dBm. The output power can be controlled between 17.8 dBm and 33.2 dBm with an insertion phase variation less than 22.5 degrees.

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35 GHz Pseudomorphic HEMT MMIC Power Amplifier (1991 [MCS])

D.W. Ferguson, S.A. Allen, M.Y. Kao, P.M. Smith, P.C. Chao, M.A.G. Upton and J.M. Ballingall. "35 GHz Pseudomorphic HEMT MMIC Power Amplifier (1991 [MCS])." 1991 Microwave and Millimeter-Wave Monolithic Circuits Symposium Digest 91.1 (1991 [MCS]): 101-104.

0.25µm gate-length double-heterojunction InGaAs Pseudomorphic HEMTs developed at the GE Electronics Laboratory have been integrated into a 3-stage power amplifier MMIC designed for the 34-36 GHz band. This first pass design exhibited a peak small-signal gain of 30 dB, minimum output power of 200 mW with 20 dB associated gain, power-added efficiency of greater than 18% and a return loss of greater than 14 dB over the entire band. This performance was measured with the MMIC operating from a single 6 Volt DC supply.

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Index of Authors (1991 [MCS])

"Index of Authors (1991 [MCS])." 1991 Microwave and Millimeter-Wave Monolithic Circuits Symposium Digest 91.1 (1991 [MCS]): 105-105.

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Symposium Schedule (1991 [MCS])

"Symposium Schedule (1991 [MCS])." 1991 Microwave and Millimeter-Wave Monolithic Circuits Symposium Digest 91.1 (1991 [MCS]): b1-b2.

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