Asia Pacific Abstracts

Papers From Journals Published in China, Korea, and Japan in 2001

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The periodicals investigated are 1) Acta Electronica Sinica (*AES*), China, 2) Journal of China Institute of Communications (*JCIC*), China, 3) Journal of Infrared and Millimeter Waves (*JIMW*), China, 4) Journal of Applied Science (*JAS*), China, 5) Journal of Electronics and Information Technology (*JEIT*), China, 6) Journal of Microwaves (*JM*), China, 7) Chinese Journal of Radio Science (*CJRS*), China, 8) Journal of the Chinese Institute of Engineering (*JCIE*), Taiwan, China, 9) Journal of Korea Electromagnetic Engineering Society (*JKEES*), Korea, 10) Journal of the Institute of Electronics Engineers of Korea (*JIEEK*), Korea, 11) Journal of the Korean Institute of Communication Sciences (*JKICS*), Korea, 12) Transactions of the Institute of Electronics, Information and Communication Engineers (*Trans. IEICE*), Japan, 13) IEICE Transactions on Communications (*IEICE Trans. Commun.*), Japan, and IEICE Transactions on Electronics (*IEICE Trans. Electron.*), Japan.

The Korean abstracts are prepared and investigated by Prof. H.-Y. Lee, EE Department, Ajou University, Wonchon-Dong, Paldal-Gu, Suwon-city, 442-749, Korea. Prof. H.-Y. Lee has also contributed the 2000 Asian Abstract published last December issue.

As for the Japanese papers in the *Trans. IEICE* that carry volume numbers J82-B-I and J82-B-II, short English summaries are found in the *IEICE Trans. Commun.*, vol. E84-B and *IEICE Trans. Electron.*, vol. E84-C, issued in the same month. Papers carrying volume numbers E84-B and E84-C are papers originally written in English. These issues are published by the IEICE Kikai-Shinko-Kaikan, 3-5-8, Minato-ku, Tokyo, 105-0011 Japan.

The full translations of some Japanese papers will appear in Electronics and Communications in Japan, published by Scripta Technica, Inc., John Wiley & Sons, Inc., 605 Third Avenue, New York, NY 10158.

The abstracts of these papers are grouped as follows:

1) Solid-State Microwave Devices and MMIC's;
2) Transmission Lines and Passive Microwave Devices;
3) Microwave Antennas;
4) Microwave/Lightwave Propagation and Scattering;
5) Microwave Medical/Biological Applications;
6) Lasers and Other Devices;
7) Optical Fibers/Waveguides;
8) Superconductive Devices;
9) Special Issues Related to Microwave Theory Techniques (only the titles and their authors for Korean and Japanese papers).

I. Solid-State Microwave Devices and MMIC's

(1) 2.9 GHz 0.35 μm CMOS Low Noise Amplifier, by R. Tao, Z.-G. Wang, T.-T. Xie and H.-T. Chen (Southeast University, Nanjing, P.R.C.): *AES*, vol. 23, pp. 1530–1532, Nov. 2001.

With the scaling-down of the transistor gate-length, and the transit frequency of MOSFET of very-deep Submicron meter (VDSM) CMOS technology has reached higher than 50 GHz. It is possible to use the CMOS technology to design high frequency analog integrate circuits that opera in GHz. This paper presents a 2.9 GHz CMOS low noise amplifier, which is implemented in 0.35 μm CMOS technology. The on-chip spiral inductors were utilized for the low noise performance and monolithic integration. With the 3 V-power supply, the operation current is about 8 mA. The gain at 2.9 GHz is larger than 10 dB and the input reflection is less than -12 dB at 2.9 GHz.

(2) Millimeter-Wave Three-Port Transistor Drain Mixer, by R.-M. Xu, S.-Q. Xiao, B. Yan and L.-J. Xue (University of Electronic Science and Technology of China, Chengdu, P.R.C.): *JIMW*, vol. 20, pp. 120–123, Apr. 2001.

The analysis and optimizing design for three-port device drain mixer in Ka-band were given. The nonlinear equivalent circuit and its parameters were simulated and obtained from the small signal S parameter and the DC measurements of three-port device. The drain mixer circuit was designed with optimum conversion gain of the drain mixer which was derived from the harmonic balance method and the conversion matrices method. The test result shows that the mixer has conversion gain 4 dB at RF 27.4 GHz and LO 33.4 GHz/10 dBm.

(3) Ka-Band Microstrip Integrated Local-Oscillator-Mixer Assembly Used in Projectile Sensors, by J.-S. Jiang, X.-G. Li, W. Wu and G.-W. Lou (Nanjing University of Science and Technology, Nanjing, P.R.C.): *JIMW*, vol. 20, pp. 139–142, Apr. 2001.

A compact Ka-band microstrip integrated local-oscillator-mixer assembly used projectile sensors was introduced. The overall configuration of microstrip circuit of this assembly was given. The functions of each component were described. The environment and reliability tests performed on this assembly were explored in detail, which include vibration, shock, and temperature. The Ka-band local-oscillator-mixer assembly exhibits a 3.4$\sim$4.2 dB double side band (DSB) noise figure over a 2-GHz RF bandwidth. LO-to-RF isolation is greater than 27 dB over the range of operating frequencies. The frequency stability of local oscillator with dielectric resonator used is less than 60 ppm/°C.

(4) Millimeter Wave Mixer With Image Recovery Using Dielectric Resonators, by J.-S. Jiang, X.-G. Li and W. Wu

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(University of Science and Technology, Nanjing, P.R.C.): *JIMW*, vol. 20, pp. 304–306, Aug. 2001.

The millimeter wave mixer with image recovery was presented, which used dielectric resonators at Ka-band as the band-rejection filter. The real circuit was also presented based on the theoretical analysis. The results show that the signal conversion loss is reduced by about 1.1 dB, and the image-to-signal conversion loss ratio is larger than 26 dB by using the millimeter wave mixer image recovery.

(5) Microwave Integrated Circuits on Silicon Substrates, by J.-F. Mao (Shanghai Jiaotong University, Shanghai, P.R.C.): *JM*, vol. 17, pp. 54–61, Mar. 2001.

The prospect of microwave integrated circuits (MIC) on silicon (Si) substrates is very attracting. In this paper the advantages of Si used as the substrate of MIC are reviewed. Electrical performance of microwave transmission lines and passive elements on Si, and of SiGe HBT are analyzed. The research progress of MIC on Si is briefly presented and some discussions are given for the uniqueness and application of integrating digital circuits with RF and microwave circuits on Si substrates.

(6) A Ka-Band Receiving Terminal for Measuring ROCSAT-1 ECP Beacon Signals, by T.-H. Chu, C.-H. Tseng, S.-D. Yang and C.-I. Chi (National Taiwan University, Taipei, P.R.C.): *JCIE*, vol. 24, pp. 29–36, Jan. 2001.

The design, integration, test and measurement results of a Ka-band receiving terminal developed by National Taiwan University to receive the experimental communication payload down-link 19.5 GHz beacon signals are described. The developed Ka-band receiving terminal has a computer controlled reflector antenna to receive the ECP beacon signal, and a Ka-band receiver to amplify and down convert the 19.5 GHz beacon signal to 150 MHz IF signal, then a HP8562A spectrum analyzer to detect the IF output signal power level. The dynamic range and sensitivity of the developed receiving terminal are about 30 dB and -170 dBm, respectively.

(7) An Improved Levelized Incomplete LU Method and Its Application to 2D Semiconductor Device Simulation, by Y.-T. Tsai, J.-F. Dai and M.-K. Tsai (National Central University, Chungli, P.R.C.): *JCIE*, vol. 24, pp. 389–396, May 2001.

To have an environment for evaluating the interaction between a semiconductor device and a circuit, the equivalent circuit approach is used. This approach allows for simple representation carrier transport models of devices through equivalent circuit elements such as voltage controlled current sources and capacitors. Therefore, the mixed-level simulation in general circuit simulators can be performed. Taking a PN diode switching circuit and MOSFET as examples the equivalent circuit model and improved circuit simulator are tested. It shows that the present method yields better matrix solutions than conventional methods.

(8) A Study on the Relative Phase Variation at the Sweet Spot of Microwave Power Transistor, by U. H. Park*, I. S. Chang**, H. Y. Cho*** (*Electronics and Telecommunications Research Institute; **Sogang University, Seoul, Korea; ***Dongyang Technical College., Seoul, Korea): *JKEES*, vol. 38-TC, no. 1, pp. 14–19, Jan. 2001.

When the high power transistor is used for amplifier in microwave frequency, the bias of transistor is usually AB-class or B-class because of power efficiency. The sweet spot point having small IMD signal compared with near neighborhood exicts frequently in the high power transistor using AB-class bias or B-class bias. On the sweet spot, the magnitude and phase of the main and IMD signal of HPA output change as the input signal power change, respective the relative phase on the sweet spot changes rapidly. If we know exactly the magnitude and phase characteristics of IMD signal, we can design a more adequate linearizer and understand the characteristics of transistor. In this paper the magnitude and phase of the main and IMD signal of HPA output on the sweet spot are measured using the designed hardware.

(9) A Study on the IMD Cancellation by Signal Combining of Predistorter Type, by U. H. Park*, H. Y. Cho**, I. S. Chang*** (*Electronics and Telecommunications Research Institute; **Electrical Engineering Dongyang Technical College., Seoul, Korea; ***Electronic Engineering, Sogang University, Seoul, Korea): *JKEES*, vol. 38-TC, no. 1, pp. 20–26, Jan. 2001.

Predistorter linearizer having small size and good efficiency is frequently used in High Power Amplifier linearizer system. In this paper, the amount of IMD signal cancellation according to amplitude and phase of predistorter in predistorter type linearizer is investigated by new experiment method. In the combining method of predistorter type, IMD signal is combined at the amplifier input port, the magnitude and phase of combining signals cannot be easily expected due to different magnitude and phase of incoming signals. By experiment, it is measured that Predistorter linearizer has lower amount of IMD signal cancellation than thoce of Feedforward linearizer at the same condition (amplitude and phase).

(10) Performance Improvement of Asynchronous DS-CDMA Systems With a Multistage Interference Canceller in the Presence of Timing and Phase Errors, by B.-C. Kim*, G.-J. Kang*, C.-H. Oh**, S.-J. Cho* (*Department of Telecommunications and Information Engineering, Graduate School of Hankuk Aviation University; **Department of Information and Communication Engineering, Korea University of Technology and Education): *JKEES*, vol. 12, no. 1, pp. 1–10, Jan. 2001.

In this paper, a multistage para ince canceler (MPIC) and a partial multistage parallel interference canceler (PMPIC) are employed as a technique for improving the performance of the asynchronous DS-CDMA systems. The degree of the effect of the timing errors and phase errors on the interference cancellation capability of two types of cancelers is theoretically analyzed and the computer simulation is performed to confirm the analytical results. From the results, the large performance improvement is obtained by employing MPIC and PMPIC with perfect synchronization over the conventional matched filter, and the performance improvement obtained by MPIC and PMPIC is very close to each other as the number of the stage of MPIC and PMPIC increases. When the timing errors and phase errors are considered (in the case of imperfect synchronization), the performance improvement reduces as the performance degradation at the first stage (no cancellation) has a bad effect on the decision statistics at each stage. However MPIC and PMPIC have the strong interference cancellation capability in spite of imperfect synchronization as the number

of the stage increases. An interference canceler, which has the strong interference cancellation capability as well as lower complexity for the implementation, is needed for practical systems with timing errors and phase errors because the perfect synchronization is impossible. Therefore, the excellent tradeoff between complexity and performance offered by PMPIC makes it an attractive approach for practical systems.

(11) A Study on Wideband Linear Power Amplifier Considering Delay Characteristics, by Y.-H. Kim, S.-I. Yang (Education Center for RF/MW, Department of Electronic Engineering, Soongsil University): *JKEES*, vol. 12, no. 1, pp. 37–43, Jan. 2001.

In this paper, we designed a linear power amplifier considering its delay characteristics for wideband operation. The power amplifier has the gain of 37 dB and is designed in 3-stage typ with 1 W output power. The error amplifier has the gain of 55 dB and is designed in 4-stage type. And directional coupler and power divider are designed. Vector modulator is used to adjust magnitude and phase of signal. A linear power amplifier, that is assembled with each modules, is designed considering the delay characteristics for 2.11$\sim$2.2 GHz. Its C/I3 ratio has been improved by 25 dB for bandwidth of 30 MHz.

(12) VCO Nonlinearity Correction Technique Using an Internal Reflection, by B. Kim, Y.-S. Kim (Radar Systems and Remote Sensing Laboratory, Division of ECE, POSTECH (Pohang University of Science and Technology)): *JKEES*, vol. 12, no. 1, pp. 44–49, Jan. 2001.

In this paper, we propose a new technique to compensate for the VCO nonlinearity using only the returned beat signal whose spectrum contains the internal reflections and the targets simultaneously. In the case of a distance measurement system using single antenna, the reflections from the circulator and the antenna are much larger than the return signal from target. The beat signal by these reflections is at much lower frequency than that of the target, and the VCO nonlinearity can be compensated for using these signals. Indoor experiments were carried out and the results show marked improvement in the shape of range profile and the range resolution.

(13) Design of a Receiver MMIC for the CDMA Terminal, by T.-W. Kwon, J.-H. Choi (School of Electrical Engineering and Automation, University of Ulsan): *JKEES*, vol. 12, no. 1, pp. 65–70, Jan. 2001.

This paper presents a Receiver MMIC for the CDMA terminal. The complete circuit is composed of Low Noise Amplifier, Down Conversion Mixer, Intermediate Frequency Amplifier and Bias circuit. The Bias circuit implementation which allows for compensation for threshold voltage and power supply voltage variation are provided. The proposed topology has high linearity and low noise characteristics. Results of the designed circuit is as follows: Overall conversion gain is 28.5 dB, input IP3 of LNA is 8 dBm, input IP3 of down conversion mixer is 0 dBm and total DC current consumption is 22.1 mA.

(14) A 3 Stage MMIC Low Noise Amplifier for the Ka Band Satellite Communications and BWLL System, by I.-B. Yom, J.-C. Cheong, S.-P. Lee (Radio and Broadcasting Technology Laboratory, ETRI): *JKEES*, vol. 12, no. 1, pp. 71–76, Jan. 2001.

A Ka Band 3-stage MMIC (Monolithic Microwave Integrated Circuits) LNA (Low Noise Amplifiers) has been designed and fabricated for the Ka band satellite communications and BWLL (Broad Band Wireless Local Loop) system. The MMIC LNA consists of two single-ended type amplification stages and one balanced type amplification stage to satisfy noise figure, high gain and amplitude linearity. The 0.15 μm pHEMT has been used to provide a ultra low noise figure and high gain amplification. Series and Shunt feedback circuits and $\lambda/4$ short lines were inserted to ensure high stability over the frequency range form DC to 80 GHz. The size of the MMIC LNA is 3.1 mm $\times$ 2.4 mm (7.44 mm^2). The on wafer measured performance of the MMIC LNA, which agreed with the designed performance, showed the noise figure of less than 2.0 dB, and the gain of more than 26 dB, over frequency ranges from 22 GHz to 30 GHz.

(15) The Design and Implementation of MCPA for IMT-2000 Using Feedforward Linearization, by S.-Y. Noh, S.-C. Jeong, J.-H. Jeong, M.-S. Park, C.-S. Park (Department of Electronic Engineering, Sung Kyun Kwan University): *JKEES*, vol. 12, no. 1, pp. 99–106, Jan. 2001.

In this paper, an 1-Watt amplifier for IMT-2000 was designed and fabricated using feedforward method which has the highest linearity and wide bandwidth. Since feedforward is sensitive to surroundings for example heat, input power level, time and so on, adaptive controller using micro controller is adopted. We fabricated a HPA with 35 dB gain, 40 dBm of 1-dB compression point, and utilized variable attenuator and variable phase shifter using reflection type to cancel loop signal. From the measured results, the following facts were obtained, in signal loop, main carrier over 35 dB was suppressed and error signal over 30 dB is canceled in error loop, IMD characteristics above 60 dBc were obtained.

(16) A Feedforward High Power Amplifier With Loops That Can Reduce RX Band Noises as Well as Intermodulation Distortion Signals, by Y.-C. Jeong (Division of Electronics and Information Engineering, Institute of Information and Communication, Chonbuk National University): *JKEES*, vol. 12, no. 2, pp. 308–315, Feb. 2001.

In this paper, a new power amplifier is proposed for reduction of amplified RX band noise signals as well as intermodulation distortion signals using feedforward technique. This power amplifier is implemented for IMT-2000 basestation TX frequency band. Both TX band intermodulation distortion signals and RX band noise signals are reduced by controlling variable attenuator, phase shifter and error amplifier. The proposed power amplifier, which contains two loops—intermodulation distortion signals cancellation loop and RX band noise signals cancellation loop, can provide duplexer with low TX path insertion loss for various wireless communication systems due to choice of loose RX attenuation characteristic. The principle of the proposed amplifier is described graphically based on the conceptual schematic diagram. A two-tone test for power amplifier is done at 2.14 GHz with frequency spacing of 5 MHz, and RX band rejection test is done over RX full band of 60 MHz with 1.95 GHz center frequency. Experimental results represent that the cancellation performance of intermodulation distortion signals and RX band noise signals are more than 31 dB and 21 dB, respectively.

(17) Hand-Held Mobile Phone Design for SAR Reduction, by S.-W. Hong*, H.-T. Oh*, C.-S. Park** (*Department of Radio Environment Research, RRL; **School of Electrical and Computer Engineering, Sungkyunkwan University): *JKEES*, vol. 12, no. 3, pp. 352–359, Apr. 2001.

We propose the new method that is able to consider the SAR compliance test from the very beginning step of developing the mobile phone. The reason this new method is plausible is that we adopt the certified FDTD for the reliability of calculation, utilizing 1 mm high resolution model that is to model the phantom and the mobile phone almost identically to the reality. In this paper we introduce the process that will apply the proposed method in order to reduce the SAR of the mobile phone that has been problematic in satisfying the SAR compliance test. It results in dropping in the SAR that we keep the mobile phone or its antenna while we use it. Therefore here we make a claim as follows. When we develop the new mobile phone, we should use the computer simulation combining the CAD design and radiation pattern rather than make a prototype and then use the trial and error method. Moreover the former way leads us to boost up the developing efficiency and reduce the cost.

(18) Performance Analysis of Groupwise Serial Interference Cancellation (GSIC) for W-CDMA System With Coherent Detection, by J.-G. Koo*, H.-J. Choi** (*Department of Digital Electronics and Information Engineering, Yong-In Song Dam College; **Comsys Lab, School of Electrical and Computer Engineering, Sung Kyun Kwan University): *JKEES*, vol. 12, no. 3, pp. 360–369, Apr. 2001.

This paper proposes the groupwise serial cross interference cancellation (GSCIC) algorithm for coherent detection and analyzes the groupwise serial block interference cancellation (GSBIC) and GSCIC algorithm for an asynchronous wideband DS-CDMA system in a single cell over multipath fading channels. In general, the GSIC algorithm can be grouped into two classes: i.e., GSBIC and GSCIC algorithm. In this paper, the proposed GSCIC algorithm is to improve the performance of the GSBIC algorithm. We compare the performance of the GSCIC and existing GSBIC algorithm in a multipath fading channel to that of the existing SIC algorithm. As a result, the performance of GSCIC algorithm is somewhat better compared with the GSBIC algorithm according to reduction factor R_f″ and is similar to that of the SIC algorithm. And also, the GSBIC and GSCIC algorithms have the advantage that it can be analyzed system performance easily, changing the number of users within a user group according to system capacity.

(19) Design and Fabrication of 5.5 GHz Band VCO for DSRC, by S.-C. Han*, S.-H. Oh** (*Department of Computer Science, Sangjiyoungseo College; **Department of Electronic Engineering, Chungnam National University): *JKEES*, vol. 12, no. 3, pp. 401–408. Apr. 2001.

This paper shows the design, fabrication and performance analysis of VCO which plays a major role in 5.8 GHz RF module for ITS. The design specifications of the VCO are determined on the basis of 5.8 GHz RF module performance requirements. The design parameters are optimized through ADS simulation tool. The operating characteristic and performance analysis of the implemented VCO based on the design parameters are accomplished. The frequency variations according to the voltage change (0∼5 V) of varactor diode are from 5.42 GHz to 5.518 GHz and the power level is 6.5 dBm. The second harmonic suppression are −21.5 dBc at 5.51 GHz and the phase noise characteristics are −83.81 dBc at 10 kHz offset frequency. The implemented VCO is available to not only DSRC and also, 5.8 GHz other systems.

(20) Low Noise Local Oscillator Design in K Band Using Baseband Noise Upconversion Gain Analysis, by Y.-T. Lee*, M.-Q. Lee**, J.-S. Lim*, I.-B. Yeom**, D.-P. Chang**, S.-W. Nam* (*Applied Electromagnetics Laboratory, School of Electrical Engineering, Seoul National University; **Radio and Broadcasting Technology Laboratory, ETRI): *JKEES*, vol. 12, no. 3, pp. 462–469. Apr. 2001.

In this paper, local oscillator in K band using low frequency noise upconversion gain analysis was designed and measured. We extended Two Signal Method (TSM) to estimate upconversion gain and resulting phase noise. To confirm the validity of the proposed method, a free-running oscillator which had low upconversion gain was designed. The measured oscillation frequency was 23.42 GHz and phase noise at 1 MHz offset was −105.2 dBc/Hz. Also, this oscillator was operated for subharmonic injection locked oscillator (SILO). In this case, SILO showed ideal frequency multiplier phase noise characteristics at low subharmonic injection power level.

(21) Millimeter-Wave Fast-Sweep FM Reflectometry Applied to Plasma Density Profile Measurements, by K. W. Kim (L-3 Communications Company): *JKEES*, vol. 1, no. 1, pp. 18–23, May 2001.

A fast-sweep broadband FM reflectometer system has been successfully developed and operated at the DIII-D tokamak, producing reliable density profiles with excellent spatial ($\leq$1 cm) and temporal resolution ($\sim$100 μs). The system uses a solid-state microwave oscillator and an active quadrupler, covering full Q-band frequencies (33∼50 GHz) and providing relatively high output power (20∼60 mW). The system hardware allows fullband frequency sweep in 10 μs, but due to digitization rate limit on DIII-D, sweep time was limited to 75∼100 μs. Fast frequency sweep has helped to reduce density fluctuation effects on the reflectometer phase measurements, thus improving reliability for individual sweeps. The fast-sweep system with high spatial and temporal resolution has allowed to measure fast-changing edge density profiles during plasma ELMs and *L–H* transitions, thus enabling fast-time scale physics studies.

(22) Design and Fabrication of the 0.1 μm Γ-Shaped Gate PHEMT's for Millimeter-Waves, by S.-D. Lee, S.-C. Kim, B.-H. Lee, W.-S. Sul, B.-O. Lim, D. An, Y.-S. Yoon, S.-D.-Kim, D.-H. Shin, J.-K. Rhee (Millimeter-Wave INnovation Technology Research Center (MINT), Department of Electronics Engineering, Dongguk University): *JKEES*, vol. 1, no. 1, pp. 73–77, May 2001.

We studied the fabrication of GaAs-based pseudomorphic high electron mobility transistors (PHEMT's) for the purpose of millimeter-wave applications. To fabricate the high performance GaAs-based PHEMT's, we performed the simulation to analyze the designed epitaxial-structures. Each unit processes, such as 0.1 μm Γ-gate lithography, silicon nitride passivation and air-bridge process were developed to achieve high perfor-

mance device characteristics. The DC characteristics of the PHEMT's were measured at a 70 μm unit gate width of 2 gate fingers, and showed a good pinch-off property ($VP = -1.75$ V) and a drain–source saturation current density ($Idss$) of 450 mA/mm. Maximum extrinsic transconductance (gm) was 363.6 mS/mm at $Vgs = -0.7$ V, $Vds = 1.5$ V, and $Ids = 0.5Idss$. The RF measurements were performed in the frequency range of 1.0∼50 GHz. For this measurement, the drain and gate voltage were 1.5 V and −0.7 V, respectively. At 50 GHz, 9.2 dB of maximum stable gain (MSG) and 3.2 dB of S21 gain were obtained, respectively. A current gain cut-off frequency (fT) of 106 GHz and a maximum frequency of oscillation ($f\max$) of 160 GHz were achieved from the fabricated PHEMT's of 0.1 μm gate length.

(23) Design and Implementation of Combined RF Receiver Front End for GPS/GLONASS, by J.-S. Joo*, K.-W. Yeom*, S.-J. Lee** (*Department of Radio Science and Engineering, Chungnam National University; **Department of Computer and Communication Engineering, Chungnam National University): *JKEES*, vol. 12, no. 4, pp. 494–502, June 2001.

GPS (Global Positioning System) and GLONASS (GLObal Navigation Satellite System) are basic technologies providing the information of the position and the time, and they have various applications such as navigation, survey, control, and so on. However, each GPS and GLONASS has limited number of visible satellites, and, from the view of strategy, it is undesirable to be heavily dependent on only one system. Thus, GPS/GLONASS combined receiver became required to obtain more precise navigation and system stability. In this paper, the RF front end of GPS/GLONASS combined receiver was fabricated on 130 × 80 mm^2 PCB (Printed Circuit Board), and its system application was shown finally one chip possibility of GLONASS receiver is studied.

(24) Adaptive Predistorter for Power Amplifier Based on Real-Time Estimation of Envelope Transfer Characteristics, by J.-H. Han*, T. Chung**, S. Nam*, K. B. Lee*, M.-J. Park*** (*School of Electrical Engineering, Seoul National University; **SK Teletech; ***Samsung Electronics Co.): *JKEES*, vol. 12, no. 4, pp. 503–512, June 2001.

A new adaptation algorithm for the digital predistorter is presented. The proposed technique employs the real-time transmitted signals through HPA for the table update. Hence the proposed algorithm does not depend on modulation format and the signal transmission of HPA is not affected during the adaptation process. The experimental results are presented to verify the proposed method and we obtained about 8.4 dB of ACPR improvement.

(25) Large Signal Unified Model for GaAs pHEMT Using Modified Curtice Model, by D.-J. Park*, K.-W. Yeom*, D.-P. Chang**, J.-H. Lee* (*Department of Radio Science and Engineering, Chungnam National University; **ETRI/Radio and Broadcasting Technology Laboratory): *JKEES*, vol. 12, no. 4, pp. 551–561, June 2001.

In this paper, the large signal unified model is established for H40 GaAs pHEMT of GEC-Marconi using modified Curtice model. This unified model includes DC characteristic, small signal, and noise characteristic as various bias. Particularly, the model can simply and physically explain trans-conductance (gm) of pHEMT using modified Curtice model, and can tell the difference gm, Rds at DC and these at AC through inclusion of internal RF-choke. The results of the established model built up using SDD in HP-Eessof show good agreement to the S/W measured data in DC, small signal, and noise characteristic. This model can also be applied to various computer aided analysis, such as linear simulation, 1-tone harmonic balance simulation, and multi-tone harmonic balance simulation, so the LNA (Low Noise Amplifier), oscillator, and mixer design has been shown using this model library.

(26) Nonlinear Design of Engineering Model Oscillator With a Very Low Phase Noise for Satellite Transponder, by M.-Q. Lee, K.-K. Ryu, I.-B. Yeom, S.-P. Lee (Electronics and Telecommunications Research Institute): *JKEES*, vol. 12, no. 4, pp. 622–629, June 2001.

An engineering model VCO with a good phase noise for Ku-band satellite transponder is designed using a nonlinear design methodology. It generates frequencies from 1745 and 1755 MHz with control voltages from 0 to 5 V DC. This unit requires 7 mA of current from 5 V DC supply voltage. Phase noise characteristics of the manufactured VCO exhibit −114 dBc/Hz @10 kHz offset and −131 dBc/Hz @100 kHz offset and its output power is 5 dBm.

(27) A Design of High Power Amplifier Predistortor Using Carrier Complex Power Series Analysis, by S. Y. Yun*, Y. C. Jeong** (*R&D Center, Sewon Teletech Inc.; **Division of Electronic and Information Engineering, Institute of Information and Communication, Chonbuk National University): *JKEES*, vol. 12, no. 5, pp. 686–693, Aug. 2001.

In this paper, a new carrier complex power series which represents nonlinear transfer function of high power amplifier is derived. Using this transfer function, the nonlinear transfer function of predistortive circuit for linearizing the distortion effect of a HPA (High Power Amplifier) is derived and fabricated. A measured gain and P1dB of the fabricated HPA in IMT-2000 basestation transmitting band are 34.06 dB and 35.4 dBm. The predistortive circuit using inverse carrier complex power series is fabricated and operated with HPA. The predistortive HPA improves C/I (Carrier to Intermodulation) ratio of HPA by 17.01 dB ($@Pout = 25.43$ dBm/tone) with 2-tone at 2.1375 GHz and 2.1425 GHz.

(28) Development of Large Signal Model Extractor and Small Signal Model Verification for GaAs FET Devices, by H.-K. Choi*, K.-I. Jeon**, B.-S. Kim***, J.-C. Lee*, B. Lee*, J.-H. Kim*, N.-Y. Kim* (*RFIC Research and Education Center and Mission Technology Research Center, Kwangwoon University; **RF Core Co.; ***Department of Electronic Engineering, Sungkyunkwan University): *JKEES*, vol. 12, no. 5, pp. 787–794, Aug. 2001.

In this paper, the development of large-signal model extractor for GaAs FET device through the Monolithic Microwave Integrated Circuit (MMIC) is presented. The measurement program controlled by personal computer is developed for the processing of an amount of measured data, and the de-embedding algorithm is added to the program for voltage dropping as attached series resistance on measurement system. The small-signal model parameters are typically consisted of 7 elements that are consid-

ered as complexity of large-signal model and its the accuracy of the small-signal model is verified through comparing with measured data as varied bias point. The fitting function model, one of the empirical model, is used for quick simulation. In the process of large-signal model parameter extraction, one-dimensional optimization method is proposed and optimized parameters are extracted. This study can reduce the modeling and measuring time and can secure a suitable model for circuit optimization as quick simulation.

(29) Design of a Linear PA for the Frequency Hopping Transmitter Using the Adaptive Predistortion Linearizer, by K. Kang, S. Lee (Division of Electronic and Computer Engineering, Hanyang University): *JKEES*, vol. 12, no. 5, pp. 802–809, Aug. 2001.

A linear power amplifier for the VHF frequency-hopping (FH) transmitter using an adaptive predistortion linearizer is designed. An analog polynomial linearizer as predistorter is employed. The recursive least square (RLS) algorithm is employed in the optimization process to minimize the errors between the predistorter and postdistorter output signals. Experimental results show that the adjacent channel power of the designed power amplifier is reduced by of 10 dB.

(30) The Effect of Phase Noise From PLL Frequency Synthesizer, by H.-R. Cho*, J.-S. Choi** (*Division of Radio and Information Communication Engineering, Korea Maritime University; **Pantech Co., Ltd., R&D Institute): *JKEES*, vol. 12, no. 6, pp. 865–870, Oct. 2001.

In this paper, we analyze the effect of phase noise from PLL frequency synthesizer on 64 QAM when detecting corrupted signals. To predict the phase noise of an oscillator very accurately, we assume that the oscillator is linearly time-varying when the input impulsive current to the oscillator is small. The performance of the detector which detects the corrupted signal by oscillator phase noise is compared with that when the detector is only affected by AWGN and then analyze how much the phase noise degrades the system performance for 64 QAM.

(31) 4H–SiC MESFET Large Signal Modeling Using Modified Materka Model, by S.-w. Lee, N.-j. Song, J. Burm (Department of Electronic Engineering, Sogang University): *JKEES*, vol. 12, no. 6, pp. 890–898, Oct. 2001.

4H–SiC (silicon carbide) MESFET large signal model was studied using modified Materka–Kacprzak large signal MESFET model. 4H–SiC MESFET device simulation have been conducted by Silvaco's 2D device simulator, ATLAS. The result is modeled using modified Materka large signal model. 4H–SiC MESFET device simulation have been conducted by Silvaco's 2D device simulator, ATLAS. The result is modeled using modified Materka large signal model. Simulation and modeling results are -8 V pinch off voltage, under $VGS = 0$ V, $VDS = 25$ V conditions, $IDSS = 270$ mA/mm, $Gm = 52.8$ ms/mm were obtained. Through the power simulation 2 GHz, at the bias of $VGS = -4$ V and $VDS = 25$ V, 10 dB Gain, 34 dBm (1 dB compression point) output power, 7.6 W/mm power density, 37% PAE (power added efficiency) were obtained.

(32) A Study on the Development of High Gain and High Power Ka-Band Hybrid Power Amplifier Module, by S. H. Lee, H. T. Kim, J. H. Jeong, Y. W. Kwon (School of Electrical Engineering and Computer Science, Seoul National University, Seoul, Korea): *JKEES*, vol. 38-TC, no. 11, pp. 443–448, Nov. 2001.

In this work, we developed a Ka-band hybrid 4-stage power amplifier module using GaAs PHEMTs and waveguide to microstrip transitions. It has high gain and high output power characteristics. We used a 10 mil-thickness duroid substrate to fabricate this power amplifier and waveguide to microstrip transitions. The fabricated waveguide to microstrip transition showed about 1 dB insertion loss (back to back) at 32–40 GHz. The measured results of power amplifier module showed over 1 W output power at 36.1–37.1 GHz. And it showed 31 dBm output power, 24 dB power gain and 15% power-added efficiency (PAE) at 36.5 GHz.

(33) Design and Fabrication of the MMIC Frequency Doubler for 29 GHz Local Oscillator Application, by J. S. Kim, S. D. Lee, B. H. Lee, S. C. Kim, W. S. Sul, B. O. Lim, S. D. Kim, H. C. Park, H. M. Park, J. K. Rhee (Millimeter-Wave INnovation Technology Research Center, MINT): *JKEES*, vol. 38, no. 11, pp. 457–464, Dec. 2001.

We demonstrate the MMIC (monolithic microwave integrated circuit) frequency doublers generating stable and low-cost 29 GHz local oscillator signals from 14.5 GHz input signals. These devices were designed and fabricated by using the MMIC integration process of 0.1 μm gate-length PHEMT's (pseudomorphic high electron mobility transistors) and passive components. The measurements showed $S11$ of -9.2 dB at 14.5 GHz, $S22$ of -18.6 dB at 29 GHz and a minimum conversion loss of 18.2 dB at 14.5 GHz with an input power of 6 dBm. Fundamental signal of 14.5 GHz were suppressed below 15.2 dBc compared to the second harmonic signal at the output port, and the isolation characteristics of fundamental signal between the input and the output port were maintained above 30 dB in the frequency range 10.5 GHz to 18.5 GHz. The chip size of the fabricated MMIC frequency doubler is 1.5 $\times$ 2.2 mm^2.

(34) MMIC Low Noise Amplifier Design for Millimeter-Wave Application, by B.-J. Jang, I.-B. Yom, S.-P. Lee (Communications Statellite Development Center, ETRI): *JKEES*, vol. 12, no. 7, pp. 1191–1198, Dec. 2001.

MMIC low noise amplifiers for millimeter-wave application using 0.15 μm PHEMT have been presented in this paper. The design emphasis is on active device model and EM simulation. The deficiency of conventional device models is identified. A distributed device model has been adapted to circumvent the scaling problems and, thus, to predict small signal and noise parameters accurately. Two single-ended low noise amplifier are designed using distributed active device model for Q-band (40$\sim$44 GHz) and V-band (58$\sim$65 GHz) application. The Q-band amplifier achieved a average noise figure of 2.2 dB with 18.3 dB average gain. The V-band amplifier achieved a average noise figure of 2.9 dB with 14.7 dB average gain. The design technique and model employed provides good agreement between measured and predicted results. Compared with the published data, this work also represents state-of-the-art performance in terms of gain and noise figure.

(35) A 6–44 GHz, 100 mW MMIC Amplifier Using Paralleler CPW Lines for Low Impedance Matching, by H.

T. Kim, D. H. Kim, J. H. Lee, Y. W. Kwon, K. S. Seo (Millimeter-Wave Integrated Systems Laboratory, Seoul National University, Seoul, Korea): *JKICS*, vol. 26, no. 1B, pp. 1–6, Jan. 2001.

A wide band CPW MMIC amplifier was designed and fabricated by 0.25 μm PHEMT process. To provide lower sensitivity to process variation, only series capacitors and CPW lines were used for impedance matching. Low $Z0$ CPW lines ($Z0 < 20\ \Omega$) were realized by paralleling two lines. The measured results of MMIC amplifier showed small signal $S21 > 7$ dB at 6–44 GHz and over 100 mW output power at 26–31 GHz.

(36) MQW QCSE Microwave Photonic Tunable FM Laser: Design and Fabrication, by J. B. Song*, X. Huang**, A. J. Seeds* (*Department of Electronic and Electrical Engineering, University College London; **E-TEK Dynamics, U.S.A.): *JKICS*, vol. 26, no. 2B, pp. 139–147, Feb. 2001.

We report on a monolithically integrated two-section ridge-guide MQW QCSE tunable FM laser for DWDM or OFDM, which required uniform FM response. To realize MQW QCSE tuning mechanism using monolithically integrated two-section, reverse bias tuning of tuning section is required. Separation between tuning section and gain section is realized using ion implantation. To operate tuning section at absorption band-edge, band-gap of tuning section is shifted using IFVD MQW intermixing. As laser parasitic parameters limit achievable laser modulation bandwidth, low parasitic laser structures have been designed. An air-bridge laser built on a semi-insulating substrate and a Polyimaide planarized laser built on an $n+$ substrate are fabricated successfully. Good CW single mode operation at $\sim$850 nm, 20 nm tuning and FM response uniformity within $\pm$3 dB over the bandwidth 6 GHz have been achieved. This report will be concentrated on design and fabrication of the MQW QCSE FM laser.

(37) Spurious Noise Reduction of Digital Direct Frequency Synthesizer With Digital Phase Modulation Function, by S. B. Ryu, J. W. Son, Y. R. Kim, H. G. Ryu (Department of Electronic, Chungbuk University, Cheongju, Korea): *JKICS*, vol. 26, no. 2B, pp. 148–152, Feb. 2001.

Dual-structured digital direct frequency synthesizer (DDFS) is designed to reduce the spurious noise which has an additional function of QPSK modulation. The proposed dual-structured DDFS is compared with conventional DDFS. Simulation results show the reduction of spurious noise. To design and verify the aimed operation of logic circuit, standard cell library and XILINX design system are used for digital simulation. By P-SPICE, it is also conformed to obtain the output sinusoidal waveform with wanted frequency and phase according to the modulation input.

(38) Low Phase Noise Ka-Band CPW PHEMT MMIC Oscillator Using Balancing, by N. Kim, H. T. Kim, D. H. Kim, W. Y. Hong, Y. W. Kwon, K. S. Seo (School of Electrical Engineering and Computer Science, Seoul National University, Seoul, Korea): *JKICS*, vol. 26, no. 2B, pp. 153–157, Feb. 2001.

Low phase noise CPW oscillator using balancing was designed and fabricated by SNU PHEMT process. It can be possible to operate OSC (oscillator) in very wide bias range and to reduce phase noise of FRO (free_running oscillator) by using balancing. This oscillator operated stably for wide bias voltage range. The measured results showed the phase noise characteristics of -105, -73 dBc/Hz @1 MHz, 100 kHz offset frequency respectively with center frequency 26.3 GHz and 3.5 dBm maximum output power. This shows that it can be possible to reduce phase noise without external resonator.

(39) Low Phase Noise CPW PHEMT MMIC Ka-Band Oscillator Using Active Parallel Feedback, by N. T. Kim, D. H. Kim, H. W. Cho, Y. W. Kwon, K. S. Seo (School of Electrical Engineering and Computer Science, Seoul National University, Seoul, Korea): *JKICS*, vol. 26, no. 2B, pp. 158–162, Feb. 2001.

Low phase noise CPW oscillator using active parallel feedback was designed and fabricated by SNU PHEMT process. The phase locking characteristic and broadband negative resistance of active parallel feedback oscillator can reduce phase noise without high Q resonator. The measured results showed the phase noise characteristics of -112, -82 dBc/Hz @1 MHz, 100 kHz offset frequency respectively with center frequency 27.3 GHz and 5.2 dBm maximum output power for the active parallel feedback oscillator. This results shows another possibility to reduce phase noise without external high Q-factor resonator.

(40) Design and Fabrication of VCDRO by Changing Characteristic Impedance of Coupled Microstrip Line, by Y. D. Hwang*, H. C. Choi** (*CDMA2000 System Development Team, Samsung Electronics Co., Ltd., Korea; **Microwave Laboratory, Department of Electronic and Electric Engineering, Kyungbook National University, Daegu, Korea): *JKICS*, vol. 26, no. 2B, pp. 238–246, Feb. 2001.

A Voltage Controlled Dielectric Resonator Oscillator (VCDRO) having larger frequency deviation with small degradation in the phase noise performance by investigating the influence of changing the microstrip line impedance of the varactor-microstrip resonant circuit, was designed and fabricated. We obtained larger frequency tuning range by means of lowering the microstrip line impedance of the resonant circuit. When the microstrip line impedance is 37.5 Ω the VCDRO shows output power of 8.33 dBm without significant deviation over the full tuning range of 8.63 MHz, a stable low phase noise of -116.9 dBc/Hz at 100 kHz away from the carrier frequency of 5.15 GHz, harmonic characteristic of 37.5 dBc and is applicable to Television Receive Only (TVRO) system as the local oscillator.

(41) Local Oscillator Leakage Rejection for Satellite Communication Intermediate Frequency Module, by C. Seo*, Y. Kim**, N. Kim**, M. Kang* (*Department of Information Communication, Soungsil University, Seoul, Korea; **Department of Wireless Broadcasting Research Center Geo-System High Speed Satellite Communication Technology, ETRI, Daejun, Korea): *JKICS*, vol. 26, no. 4B, pp. 400–405, Apr. 2001.

In this paper, a novel structure is proposed for rejecting the LO leakage RF near channel using the mixer characteristics. LO leakage appeared far from the RF channel compared with nomal case in this structure, which means it is easy to eliminate the LO leakage by the bandpass filter. The lowpass filter, the bandpass filter and the amplifier have been designed for up converting and the image of the mixer has been eliminated by the phases of the mixer.

(42) Improvement of Broadband Feedforward Amplifier Using Photonic Band-Gap, by J. Yoon, C. Seo (Department of Information Communication, Soungsil University Seoul, Korea): *JKICS*, vol. 26, no. 4B, pp. 406–409, Apr. 2001.

In this paper, the photonic bandgap, the predistortion and the secondary harmonic balance are simultaneously employed in feedforward amplifier to maximize the power added efficiency (PAE) and the operating bandwidth for in IMT-2000 band. In this case, the secondary harmonic balance and the predistortion linearizer can cancel the second and the third harmonics, respectively. The PBG prevented any more harmonics to appear over 6 GHz. The feedforward amplifier was improved 4%, and 15 dBc in the PAE and the IMD (Intermodulation Distortion), respectively. The operation bandwidth was achieved twice wider than the conventional feedforward amplifier.

(43) The I–V Modeling in the Strong Inversion of MOSFET Using the Multiple Box Segmentation Method, by Y.-J. Noh*, C.-S. Kim** (*Department of Information Communication, Jaeneng University, Korea; **Department of Electronics, Inha University Inchon, Korea): *JKICS*, vol. 26, no. 5B, pp. 677–684, May 2001.

In this paper, we present the drain current equation of the enhancement MOSFET under the strong inversion condition using not the approximation step but the multiple box segmentation method. That is, the proposed drain current model is implemented from the inversion layer depth extracted using the multi-box segmentation method and the mobile electric charge concentration and the mobility which is based on a vertical field dependent LSM mobility model in its depth. This I–V modeling was simulated under various gate voltage conditions. The results show that the proposed drain current values have similar I–V characteristics with the drain currents values which are simulated by the Charge-sheet model.

(44) A Study on the New Oscillator Using Low Noise Amplifier, by S.-J. Ha, C. Y. Ji, Y.-D. Lee, U.-S. Hong (Department of Radio Sciences and Engineering, Kwangwoon University, Seoul, Korea): *JKICS*, vol. 26, no. 7B, pp. 880–883, July 2001.

In this thesis, the oscillator with new structure obtained through analysis the phase noise model of Lesson is proposed for improving phase noise characteristic. The proposed parallel feedback dielectric resonator oscillator is composed of a balanced low noise amplifier, a power divider, and a dielectric resonator coupled with microstripline. Measurement show the oscillator is output power of 18 dBm at 12.653 GHz and fundamental frequency suppression of -38 dBc, and the phase noise of -82.67 dBc/Hz at 10 kHz offset frequency from carrier.

(45) 0.2 W Ka-Band MMIC CPW Power Amplifier Design and Fabrication, by S. Jung*, S. Lee*, D.-h. Kim**, S.-C. Hong**, Y. Kwon*, and K.-S. Seo** (*Millimeter-Wave Integrated System Laboratory, Department of Electrical and Computer Engineering, Seoul, Korea; **Millimeter-Wave Devices and Circuits Laboratory, Department of Electrical and Computer Engineering, Seoul, Korea): *JKICS*, vol. 26, no. 8B, pp. 1035–1040, Aug. 2001.

0.2 W Ka-band MMIC CPW power amplifier was designed and fabricated using SNU-ISRC 0.25 μm PHEMT standard process. Because microstrip transmission line in conventional MMIC process was replaced with CPW transmission line, it was possible to fabricate with simple and low cost process. For power amplifier design with broad band performance of output power, Wilkinson coupler comprising 25 Ω characteristic impedance transmission line instead of 50 Ω characteristic impedance line was utilized. Designed Wilkinson coupler satisfied the conditions for optimum output power matching and good output return loss simultaneously. The fabricated power amplifier showed the measured results of output power 23.4 dBm and Power-added Efficiency 21.7% at 27 GHz.

(46) High Efficiency CMOS Power Amplifier for Wireless Applications, by C. Yoo (Samsung Electronics Semiconductor Co., Ltd.): *JKICS*, vol. 26, no. 10B, pp. 1475–1481, Oct. 2001.

A power amplifier for wireless applications has been implemented in a standard 0.25 m CMOS technology. The power amplifier employs class-E topology to exploit its soft-switching property for high efficiency. The finite DC-feed inductance in the class-E load network allows the load resistance to be larger for the same output power and supply voltage than that for an RF-choke. The common-gate switching scheme increases the maximum allowable supply voltage by almost twice from the value for a simple switching scheme. By employing these design techniques, the power amplifier can deliver 0.9 W output power to 50 load at 900 MHz with 41% power-added efficiency (PAE) from a 1.8 V supply without stressing the active devices.

(47) Design and Implementation of ASK Modulator MMIC Operating at 5.8 GHz, by M. S. Jang*, Y. C. Ha*, H. Hyuk*, T. J. Moon**, S. B. Hwang**, C. K. Song*, C. H. Hong* (*Department of Electronic Engineering, Nanoelectronics Laboratory, Donga University; **Electronic Information Communication Control Subdivision, Kyungnam College of Information and Technology): *JKICS*, vol. 26, no. 11B, pp. 1595–1599, Nov. 2001.

In this paper, we have designed and implemented of ASK modulator MMIC operating at 5.8 GHz for OBE used in AGPS (Automatic Gate Passing System). The proposed ASK modulator MMIC was implemented to apply a single supply voltage of 3 V to the drain in order to decrease ACP (Adjacent Channel Power). As a result, it exhibits a broad linear modulation range from 0.7 V to 3 V and an On/Off characteristic over 40 dB. The layouts of ASK modulator MMIC's was designed and fabricated by using ETRI 0.5 μm MESFET library. The chip size was 1.0 mm $\times$ 1.0 mm.

(48) A Monolithic 5 GHz Image Reject Mixer for Wireless LAN Applications, by H.-Y. Kim, J.-H. Cho, J.-H. Park (Department of Electronic Engineering, Opto-Electronics Laboratory, Korea University): *JKICS*, vol. 26, no. 12B, pp. 1733–1740, Dec. 2001.

A monolithic 5 GHz image reject mixer using a 0.5-m GaAs MESFET technology is designed and simulated. The Mixer exhibits a 13.56 dB down-conversion gain, a SSB (Single Side-Band) noise figure of 11.91 dB, an input IP3 (third order intercept point) of -3.73 dBm and a P1dB (1-dB compression point) of -11.0 dBm. The critical issue in the image reject mixer is the phase accuracy and magnitude balance of the 90 phase shifting network. The proposed image reject mixer realizes a 90

phase shifter on chip. This phase shifting network does not need any phase adjusting to achieve the phase error specification of 3 over a frequency range from 800 MHz to 1 GHz. The simulated overall image rejection ratio is better than 50 dB.

(49) Design and Fabrication of Amplifier Using Photonic Bandgap and Coplanar Waveguide, by J. Yoon, C. Seo (Department of Information and Telecommunication Engineering, Soongsil): *JKICS*, vol. 26, no. 12B, pp. 1754–1757, Dec. 2001.

In this paper, a R-band hybrid amplifier with the coplanar waveguide (CPW) and the photonic bandgap (PBG) structure is designed and fabricated. The PBG and the CPW techniques are simultaneously employed in amplifier to improve the power added efficiency (PAE) and the IMD (Intermodulation Distortion) in R-band. In this paper, the PBG structures are optimized to obtain matching network. The output impedance of amplifier and the input impedance of PBG are matched to minimize the return loss. The PAE and the IMD were improved 15% and 4.5 dB compared with the conventional amplifier, respectively.

(50) Theoretical Analysis of Resonant Tunneling in Double-Barrier Structures Under Electric Fields, by M. Arakawa*, H. Yamamoto** (*Department of Electrical Engineering, Fukui National College of Technology, 16-1 Geshi-cho, Sabae-shi, 916-8507 Japan; **Faculty of Engineering, Fukui University, 3-9-1 Bunkyo, Fukui-shi, 910-8507 Japan): *IEICE Trans. Electron.*, vol. J84-C, no. 1, pp. 25–33, Jan. 2001.

Analytical expressions of tunneling transmission coefficient have been derived when the electric field is applied on the double-barrier structures. The two typical structures have been considered: One has no potential drop in the well layer and the other has some potential drops. Next, resonance condition has been examined for the double-barrier structure under the electric field by using the analytical expression. In addition, the usefulness of the rectangular approximation is discussed by comparing the result of this method with calculated one by the analytical expression.

(51) 1.0 V Operation Power Heterojunction FET for Digital Cellular Phones, by T. Kato, Y. Bito, N. Iwata (Kansai Electronics Research Laboratories, NEC Corporation, Otsu-shi, 520-0833 Japan): *IEICE Trans. Electron.*, vol. E84-C, no. 2, pp. 249–252, Feb. 2001.

This paper describes 1.0 V operation power performance of a double doped AlGaAs/InGaAs/AlGaAs heterojunction FET for personal digital cellular phones. The developed FET with a multilayer cap consisting of a highly Si-doped GaAs, an undoped GaAs and a highly Si-doped AlGaAs exhibited an on-resistance of 1.3 Ω•mm and a maximum drain current of 620 mA/mm. A 28 mm gate-width device, operating with a drain bias voltage of 1.0 V, demonstrated an output power of 1.0 W, a power-added efficiency of 59% and an associated gain of 13.7 dB at an adjacent channel leakage power at 50 kHz off-center frequency of -48 dBc with a 950 MHz $\pi/4$-shifted quadrature phase shift keying signal.

(52) MMIC High-Precision S-Band Five-Bit Attenuator With 1.5° Phase Variation, by H. Takasu*, F. Xiao** T. Yakabe**, H. Yabe** (*Microwave Solid-State Engineering Department, Komukai Operations, Toshiba Corporation, 1 Komukai Toshiba-cho, Saiwai-ku, Kawasaki-shi, 212-8581 Japan; **University of Electro-Communications, 1-5-1 Chofugaoka, Chofu-shi, 182-8585 Japan): *IEICE Trans. Electron.*, vol. J84-C, no. 2, pp. 97–103, Feb. 2001.

This paper describes the design and performance of a high-precision S-band five-bit MMIC digital attenuator. To realize small phase variation, we adopted the attenuation circuit based on FET and that using two SPDT switches, resistor circuit and transmission line. The developed MMIC attenuator exhibits the minimum insertion loss of 7 dB, attenuation error of 0.09 dB (rms), phase variation of 1.38 degrees (rms), and the input and output VSWR's of 1.3, which agree well the simulation data and make it very attractive for applications to modern microwave and millimeter-wave communication system.

(53) A K-Band MMIC Subharmonically Pumped Mixer Integrating Local Oscillator Amplifier With Low Spurious Output, by Y. Shizuki, K. Onodera, K. Arai, M. Ishida, S. Watanabe (Semiconductor Devices Microwave Solid-State Engineering Department, Komukai Operations, Information and Industrial Systems and Services Company, Toshiba Corporation, Kawasaki-shi, 210-8581 Japan): *IEICE Trans. Electron.*, vol. E84-C, no. 4, pp. 433–442, Apr. 2001.

A K-band MMIC subharmonically pumped mixer integrating local oscillator (LO) amplifier has been developed. For up-converter application, it is necessary to reduce the leakage of second harmonic component of LO frequency to RF port, which is generated by nonlinear operation of LO amplifier. A quasilumped short-circuited stub using microstrip structure has been successfully applied to the MMIC mixer to enhance $2f_{LO}$-suppression. We propose a new configuration of a quasilumped short-circuited stub, which reduces the influence of parasitic elements of via-holes. The developed MMIC has a one-stage LO amplifier and it has shown about 10 dB-improvement of $2f_{LO}$-suppression compared to conventional configuration using a quarter-wavelength short-circuited stub.

(54) Ku-Band Frequency-Tunable Low-Noise Amplifier Using Variable-Capacitance Elements and Negative Feedback Circuits, by K. Yamanaka*, K. Sugaya**, T. Yamaguchi***, N. Takahashi****, Y. Itoh* (*Information Technology R&D Center, Mitsubishi Electric Corporation, Kamakura-shi, 247-8501 Japan; **Kamakura Works, Mitsubishi Electric Corporation, Kamakura-shi, 247-8501 Japan; ***Communication Systems Center, Mitsubishi Electric Corporation, Amagasaki-shi, 661-8661 Japan; ****Kitaitami Administration Center, Mitsubishi Electric Corporation, Itami-shi, 664-8641 Japan): *IEICE Trans. Electron.*, vol. J84-C, no. 5, pp. 385–393, May 2001.

A frequency-tunable low-noise amplifier using variable-capacitance elements and negative feedback circuits is proposed. It employs two-stage series feedback amplifiers combined with the interstage network using shunt and series variable-capacitance elements. With the use of the variable-capacitance elements in the design of interstage networks, the noise figure and output power are not degraded. In addition, changing the value of bias resistors can easily shift operating frequency. In this paper, the relation between the variable range of impedance and the feedback amount is discussed first. Then it is shown that the frequency-tunable range can be made wider by increasing the feedback amount. Next, in application to the design of the

Ku-band low-noise amplifiers, it is shown in calculation and verified by experiment that the frequencies providing the maximum gain and the minimum return loss can be tuned by varying the value of the variable-capacitance element.

(55) Determination Method of the Source Inductor Values for Multi-Stage Low-Noise Amplifiers and Its Application to the Design of Ka-Band Low-Noise MMIC Amplifiers, by K. Nakahara*, K. Yamanaka*, H. Uchida*, K. Iyomasa*, S. Takatsu**, H. Hoshi***, Y. Itoh* (*Mitsubishi Electric Corporation, Information and Technology R&D Center, 5-1-1 Ofuna, Kamakura-shi, 247-8501 Japan; **Mitsubishi Electric Corporation, Kamakura Works, Kamakura-shi, 247-8510 Japan; ***Mitsubishi Electric Corporation, Kitaitami Administration Center, Itami-shi, 664-8641 Japan): *IEICE Trans. Electron.*, vol. J84-C, no. 6, pp. 471–479, June 2001.

It is well known that a simultaneous noise and reflection matching can be achieved with the use of source inductors for FET's. In this paper, based on this technique, a determination method of source inductor values for each stage of multi-stage low-noise amplifiers is proposed in order to meet various requirements for noise figure and gain, keeping reflections in each stage the minimum. The method employs a noise measure as an objective function when input and output matching conditions are determined. In this paper, the algorithm for determining the source inductor values is described first. Then it is shown in calculation that the value of the source inductor of the 1st stage has a great effect on noise figure and gain as a multi-stage amplifier. In addition, the optimum value has to be determined for each stage in accordance with the spec of the amplifier. Finally, the design, fabrication, and performance of the Ka-band 3-stage low-noise MMIC amplifier are presented, showing that this method is useful for the design of multi-stage low-noise amplifiers loaded with a source inductor.

(56) An Ultra Low-Noise Amplifier Loaded With a Series Drain Resistor and Lower Resonant Matching Stubs, by H. Yukawa*, K. Nakahara*, H. Kajikawa**, Y. Itoh*, O. Ishida* (*Information Technology R&D Center, Mitsubishi Electric Corporation, Kamakura-shi, 247-8501 Japan; **Communication Equipment Works, Mitsubishi Electric Corporation, Amaga-saki-shi, 661-8661 Japan; ***Mitsubishi Electric Corporation, Kitaitami Administration Center, Itami-shi, 664-8661 Japan): *IEICE Trans. Electron.*, vol. J84-C, no. 6, pp. 480–486, June 2001.

An ultra low-noise amplifier loaded with a series drain resistor and lower resonant matching stubs is proposed in this paper. It employs a series drain resistor for high stability, high gain, and small size in addition to lower resonant matching stubs comprised of a short-circuited stub and a capacitor for simultaneous reflection and noise matching. With the use of the lower resonant matching stubs, the frequencies providing the minimum reflection and the minimum noise figure become lower, and the bandwidth providing low noise performance becomes wider. By applying these matching circuits to the design of S-band low-noise amplifiers, it has been shown that this design method is useful especially for lower frequencies where source inductors of FET's significantly degrade stability, gain, and size of the amplifier.

(57) A 100-GHz-Band Quadruple Power Combined Monolithic HBT Oscillator, by K. Uchida, H. Matsuura, T. Yakihara, S. Kobayashi, S. Oka, T. Fujita, A. Miura (Research and Development Department 1, Teratec Corporation, 2-9-32 Naka-cho, Musashino-shi, 180-8750 Japan): *IEICE Trans. Electron.*, vol. J84-C, no. 7, pp. 591–598, July 2001.

In this paper, the development of 100-GHz-band quadruple power combined monolithic heterojunction bipolar transistor (HBT) oscillator is reported. The oscillator design parameters are adjusted to a condition in which the quadruple oscillating power is combined with the same phase. We use 1.0 μm $\times$ 5.0 μm single-emitter InGaP/InGaAs HBTs as active devices. The f_r and $f_{\max}$ values of the HBTs are 190 GHz and 240 GHz, respectively. The oscillation frequency is 97.4 GHz and the output power is $+3.0$ dBm. The oscillation is biased to $I_c = 10$ mA and $V_{ce} = 2.0$ V for each HBT.

(58) A 2.4 GHz Low Voltage CMOS Down-Conversion Double-Balanced Mixer, by C.-C. Tang*, C.-H. Wu*, W.-S. Feng**, S.-I. Liu* (*Laboratory 328, Department of Electrical Engineering and Graduate Institute of Electronics Engineering, National Taiwan University, Taipei, Taiwan 10167, R.O.C.; **Department of Electrical Engineering, Chang Gung University, Tao-Yuan, Taiwan, R.O.C.): *IEICE Trans. Electron.*, vol. E84-C, no. 8, pp. 1084–1091, Aug. 2001.

In this paper, a CMOS down-conversion double-balanced mixer is presented with the modified low voltage design technique. The frequencies of the radio frequency (RF) signal, local oscillator (LO) and intermediate frequency (IF) are 2.4 GHz, 2.3 GHz and 100 MHz, respectively. Measurement results of the proposed mixer exhibit 6.7 dB of conversion gain, -18 dBm of input 1 dB compression point ($P_{-1\,\mathrm{dB}}$), -8 dBm of input-referred third-order intercept point (IIP_3), and 14.7 dB single-side band (SSB) noise figure (NF) while applying -8 dBm LO power and consumes 3.3 mA from 1.8 V supply voltage. It can provide 0.7 dB conversion gain when the supply voltage reduces to 1.3 V. This mixer was fabricated in a 0.35 μm 1P4M standard digital CMOS process and the die size is 1.5×1.1 mm^2.

(59) Effects of Source and Load Impedance on the Intermodulation Distortion Products of GaAs FETs, by K.-H. Ahn*, S.-H. Lee**, Y.-H. Jeong* (*Department of Electronic and Electrical Engineering, Pohang University of Science and Technology, San-31, Hyoja-dong, Nam-gu, Pohang, Kyung-buk, 790-784, Republic of Korea; **LTI Laboratory, 182-6, Sadang-5dong, Dongjak-Ku, Seoul, 156-095, Republic of Korea): *IEICE Trans. Electron.*, vol. E84-C, no. 8, pp. 1104–1110, Aug. 2001.

The linearity of the GaAs Field Effect Transistor (FET) power amplifier is greatly influenced by the nonlinear characteristics of gate–source capacitance (C_{gs}) and drain–source current (I_{ds}) for the FETs. However, previously suggested analysis methods of GaAs FET nonlinearity are mainly focused on the investigations by each individual nonlinear component (C_{gs} or I_{ds}) without considering both nonlinear effects. We analyze more accurately the nonlinearity of GaAs FETs by considering nonlinear effects of C_{gs} and I_{ds} simultaneously. We also investigate the third-order intermodulation distortion (IMD_3) of the GaAs FET in relation to source and load impedances that minimize FET nonlinearities. From the simulation results by Volterra-series technique, we show that the least IMD_3 is found at the

minimum source resistance (R_S) and maximum load resistance (R_L) in the equivalent output power (P_{out}) contour. Simulated results are compared with the load and source pull data, with good agreement.

(60) Conditions of Half-Frequency Oscillation in High-Power Amplifier With FET and Its Suppression Method Using Quarter-Wavelength Open-Circuited Stub, by H. Uchida, Y. Itoh, M. Miyazaki, S. Urasaki (Mitsubishi Electric Corporation, Information and Technology R&D Center, 5-1-1 Ofuna, Kamakura-shi, 247-8501 Japan): *IEICE Trans. Electron.*, vol. J84-C, no. 8, pp. 681–689, Aug. 2001.

Conditions for parasitic half-frequency oscillation in FET amplifiers excited by large signal frequency $2f_0$ are derived. In the derivation, Fourier series expansion based on the half-wave frequency f_0 is employed to analyze the voltages and currents in the FET. As a result, the derived condition is $\det[\mathbf{W}] = 0$, where $\mathbf{W}$ is a matrix containing time-average components of gate-to-source capacitance C_{gs}, mutual conductance g_m, drain conductance g_{ds}, and the load impedances of FET at frequency of f_0. In addition, a method to suppress the half-wave frequency oscillation by using a quarter-wavelength open-circuited stub at the half-wave frequency f_0 is proposed, and its validity has been confirmed experimentally.

(61) A High Performance Downconverter MMIC for DBS Applications, by Y. Yun*, T. Fukuda*, T. Kunihisa*, O. Ishikawa** (*Semiconductor Device Research Center, Matsushita Electric Industrial Co., Ltd., Takatsuki-shi, 569-1193 Japan; **Analog LSI Division, Matsushita Electric Industrial Co., Ltd., Nagaokakyo-shi, 617-8520 Japan): *IEICE Trans. Electron.*, vol. E84-C, no. 11, pp. 1679–1688, Nov. 2001.

In this work, using 0.2 μm GaAs modulation doped FET (MODFET), a high performance downconverter MMIC was developed for direct broadcasting satellite (DBS) applications. The downconverter MMIC showed a noise figure of 4.3 dB which is lower by 5 dB than conventional ones, and required only a low LO power of -10 dBm for normal DBS operation. At a low LO power of -10 dBm, the power consumption was 175 mW, which is lower than 50 percent of conventional ones. The frequency response of conversion gain exhibited a low gain ripple of 0.9 dB, and the LO leakage power was suppressed to a lower value than -30 dBm under a LO input power of -10 dBm. The fabricated chip exhibited a small size of 0.84×0.9 mm^2. The objectives of this work are to improve the traditional direct broadcasting satellite (DBS) downconverters by an efficient circuit design and to describe the techniques employed in the design.

II. Transmission Lines and Passive Microwave Devices

(1) On-Wafer Measurement Techniques Using Coplanar Microwave Probe, by W. Sun, X.-J. Tian, W.-Y. He, D.-M. Zhang, D.-H. Li and M.-B. Yi (Jilin University, Changchun, P.R.C.): *AES*, vol. 29, pp. 222–224, Feb. 2001.

An on-wafer technique is presented for semiconductor wafer using special coplanar microwave probes. The probe parameters are repeatable enough for S-parameter measurements and the probe life is with 100 000 contacts guaranteed. The multi-contact microwave wafer probe has been developed for on-wafer testing and sifting of GaAs integrated circuits with coplanar type. The insertion loss of microwave probe with a GSG footprint pattern is typically less than 3.0 dB, and the return loss is at least 10 dB at frequencies below 14 GHz.

(2) Simulation of Electrical Performance for High-Speed Dual-Coplanar PCB, by X.-J. Cai, Y. Cao, J.-F. Mao and Z.-F. Li (Shanghai University, Shanghai, P.R.C.): *AES*, vol. 29, pp. 287–288, Feb. 2001.

In order to accommodate to the irregular fabrication configuration, the 3D electromagnetic parameters extraction method of partial element equivalent circuit (PEEC) technology is used to model the cells of automatically partitioned ground/feeding plane with arbitrary shape. Then the response analysis in the time domain for the nonlinear circuit including I/O buffers is performed. The simulation result for a high-speed dual-coplanar PCB well fits the measured one, which indicates the validity of the proposed method.

(3) The Analysis and Synthesis of Non-Uniform Mesh Network in FDTD Computation, by Y. Zhang and B.-Q. Gao (Beijing Institute of Technology, Beijing, P.R.C.): *AES*, vol. 29, pp. 965–969, July 2001.

According to the theory of microwave network and the concept of mesh wave impedance, the wave reflection of nonuniform mesh for FDTD technique is analyzed, and the concept of analysis and synthesis of mesh network is presented. The reflecting characteristic of mesh network is analyzed first. Then the procedure of synthesizing a mesh network is deduced. On the basis of the above theory, network characteristics of nonuniform mesh, which can be used to match nonuniform mesh or improve the transmitted characteristic for a mesh wave to travel along the nonuniform mesh etc., are realized in 1-D (TEM wave), 3-D microstrip structures and waveguide.

(4) Modeling Evaporation Duct Over Sea With Pseudo-Refractivity and Similarity Theory, by C.-G. Liu*,**, J.-Y. Huang*, C.-Y. Jiang** and F.-J. Lin** (*Xidian University, Xi'an, P.R.C.; **China Research Institute of Radio-Wave Propagation, Xinxiang, P.R.C.): *AES*, vol. 29, pp. 970–972, July 2001.

The theoretic method used for calculating evaporation duct height is described based on similarity theory with pseudo-refractivity $N_p(h)$ as similarity variable. With the approximation of refractivity gradient independent of air pressure in the vicinity of sea surface, a parameter, the pseudo-refractivity $N_p(h)$ is defined. The M profile of evaporation duct, which is not available in the reference, is given explicitly. The modeling results of evaporation duct height and the calculated results of evaporation duct parameters from the measured weather data are in agreement.

(5) The Simulative Analysis of Electromagnetic Field and Energy Distribution Existing in 3 mm Quasioptical Resonator, by G.-F. Guo, E. Li, Q.-S. Zhang, Z.-X. Tang and K. Yang (University of Electronic Science and Technology of China, Chengdu, P.R.C.): *AES*, vol. 29, pp. 996–999, July 2001.

The electromagnetic field and energy distribution of Gaussion beam existing in 3 mm quasioptical resonator are simulated by using "Matlab" software package. Its results can be used as references to design resonator and in its measurement. The paper also reveals that whatever mode the resonator applies its tangential electrical field is always zero at $z = 0$.

(6) Method of Calculating Modal Absorbing Boundary Condition for Waveguide Problems, by S.-M. Li*, D.-K. Zhang* and W.-G. Lin** (*Guilin Institute of Electronic Technology, Guilin, P.R.C.; **University of Electronic Science and Technology of China, Chengdu, P.R.C.): *AES*, vol. 29, pp. 1250–1258, Sept. 2001.

Based on impulse response of modes in a uniform waveguide, a modal absorbing boundary condition, employed in the FDTD method, is specially calculated and investigated. The high order interpolated method is used to significantly improve the accuracy of modal absorbing boundary condition, and computing speed is accelerated by applying point matched method to identify the amplitude of modes. The numerical simulation shows that the number of nodes of FDTD can be dramatically reduced by applying the modal absorbing boundary condition that leads to the improvement of the efficiency of FDTD method.

(7) Knowledge-Based Artificial Neural Network Models for Microstrip Radial Stub, by C. Li, L.-J. Xue and J. Xu (University of Electronics Science and Technology, Chengdu, P.R.C.): *AES*, vol. 29, pp. 1696–1698, Dec. 2001.

A knowledge-based artificial neural network is used to model the microstrip radial stub. Utilizing prior knowledge for reducing complexity of input–output relationships that the ANN must learn, it allows an accurate ANN model to be developed with less training data which is very advantageous when training data is expensive/time-consuming to obtain, such as with EM simulation.

(8) Micro-Mechanical Resonant Devices in the Communication Field, by B. Zhang and Q.-A. Huang (Southeast University, Nanjing, P.R.C.): *JCIC*, vol. 22, pp. 102–108, May 2001.

The progress of the wireless communication requires the passive device in the system to be miniaturized to integrate whole system on a single chip. The MEMS passive device fabricated by micromachining technology can not only meet with this requirement, but its quality factor can also reach 50 000 between 300 kHz and 14.5 MHz. In view of this, MEMS resonators and filters using both resonators and coupling springs fabricated by surface-micromachining technology, bulk-micromachining technology and bonding technology are mainly introduced. Their operation principle, design and fabrication process are presented.

(9) Propagation at 2 GHz in a Enclosed Area Using a Coaxial Cable With Leaky Sections as the Transmitting Antenna, by W.-M. Zhang, Y.-P. Zhang, G.-X. Zheng and J.-H. Sheng (Taiyuan University of Science and Technology, Taiyuan, P.R.C.): *JCIC*, vol. 22, pp. 67–73, July 2001.

This paper presents the results of narrowband and wideband propagation measurements carried out at 2 GHz in a larger enclosed area using a coaxial cable with leaky sections as the transmitting antenna. The narrowband measurements were devised to measure attenuation of radio signals and the wideband techniques to measure multipath impulse responses and their associate root mean square delay spread. Analysis of the narrowband data files shows that the received signal levels in the direction parallel to the cable generally decay and display peaks in front of leaky sections due to the specific attenuation and specific structure of cable. The received signal levels in the direction radial to the cable decrease slowly. The slow variations do not follow the lognormal distribution, while the fast variations fir the Rayleigh distribution in both parallel and radial direction.

(10) A Novel Finline SPDT Switch, by R.-M. Xu, J. Xie, B. Yan and L.-J. Xue (UESTC, Chengdu, P.R.C.): *JIMW*, vol. 20, pp. 301–303, Aug. 2001.

The design method, manufacture and testing results are given for new kind of T junction finline single pole double throw (SPDT) switch, which has only a controlling port with positive or negative pulses. In order to increase the isolation and reduce the insert loss of the switch, some improving measures were taken in the circuit. The test results show that the insert loss $<=$ 1.5 dB and the isolation $>=$ 30 dB in Ka bands and the insert loss $<=$ 2 dB and the isolation $>=$ 25 dB in W bands.

(11) Simple Method for Estimating Minimum Bend Radii of SOI Single Mode Curved Rib Waveguides, by H.-Z. Wei*, J.-Z. Yu*, X.-F. Zhang*, Z.-L. Liu*, Q.-M. Wang*, W. Shi** and C.-S. Fang** (*Chinese Academic of Science, Beijing, P.R.C.; **Shandong University, Jinan, P.R.C.): *JIMW*, vol. 20, pp. 398–400, Oct. 2001.

A simple method based on the effective index method was used to estimate the minimum bend radii of curved SOI waveguides. An analytical formula was obtained to estimate the minimum radius of curvature at which the mode becomes cut off due to the side radiative loss.

(12) Object-Fitted FDTD Method Based on MEI-ABC, by C. Liao (Southwest Jiaotong University, Chengdu, P.R.C.): *JIMW*, vol. 20, pp. 442–446, Dec. 2001.

The FDTD computational zone was truncated by an artificial boundary, of which the geometric shape was conformal with the boundary of an arbitrary-shaped scatterer. The external conformal mesh was generated by the Thompson transformation. On the truncating boundary, the time domain measured equations of invariance (MEI) were applied as a local absorbing boundary condition. Therefore, the FDTD computational domain was compressed remarkably. The numerical experiment proved that the requirement of computer storage is reduced while the numerical accuracy is not decreased.

(13) Application of 3-D PML Absorbing Boundary Conditions to the Analysis of Microstrip Discontinuities, by P. Zhou and S.-J. Xu (University of Science and Technology of China, Hefei, P.R.C.): *JIMW*, vol. 20, pp. 451–454, Dec. 2001.

The perfectly matched layer (PML) absorbing boundary conditions were extended from 2-D TE/TM modes problem to the case of 3-D hybrid modes transmission problem. Scattering characteristics of 3-D discontinuity structures in microstrip lines were successfully investigated. Numerical results show that the presented 3-D PML absorbing boundary condition maintains the advantage of wide band and high accuracy of ordinary 2-D PML. This technique can be further used in the FDTD analysis for complicated structures.

(14) Transmission Characteristics of Taper TEM Cell, by F.-R. Cui, S.-L. Lai, F. Ji and B.-J. Hu (South China University of Technology, Guangzhou, P.R.C.): *JAS*, vol. 19, pp. 10–13, Mar. 2001.

This paper analyzes a new type of taper TEM cell using FDTD method in the spherical coordinate. The field distribution, field uniformity and the upper work frequency have been

analyzed. The results prove very important to the design and application of taper TEM cell.

(15) A New Kind of Absorbing Boundary Condition and Its Application for 3-D TLM Method, by Z.-H. Shao, C.-D. Zhu, W. Hong and L.-Q. He (Southeast University, Nanjing, P.R.C.): *JAS*, vol. 19, pp. 24–28, Mar. 2001.

A new kind of absorbing boundary conditions based on the theory of generalized Z-domain absorbing boundary conditions (Z-ABCs) for the 3D TLM SCN method is presented. The results indicate that the Z-ABCs show better performance than Higdon's ABC in suppressing instability caused by spurious modes. The different order coefficients of this new Z-ABCs can be given by a recurrence formula.

(16) Multipole Theory Analysis of the Higher Order Modal Characteristics of Circular-Rectangular Coaxial Waveguide, by Q.-H. Zheng, H. Zeng and F.-Y. Xie (Yunnan Normal University, Kunming, P.R.C.): *JAS*, vol. 19, pp. 100–102, June 2001.

The multipole theory (MT) method is presented for calculating the higher order modal characteristics of circular–rectangular coaxial waveguides. The results obtained by the MT method are compared with the exact data reported in the literature. It is shown that the MT method is an accurate and reliable approach for analyzing the higher order modal characteristics of circular–rectangular coaxial waveguide.

(17) High-Order 3-D Edge-Element Analysis of the 3-D Discontinuity Problems in Guided Wave Structures, by S.-J. Xu and D.-Y. Jia (University of Science and Technology of China, Hefei, P.R.C.): *JEIT*, vol. 23, pp. 160–167, Feb. 2001.

A 54 parameter high-order 3-D edge-element approach based on full magnetic vector variational formulas is discussed. This approach eliminates the spurious solutions efficiently and possesses very high accuracy. The analyzes of the scattering characteristics of some 3-D discontinuity problems in guided wave structures verify the effective and reliability of the present method. The comparison between the numerical results obtained with 54 and 12 parameter edge element methods shows that the present approach is more accurate and efficient.

(18) Study in Electromagnetic Compatibility on Printed Circuit Board of Switching Power Supply, by X. Wu*, Z.-M. Qian* and M.-X. Pang** (*Zhejiang University, Hangzhou, P.R.C.; **HongKong University, HongKong, P.R.C.): *JEIT*, vol. 23, pp. 181–186, Feb. 2001.

Crosstalk between conductor traces on printed circuit board is a primary source of EMI in switching power supply. Field analysis is carried out to study the electric field on PCB. Simulation and measured emission map offer valuable visual aids to PCB designer; coupling index is introduced to indicate coupling level between two traces. Based on the these emission maps and coupling index PCB designer can arrange critical trace in suitable location, so crosstalk problem between traces can be suppressed during PCB design stage.

(19) Design of Broad-Band L Band 360° Analog Signal Phase Shifter, by K. Liu, X.-J. Tian, Y. Liu and M.-B. Yi (Jilin University, Changchun, P.R.C.): *JEIT*, vol. 23, pp. 292–299, Mar. 2001.

A 360° broadband analog phase shifter is designed by means of CAD. Linear phase-shift, balancing insertion loss and expanding bandwidth of phase shifter are analyzed in detail. The objective function about phase shifter's bandwidth is also deduced. The analog phase shifter, which uses hyperabrupt varactor chips, is fabricated with MIC technology. In the frequency range of 1.3∼2.1 GHz, continuous variable phase-shifter up to 360° and linear deviation of less than ±2.5% can be obtained. Its insertion loss varies less than 3 dB.

(20) A Method Based on Neural Network to Estimate Scattering Parameter, by L. Zhou, J.-J. Mao and D.-M. Yao (National University of Defense Technology, Changsha, P.R.C.): *JEIT*, vol. 23, pp. 304–307, Mar. 2001.

In this paper, a new neural network's training method combining back error propagation with simulated annealing used to microwave circuit design is discussed. This method can solve the local minimum question of the BP neural network. The new training technique does not require any structure change in neural network model. An example is calculated and the results verified the proposed technique.

(21) Multimode Network Analysis for 3-Dimension Dielectric FSS Structures, by L. Yang and S.-J. Xu (University of Science and Technology of China, Hefei, P.R.C.): *JEIT*, vol. 23, pp. 603–610, June 2001.

In this paper the scattering characteristics of dielectric periodic structures by an oblique incidence are analyzed by a method, which combines the multimode network approach with rigorous mode matching method. The dependence of frequency selective characteristics of the 3-D frequency selective surface (FSS) structures on frequency and angle of the incident wave and the structure parameters in quantitatively studied, and some guidelines for design and application of the 3-D FSS structures are given.

(22) Discussion on Modern Electromagnetic Theory, by Y. Wang, C. Xu, X.-J. Zhang and W.-M. Song (Chinese Academy of Sciences, Beijing, P.R.C.): *JEIT*, vol. 23, pp. 802–808, Aug. 2001.

The difficulties that exist in classical electromagnetic field theory are discussed and it is pointed out that the Maxwell's equation set in classical theory is not self-consistent and only the approximate solutions can be gotten in classical electromagnetic theory. And how to establish the modern electromagnetic field theory based on modern mathematics and concepts of modern physics is given for solving this problem. By the modern electromagnetic theory, the mathematical form for macroscopic electromagnetic field theory is obtained and the exact solutions for electromagnetic field boundary value problem can be gotten.

(23) A New Type of Closed-Form Spatial Green's Function and Its Application to the Capacitance Extraction of the 3-D Interconnects, by B. Song, X.-D. Chen and W. Hong (Southeast University, Nanjing, P.R.C.): *JEIT*, vol. 23, pp. 1236–1239, Nov. 2001.

A general and efficient technique is presented for deriving the closed-form spatial Green's functions of 3-D Poisson equations in multiplayer media. Based on the spectral-domain equivalent transmission line model of the layered Green's function, an efficient Krylov subspace order-reduction technique is used to get the rational approximation of the Green's function in the spectral-domain, then, the spatial-domain Green's function is acquired directly via the residual theorem. The derived Green's

function combined with MoM can facilitate the capacitance extraction of the 3-D multiplayer media and multiconductor interconnects. Numerical results have demonstrated the accuracy and efficiency of the proposed method.

(24) A Hybrid Algorithm for Near-Field Diagnosis Based on Plane-Wave Spectra and Equivalent Magnetic Currents, by H.-F. Hu and D.-M. Fu (Xidian University, Xi'an, P.R.C.): *JEIT*, vol. 23, pp. 1417–1422, Dec. 2001.

A hybrid algorithm is presented for the planar near-field diagnostic measurement based on plane-wave spectra and equivalent magnetic currents. With the main computational formulae given, the algorithm is proved to be accurate and effective by the use of numerical simulation and experimental test.

(25) Numerical Calculation of Plane Ground Influence on Induced Current on Cable by EMP, by Y.-H. Cheng, H. Zhou, Q.-C. Xie and B.-Z. Li (Northwest Institute of Nuclear Technology, Xi'an, P.R.C.): *JEIT*, vol. 23, pp. 1423–1426, Dec. 2001.

The influence of conductivity and permittivity of plane ground on this current is calculated by FDTD method. The relationship between induced current and cable position above the earth is obtained, and the results are compared with the free-space case.

(26) Multipole Theory Analysis for Resonant Frequencies of a Cavity Resonator, by Q.-H. Zheng*, S.-P. Qian** and F.-Y. Xie* (*Yunnan Normal University, Kunming, P.R.C.; **Yunnan Radio and TV University, Kunming, P.R.C.): *JM*, vol. 17, pp. 73–77, Mar. 2001.

A new approach, the multipole theory (MT) method, is briefly described for the computation of resonant frequencies of a cavity resonator. The applied rules for MT method are introduced, and the formula is derived for the calculation of resonant frequencies of a cavity resonator. It is shown that MT method is an effective approach for the computation of resonant frequencies of a cavity resonator.

(27) A Rapid and Accurate Approach for the Solution of Partial Irregular Microstrip Patch, by Y.-X. Sun*,**, Y.-L. Chow* and D.-G. Fang** (*City University of Hongkong, Hongkong, P.R.C.; **Nanjing University of Science and Technology, Nanjing, P.R.C.): *JM*, vol. 17, pp. 72–76, June 2001.

This paper is based on an observation that the partial irregular patch can usually be taken as perturbations of a regular one with cuts and additions. The regular patch has a fast convergent model solution. The perturbation of the cuts can be obtained from circuit analysis and fringe field is considered through the full wave discrete images. This method is simple and has clear physical insight into the structure. The numerical results show that it is an accurate and efficient method.

(28) Analysis of the Scattering Characteristics of Electric-Large-Size Waveguide Structures With an Efficient Direct Finite Element Method, by J.-F. Cheng and S.-J. Xu (University of Science and Technology of China, Hefei, P.R.C.): *JM*, vol. 17, pp. 1–7, Dec. 2001.

An alternative direct finite element method is presented for analysis if the scattering characteristics of the electric-large-size structure. Based on the property of the finite element method that the divided domain can be composed of several modules, the present method makes use of the two properties of module: recycling and hierarchy smartly to speed up the analysis. Compared with the tradition method—sparse storing combined with preconditioned conjugate gradient method, the computing time needed in the present analysis is only as 1/10 as that in the mentioned method, while the memory requirement is also decreased to some extent.

(29) The Electromagnetic Field of a Vertical Electric Dipole on the Non-Perfect Conductor Coated With a Layer of Dielectric, by H.-Q. Zhang*,** and W.-Y. Pan** (*Shanxi Astronomical Observatory Chinese Academy of Sciences, Lintong, P.R.C.; **China Research Institute of Radiowave Propagation, Xinxiang, P.R.C.): *CJRS*, vol. 16, pp. 5–11, Mar. 2001.

The simple analytical expression of the electromagnetic fields induced by a vertical electric dipole on the nonperfect conductor coated with a dielectric layer has been obtained. The numerical results of the electromagnetic field that induced by different kinds of conductors are shown.

(30) Accurate and Analytical Expression for Electromagnetic Fields of a Vertical Magnetic Current Element Over the Ground Plane, by B.-H. Jiang and Y.-T. Liu (Harbin Institution of Technology, Harbin, P.R.C.): *CJRS*, vol. 16, pp. 12–17, Mar. 2001.

By using the Bateman's expansion formula, Sommerfeld type integral contained in electromagnetic fields of a vertical magnetic current element over the ground plane is expressed as a rapidly and absolutely convergent series of spherical wave functions, and the coefficients of the series are cast into the Jacobi polynomials for the complex permittivity by the aid of the Barne's integral representation of the hyper-geometric function. The obtained result is an accurate and analytical expression for the Sommerfeld half-space problem and can give a good service to correlated investigations in theory of electromagnetic fields.

(31) Derivation of Higher-Order Anisotropic Impedance Boundary Conditions, by H.-L. Zhao, G.-B. Wan and W. Wan (Northwestern Polytechnical University, Xi'an, P.R.C.): *CJRS*, vol. 16, pp. 25–29, Mar. 2001.

A novel spectral domain approach was adopted to derive higher-order tensor impedance boundary conditions (HOTIBC) for anisotropic coated planar conductor. Second order HOTIBC for cases of optical axis of anisotropic material in incident face and in interface between anisotropic material and air were given. The examples illustrate that the HOTIBC obtained coincides with exact one perfectly.

(32) Analysis on the Range-Displacement and Direction-Deflexion Induced by Ionospheric Refraction, by W.-L. Zhao, D.-N. Liang and Z.-M. Zhou (The National University of Defense Technology, Changsha, P.R.C.): *CJRS*, vol. 16, pp. 85–88, Mar. 2001.

The range-displacement and direction-deflexion of radio induced by ionospheric refraction is analyzed, the approximative formula is expandable and more veracious than the formula given in the literature for both the plane and spherical ionospheric models.

(33) Effects of Trains on Cutoff Frequency in Rectangular Tunnel, by J.-P. Sun and Q.-D. Shi (China University of Mining and Technology, Beijing, P.R.C.): *CJRS*, vol. 16, pp. 100–102, Mar. 2001.

Effects of trains in a rectangular tunnel on the cutoff frequency were analyzed by the finite-element method when the tunnel had been regarded as a waveguide. Generally, the trains in tunnel lowered TE wave cutoff frequencies and raised TM wave cutoff frequencies.

(34) An Analysis of Microstrips With Inhomogeneous Substrates in Shielded Waveguiding Structures Using 2.5D Edge Element Method, by L.-W. Li* and W.-X. Zhang** (*The National University of Singapore, Singapore; **Southeast University, Nanjing, P.R.C.): *CJRS*, vol. 16, pp. 137–143, June 2001.

The edge element method in 2.5-dimension was used to investigate the dispersion characteristics of shielded waveguiding structures. The underlying formulation in the 2.5D was applicable basically to all types of geometrically complex waveguiding structures. Various examples were considered and their respective results were obtained using the edge element method in the 2.5D.

(35) Studies of Reflection Characteristics of Electromagnetic Waves Propagating Into Magnetized Plasma, by H. Yang, J.-M. Shi and Y.-S. Ling (Electronics Engineer Institute, Hefei, P.R.C.): *CJRS*, vol. 16, pp. 196–199, June 2001.

The paper explained method calculating the total reflection coefficient an incident electromagnetic wave vertically propagated into nonuniform magnetized plasma, which is made of series of sub-slab where the electron number densities are assumed constant. Besides, it presented the numerical results of a nonuniform plasma slab over metal; across the whole slab the overall electron number density profile follows a linear function.

(36) Proposal and Application of a Group of Parameters for Radio Propagation Environments, by A. Tang and K. Gong (Tsinghua University, Beijing, P.R.C.): *CJRS*, vol. 16, pp. 217–221, June 2001.

A novel group of parameters for microcell propagation environments are proposed. They are clearly defined and useful for qualifying the real wireless channels with nonuniformly distributed scatters. They are explored to calculate Time of Arrival and Angle of Arrival distribution. The r.m.s. delay spread and angular spread are also been investigated, which prove the usefulness of the parameters in channel simulation work.

(37) Calculation of Effective Permittivity of Microstrip With Time-Domain Transform Method, by X.-P. Yu, Y.-H. Lu, X.-W. Wang and Y.-M. Huang (Beijing University of Posts and Telecommunications, Beijing, P.R.C.): *CJRS*, vol. 16, pp. 353–357, Sept. 2001.

The PML is needed to truncate the FDTD lattices and simulate the propagation of EM wave in microstrip. From time-domain transform, effective permittivity of microstrip is calculated. The integrate PML boundary condition and numerical simulation technique is integrated to replace the electric and magnetic wall boundary condition.

(38) Resonant Mode Analysis of Microwave Film Bulk Acoustic Wave Resonator Using 3D Finite Element Method, by J.-H. Jung, Y.-M. Song, Y.-H. Lee, J.-H. Lee, K.-S. Ko, H.-C. Choi (School of Electronic and Electrical Engineering, Kyungpook National University): *JKEES*, vol. 12, no. 1, pp. 18–26, Jan. 2001.

In this paper, the resonant characteristics and modes of the film bulk acoustic wave resonator (FBAR) used in 1$\sim$2 GHz frequency region are analyzed by it's input impedance which was calculated by three dimensional finite element method formulated as eigenvalue problem using electro-mechanical wave equation and boundary condition. It was extracted that the resonant and the spurious characteristics considering the effects of electrode area and shape variation and unsymmetry of upper and lower electrode. Those effects couldn't be analyzed by one dimensional analysis, e.g., Mason equivalent model. The simulation results was confirmed by comparing with the simulation data from Mason model analysis and the measured data of the ZnO FBAR fabricated using micro-machining technique. Also, through the simulation of the area variations of FBAR, it was obtained that the optimum ratio of length and thickness is 20 : 1 and the minimum ratio is 5 : 1 to operate thickness vibration mode.

(39) Micromachined Millimeter-Wave Cavity Resonators, by K. J. Song*, B. S. Yoon*, J. C. Lee*, B. Lee*, J. H. Kim*, N. Y. Kim*, J. Y. Park**, G. H. Kim**, J. U. Bu**, K. W. Chung** (*RFIC Research and Education Center and Mission Technology Research Center, Kwangwoon University; **Microsystem and RF Team, Materials and Device Laboratory, LG Electronics Institute of Technology): *JKEES*, vol. 12, no. 1, pp. 27–36, Jan. 2001.

In this paper, micromachined millimeter-wave cavity resonators are presented. One-port and two-port cavity resonators at Ka-band are designed using 3D design software, HP HFSSTM ver. 5.5. Cavity resonators are fabricated on Si substrate, which is etched down for the cavity, bonded with a Quartz wafer in which metal patterns for the feeding line and coupling slot are formed. One-port resonator shows the resonant frequency of 39.34 GHz, the return loss of 14.5 dB, and the loaded Q (QL) of 150. Two-port cavity resonator shows the resonant frequency of 39 GHz, the insertion and return losses of 4.6 dB and 19.8 dB, the loaded (QL) and unloaded Q (QU) of 44.3 and 107, respectively.

(40) A Study on the PCB Design of a CAT. 5E Modular Jacks Employing Field Cancellation Techniques, by D.-W. Ryu, J.-G. Rhee (Department of Electronic Communication Radio Science and Engineering, Hanyang University): *JKEES*, vol. 12, no. 1, pp. 136–142, Jan. 2001.

In this paper, a method of canceling and suppressing differential mode crosstalk noise signals caused by nonuniform coupling between two transmission lines in UTP (unshielded twisted pair) modular jacks is discussed. Differential mode crosstalk noise signals in balanced transmission lines with UTP modular jacks were suppressed, by applying field cancellation techniques to this modular jack. To verify an effectiveness of the field cancellation techniques, 8 pin modular jacks were made, and the NEXT (Near End Crosstalk) losses were measured to prove its applicability by the network analyzer (HP8720C) at 100 Mb/s.

(41) Efficient Calculation Method of the Green's Function for the Rectangular Cavity, by M.-J. Park (Samsung Electronic Company): *JKEES*, vol. 12, no. 1, pp. 153–159, Jan. 2001.

This paper presents an efficient method of calculation for the potential Green's function in the rectangular cavities. This method converts the slowly convergent Green's function into the sum of two, rapidly convergent series through the application of

the Ewald sum technique. As a result, accurate, fast convergent results are obtained with only small number of calculated terms.

(42) A Design and Fabrication of Bandpass Filter Using Miniaturized Square SIR, by H. Nam, Y. S. Lim (Department of Electronics Engineering, Chonnam National University, RRC-HECS, Kwangju, Korea): *JKEES*, vol. 38-TC, no. 2, pp. 55–60, Feb. 2001.

In this paper, a four-pole quasi-elliptic function bandpass filter of 1.95 GHz center frequency with 60 MHz bandwidth for IMT-2000 using miniaturized square SIR (Stepped Impedance Resonator) is designed and fabricated. The simulation of NUFDTD (Nonuniform Finite Difference Time Domain) is used to design the resonator and to calculate the coupling coefficient of three basic structures. The size reduction of miniaturized square SIR resonator is about more than 50% compare with a square open loop resonator. Bandpass filter using this resonator shows good microwave characteristic with the harmonic suppression of about −19 dB. The results of measurements are almost similar to those of simulation.

(43) A Study on the Small Isolator Characteristics and Design of Mobile Phones, by Y.-H. Lee*, W.-H. Kwon** (*Department of Radio Communication, Honam University; **Department of Information and Communication, Anyang University): *JKEES*, vol. 12, no. 2, pp. 165–175, Feb. 2001.

In this paper, it is analyzed lumped element isolators analytically by the analysis program using scattering matrixes including ferrite saturation magnetization, external direct current magnetic field and strip line length and width, designed and experimented the small isolator of mobile phone. The simulation results show that the characteristics of the isolator are affected by external R, C, length and width of strip line and ferrite width and saturation magnetization sensitivity. We proposed the isolator specification applied cellular and PCS mobile phones, experimented the isolator for cellular mobile phones. From the experimented result, isolation and return loss are measured below 20 dB, insertion loss is below 0.7 dB, bandwidth is about 44 MHz at center frequency 836.5 Mhz. The implemented isolator has better performances than the conventional one.

(44) A Study on Development of EMC Filter for Power Line in Break-Box, by D.-H. Bae*, D.-I. Kim**, J.-Y. Bae** (*Department of Electronics and Communication Engineering, Korea Maritime University; **Department of Radio Sciences and Engineering, Korea Maritime University): *JKEES*, vol. 12, no. 2, pp. 245–250, Feb. 2001.

Since the most of malfunctions in the industrial equipment controlled by processors is occurred by the Electrical Fast Transient (EFT), the International Electrotechnical Commission (IEC) prepared the dummy signal to test the immunity level of the equipments. In this paper, we designed a new EMC filter for power line in break-box, which consist of the feed-through capacitor and ferrite materials with high permeability which was wound or inserted in the second layer of the power cable in order to increase common mode inductance. We have obtained a excellent insertion loss characteristics over wide frequency band from 10 MHz up to 1.5 GHz. It is expected that the new EMC filter could be effectively used for industrial, MIL, and medical equipments to reduce a malfunctions and be suitable for IEC 61 000-4-4.

(45) A FG-CPW Single Balanced Diode Mixer for C-Band Application, by J.-S. Bae, J.-C. Lee, J.-H. Kim, B.-J. Lee, N.-Y. Kim (RFIC Research and Education Center and Mission Technology Research Center, Kwangwoon University): *JKEES*, vol. 12, no. 3, pp. 339–345, Apr. 2001.

In this paper, FG-CPW (Finite-Ground Coplanar Wave-Guide) balanced diode mixer is presented. Frequency bandwidth is selected for a C-band, which is 5.72∼5.82 GHz for RF, 5.58∼5.68 GHz for LO, and 140 MHz for IF signals. A rat-race hybrid is designed for the accomplishment of single balanced type. A low pass filter (LPF) with CPW structure is used for good conversion loss and unwanted harmonics suppression. When LO signal with the power of 4 dBm at 5.635 GHz is injected, a conversion loss of 6.2 dB is obtained for the mixer. Also, the LO to RF and LO to IF isolation of 30 dB and 40 dB are obtained, respectively. This mixer can be used in the area on wireless LAN application.

(46) A Study on Analysis Method of Tap-Offs for CATV/DBS/CS by Even·Odd-Mode Theory, by D.-I. Kim, J.-H. Hwang, H.-W. Ryu, D.-H. Ha, S.-M. Chung (Department of Radio Sciences and Engineering, Korea Maritime University): *JKEES*, vol. 12, no. 3, pp. 346–351, Apr. 2001.

A new analysis method was proposed, where the even·odd-mode theory for a symmetrical coupled-line directional coupler was applied to a transformer-type directional coupler. In addition, the tap-offs were analyzed by the proposed theory, which are widely used in CATV (Cable Television), DBS (Direct Broadcasting Satellite), CS (Communication Satellite) systems. By comparing the calculation results to the measured ones using the even·odd-mode reflection coefficients only, the validity of the proposed analysis method was confirmed. Then, the tap-off has been broadened from 5 MHz over 4000 MHz by adopting the proposed theory.

(47) Design of an Amplifier Using DGS DC Block, by K.-H. Lee*, Y.-C. Jeong** (*Radio Technology Department, Radio and Broadcasting Technology Laboratory, ETRI; **Division of Electronic and Information Engineering, Institute of Information and Communication, Chonbuk National University): *JKEES*, vol. 12, no. 3, pp. 432–438, Apr. 2001.

In this paper, after applying Defected Ground Structure (DGS) to DC block, changes of gap and length of $\lambda/4$ coupled line are investigated by EM simulation and fabrication. As a result, on condition of the same output with the case using typical DC block, the gap between $\lambda/4$ coupled line is widen from 0.1 mm to 0.46 mm by 0.36 mm and the length of $\lambda/4$ coupled line gets shorter from 17.7 mm to 13.2 mm by 4.5 mm. Also three type power amplifiers using blocking capacitor, typical DC block and DGS DC block are fabricated and investigated. At first, when S parameter characteristics of each amplifier are considered at frequency band of 3.2 ± 0.05 GHz, every amplifier has similar characteristics of gain and S parameter. Second when the output power of amplifiers is 25 dBm after putting CW signal of 3.2 GHz into three type amplifiers, the difference of dominant signal and 2nd harmonic signal using blocking capacitor, typical DC block and DGS DC block is each −44.83 dBc, −66.84 dBc and −64.33 dBc. Therefore harmonic characteristics of amplifiers using typical DC block and DGS DC block is almost same.

(48) A Simple Method for Designing Traveling-Wave Electrodes With Periodic Capacitive Loads of Velocity-Matched Distributed Photodetectors, by J.-P. Oh, S.-S. Lee (Opto-Electronic Integrated Circuit Laboratory, Division of Electrical and Computer Engineering, Hanyang University): *JKEES*, vol. 12, no. 3, pp. 451–461, Apr. 2001.

We present a simple design method of velocity-matched traveling-wave (TW) electrode with periodic capacitive loads. Once matching impedance and optical phase velocity are defined, the width and separation of coplanarstrip (CPS) and the magnitude and period of capacitive load are determined analytically. Calculation results of velocity-matched TW electrodes on GaAs substrates show bandwidths of more than 100 GHz.

(49) A Measurement Method of Dielectric Properties of Dielectric Materials Using TE011 Mode of Cylindrical Cavity Resonators, by W. H. Lee*, T. S. Kim*, J. Hur*, S. Y. Lee** (*Department of Electronics, Information and Communication Engineering, Konkuk University, Seoul, Korea; **Department of Physics, Konkuk University, Seoul, Korea): *JKEES*, vol. 38-TC, no. 5, pp. 175–181, May 2001.

This paper describes measurement method of dielectric properties of dielectric materials using cylindrical cavity resonators. Dielectric properties of concern here are relative permittivity, loss-tangent, quality factor and so on. An analysis of TE011 mode in dielectric properties of concentric dielectric-rod inserted cylindrical cavity resonator is presented. The frequency variation by the air gap at TE011 mode turns out to be the least sensitive. A technique using a TE011 mode of concentric dielectric-rod inserted cylindrical cavity resonator and an exact field representation of neo nondecaying mode are introduced for measurement of dielectric properties.

(50) The Design of High-Temperature Superconducting Microstrip Filter Using Multiple Coupled Line Resonators, by H. C. Park*, S. S. Yun*, I. M. Park*, T. I. Kim**, S. K. Kim**, B. C. Min**, J. P. Jang**, H. S. Lee**, Y. H. Choi**, B. D. Oh** (*School of Electronics Engineering Ajou University, Suwon, Korea; **LG Elite): *JKEES*, vol. 38-TC, no. 5, pp. 189–196, May 2001.

A very compact narrowband high-temperature superconducting microstrip filter using multiple coupled line resonators is designed and fabricated to effectively use the limited space of the wafer. The fabricated 12 pole filter has a center frequency of 1.79 GHz and a 3 dB bandwidth of 7.63 MHz (0.43% fractional bandwidth). The filter also shows sharp skirt characteristics of 71 dB/MHz and 41 dB/MHz blow and above the passband, respectively, and has an insertion loss of less than 0.5 dB and a return loss of more than 15 dB in the passband.

(51) Efficient Derivation of Closed-Form Green's Functions for a Microstrip Structure, by B.-H. Oh*, E.-J. Kim*, Y.-S. Lee*, Y.-K. Cho** (*Department of Electronic Engineering, Kum-oh National University of Technology; **Department of Electronics, Kyungpook National University): *JKEES*, vol. 1, no. 1, pp. 63–66, May 2001.

In order to derive simple and accurate closed-form spatial Green's functions for the thick microstrip substrate, an efficient method based on the two-level approach, which circumvents the burdensome steps (i.e., without necessity of extraction of quasistatic contributions and subsequent determination of approximation parameters) in the previous complex image method, is considered in conjunction with the use of the original Prony's method. The present method is observed to give more accurate results for the evaluation of the Green's functions over wider frequency range independently of the source-to-field distances than the previous method.

(52) An RF Amplitude Equalizer; Improved Passband Flatness of a Bandpass Filter, by H.-Y. Hwang*, J.-S. Jung**, S.-w. Yun*** (*Department of Electric and Computer Engineering, University of Maryland; **Microwave Lab, AMOTECH Co., Ltd.; ***Department of Electronics Engineering, Sogang University): *JKEES*, vol. 1, no. 1, pp. 83–87, May 2001.

Many communication systems require bandpass filters with sharp skirt frequency characteristics in order to avoid the interference, which results in more order in the filter design. However, because of the limited Q values bandpass filters made of small sized ceramic resonators suffer from relatively large ripples at the band edges as the order of the filter increases. In order to compensate the large ripples while maintaining the sharp skirt frequency we propose a new RF amplitude equalizer. The equalizer made of two pole bandpass filter and an amplifier whose amplitude characteristics are the reverse of those of the bandpass filter. At the cellular band 9-pole bandpass filter with 10 MHz bandwidth exhibits 3 dB ripple when 8 mm $*$ 8 mm ceramic coaxial resonators are used. We added the RF equalizer to this filter and the flatness is improved as less than 1 dB.

(53) Development of Improved EMC Filter for EFT in Power Supply, by D.-H. Bae*, D. I. Kim**, J. M. Song*** (*Department of Electronics and Communication Engineering, Korea Maritime University; **Department of Radio Sciences and Engineering, Korea Maritime University; ***RIIT, Korea Maritime University): *JKEES*, vol. 1, no. 1, pp. 100–104, May 2001.

Since the most of malfunctions in the industrial equipment controlled by processors is consist of the electrical fast transient (EFT) [1], [2], the International Electrotechnical Commission (IEC) prepared the dummy signal to test the immunity level of the equipments. To work out a countermeasure for the malfunction, We designed a new electromagnetic compatibility (EMC) filter for high power supply, which is consisted of a feed-through capacitor and ferrite materials with high permeability. The ferrite material is surrounded with a power cable or is inserted on the cable's second layer in order to increase common-mode inductance. We have obtained a excellent insertion loss characteristics over the frequency band from 150 kHz to 30 MHz. The developed new EMC filter satisfy IEC 61000-4-4 and is suitable for industrial, military, and medical equipments with reduced malfunctions.

(54) Improvement of the Microstrip Patch Bandpass Filter Using Interdigital Coupling Structure and Embedded Slot, by H. Kim, H.-j. Lim, H.-B. Yoon (Department of Electronic Engineering, Dong Kuk University): *JKEES*, vol. 12, no. 4, pp. 487–493, June 2001.

In this paper, A new microstrip bandpass filter is proposed. The novelty of the proposed structures is to use a interdigital capacitor and embedded slot that are formed on a patch resonator such that its insertion loss and size can be significantly

reduced simultaneously. As a result, it is found that the resonant frequency of patch filter designed at 5 GHz is decreased to 1.8946 GHz and the insertion loss is reduced from −2.168 dB to −0.379 dB. This proposed filter has small size and low insertion loss in comparison with the conventional parallel edge coupled bandpass filter.

(55) A Study on the Design of the Directional Coupler Using Three Layer Microstrip Substrate, by D.-W. Chun*, W.-K. Kim*, J.-H. Park***, S.-T. Kim**, C.-C. Shin* (*School of Electronics Engineering, Ajou University; **Korea Institute of Industrial Technology Evaluation and Planning; ***Department of Communication, Inchon College): *JKEES*, vol. 12, no. 4, pp. 513–520, June 2001.

In this paper, the directional coupler using three layer microstrip substrate is proposed and the design method is notified. Modified re-entrant mode coupler is the proposed structure that one layer is added on upper plane of coupled transmission lines and the floating conductor is placed on added layer's upper planes. This structure has high coupling for the increase of odd mode capacitance and also has good performance in VSWR, isolation, phase difference because the difference of effective permittivity is small in each mode. We have designed the coupler from the calculation of impedance, effective permittivity, coupling coefficient using even, odd mode analysis method. From the simulation and measurement, proposed coupler has about 2 dB more tighter coupling than conventional coupler and also has good performance in VSWR, isolation, phase difference.

(56) Design of a Channel Combiner for Digital Terrestrial Television Transmission, by S.-H. Kim, J.-H. Park, J.-H. Choi (Division of Electrical and Computer Engineering, Hanyang University): *JKEES*, vol. 12, no. 4, pp. 542–550, June 2001.

In this paper, a channel combiner is designed to combine two adjacent digital TV channels without interference to transmit these channels with one broadband antenna. A constant impedance type combiner, consisting of two identical bandpass filters and two identical 3 dB power combiners, is chosen as a channel combiner. The bandpass filter used in the channel combiner also suppresses out-of-band signal caused by digital transmitter's nonlinearity. H-plane type bandpass filters and branch-line power combiners are adopted in the design. The simulated results of the designed bandpass filter and power combiner show excellent agreement with the theoretical results. Finally, a channel combiner is designed by combining filters with power combiners and the characteristics are simulated. It is shown that the designed channel combiner shows excellent performance.

(57) Design of Microstrip Line Bandpass Filter Using Photonic Bandgap Structures, by T.-I. Kim*, M.-K. Kim*, I. Park*, H. Lim** (*School of Electronics Engineering, Ajou University; **Department of Molecular Science and Technology and School of Electronics Engineering, Ajou University): *JKEES*, vol. 12, no. 4, pp. 611–621, June 2001.

This paper presents a design methodology of bandpass filter by using defect modes in photonic bandgap (PBG) structures. PBG structures are realized with alternating section of microstrip line arranged in a periodical manner. A passband is created within the stopband of PBG structures with defect modes, which can be generated by changing the period of certain part of PBG structure. We also extract a simple equivalent circuit of a bandstop filter by using several LC sections.

(58) Design of a Microwave Planar Broadband Power Divider, by J.-S. Park*, H.-S. Kim*, D. Ahn*, K.-Y. Kang** (*Division of Information Technology Engineering, Soonchunhyang University; **Telecommunication Basic Research Lab, ETRI): *JKEES*, vol. 12, no. 4, pp. 651–658, June 2001.

A novel multi-section power divider configuration is proposed to obtain wide-band frequency performance up to microwave frequency region. Design procedures for the proposed microwave broadband power divider are composed of a planar multi-section three-ports hybrid and a waveguide transformer design procedures. The multi-section power divider is based on design theory of the optimum quarter-wave transformer. Furthermore, in order to obtain the broadband isolation performance between the two adjacent output ports, the odd mode equivalent circuit should be matched by using the lossy element such as resistor. The derived design formula for calculating these odd mode matching elements is based on the singly terminated filter design theory. The waveguide transformer section is designed to suppress the propagation of the higher order modes such as waveguide modes due to employing the metallic electric wall. Thus, each section of the designed waveguide transformer should be operated with evanescent mode over the whole design frequency band of the proposed microwave broadband power divider. This paper presents several simulations and experimental results of multi-section power divider to show validity of the proposed microwave broadband power divider configuration. Simulation and experiment show excellent performance of multi section power divider.

(59) Wideband Characterization of Double Bondwires and Ribbon for Millimeter-Wave Packaging, by J. Y. Kim*, D. P. Chang**, I. B. Yom**, H. Y. Lee* (*Department of Electronics Engineering, Ajou University, Suwon, Korea; **Satellite Communication System Department, Electronics Telecommunication Research Institute): *JKEES*, vol. 38-TC, no. 7, pp. 243–249, July 2001.

The wirebonding is a common interconnection technique for modern devices because of rather simple and reliable processes involved. At millimeter-wave frequencies, however, the bondwire parasitics are significant and consequently limit the external performance of packaged devices. In this paper, we represent wideband characterization of multiple bondwires and ribbon in a frequency range from 20 to 35 GHz. From these results, the double bondwire shows very small insertion loss less than 0.55 dB up to 35 GHz and its performance is comparable to that of the ribbon in the millimeter-wave frequencies. Therefore, the wirebonding is very suitable for millimeter-wave packaging in term of performance and manufacturing cost.

(60) An Analysis in Optimum Coupling Method of Cylindrical Dielectric Resonator Filter Designed by Non-Decaying Mode Analysis, by W. H. Lee*, C. W. Park**, T. S. Kim*, J. Hur*, S. Y. Lee*** (*Department of Electronics, Information and Communication Engineering, Konkuk University, Seoul, Korea; **Hea-Ri-Com Co., Ltd., Seoul, Korea;

***Department of Physics, Konkuk University, Seoul, Korea): *JKEES*, vol. 38-TC, no. 7, pp. 250–257, July 2001.

In this paper, we designed and fabricated C-band bandpass filter using dielectric resonators. From waveguide cutoff frequency which applied the region the region between adjacent dielectric resonators, the height of cavity is determined. The cavity's diameter to the twice of dielectric resonator's diameter considering the conductor loss. The resonant frequency of the DR-cavity is calculated with nondecaying mode analysis. Conventionally, cylindrical dielectric resonator is analyzed by Cohn's model which rse the decaying mode in the region between dielectric resonator wall and circular cavity wall, which is an approximated method. The external quality factor, Qex has found with simulation result using Ansoft's Maxwell simulation tool. The designed filter using dielectric resonators with dielectric constant of 45 has the passband center at 5.065 GHz. The bandpass filter using dielectric resonators has about 1 dB insertion loss, 20 MHz bandwidth and more than 30 dB attenuation at $fo \pm 15$ MHz.

(61) Measurement of the Complex Permittivities of Various Dielectrics Using an Open-Ended Coaxial Probe, by H. Shin*, S. Y. Hyun**, S. W. Kim***, S. Y. Kim*** (*Samsung Electro-Mechanics, Co., Korea; **Department of Radio Sciences and Engineering, Korea University, Seoul, Korea; ***Imaging Media Research Center, Korea Institute of Science and Technology): *JKEES*, vol. 38-TC, no. 7, pp. 258–263, July 2001.

In this paper, the complex permittivity of various dielectrics such as powder (sugar and flour) and solid (teflon and acryl) are measured by using an open ended coaxial-line probe, which is self-designed and manufactured. The probe is connected to a vector network analyzer (VNA) through a coaxial cable. The end of the cable is corrected by using an OSL (open, short, and load) calibration kit. The phase difference, which is produced by inserting the probe at the end of the line is compensated by using the numerically calculated reflection coefficient of distilled-water. The complex permittivity is reconstructed by inserting the measured reflection coefficient, which is produced at the interface between the probe and measuring material into an virtual conical-cable conversion model. Over a wide frequency range from 30 MHz to 3 GHz, the measured complex permittivities of various power and solid using the our method are compared with the results, which are measured by using an transmission-line method of the Korea Research Institute of Standards and Science (KRISS).

(62) Design Method of the Meander-Coupled Wilkinson Power Divider for L-Band, by Y.-S. Lee*, C.-O. Lee*, S.-H. Kim**, C.-C. Shin* (*School of Electronics Engineering, Ajou University; **Department of Electronics Engineering, Changwon Polytechnical College): *JKEES*, vol. 12, no. 5, pp. 676–685, Aug. 2001.

In this paper, the design method of the meander-coupled Wilkinson power divider with slit is proposed. Because the electrical performance of this structure is varied with each coupling distance and the slit's size, a tedious design work, which is done by trial and error correction, is required to determine the values of parameters for the best suitable operation. To solve this problems, therefore, an experimental design formulas for optimum performance are presented by curve fitting, under the desired center frequency (fo). As the example using the proposed design equation, we designed and fabricated the meander-coupled divider at $f0 = 1.5$ GHz. It has better electrical performance and measured results also agrees very well that of the simulated. From these observation, it can be concluded that the obtained design formulas are useful for design of this divider.

(63) Analysis and Optimization of Passive Intermodulation Distortion in Microwave Filter Using Coaxial Line Resonator, by I.-K. Cho, J. T. Kim, M. Y. Jeong, T. G. Choy (Electronics and Telecommunications Research Institute): *JKEES*, vol. 12, no. 5, pp. 734–739, Aug. 2001.

In this paper, the technique of analysis and optimization on the Passive Intermodulation (PIM) in a filter using coaxial transmission resonator, is presented. The developed simulation technique can reduce PIM power without the degradation of the linear filter response, through the variation of filter dimensions. The increase of PIM in filter is depended on currents flowing through each resonator forming filter. The reduction of these currents therefore makes the reduction of the PIM power.

(64) A Fabrication of Form and a Measurement of Relative Permittivity of Illite Found in Young-Dong Area, by W.-H. Lee*, H.-J. Choi*, K.-W. Koo**, J. Hur* (*Department of Electronics, Information and Communication Engineering, Konkuk University; **Faculty of Information · Electronics Engineering, Youngdong University): *JKEES*, vol. 12, no. 5, pp. 747–754, Aug. 2001.

This paper describes measurement of relative permittivity of illite found in young-dong area. A measurement of relative permittivity of the illite was made using cylindrical cavity resonators with a moveable cap. A concentric dielectric-rod inserted the cylindrical cavity resonator and an exact field representation of nondecaying mode of the resonator are introduced for the measurement of relative permittivity. The exact electromagnetic fields in cylindrical cavity with a concentric dielectric rod is analyzed. The relative permittivity of dielectric in the cavity is calculated by analyzing a characteristic equation. The characteristic equation is solved by using the ContourPlot graph of Mathematica. We know that the field representation of nondecaying mode is exact. As a result, the relative permittivity of dielectric materials was 7.820 for a sample with binder and 7.894 for a pure sample.

(65) Analysis and Design of Branch Line Coupler Using Microstrip Lines With Overlay, by S.-Y. Rhee (Department of Electronics Communication Engineering, Yosu National University): *JKEES*, vol. 12, no. 5, pp. 795–801, Aug. 2001.

A method of miniaturizing branch line coupler is presented. The method utilizes the microstrip line with overlay (or superstrate). The frequency dependent characteristics, dispersion and characteristic impedance, of this line are obtained by Immittance method in spectral domain and Method of Line. The relevant spectral domain Green's function is given and used to obtain numerical results. The branch line couplers with overlays are designed and fabricated at 2 GHz. The experimental results show that the size of coupler with overlay (epsilon_r $= 10.2$) is 31.4 percent smaller than conventional coupler. This minimized

coupler is suitable for Butler Matrix as feeder for mobile communication beam forming antenna.

(66) Design of Band Pass Filter Using the Triple-Mode Resonators, by J.-H. Hwang (School of Computer Electronics Engineering, Kyongju University): *JKEES*, vol. 12, no. 6, pp. 899–905, Oct. 2001.

This paper presents a triple-mode dielectric resonator for low loss and simple structure filter design. The BPF (Band Pass Filter) was designed using HFSS simulation results and fabricated using proposed resonators. The filter (3-stage BPF) has an insertion loss of about 0.9 dB at the center frequency of 1.93 GHz and a 3 dB bandwidth of about 25 MHz. If more complex characteristic is required, slot coupling between resonators can be used. Especially, the proposed BPF can be applied to the next generation mobile communication IMT-2000 system.

(67) The Design and Implementation of a TV Tuner for the Digital Terrestrial Broadcasting, by Y.-J. Chong*, J.-Y. Kim*, I.-K. Lee*, J.-I. Choi*, S.-H. Oh** (*Radio Technology Department, ETRI; **Department of Electronics Engineering, Chungnam University): *JKEES*, vol. 1, no. 2, pp. 131–138, Nov. 2001.

The DTV (Digital TV) tuner for an 8-VSB (Vestigial Side-Band) modulation was developed to meet the requirements of the ATSC (Advanced Television Systems Committee). The double frequency conversion and the active tracking filter in the front-end were used to cancel interferences between adjacent channels and multi-channels by suppressing the IF beat and the image frequency. However, it was impossible to get frequency mapping between the tracking filter and the first VCO (Voltage Controlled Oscillator) in the existing DTV tuner structure which differs from the NTSC (National Television Systems Committee) tuner. This paper, therefore, suggests an available structure and a new method for the automatic frequency selection by mapping the frequency characteristics over the tracking voltage and the combined H/W which is composed of a Micro-controller, an EEPROM (Electrically Erasable Programmable Read Only Memory), a DAC (Digital-to-Analog Converter), an OP amplifier, and a switch driver.

(68) A Study on the Improvement of the Performance of Power Amplifiers by Defected Ground Structure, by J.-S. Lim*, Y.-T. Lee*, J.-S. Park**, D. Ahn**, J.-H. Han*, B.-S. Kim***, S.-w. Nam* (*School of Electrical Engineering, Seoul National University; **Division of Information Technology Engineering, SoonChunHyang University; ***School of Electrical and Computer Engineering, SungKyunKwan University): *JKEES*, vol. 1, no. 2, pp. 146–155, Nov. 2001.

This paper describes the improvement in performance of power amplifiers by Defected Ground Structure (DGS) for several operating classes. Due to its excellent capability of harmonic rejection, DGS plays a great role in improving the main performance of power amplifiers such as output power, power added efficiency, harmonic rejection, and intermodulation distortion (IMD3). In order to verify the improvement in performance of power amplifiers by DGS, measured data for a 30 Watts power amplifier with and without DGS attached under several operating classes are illustrated and compared. The principle of the performance improvement is described with simple Volterra nonlinear transfer functions. Also, the measured performance for two cases, i.e., with and without DGS, and the quantities of improvement for the various operating classes are compared and discussed.

(69) Analysis of Attenuation Poles Using Closed-Form Solutions for Bandpass Filters, by Y. m. Shin, B. s. Lee (Department of Radio Engineering, Kyunghee University): *JKEES*, vol. 1, no. 2, pp. 156–160, Nov. 2001.

Very convenient equivalent circuits for the design of bandpass filters with an attenuation pole in the lower or upper stopband are provided together with necessary closed-form solutions. The proposed approach gives us much flexibility and simplifies the design of inserting attenuation poles.

(70) A Varactor-Tuned RF Tunable Bandpass Filter With Constant Bandwidth, by B.-W. Kim, D.-I. Yun, S.-W. Yun (Department of Electronics Engineering, Sogang University): *JKEES*, vol. 1, no. 2, pp. 166–172, Nov. 2001.

A novel RF tunable bandpass filter structure using dielectric resonators and varactor diodes is considered for the optimization to achieve constant bandwidth with minimum passband insertion loss. The coupling between resonators is realized by coupling windows and series lumped L, C elements are used to realize the input/output stage couplings. A 5 poles, 0.01 dB ripple Chebyshev type filter tuned from 800 MHz$\sim$900 MHz is designed and presented in this paper. The passband bandwidth for the design is 10 MHz (fractional bandwidth $=$ 1.2%). Experimental results show that the 3 dB passband bandwidth variation is 12.04 MHz$\sim$12.16 MHz (less than 1%) and passband insertion loss is 15 dB$\sim$7 dB depending on the tuning voltages.

(71) Design of Microstrip PBG Structure and Duplexer Using PBG Cell With Stub, by M. Y. Jang*, C. S. Kee*, I. M. Park*, H. j. Lim*, T. I. Kim**, J. I. Lee*** (*Department of Molecular Science and Technology and School of Electronics Engineering Ajou University, Suwon, Korea; **LG Electronics Institute of Technology; ***Photonics Research Center, KIST, Seoul, Korea): *JKEES*, vol. 38-TC, no. 12, pp. 503–512, Dec. 2001.

We have studied the design of the photonic bandgap (PBG) structure on the microstrip line that can effectively control the fractional bandwidth of the passband formed in the stopband by adding the stub in the cell of the microstrip PBG structure. As the length of the stub increases, the cutoff frequency and the center frequency of the stopband are decreased, while the bandwidth of the stopband is increased. We have also found that the fractional bandwidth of the passband formed in stopband by the introduction of defect decreases as the stub length is increased. These results mean that adding the stub in the normal PBG structure is an effective way to control the fractional bandwidth. As an application example, we have implemented a microwave duplexer using the proposed structure.

(72) Silicon Substrate Coupling Modeling, Analysis, and Substrate Parameter Extraction Method for RF Circuit Design, by W. J. Jin, Y. S. Eo, J. I. Shim (Department of Electrical and Computer Engineering, Hanyang University, Ansan, Korea): *JKEES*, vol. 38-TC, no. 12, pp. 513–521, Dec. 2001.

In this paper, equivalent circuit model and novel model parameter extraction method of a silicon (Si) substrate are presented. Substrate coupling through Si-substrate is quantitatively

investigated by analyzing equivalent circuit with operating frequency and characteristic frequencies (i.e., pole and zero frequency) of a system. For the experimental verification of the equivalent circuit and parameter extraction method, test patterns are designed and fabricated in standard CMOS technology with various isolation distances, substrate resistivity, and guard-ring structures. Then, these are measured in 100 MHz$\sim$20 GHz frequency range by using vector network analyzer. It is shown that the equivalent-circuit-based HSPICE simulation results using extracted parameters have excellent agreement with the experimental results. Thus, the proposed equivalent circuit and parameter extraction methodology can be usefully employed in mixed-signal circuit design and verification of a circuit performance.

(73) Design of Postdistortion Linearizer Using Complex Envelope Transfer Characteristics of Power Amplifier, by J.-H. Han*, D.-H. Lee*, S. Nam*, J.-S. Lim*, B.-S. Kim** (*School of Electrical Engineering and Computer Science, Seoul National University; **School of Electrical and Computer Engineering, Sungkyunkwan University): *JKEES*, vol. 12, no. 7, pp. 1086–1093, Dec. 2001.

A new linearization technique for RF high-power amplifiers (HPA's) using nth order error signal generator (ESGn) is proposed. The n-th order ESG generates an error signal based on the complex envelope transfer characteristics of the HPA, which is combined at the output of the HPA. Therefore, the higher-order nonlinearities are not affected by the ESGn and the stability of the linearized system is guaranteed due to the inherent open-loop configuration. Moreover, the output delay loss can be avoided, because the error signal is generated with the input signal of the HPA. The IMD (intermodulation distortion) improvement obtained applying the ESG7 to 5W class A HPA in cellular band demonstrates the feasibility of the proposed postdistortion system.

(74) A Study on the Efficient IFEM for Analyzing an Arbitrary-Shaped Iris in Rectangular Waveguide, by J. Park*, B. Kim**, S. Nam*** (*R&D Group Senior Research Engineer, LG Innotek Co. Ltd.; **EEC Department Sungkyunkwan University; ***SoEECS, Seoul National University): *JKEES*, vol. 12, no. 7, pp. 1175–1181, Dec. 2001.

An efficient hybrid method is proposed to analyze discontinuities in a rectangular waveguide. Only with a small number of meshes around a discontinuity, the typical finite element method is shown to give an exact solution through several iterative updates of the boundary conditions. To show the validity of the proposed method, a simple circular aperture in a rectangular waveguide is analyzed and its result is compared with FEBIM.

(75) A Study on the Improvement of Efficiency and Linearity of Power Amplifier Using PBG Structure, by B.-H. Kim, C.-S. Park (School of Electrical and Computer Engineering, Sungkyunkwan University): *JKEES*, vol. 12, no. 7, pp. 1182–1190, Dec. 2001.

In this paper, microstrip photonic bandgap (PBG) structure with special perforation patterns etched on the line itself is analyzed and optimized in shape, then used for harmonic tuning of power amplifier. This PBG has an advantage in being fabricated and grounded. The dimension of unit lattice is enlarged vertically, but its input and output line maintain 50 Ω using tapered line. This modification from original structure can lessen possible error in etching PCB. The analysis and design of PBG structure are acquired from using EM simulation. The measured insertion loss of the final structure is 0.3$\sim$0.4 dB, and its bandwidth of stopband is 6$\sim$7 GHz. Measured results of improved characteristics by using PBG structure at the output of the power amplifier are 0.72$\sim$0.99 dB in output power, 1.14$\sim$7.8% in PAE, and 1 dBc in the third IMD.

(76) Novel Micromachined CPW Structures With Low Loss Over Wide Impedance Range, by H. T. Kim, J. H. Park, S. H. Jung, C. W. Baek, Y. K. Kim, Y. W. Kwon (Millimeter-Wave Integrated Systems Laboratory, Seoul National University, Seoul, Korea): *JKICS*, vol. 26, no. 1B, pp. 7–13, Jan. 2001.

In this work, novel micromachined CPW (Coplanar Waveguide) structures are developed to achieve wider characteristic impedance ($Z0$) range and lower loss than conventional CPW. In these structures, the edges of the center conductor are partially elevated and overlapped with ground planes, or, the edges of the ground planes are partially elevated and overlapped with center conductor. The $Z0$, εeff, and loss of the new proposed CPW lines are examined in detail using EM simulation for various elevations and overlaps. In fabrication, micromachining techniques are employed for elevation and overlap. At elevation of 15 μm, the proposed OCPW (Overlay CPW) and IOCPW (Inverted Overlay CPW) show broader $Z0$ range and lower loss on the entire $Z0$ range when compared to the conventional CPW.

(77) Design of Coupled Microstrip Bandpass Filter on Composite Dieletric Substrate, by S. C. Moon*, I. S. Kim** (*Department of Information and Communication, Yeong Dong College; **Department of Information and Communication, Inchon University): *JKICS*, vol. 26, no. 8B, pp. 1041–1047, Aug. 2001.

Parallel coupled microstrip bandpass filter is widely used in microwave circuits. But this filter limits the filter applications because of the spurious passband at twice the basic passband frequency. In order to solve this problem, a method of using on composite dielectric substrate is presented. Closed form method is used to analyze coupled microstrip lines on composite dielectric substrate. An experimental filter is fabricated over 20 percent bandwidth centered at 9 GHz. Compared with the filter on a single substrate, this filter on composite substrate shows improvement of the spurious passband.

(78) Novel Microstrip Bandpass Structure Using TEM Mode Dielectric Resonators and Shunt Posts, by S.-y. Yoo*, Y.-i. Han**, I. S. Kim*** (*Cyberbank Co., Ltd.; **Department of Radio Communication Engineering, KyungHee University; ***College of Electronics and Information Engineering, KyungHee University): *JKICS*, vol. 26, no. 9B, pp. 1196–1202, Sept. 2001.

In this paper, two novel microstrip structures having attenuation poles at upper and lower stopbands for band pass filter characteristics will be proposed. The structures have been composed of TEM mode dielectric resonators connected to microstrip line by using capacitive and inductive posts. Equivalent circuits for the structures have been extracted. S-parameters for the structures have been obtained by measurement and equivalent circuit simulation, and compared with each other. For the case of induc-

tive block, the results have been also compared with 3-D FDTD calculation. The measurement results agree well with the equivalent circuit simulation and/or FDTD calculation.

(79) Study on 5.8 GHz DR Duplexer Using Cavity Filter, by C.-h. Bae*, P.-d. Cho*, B.-h. Cho**, Y.-s. Kim**, H.-s. Chang** (*Electronics and Telecommunications Research Institute, Daejeon, Korea; **Department of Electronics and Statistic, Hongik University): *JKICS*, vol. 26, no. 12B, pp. 1712–1723, Dec. 2001.

This paper presents a design procedure and manufacturing techniques realizing of a 5.8 GHz duplexer based on cylindrical coaxial dielectric resonator. Upto $Q \times fo = 30\,000$ cylindric coaxial dielectric resonator was developed control by addition of dielectric materials. This resonator shows attenuation characteristics -40 dB for transmitter and -50 dB for receiver by consisting of two sets of 4-stage cavity resonator within $fo \pm 10$ MHz bandwidth which was requirement of DSRC. Employing the measurement results, design procedure to characterize the transmission and reflection properties are presented.

(80) Design and Fabrication of SMD Type Wilkinson Power Divider for PCS Basestation, by J.-K. Kim*, H.-S. Oh** (*Korean Electronics Technology Institute; **Konkuk University): *JKICS*, vol. 26, no. 12B, pp. 1747-1753, Dec. 2001.

This paper describe the design and fabrication of a SMD type Wilkinson power divider for PCS basestation. It has been designed for commercial power amplifier system by HP-ADS and fabricated with the size 0.56 $\times$ 0.35 inches. As a result, the power divider was well-operated in the frequency ranges of 1.75$\sim$1.98 GHz for the application of PCS system. The power divider reveals insertion loss 0.2 dB, isolation -19.8 dB, amplitude balance 0.02 dB, phase balance 0.5o, input and output impedance matching -20.6 dB respectively.

(81) Applicability of Impedance Boundary Condition for Approximating a Loaded Trough on a Ground Plane, by R. Sato*, H. Shirai** (*Faculty of Education and Human Sciences, Niigata University, Niigata-shi, 950-2181 Japan; **Faculty of Science and Engineering, Chuo University, Tokyo, 112-8551 Japan): *IEICE Trans. Electron.*, vol. E84-C, no. 1, pp. 123–125, Jan. 2001.

An electromagnetic wave scattering by a material loaded rectangular trough on a ground plane is approximately analyzed by using standard impedance boundary condition (SIBC). The validity of the derived approximate solution is examined by comparing with the rigorous one not only for the oblique incidence but also for the variation of both the filled material's parameters and the trough dimension. An applicability condition has been derived here for this trough structure.

(82) Design of a Microwave Variable Delay Line Using Liquid Crystal, and a Study of Its Insertion Loss, by T. Kuki, H. Fujikake, T. Nomoto, Y. Utsumi (NHK Science and Technical Research Laboratories, 1-10-11 Kinuta, Setagaya-ku, Tokyo, 157-8510 Japan): *IEICE Trans. Electron.*, vol. J84-C, no. 2, pp. 90–96, Feb. 2001.

This paper presents simulated and experimental results of a microwave variable delay line using a liquid crystal. Except for a large insertion loss, the delay characteristics are flat over a wide microwave frequency range. Analysis of the delay line attenuation indicates that the large insertion loss is mainly caused by conductor loss of the microstrip line. Increasing the thickness of the liquid crystal reduces the loss, but makes controlling the molecular orientation of the liquid crystal difficult. The liquid crystal variable delay line should thus be designed to meet the requirements, low loss or high controllability, for example.

(83) Measurements of Complex Permittivities in 100 GHz Band by the Whispering-Gallery Mode Resonator Method, by Y. Kogami, H. Tamura, K. Matsumura (Faculty of Engineering, Utsunomiya University, 7-1-2 Yoto, Utsunomiya-shi, 321-8585 Japan): *IEICE Trans. Electron.*, vol. J84-C, no. 8, pp. 703–706, Aug. 2001.

The whispering-Gallery mode dielectric resonator method is applied for measuring the complex permittivities of Alumina ceramic samples in 100 GHz band. A customized measuring system to evaluate high permittivity dielectric materials in millimeter wave region is presented and some measured results is shown in this paper.

(84) Electromagnetically Coupled Power Divider Using Parasitic Element, by H. Izumi*, H. Arai** (*Kisarazu National College of Technology, Kisarazu-shi, 292-0041 Japan; **Division of Electrical and Computer Engineering, Yokohama National University, Yokohama-shi, 240-8501 Japan): *IEICE Trans. Electron.*, vol. E84-C, no. 10, pp. 1597–1601, Oct. 2001.

This paper describes an electromagnetically coupled microstrip divider that provides high output port isolation and DC cutting. The device consists of a parasitic resonator placed above microstrip patch resonators, achieving tight coupling for both input and output ports. FDTD simulation and measurements reveal that the device has a high isolation between output ports. Equal and unequal 2-way and 3-way power dividers are presented in this paper.

(85) Analysis on Inductive Coupling Structure of $\lambda/4$ Coplanar Waveguide Filter, by T. Tsujiguchi*, K. Tsunoda**, H. Matsumoto* (*Kanazawa Murata Manufacturing Co., Ltd., chi-8 Sodani, Tsurugi-machi, Ishikawa-gun, Ishikawa-ken, 920-2101 Japan; **Murata Manufacturing Co., Ltd., 2-26-10 Tenjin, Nagaokakyo-shi, 617-8555 Japan): *IEICE Trans. Electron.*, vol. J84-C, no. 10, pp. 972–979, Oct. 2001.

Inductive coupling structures for $\lambda/4$ coplanar waveguide (CPW) filter which has wide pass band in small size were investigated, and we found small reduction of unloaded Q at large coupling coefficient (k) using meandering short-circuit line. We propose an equivalent circuit by TEM transmission lines, and the validity of the equivalent circuit is confirmed by the experimental sample using a ceramic substrate with high dielectric constant. This coupling structure obtains 2–18% coupling coefficient (k). Therefore, it is useful for the inductive coupling of the CPW filter has wide pass band.

(86) A Multiport Representation of the Step Junction of Two Circular Dielectric Waveguides, by K. Pirapaharan*, N. Okamoto** (*Graduate School of Engineering, Kinki University, Higashi-osaka-shi, 577-8502 Japan; **Department of Electronics, Faculty of Science and Technology, Higashi-osaka-shi, 577-8502 Japan): *IEICE Trans. Electron.*, vol. E84-C, no. 11, pp. 1697–1702, Nov. 2001.

A multiport representation of the step junction of two circular dielectric waveguides of different size is given. Contin-

uous spectral modes of the circular dielectric waveguide are discretized at a terminal plane by means of expressing their mode amplitudes in the form of infinite series of orthonormal Gaussian Laguerre function. Applying the mode matching technique, a multiport representation of the step junction is derived. Numerical examples are given where the results are tested for the conservation of power. Also the numerical results are compared with those from Marcuse's approximate methods.

III. Microwave Antennas

(1) Time-Domain Near-Field Measurement of Antenna by IDFT Technique, by Z.-H. Xue, B.-Q. Gao, R.-X. Liu, S.-M. Yang and C. Liu (Beijing Institute of Technology, Beijing, P.R.C.): *AES*, vol. 29, pp. 1183–1187, Sept. 2001.

This paper describes a new method, which uses IDFT (Inverse Discrete Fourier Transform) technique to do time-domain near-field measurement for antenna. According to Fourier Transform Theory, the feasibility of this method is demonstrated. Some calculation examples show that this method is effective and exact. The errors led by this method are analyzed and the principles for deciding the key parameters in using this method are given.

(2) The Excitation of CA-RLSA by a Co-Planar Waveguide Circuit, by R.-H. Jin*, H.-W. Zhu* and M.-T. Ando** (*Shanghai Jiaotong University, Shanghai, P.R.C.; **Tokyo Institute of Technology, Tokyo, Japan): *AES*, vol. 29, pp. 1233–1235, Sept. 2001.

A planar feeding circuit is proposed, which is structured by co-planar waveguide and excites a rotating mode in parallel plate waveguide. A CA-RLSA fed by this circuit has a foreside beam. The structure is planar and available to integration and minimization even in millimeter wave band. It is also suitable to excite a CA-RLSA with a conical beam if parameters are properly changed. It is proved by the simulation and experiments that the mechanism and principle are reasonable.

(3) Simulation Results of Angular Spread Characteristics in Microcell Environment, by J.-X. Sun, Q.-X. Wei and K. Gong (Tsinghua University, Beijing, P.R.C.): *AES*, vol. 29, pp. 1269–1271, Sept. 2001.

Smart antenna and other spatial filtering technologies provide promising improvement to the future wireless communication systems. The successful implement of these technologies demands detailed research and analysis of the temporal and angular characteristics of the wireless channels. This paper introduces some simulation work about the temporal and angular spread characteristics in typical microcell environment using ray-tracing technique. The simulation results are divided into two parts: Line of Sight (LOS)'s and Non-Line of Sight (NLOS)'s. According to the temporal research method, the author uses average angular spread and rms angular spread to describe the characteristics of angular spread. The detailed descriptions of angular spread in typical microcell environment are also given.

(4) Effect of Mutual Coupling Between Antenna Elements on the Imaging of Synthetic Aperture Radiometer and Its Calibration, by X.-L. Dong, S.-W. Zhang, J. Wu, Y.-H. Huang and J.-S. Jiang (Chinese Academy of Sciences, Beijing, P.R.C.): *AES*, vol. 29, pp. 1280–1282, Sept. 2001.

Theoretical model of the effect of mutual coupling between antenna elements on the imaging of synthetic aperture radiometer (SARad) is established. The effect of mutual coupling on the resolution of SARad is analyzed. An analytical expression for the calibration of mutual coupling is presented. On the basis of theoretical results, a scheme for the calibration of SARad is proposed. Numerical simulations show the validity of the proposed method.

(5) FDTD Calculation of Antenna Impedance by a Simple and Efficient Method, by C.-W. Li and S.-W. Lu (Beijing University of Aeronautics and Astronautics, Beijing, P.R.C.): *AES*, vol. 29, pp. 1635–1637, Dec. 2001.

A new formula, which is based on δ-gap and probe sources, to calculate the antenna input impedance using the FDTD method is derived from Yee's difference equation. It is very simple and efficient, and reduces the errors of antenna impedance at the low frequencies near zero. The method makes it easy to calculate antenna input impedance. A monopole antenna on a box is simulated using FDTD, and the result shows that the errors of antenna impedance at the low frequencies disappear. A patch antenna fed by coaxial line is also calculated, and result has a good agreement with that by another software.

(6) Probe Errors Analysis and Correction in Time-Domain Near-Field Measurement, by C. Liu, Z.-H. Xue, B.-Q. Gao, R.-X. Liu and S.-M. Yang (Beijing Institute of Technology, Beijing, P.R.C.): *AES*, vol. 29, pp. 1689–1692, Dec. 2001.

Probe errors analysis and correction are the key technique in time-domain near-field measurement. It is deduced that the transform formulas of probe receiving character error function between different coordinate systems; used etime-windowf to get rid of the multi-reflection wave, and presented the selection principle of etime-windowf. Numerical results illustrated the efficiency of the new ways.

(7) Performance Analysis of Cellular CDMA Network Based on Smart Antenna Receiver, by H.-M. Zheng, W.-J. Zhu and G.-G. Bi (Southeast University, Nanjing, P.R.C.): *JCIC*, vol. 22, pp. 19–25, Apr. 2001.

In this paper the performance of uplink in the cellular CDMA network, based on the reception of smart antenna is analyzed in the frequency-selective fading channel. The analysis is under the asynchronous cellular CDMA system of multiple cells, in which BPSK modulation and Rake combination based on smart antenna reception are employed. The closed-forms of average error probability are derived. The numerical results show that the performance of cellular CDMA system based on smart antenna is improved greatly.

(8) Performance Analysis of Two-Stage Signal Processing Structure in Adaptive Antenna, by H.-W. Xiao and Y.-A. Liu (Beijing University of Posts and Telecommunications, Beijing, P.R.C.): *JCIC*, vol. 22, pp. 41–47, Dec. 2001.

A two-stage signal processing structure is proposed. From theoretical analysis and simulation, it is found that performance of two-stage signal processing structure and traditional one is similar, but the later processing structure can save much hardware. By this method, the restrictive problem of the calculation can be solved and the performance of systems is improved.

(9) FDTD Analysis for Satellite BFN Consisting of Rectangular Coaxial Lines, by S.-J. Xu and P. Zhou (University of

Science and Technology of China, Hefei, P.R.C.): *JIMW*, vol. 20, pp. 467–471, Dec. 2001.

The scattering characteristics of various rectangular coaxial line discontinuities, with which a satellite beam-forming network (BFN) was built, were investigated by the FDTD method. The scattering parameters were directly calculated through the simulation procedure of the wave propagation, thus the analysis was tremendously simplified as compared with the mode matching method. Good agreement was found between the numerical results and the experimental data.

(10) Phased Array Antenna Nulling Using Phase-Only Control, by Z. Cheng*, X.-F. Jiang** and S.-W. Lu* (*Beijing University of Aeronautics and Astronautics, Beijing, P.R.C.; **Beijing Institute of Radio Measurement, Beijing, P.R.C.): *JEIT*, vol. 23, pp. 286–291, Mar. 2001.

Based on a linear phased array antenna, sector nulling using phase-only control is analyzed by using a fast algorithm and a partly controlling method. And it can be modeled to a constrained discrete nonlinear optimization problem. An experiment is performed to verify the algorithm and the method.

(11) Design of Unequally Spaced Thinned Arrays Based on Genetic Algorithm and Simulated Annealing, by Y.-Q. Fu, N.-C. Yuan and J.-J. Mao (National University of Defense Technology, Changsha, P.R.C.): *JEIT*, vol. 23, pp. 700–704, July 2001.

A model of unequally spaced thinned array is given, which introduces a distance perturbation into the element of a thinned array, in order to improve the side-lobe level. Genetic algorithm and simulated annealing are used to design this kind of array. The pattern of a 200 elements linear array and a 40 x 20 planar array is presented for the isotropic element pattern, the results verifies the improvement of the side-lobe level.

(12) Analysis of the Effect of Radome on Antenna Radiation With the Spectral Domain Approach, by X.-Y. Cao*, J. Gao**, C.-H. Liang* and G.-X. Dai** (*Xidian University, Xi'an, P.R.C.; **Missile Institute Air Force Engineering University, Sanyuan, P.R.C.): *JEIT*, vol. 23, pp. 1246–1248, Nov. 2001.

The effect of radome on antenna radiation with the spectral-domain approach is analyzed. Radiated pattern of antenna with radome is calculated, and the conclusion is got that the experimental results agree with those calculated. The quantitative analysis of the effect of radome on antenna radiated pattern is given and provide valuable basis for the design of antenna and radome.

(13) Analyzing HF Antenna Characteristics on Dielectric Plane, by W.-B. Deng, Y.-T. Liu and X.-G. Liu (Harbin Institute of Technology, Harbin, P.R.C.): *JEIT*, vol. 23, pp. 1411–1416, Dec. 2001.

FDTD method is used to calculate the radiation characteristics of the antenna located on loss ground. The results calculated by different feed models are compared with each other. The important point of the paper is to calculate the radiation characteristics of monopole on dielectric plane, and analyzes input impedance change with the size change of conducting ground system on the surface of dielectric plane.

(14) Application of FDTD Method to the Analysis of Dual-Polarization Microstrip Antennas, by J.-X. Yin, H.-Y. Tan and K.-C. Liu (NUDT, Changsha, P.R.C.): *JM*, vol. 17, pp. 13–17, Mar. 2001.

A direct three-dimensional FDTD method is applied to full-wave analysis of dual-polarization aperture-coupled microstrip antenna. Using Gauss pulse source excitation, the parameters of antenna, such as resonance frequency, return loss, coupling level, gain, etc. can be obtained by FFT. Computed results are useful for optimal design of antenna.

(15) Analysis of Wire Antennas Using Wavelet Matrix Transform, by B.-H. Sun, Q.-Z. Liu and Y.-Z. Yin (Xidian University, Xi'an, P.R.C.): *JM*, vol. 17, pp. 67–72, Mar. 2001.

A study is made of the solution of wire antennas using wavelet transform. The impedance matrix equations obtained by MoM are efficiently solved using Daubechies discrete wavelet transform, several numerical samples indicate that wavelet transform can lead to sparse impedance matrix; hence the computing time is greatly reduced.

(16) A New Type of Broadband Printed Antenna, by Q. Jiang and W. Hong (Southeast University, Nanjing, P.R.C.): *JM*, vol. 17, pp. 17–23, Sept. 2001.

A new type of broadband printed twin-dipole antenna is proposed. A practical printed antenna was designed according to theoretical analysis by the Method of Moments (MoM) with integral equation. The measurement results indicate that bandwidth of the new antenna is larger than that of the normal microstrip dipole fabricated on the same substrate. Bandwidth greater than 23% at VSWR $<$ 2.0 can be obtained on a 0.8 mm substrate at the center frequency of 2 GHz. This new broadband printed antenna is easy to be integrated with MMIC, and suitable for element of array due to its simple planar configuration.

(17) Fractional Fourier Transform and the Computation of Near Field, by X.-L. Dong, J. Wu and J.-S. Jiang (Chinese Academy of Science, Beijing, P.R.C.): *CJRS*, vol. 16, pp. 18–21, Mar. 2001.

The integral representation of two-dimensional FRFT is proposed. On the base of the definition of one-dimensional fractional Fourier Transform (FRFT), after analyzing the radiated field of an aperture current distribution, the relationship between this field and the 2D-FRFT of the current distribution is presented. Discussions on two limitation cases show that the 2D-FRFT can provide a uniformly effective tool for the computation of aperture radiation both in Fresnel and in Fraunhofer regions.

(18) The Analysis of a Coaxial Probe-Fed Coupled Patch Antenna Using the FDTD Method, by F. Xu*, W. Hong* and Z.-W. Feng** (*Southeast University, Nanjing, P.R.C.; **Nanjing Research Institute of Electronics and Technology, Nanjing, P.R.C.): *CJRS*, vol. 16, pp. 34–38, Mar. 2001.

A method is proposed for the integrated use of conformal grids and rectangular grids. In the coaxial line region, conformal grids are used instead of the classical staircasing method. In other regions and boundaries, rectangular grids are used. This greatly increased the calculation efficiency. Besides, the FDTD method with nonuniform orthogonal grids, extrapolation techniques and perfectly match layer (PML) are also applied to analyze a coaxial feeding coupled patch antenna.

(19) The Influence for the Radiation Characteristic of the Antenna in Missile Due to Truncation of the Missile Body, by X.-L. Ding, J. Wang and C.-L. Lin (UEST of China, Chengdu, P.R.C.): *CJRS*, vol. 16, pp. 49–53, Mar. 2001.

The pattern of an antenna in missile was calculated by using GTD method. The influence for pattern of the antenna in missile was analyzed when the cylinder of tail, or the cone of head, or both ends of the missile body were truncated according to different lengths appropriately. The results show that the influence for antenna pattern due to truncation of the missile body is very small, thus the truncating disposal for the missile body is entirely possible in the antenna measurements.

(20) A Novel Dual Pointing Feed Horn, by H.-L. Zheng, Y.-Z. Yin, G. Fu and D.-M. Fu (Xidian University, Xi'an, P.R.C.): *CJRS*, vol. 16, pp. 54–56, Mar. 2001.

A new feed horn is introduced. The horn reflector idea was used in the design of the feed. The dual frequency band, perpendicular polarity and two beam pointing properties were realized. The design idea and correction method of beam of this feed was discussed emphatically. Also, the measurement results of the feed horn patterns are given.

(21) Synthesis of the Array Antennas Using Genetic Algorithm, by Y.-H. Ma (Zhongshan College, Zhongshan, P.R.C.): *CJRS*, vol. 16, pp. 172–176, June 2001.

A real coded genetic algorithm based on sorting is presented and applied to synthesizing the array antenna pattern by controlling only the current amplitudes. This algorithm improves on encoding, selection, crossover and mutation operations of SGA. It enhances searching efficiency greatly, and avoids effectively premature convergence. Good property is present in practical designs, the results obtained are better than those reported in the literature.

(22) Design of Microwave Omnidirectional Circularly Polarized Antenna, by Y.-F. Bo and L.-K. Liu (PLA Information Engineering University, Zhengzhou, P.R.C.): *CJRS*, vol. 16, pp. 182–184, June 2001.

By using computer data analysis and CAD technology, a microwave omnidirectional circular polarized antenna composed of Vee dipole array is designed. In the practical application, good result has gained.

(23) The Variable Phase Center of the Log-Periodic Dipole Antenna, by Y.-S. Jin, M.-Y. Dong, S.-L. He and J.-Y. Deng (China Research Institute of Radiowave Propagation, Xinxiang, P.R.C.): *CJRS*, vol. 16, pp. 323–328, Sept. 2001.

In this paper the condition making that the linear array have fixed phase center is derived. The variable phase center is defined for general linear array, which makes that the directive antenna can be used as elements of the interferometer array. The variable phase centers are calculated for the log-periodic antenna.

(24) FDTD Analysis of Tapered Slot Antenna Arrays, by Y.-Q. Fu, N.-C. Yuan and G.-H. Zhang (NUDT, Changsha, P.R.C.): *CJRS*, vol. 16, pp. 334–337, Sept. 2001.

This paper describes the FDTD analysis of infinite arrays of tapered slot antennas for UHF application. The computing region is reduced to one array cell by adopting Floquet's theorem. The scanning characteristics as phased array antennas in the frequency and spatial domains are mainly studied, and some valuable results are given.

(25) Realizing Multi-Step Amplitude Quantization of Ultralow Sidelode Phased Array Using Constrained Optimization, by T. Dong, X.-W. Xu and H. Zhu (Beijing Institute of Technology, Beijing, P.R.C.): *CJRS*, vol. 16, pp. 358–362, Sept. 2001.

A constrained optimization method to accomplish the amplitude quantization of ultralow sidelobe phased array excitation is described. In this method, the 2-D separable multi-step amplitude quantization and the correction of element mutual coupling of phased array synthesis are realized by means of introducing proper constrains into the optimization model. This method can be applied to other forms of phased array.

(26) Full-Wave Analysis and Broadband Design of Bow-Tie Microstrip Antenna, by X.-P. Zhang and S.-S. Zhong (Shanghai University, Shanghai, P.R.C.): *CJRS*, vol. 16, pp. 419–421, Dec. 2001.

A full-wave method (MOM) is presented to analyze the bow-tie microstrip antenna, which has wider application than the multiport network method. A design method for broadening bandwidth is developed. By using asymmetry microstrip feeding, two adjacent-frequency modes are excited, which makes VSWR bandwidth be broadening significantly. The measured results are in good agreement with the calculated ones, which verifies the validity of this numerical analysis and design procedure.

(27) Design of the Frequency Selective Surface With Transformation of Linear-to-Circular Polarization, by J. W. Ko*, Y. K. Cho** (*School of Electronic Engineering, Kumoh National University of Technology, Pohang, Korea; **School of Electronic and Electrical Engineering, Kyungpook National University, Daegu, Korea): *JKEES*, vol. 38-TC, no. 1, pp. 27–42, Jan. 2001.

The new periodic array structure of frequency selective surface with polarizer's characteristic is proposed. The present structure is constructed with two sheets of FSS material, spaced about one-eight wavelength apart, the dipole element orientations of the two sheets being almost perpendicular to each other. The methods of the spectral domain immittance and MoM are used to analyze electromagnetic scattering from this periodic array structure. To confirm the validity of the polarizer's functions of the new periodic array structure, frequency selective surfaces are fabricated, calculated values for the frequency response of the reflection and transmission loss are compared with measured values. Good correspondence has been observed between them. Good axial ratio has been also observed to be achieved in the proposed structure.

(28) Design for the Circularly Polarized Microstrip Cross Dipole Array Antenna by Electromagnetic Coupled Technique, by K.-S. Min, J.-N. Lim (Department of Radio Sciences and Engineering, College of Sciences and Engineering, Korea Maritime University): *JKEES*, vol. 12, no. 1, pp. 50–57, Jan. 2001.

This paper describes a design for the circularly polarized microstrip EMC cross dipole array antenna with the wide bandwidth. To realize the characteristics of wide bandwidth and circular polarization, the electromagnetic-coupled cross dipole el-

ement is proposed. The optimum design parameters of a circularly polarized EMC cross dipole element are calculated by the FDTD and the Ensemble. To obtain the uniform aperture illumination of electric field in an array, offset technique that the cross dipole elements are alternatively arranged on center of the microstrip feed line is adopted. In 20-element array design, the calculated axial ratio and gain are about 0.1 dB and 9.9 dBi at 12 GHz, respectively. The frequency characteristics of a fabricated 20-element array antenna are measured. The calculated results agree well with the measured ones.

(29) A Broad-Band Microstrip Patch Antenna for B-WLL System Applications, by C.-Y. Oh, S.-H. Seo, S.-s. Oh, M.-K. Yoon, E.-b. Kim, Y.-S. Kim (Department of Radio Sciences and Engineering, Korea University, Radio and Broadcasting Technology Laboratory, ETRI): *JKEES*, vol. 12, no. 1, pp. 58–64, Jan. 2001.

A microstrip patch antenna with B-WLL applications is designed and manufactured. To make a array antenna the size of patch antenna was miniaturized. A broad band is obtained by two additional parasitic elements which are closely located to the main patch. The bandwidth of the manufactured antenna is 15% at the center frequency of 26.8 GHz. Radiation patterns are measured over a wide bandwidth.

(30) Design and Analysis of PIFA With Dual Frequency Operation, by J.-H. Park*, N. Kim** (*Department of Information and Communication Engineering, Chungbuk National University; **School of Electronic and Electrical Engineering, Choongbuk National University): *JKEES*, vol. 12, no. 1, pp. 107–116, Jan. 2001.

In this thesis, characteristics of compact PIFA is analyzed for operation in dual frequencies (dual-PIFA) as variety of parameters. The antenna is composed of two patches. These are operated in high frequency and low frequency. The dimension of experiential antenna is fixed for attaching at the handset. The variable parameters are dimension of small patch, length of shorting strip and dimension of folded conductor plate, the frequencies are 900 MHz and 1800 MHz. The compact antenna is implemented with 2-layer type, electric field intensities and radiation patterns are simulated. In order to analyze characteristics of a performance as variety of parameters, FDTD method is used.

(31) Design of U-Slot Array Antenna for PCS Base Station, by J.-S. Jean (KT M.com R&D Division): *JKEES*, vol. 12, no. 1, pp. 117–124, Jan. 2001.

In this paper, the design of a U-slot array antenna for PCS base station has been implemented and studied. The U-slot antenna is a single layer type with an antenna volume smaller but a bandwidth lager than the designs utilizing parasitic patches, which exceed 17% bandwidth, for the probe fed case. Designed U-slot array antenna has stable radiation patterns and an average gain above 12 dB across the PCS frequency band. In this paper, through the designing of a U-slot array antenna, we have presented the availability for PCS base station antenna.

(32) Design and Fabrication of a Dual Polarized Load-Bearing Microstrip Antenna, by R.-M. Lee*, J.-S. Lee*, W.-S. Park*, H.-C. Park**, W.-B. Hwang** (*Department of Electronic and Electrical Engineering, Microwave Application Research Center, Pohang University of Science and Technology; **Department of Mechanical Engineering, Pohang University of Science and Technology): *JKEES*, vol. 12, no. 1, pp. 125–135, Jan. 2001.

A 8×4 microstrip antenna array is designed at 5.3 GHz and its characteristics are investigated with respect to the application in dual polarized synthetic aperture radars. The design is focused on the achievement of a wide bandwidth, a high polarization purity, a low loss, a good isolation and some mechanical requirements suitable for the application. The antenna is fed by a -3 dB tapered feed network, and is composed of dual polarized SSFIP (Strip-Slot-Foam-Inverted Patch) elements with honeycomb and shielding plane. Simulation results for the antenna array are presented and compared with measurements. It is observed that the antenna shows a bandwidth of 80 MHz, a polarization isolation better than 20 dB, an isolation of 40 dB, and good mechanical characteristics.

(33) Characteristics of Stacked Probe-Fed Square-Ring Microstrip Antenna, by J.-Y. Lee*, J.-G. Rhee**, S.-C. Kim** (*Department of Electronic Communication Radio Science and Engineering, Hanyang University; **Department of Electronic Engineering, Hanyang University): *JKEES*, vol. 12, no. 1, pp. 143–152, Jan. 2001.

A method for miniaturization of microstrip patch antenna without degrading its radiation characteristics is investigated in this paper. It involves perforating the patch to form a microstrip square-ring antenna, and it's BW enhancement is investigated numerically and experimentally. A ring geometry introduces additional parameters to the antenna, and those are used to control impedances, resonance frequencies, and bandwidths. For a single square ring antenna, an increase of the size of perforation increases its input impedance, decreases the resonance frequency, and bandwidths. But it affects little on directivity of the antenna. To match the antenna to a transmission line and also enhance its bandwidth, the ring is stacked by a square patch or another square ring. Also numerically simulated results by the IE3D, and experimental data are compared for proof.

(34) A Comparison Study of Antenna Feed Models Suitable for Computation of Responses for a Ground-Penetrating Radar, by S. Y. Hyun*, S. Y. Kim** (*Department of Radio Sciences and Engineering, Korea University, Seoul, Korea; **Imaging Media Research Center, Korea Institute of Science and Technology, Seoul, Korea): *JKEES*, vol. 38-TC, no. 2, pp. 61–69, Feb. 2001.

An accurate and efficient antenna feed model is very important for computing GPR responses using the FDTD method. In literature, there are several feed models such as the equivalent network in angular-frequency domain, 1-D transmission-line cell, voltage boundary condition in time domain, etc. In this paper, theoretical relationship among the models is investigated. It is found that the above three models become equivalent when a short and lossless feed line can match with its connected transmitter (or receiver). In view of accuracy and efficiency of the simulation, the FDTD results according to the feed models are compared with the measured data of the receiving responses for an actual GPR system.

(35) Small-Sized GPS/GLONASS Patch Antenna Using a Ceramic Dielectric, by J.-S. Moon, T.-K. Lee (School of Electronics, Telecommunication, and Computer Engineering,

Hankuk Aviation University): *JKEES*, vol. 12, no. 2, pp. 217–226, Feb. 2001.

A small sized ceramic dielectric patch antenna is designed and implemented for GPS/GLONASS combined receiver, and it shows a wideband characteristics with circular polarization. For the miniaturization of the antenna, high-permittivity dielectric material is used, and the wideband characteristics with low axial-ratio is achieved by using dual feed with 90° phase difference. The measured data of the manufactured antenna show that the bandwidth is 242 MHz, the axial ratio is less than 3 dB, the half-power beam-width is more than 112°, and the antenna satisfies the required characteristics of the GPS/GLONASS antenna.

(36) The Wide-Band and High-Gain Strip Patch Antenna Coupled With a H-Shaped Aperture, by H. S. Shin, N. Kim (Department of Computer and Communication Engineering, Chungbuk National University, Choungju, Korea): *JKEES*, vol. 38-TC, no. 4, pp. 149–159, Apr. 2001.

The design, fabrication, and an experimental implementation of the strip patch antenna coupled with a H-shaped aperture are presented in this paper. The proposed antenna has the wide bandwidth, high gain, and low cross-polarization levels. We measured the VSWR, smith chart impedance characteristic, co/cross polarization pattern, gain, and so on. The measured bandwidth of this antenna is 47.1%. To reduce the back lobe and increase the gain, when the reflector is used, cross polarization level is below -18.2 dB at E-plane and below -25.7 dB at H-plane. The maximum gain at 2.05 GHz is also 10.4 dBi and the 3 dB gain bandwidth with center frequency at 2.17 GHz is 24%, which is the wide bandwidth. This antenna can find applications in mobile communication, wireless LAN, RF communication system, and so on.

(37) The Design of a PCS Band Microstrip Patch Antenna With Auxiliary Wire and Annular Gap, by K.-S. Choi, J.-S. Yoon, M.-R. Ryu, W.-H. Lee, J. Hur (Department of Electronics, Information and Communication Engineering, Konkuk University): *JKEES*, vol. 12, no. 3, pp. 329–338, Apr. 2001.

In this paper, we designed microstrip patch antenna to enhance the weak point of general microstrip patch antenna that has narrow bandwidth and analyzed that. To reduce reactance in probe feed antenna, capacitive gap added to the patch. Using single patch and auxiliary wire, makes dual frequency resonant. So bandwidth is improved and gain also becomes higher. To verify with experiment, PCS band antenna is designed, fabricated. For PCS band antenna, bandwidth is 180 MHz in VSWR 1.5 and gain is 8.6 dBi.

(38) A Design of Wideband Eccentric Annular Ring Microstrip Antenna, by D.-B. Seol, Y.-C. Yoo, H.-B. Yoon (Department of Electronics Engineering, Dongguk University): *JKEES*, vol. 12, no. 3, pp. 370–377, Apr. 2001.

This paper proposed an eccentric annular ring microstrip antenna which has an asymmetric slot and a tuning stub for improving bandwidth and size of the circular microstrip patch antenna. The field characteristics of the eccentric annular ring microstrip antenna have been calculated by using the method of FDTD (finite difference time domain). The calculated results showed good agreement with the measured results. As a result of measurement, the antenna size and the bandwidth has been improved to that of 12.2% and 4.8% respectively, comparing to circular microstrip patch antenna.

(39) Design and Fabrication of Aperture-Coupled Microstrip Cylindrical Dielectric Resonant Antenna for Wireless LAN, by K.-I. Lee*, H.-S. Kim** (*Department of Telecommunication Engineering, Cheju National University; **Faculty of Telecommunication and Computer Engineering, Cheju National University): *JKEES*, vol. 12, no. 3, pp. 425–431. Apr. 2001.

In this paper, on aperture-coupled microstrip cylindrical dielectric resonant antenna (DRA) consisting of dielectric material with permittivity $\varepsilon r = 36$ is designed and fabricated for wireless LAN. First of all, the feedline length, width, slot length and width of the feeding element were calculated using the theory of microstrip transmission line. Radiation element is designed using the theory of cylindrical dielectric cavity. Resonant frequency of the fabricated cylindrical DRA is 2.449 GHz and VSWR, return loss and bandwidth is 1.009, -47 dB and 70 MHz, respectively. Front-to-back radiation ratio is about 12 dB and 3 dB beamwidth of E-plane and H-plane is 110° and 90°, respectively.

(40) Microstrip Circular Slot Antenna Using a Spiral Line, by M. K. Kim, I. M. Park (School of Electronics Engineering Ajou University, Suwon, Korea): *JKEES*, vol. 38-TC, no. 5, pp. 182–188, May 2001.

A novel microstrip circular slot antenna fed by a spiral-line is presented in this paper. This antenna is a planar equivalent structure of an eccentric spiral antenna generates a circularly-polarized wave. We have investigated the input impedance and radiation characteristics of this antenna by using an EM (electromagnetic) simulator, and obtained a design method for optimum structure. The main characteristic of the antenna is that the main beam direction is off-normal to the antenna plane and moves linearly into θ and ϕ direction as the frequency increases. This feature allows one to predict the main beam direction easily for a given operating frequency. This antenna has axial ratio lower than 3 dB in the direction of main beam over one octave bandwidth.

(41) Characterizations of Spherical Luneburg Lens Antennas With Air-Gaps and Dielectric Losses, by K. W. Kim (L-3 Communications Company): *JKEES*, vol. 1, no. 1, pp. 11–17, May 2001.

In this paper, spherical Luneburg lens antennas have been systematically analyzed using the Eigenfunction Expansion Method (EEM). The developed technique has capability of performing a complete 3-D analysis to characterize the multi-layered dielectric spherical lens with arbitrary permittivity and permeability. This paper describes the analysis technique, and presents the results of the parametric study of Luneburg lens antennas by varying design parameters such as the diameter of the lens antenna (up to 80 wavelength), number of spherical shells (up to 30 shells), air-gaps between spherical shells, and dielectric loss of the material. Many representative engineering design curves including the far-field patterns, wide-angle sidelobe characterizations, antenna efficiency have been presented.

(42) Design of Dual Band Antenna by EMC Feeding Structure, by J.-S. Jeon (Korea Telecom Freetel): *JKEES*, vol. 1, no. 1, pp. 24–29, May 2001.

In this paper, the wideband microstrip antennas for the PCS & IMT-2000 dual band are studied. Experimental and simulation results on the dual band antenna are presented. Simulation results are in good agreement with measurements. The experimental and simulation results confirm the wideband characteristics of the antenna. The studied antenna satisfies the wideband characteristics that are required characteristics for above 420 MHz impedance bandwidth for the PCS & IMT-2000 dual band antenna. In this paper, through the designing of a dual band antenna, we have presented the availability for PCS & IMT-2000 base station antenna.

(43) Forced Resonant Type Cutoff Cavity-Backed Slot Antenna Elements for Electromagnetic Power Transmission, by K.-C. Kim*, I.-S. Kwon** (*School of Electrical Engineering and Computer Science, Yeungnam University; **LG Electronics Inc.): *JKEES*, vol. 1, no. 1, pp. 37–42, May 2001.

This paper presents the basic characteristics of a cutoff cavity-backed slot antenna, for the application of spacetenna, with a feed post and a parasitic post inserted parallel to the slot. This type of antenna might effectively excite the slot and forcibly resonate the cavity by adding external reactance to the parasitic post. The Galerkin's method of moments is used to analyze integral equations for the unknown electric current on each post and electric field in the slot. The value of external reactance for forced resonance is discussed by deriving a determining equation, the current distribution on each post and the radiation patterns are considered. The analysis is in excellent agreement with the experiment for the radiation patterns.

(44) Compact Size Wideband Microstrip Antenna Element for Repeater and Base Stations at 2 GHz, by Y. Choi, B. Lee (Department of Radio Engineering, Kyunghee University): *JKEES*, vol. 1, no. 1, pp. 43–47, May 2001.

A compact size microstrip antenna element using FR-4 substrate is proposed for use in repeater and base stations. Two stacked patches are aperture-coupled by two split feedlines. Rectangular stubs on the split feedlines are laid under the aperture and have the effect of considerably lowing the magnitude of $S11$ [dB] and broadening impedance bandwidth. The designed structure has been fabricated and measured. Based on 20 dB, the return loss bandwidth is about 16.8% (1.86 GHz$\sim$2.20 GHz), which covers the frequency range assigned for IMT-2000 with a large margin. The overall dimension of the proposed antenna structure is 37 mm $\times$ 41 mm $\times$ 19 mm (very compact). The antenna gain is more than 7.5 dBi over the required frequency range.

(45) Design of Plano-Convex Lens Antenna Fed by Microstrip Patch Considering Integration With Microwave Planar Circuits, by S.-G. Yu, D.-M. Yeon, Y.-H. Kim (Department of Mechatronics, Kwangju Institute of Science and Technology): *JKEES*, vol. 1, no. 1, pp. 67–72, May 2001.

In this paper, the plano-convex lens antenna fed by a single patch is studied for a microwave remote-traffic monitoring sensor with constraints of small size and low cost. Measurement of an AUT (Antenna Under Test) involves the considerations of a triangular groove for matched layer and metallic shielding effects. A formulation for extracting the parameters of a plano-convex lens antenna, based on geometrical optics, is introduced using Fermat's principle of the equi-phased ray condition. Teflon ($\varepsilon r = 2.0$) is chosen as a material of a plano-convex lens antenna for adjustment of aberrations on the lens surfaces automatically. A fabricated plano-convex lens shows 3-dB beamwidth of 7.5 degree and side-lobe level of -29 dB with an aperture distribution of the parabolic-squared taper on pedestal. This lens supports easier integration with the planar microwave circuits by using a microstrip single patch as a primary feeder of the lens antenna.

(46) Design of a Small Microstrip Antenna to Load Capacitors, by Y. H. Ko*, S. H. Sun* (Department of Information and Communication Engineering Dongshin University, Naju, Korea): *JKEES*, vol. 38-TC, no. 6, pp. 216–225, June 2001.

In this paper, the MSA to load a capacitor without limitation of the electric force on the transformed MSA is proposed. Bandwidth of the proposed antenna is 7.76% at the resonant frequency of 1.9 GHz, is observed the resonant frequency and bandwidth versus change of any arbitrary feed point. It was found that the bandwidth of this MSA to load a capacitor is broader than that of the transformed MSA. Antenna's equivalent circuit with transmission line model is designed to find more accurate resonant frequency and is calculated return loss value. The calculated value is agreed reasonably with experimental value.

(47) The Detection Method of a Target Position Above a Ground Medium Using the Buried Antenna, by J.-S. Cho, C.-Y. Kim, S.-H. Lee, J.-C. Jung (Department of Electronics, Kyungpook National University): *JKEES*, vol. 12, no. 4, pp. 521–531, June 2001.

This paper presents the extraction scheme of the scattered waves by a target above the ground using the buried antenna in a lossy and dispersive medium. The half wave dipole antennas are used to transmit and to receive a signal. The transmission line model as a feeding model is considered to take into account the effect of transmission line in a real system. The ground is modeled by the 2nd order Debye approximation with the dispersion and loss. PLRC algorithm and DPML as absorbing boundary condition are utilized to apply the 2nd order Debye approximation to FDTD. To extract the scattered wave, in addition, we employed the delay time extraction algorithm. The simulations are conducted to observe the variation of magnitude in scattered wave and detection of target position according to the change of moisture content of the lossy medium.

(48) Gain Analysis of the Radome Circular Microstrip Antenna Using the Attachment Mode, by D.-H. Choi*, K.-B. Park*, Y.-B. Jung*, S.-O. Park*, Y.-C. Moon**, S.-I. Jun** (*Information and Communications University; **Electronics and Telecommunications Research Institute): *JKEES*, vol. 12, no. 4, pp. 532–541, June 2001.

In the case of the microstrip antenna with the coaxial probe-feeding, there is rapidly-varying patch current near the point where the probe feed is connected to the patch. We represent this current distribution using the attachment mode that insures continuity of currents from the feed to the patch. In this paper, we can accurately analyze the effect of a cover layer or radome for an antenna with the attachment which model rigorous probe feed.

(49) Optimum Design of T-Shaped Microstrip-Line-Fed Slot Antennas, by K. Kim, Y. Suh, I. Park (School of Electronics Engineering, Ajou University): *JKEES*, vol. 12, no. 4, pp. 562–569, June 2001.

This paper presents the optimum design method for T-shaped microstrip-line-fed slot antennas on various substrates. Since the impedance bandwidth of the antenna depends highly on the vertical offset position and the length of horizontal strip conductor, we derived the formulas regarding these design parameters to get the maximum bandwidth. The formulas can compute the offset position and the length of horizontal strip conductor for any given substrate parameters. We compared the results obtained by using these design formulas and the one obtained by the simulation for each slot width, and it showed very good agreement.

(50) Design of the Aperture Coupled Microstrip Antenna With Tilted Beam, by J. K. Ha*, D. C. Park** (*BlueWaveTel Co., Ltd.; **Department of Radio Science and Engineering, Chungnam National University): *JKEES*, vol. 12, no. 5, pp. 705–712, Aug. 2001.

In this paper, a new type of apertcod microstrip patch antenna with tilted-beam based on the principal of the dipole yagi antenna is proposed and investigated experimentally. Its configuration is composed by 3 types of patches; reflector, driver, and director. Tilted beam patterns are effected by many parameters as those of dipole yagi antenna; sizes of the patches, gaps between the patches, characteristics of the substrates, feeding method and etc. Therefore, in this paper, the effects of varying design parameters of this antenna are studied with a goal of enhancing the gain and tilting the beams. A microtrip patch antenna with tilted beam based on performance trade-offs is designed and fabricated. Measured and simulated results for return loss and radiation patterns are presented. It has 45° tilted beam and very close to simulation beam pattern at resonant frequency, 2.58 GHz.

(51) A Study on Compound Technique for Increasing the Bandwidth of Microstrip Antennas Using the Parallel Coupled Lines, by J.-I. Kim*, M.-G. Han**, Y.-J. Yoon*** (*Electronics and Telecommunication Research Center; **Department, Electrical and Electronic Engineering, Yonsei University; ***Department Electrical and Mechanical Engineering, Yonsei University): *JKEES*, vol. 12, no. 5, pp. 713–721, Aug. 2001.

In this paper, parasitic patches gap-coupled microstrip antenna and stacked microstrip patch antenna combined with parallel coupled lines, which are a kind of wideband impedance matching network, are proposed to get the wider bandwidth. The iterative method using a distributed network is proposed to design the parallel coupled lines as a wideband impedance matching network. Measurements show that the proposed antennas provide wider bandwidths $\sim$1.6 times and $\sim$1.5 times those of conventional parasitic gap-coupled microstrip patch antenna and stacked microstrip patch antenna. In addition, measured radiation patterns show no serious variation of radiation patterns though the parallel coupled lines is added. The antenna gain is, however, lowered about 1 dB and 0.5 dB by the coupling loss in the parallel coupled lines.

(52) Design of Shaped Offset Gregorain Antennas for Domestic Satellites, by D.-J. Lee*, H.-K. Choi*, S.-H. Yun**, J.-H. Han**, J.-H. Park**, S.-P. Lee** (*School of Electronics Engineering and Computer Science, Dankook University; **Electronics and Telecommunications Research Institute): *JKEES*, vol. 12, no. 5, pp. 765–776, Aug. 2001.

In this paper, a shaped offset Gregorian antenna is electrically designed for Ku band FSS antennas of the domestic communications and broadcasting satellite which will be launched in the near future. For this, a design procedure for shaped offset Gregorian antennas is described in detail, and a satellite antenna is designed by using the described design procedure. The radiation characteristics of the designed antenna are evaluated and compared with the design goals. The designed antenna is found to have 1.2° beamwidth, 38.57 dBi EOC gain, and 43.19 dBi gain at Tx frequency 12.25 GHz and 1.08° beamwidth, 38.12 dBi EOC gain, and 44.11 dBi gain at Rx frequency 14.0 GHz. And also, side lobe levels and cross-polarization levels are less than -30 dB and -33 dB, respectively. From these results, the designed antenna is found to be able to use for the domestic satellite FSS antennas.

(53) Broad-Band Microstrip Patch Antenna With an L-Shaped Strip, by J.-K. Kim*, H.-J. Lee*, H.-S. Oh** (*Korea Electronics Technology Institute; **Department of Electronic Engineering, Konkuk University): *JKEES*, vol. 12, no. 5, pp. 827–836, Aug. 2001.

The L-shaped strip is shown to be an attractive feed for the thick microstrip antenna (thickness around 10% of the operating wavelength). The L-strip incorporated with the radiating patch introduces a capacitance suppressing some of the inductance introduced by the strip itself. In this paper, a wideband microstrip patch antenna fed by L-strip for the PCS (1750$\sim$1850 MHz) and IMT-2000 (1920$\sim$2170 MHz) broad-band is presented. A two-element array fed by L-strip is also proposed. Both the antennas have stable radiation patterns across the passband. The impedance bandwidth is over 31% (VSWR $<$ 1.5, 615 MHz) of the center frequency. Moreover, both the antennas have about 7 dBi average gain.

(54) Design of Wide Band U-Slot Patch Antennas for Mobile Communications, by J.-S. Jeon (KTF TCS Team): *JKEES*, vol. 12, no. 6, pp. 882–889, Oct. 2001.

In this paper, the characteristics of u-slot antennas are computed by changing the feed structure, and compared with the measured results. The impedance bandwidths of 13% (255.1 MHz) and 30.7% (602.1 MHz) are obtained for probe feed and L-strip feed, respectively. It is known that the designed L-strip feed can be used for increasing the bandwidth of u-slot antennas. In addition, it is shown that the designed L-strip fed u-slot antenna can be used for domestic PCS and IMT-2000 dual band applications.

(55) Implementation of a Smart Antenna System for Wide-Band CDMA WLL Channel, by M. Kim*, H. Hwang*, J. Kim**, H. Bahk**, S. Kim***, S. Choi* (*School of Electrical and Computer Engineering, Hanyang University; **Hantel Co., Ltd.; ***Korea Institute of Industrial Technology Evaluation and Planning): *JKEES*, vol. 12, no. 6, pp. 912–918, Oct. 2001.

This paper presents a performance analysis of experimental observations of a uplink smart antenna system operating in a wide-band CDMA environment designed for a WLL (Wireless

Local Loop) system. The numerical results shown in this paper have been obtained from practical experiments using commercially developed mobile terminals. The beam pattern provided by the weight vector and the resultant BER (Bit Error Rate) are observed in both indoor and outdoor signal environments. From the experimental observations, it is concluded that the proposed smart antenna system provides significant improvements in receiving both indoor and outdoor signal environments.

(56) The Research of Single Fed Broadband Planar Array Antenna With Modified Stacked-Structure Using Circular Polarization, by Y.-B. Jung*, Y.-H. Lee**, J.-I. Moon**, S.-O. Park**, G.-K. Ha*** (*Antenna Technology Research Center, ETRI; **School of Engineering, Information and Communication University; ***Bluewave Telecommunications Inc.): *JKEES*, vol. 12, no. 6, pp. 919–930, Oct. 2001.

This paper presents a wideband technique of impedance and axial-ratio bandwidth which uses the stacked planar array structure through optimum design of sub-polarization generating sections and parasitic patch. So, the effect of the dual-resonance characteristic can contribute to the bandwidth expansion of single fed planar array antenna using circular polarization which doesn't hire previous bandwidth expansion technique. The antenna can be used as a dual-band antenna by adjusting the resonance frequencies as well, and then the antenna is designed and fabricated in the frequency band of domestic satellite-TV service. This antenna has the performance of 9.7% impedance bandwidth and 24 dBi of antenna gain. And it has also 2.8% and 1.4% of 3 dB Axial-ratio bandwidth at 11.4 GHz and 11.8 GHz respectively.

(57) Efficient Analysis of Couplings Through Periodically Arranged Slots in a Radial Line Slot Antenna, by J. Lee, Y. Kim, J. Park, S. Nam (School of Electrical Engineering and Computer Science, Seoul National University): *JKEES*, vol. 12, no. 6, pp. 931–938, Oct. 2001.

The slot coupling characteristics was analyzed in a radial-line slot antenna for its design. The previously proposed waveguide model with a periodic boundary condition on its narrow walls and periodically arranged slots on its wide wall was used. The magnetic field integral equation and two dyadic Green's functions for respective regions was derived and the method of moments was used. To maximize the efficiency of numerical analysis and to extract singularities, two different kinds of basis functions, the entire domain basis function and the sub-domain one, are used. In addition, the Ewald sum technique for the rectangular waveguide and the Shanks transform for the half space were used to accelerate the computation of the slowly convergent potential Green's functions. Simulation results expressed the effects of the various design parameters on the slot coupling.

(58) A Novel Feed Structure for a Broadband Microstrip Circular Slot Antenna, by Y. H. Suh, I. Park, C.-C. Shin (School of Electronics Engineering, Ajou University): *JKEES*, vol. 12, no. 6, pp. 948–957, Oct. 2001.

We proposed a novel feed structure for a broadband circular slot antenna. The proposed antenna has a circular slot, a radiating element, and a novel microstrip feed structure which is composed of a 50 Ω microstrip feedline and a circular-shaped microstrip patch. This antenna is analyzed and optimized by using the finite difference time domain (FDTD) method. The impedance bandwidth of optimized antenna is 1.94 octave that is much broader than the conventional microstrip slot antennas.

(59) Design of Wideband Printed Monopole Antenna, by J. P. Lee*, S. O. Park*, S. K. Lee** (*Information and Communications University; **ShinA Information and Telecommunications Co., Ltd.): *JKEES*, vol. 12, no. 6, pp. 958–964, Oct. 2001.

In this paper, we propose a novel wide band printed monopole antenna called the staircase bow-tie monopole antenna (SBMA). We apply an extraordinary method for an impedance matching to conventional bow-tie monopoles. So we get the SBMA with a very wide band. Our antenna is smaller than a quarter wavelength in size but provides a $2:1$ VSWR bandwidth of about 77.1%. An antenna gain and a radiation pattern are about 1.7 dBi and omni-directional at 1.7 GHz, respectively.

(60) Triangular U-Slot Patch Antenna for PCS & IMT-2000 Dual Band, by J.-S. Jeon (KTF TCS Team): *JKEES*, vol. 12, no. 6, pp. 965–971, Oct. 2001.

In this paper, the triangular u-slot patch antenna for the PCS & IMT-2000 dual band are studied. The frequency bandwidth of a triangular u-slot patch antenna can be increased by L-strip fed structure. The impedance bandwidth (VSWR ≤ 2) of the fabricated single element is 590 MHz (30.18%). Using the frequency bandwidth of PCS & IMT-2000, we confirm VSWR below 1.65, which is a good characteristic. Thus the wideband characteristic of the L-strip fed structure is confirmed experimentally.

(61) The Design of Small Size and High Gain Chip Ceramic Dielectric Antenna for Bluetooth Application, by J.-I. Moon*, S.-O. Park*, D.-J. Lee**, Y.-S. Wang**, C.-K. Lee** (*Information and Communications University; **Lathron Co., Ltd.): *JKEES*, vol. 12, no. 6, pp. 983–993, Oct. 2001.

This paper proposed a novel chip type ceramic dielectric antenna by using the advanced meander line technique that the radiational metals are formed on the face of ceramic dielectric ($8 \times 4 \times 1.5$ mm, alumina) and both faces of substrate (1.0 mm thickness, FR-4). The performance of the antenna model has a good agreements between measurements and computed results. Resultly, it has a 10 dB return-loss bandwidth (2.4$\sim$2.4835 GHz) and 1.7 dBi measured radiation gain for Bluetooth application. The proposed antenna model can overcome the limited radiation of the small-sized antenna.

(62) Base Station Antenna With Rectangular Radiation Pattern Using Strip Feeding Planar Monopole Array, by H.-C. Shin*, S.-M. Moon**, J.-M. Woo** (*Department of Radio Communication, Juseong College; **Department of Radio Science and Engineering, Chungnam National University): *JKEES*, vol. 12, no. 6, pp. 1018–1024, Oct. 2001.

In this paper, an array antenna is designed for base station of a street micro-cell in urban areas. It has a rectangular radiation pattern. The current distribution of the array is decided by using a modified Woodward–Lawson sampling pattern synthesis method. To confirm the realization of the array antenna with rectangular pattern, 12 array antenna with a planar type monopole fed by stripline is fabricated and measured. In the results of the measured values, H-plane pattern of the antenna nearly yields a rectangular radiation pattern.

(63) A Design and Fabrication of Microstrip Patch Antenna for PCS Band and IMT-2000 Band, by W. H. Lee, K. S. Choi, J. Hur (Department of Electronics, Information and Communication Engineering, Konkuk University, Seoul, Korea): *JKEES*, vol. 38-TC, no. 12, pp. 476–475, Dec. 2001.

In this paper, to improve bandwidth of microstrip antenna, we discussed the patch structure using dual patch and probe feed. To provide PCS service and IMT-2000 service simultaneous, a microstrip patch antenna needs impedance bandwidth of 22%. We propose wide-band microstrip path antenna without complexity. To analyze characteristics of microstrip patch antenna, we used Ensemble of commercial software. The microstrip patch antenna was designed, fabricated, and tuned. The result was that 500 MHz (25.5%) of impedance bandwidth for VSWR 2430 MHz (21.9%) of impedance bandwidth for VSWR 1.5. The microstrip patch antenna has side lobe of -14 dB. The front to back ratio is 20 dB overall. The measured gain of the micostrip patch antenna is 5.2 dBi.

(64) Design for Linearly Polarized Microstrip Antenna Using Electromagnetic-Coupled Dipoles, by K.-S. Min*, C.-S. Jang** (*Department of Radio Sciences and Engineering, Korea Maritime University; **Shin Dong Ltd.): *JKEES*, vol. 12, no. 7, pp. 1057–1066, Dec. 2001.

This paper describes a design for linear polarization antenna using the EMCD (electromagnetically coupled dipole). The analysis and the design of model antennas are conducted by FDTD method. Vertical and horizontal linear polarizations are easily obtained by variation of dipole position. In 1-element antenna design, mutual coupling between microstrip feed line and radiator is considered. Design parameters of each 1-element antenna with vertical and horizontal polarization are used for array design. Radiation power and main beam tilting angle can be controlled by the offset and the distance between radiating elements in an array, respectively. 5-element array antennas are fabricated and measured to prove the design validity. The results of FDTD simulation and measurement show the reasonable agreement.

(65) Analysis of Annular Corrugated Horn Using FDTD, by D.-H. Kim*, B.-M. Son**, Y.-G. Koo** (*SK Teletech Corp; **Department of Electronics Engineering, Hongik University): *JKEES*, vol. 12, no. 7, pp. 1067–1075, Dec. 2001.

The fields at the aperture of conical horn antenna with corrugations parallel to the axis have been analyzed using FDTD (Finite Difference Time Domain). Easy calculation depending on the change of the structure of antenna and time reduction can be achieved by 2-D FDTD coding with the first-order Mur ABC (absorbing boundary condition). It is confirmed that the corrugation can reduce phase difference of field on aperture. also it is investigated that the directivity is increased by 6.1%, 12.9%, and 28.4% with one corrugation, two corrugations, three corrugations, respectively. It is also found that the improvement of the characteristics of the antenna is not proportional to the number of the corrugation but more dependent on the location of the corrugation near the aperture than that far the aperture.

(66) A Compact Folded Patch Antenna for Omni-Directional Radiation Patterns, by Y. H. Suh*, T.-Y. Kim*, M. K. Kim*, I. Park*, Y. G. Seo**, C. M. Song** (*School of Electronics Engineering, Ajou University; **Samsung Advanced Institute of Technology): *JKEES*, vol. 12, no. 7, pp. 1084–1101, Dec. 2001.

The design of a compact folded patch antenna with moderately broad bandwidth is presented in this paper. The proposed antenna has radiation characteristics that are similar to the conventional monopole antenna. However, since this antenna is designed in a planar form, it has smaller size than that of a conventional monopole antenna. We have investigated the resonance frequency and bandwidth characteristics of the proposed antenna by changing the antenna design parameters. The proposed planar form of a monopole antenna in this paper has 1.17 GHz bandwidth with a matching circuit at the center frequency of 6.05 GHz.

(67) A Study on the Antenna PIM Measurement in Anechoic Chamber, by J. T. Kim, I.-K. Cho, M. Y. Jeong, T. G. Choy (Component Technology Development Department, Electronics and Telecommunications Research Institute): *JKEES*, vol. 12, no. 7, pp. 1167–1174, Dec. 2001.

Antenna PIM (Passive Intermodulation) level measurement results are rarely credited due to the external signal receiving characteristics of antenna, and seriously affected by the external PIM sources such as anechoic chamber absorber and antenna tower. In this paper, antenna PIM model for the Reflect PIM measurement method is presented. Through the null point phenomena of the PIM level obtained by antenna PIM model simulations and experimental results, we concluded that antenna PIM level measurements are greatly affected by the PIM level generated on the anechoic chamber absorber and the path differences of PIM signal reflected to the antenna.

(68) Electromagnetic Coupling Mechanism in the Aperture-Coupled and Feedline Gap-Coupled Microstrip Patch Antenna, by J. K. Kim, L. G. Yoon, Y. K. Cho (School of Electronic and Electrical Engineering; Kyungpook National University, Seoul, Korea): *JIEEK*, vol. 38-TC, no. 1, pp. 27–33, Jan. 2001.

This article describes an observation that the aperture coupling mechanisms in the aperture coupled microstrip antenna can be divided into two categories, cavity and parasitic types, depending on the separation between the microstrip patch and the ground plane. The similar phenomenon was observed in the relatively simple gap-coupled microstrip antenna. The specific characteristics between two coupling mechanisms is discussed.

(69) The Wide-Band Four-Element Microstrip Slot Array Antenna With the Cross-Shaped Feedline, by H. S. Shin*, N. Kim*, Y. W. Jang** (*Department of Information and Communication Engineering, Chungbuk University, Cheongju, Korea; **Department of Electronic and Communication, Keukdong College, Umsong, Korea): *JKICS*, vol. 26, no. 1B, pp. 14–20, Jan. 2001.

The cross-shaped microstrip line-fed printed slot four-element array antenna for IMT-2000, PCS, WLL at the 2.0 GHz band was designed in this paper. The proposed antenna with relative permittivity 4.3 and thickness 1.0 mm was simulated by the Finite-Difference Time-Domain (FDTD) method. The antenna was fabricated on the FR-4 Laminate and was tested. It was shown that the measured 2.0 VSWR bandwidths of one-element antenna, two-element, and four-element array antennas are respectively 61.8% (1.42$\sim$2.69 GHz), 57.3% (1.42$\sim$2.69 GHz),

and 57.6% (1.46∼2.64 GHz). Because the −3 dB beamwidth of four-element array antenna is 25°, the gain is 6.92 dBi, and the cross-polarization is −12.5 dB, the 4-element array antenna has far more performance improvement than a 1-element antenna. The measured results are in good agreements with the FDTD results.

(70) A Novel Active Array Antenna Using Open Stub and Voltage Controlled Oscillator With Varactor Diode, by M. S. Kim, C. H. Seo (Department of Information and Communication Engineering, Soongsil University, Seoul, Korea): *JKICS*, vol. 26, no. 2B, pp. 129–133, Feb. 2001.

In this paper, a $1*4$ active phased array antenna was designed using the voltage controlled oscillators (VCO) with the varactor diode and the transmission line network with open stub. The varactor diode was connected in parallel to the FET for the wide tuning range of the VCO and the open stubs were connected at the end of the transmission line network to increase the scan range. The scan range, −20 degree to 22 degree at 2.44 GHz, was controlled by the applied varactor diode voltage and the transmission line coupling network.

(71) Analysis of a Rectangular Microstrip Patch Antenna on a Uniaxial Anisotropic Substrate Loaded by Superstrate, by J.-K. Park*, S. H. Chang**, J. H. Yoon***, G. C. An***, K.-S. Kwak**** (*Department of Information Communication Tatal Communication Research Center, Samsung Electronics, Korea; **Inpetron Inc.; ***Department of Electronics, Inha University, Inchon, Korea; ****Department of Information Communication, Inha University, Inchon, Korea): *JKICS*, vol. 26, no. 6B, pp. 693–700, June 2001.

In this paper the resonant frequency, input impedance and radiation pattern on a uniaxial substrate with superstrate-loaded rectangular microstrip patch antenna are investigated. Dyadic Green functions are derived for selected uniaxial material by constitutive relations, and then integral equations of electric fields are formulated. The electric field integral equations are discretized into the matrix form by Galerkin's Moment Method. On this way sinusoidal functions are selected as basis functions, which have fast numerical convergence because they resemble in the actual current distribution on the patch. Numerical results show how the material permittivity and the superstrate width affect on the resonant frequency, input impedance and radiation pattern.

(72) Design of a Broadband PIFA for IMT-2000 Handheld Terminal, by S.-H. Kim*, K.-J. Oh*, J.-p. Kim*, J.-H. Choi**, T.-Y. Lee*** (*Department of Electronic Communication and Radio Science Engineering, Hanyang University, Korea; **Department of Electronic Communication and Computer Engineering, Hanyang University, Korea; ***ETRI, Daejun, Korea): *JKICS*, vol. 26, no. 6B, pp. 701–708, June 2001.

In this paper, a broadband PIFA for IMT-2000 hand-held terminal was designed. Since PIFA usually has a narrowband characteristic and low gain, dual L antenna structure is utilized in order to satisfy the bandwidth and gain requirement. The bandwidth of a designed antenna is 250 MHz (1920 MHz–2170 MHz) for VSWR < 2, and the pattern and gain requirements are satisfied. The commercial software, IE3D, was used to design a PIFA. Its performance was verified by comparing simulated results with FDTD analysis and measurement results.

(73) Broadband Improvement of The Rectangular Microstrip Patch Antennas, by H. Lee*, Y. Lim** (*Department of Electronic and Information Engineering, DongKang College; **Department of Electronics Engineering, ChonNam University): *JKICS*, vol. 26, no. 7B, pp. 875–879, July 2001.

There has been a constant effort to increase the bandwidth of microstrip patch antenna. In this paper, we propose a special type of the rectangular patch with parasitic element of bar and band type to improve the bandwidth, to design and analyze antennas for a local multi-point distribution system (LMDS) of 24.6 GHz∼28.5 GHz frequency band. As a result, we obtain an increase in antenna efficiency and frequency bandwidth. We were also able to design the wide band antenna easily, because of the difference in parameter between the aimed and the simulated antenna was reduced greatly. In case of proposed band structure, we can obtain the band width up 12.92% as VSWR2. In comparison with the rectangular patch antenna, the banded one has better matching characteristics and winder bandwidth.

(74) A New Beam Tracking Technique Using Intermediate Frequency Processing, by C. Seo*, T.-K. Choi** (*College of Information Communication and Electronics Engineering, SoongSil University; **LG Electronics Co., Ltd.): *JKICS*, vol. 26, no. 7B, pp. 894–894, July 2001.

A method for the electronic beam self tracking using the intermediate frequency (IF) processing is introduced in this paper. The array elements of antenna were coupled to the phase detector, the voltage controlled oscillator (VCO) and the mixer which converted the RF signal into the IF signals on the array elements. The input voltage of the VCO was controlled by the phase detector. The phase detector and the VCO determined the scan range of the array.

(75) Circular Sector Microstrip Antenna, by D.-k. Park*, T. Itoh** (*Division of Radio and Information Communication Engineering, Korea Maritime University; **Department of Electrical Engineering, UCLA, United States): *JKICS*, vol. 26, no. 7B, pp. 895–900, July 2001.

In this paper we designed a single fed dual-frequency circular sector microstrip antenna with orthogonal polarization. The excited modes and operating frequencies of the antenna are calculated by using cavity model. The two frequencies of the antenna depend on the sector angle and radius of the antenna. We made the antenna operating at about 2 GHz and measured the antenna characteristics. When the radius of the antenna is fixed and its sector angle is varied from 75° to 120°, the ratio of two frequencies is a range 1.08 to 1.518.

(76) A Design of Dual-Band Microstrip Patch Antenna in Multilayered Planner Structures for IMT-2000 Systems, by S. J. Oh*, J. H. Yoon**, S. M. Lee***, K.-s. Kwak**** (*LG InnoTek Co., Ltd.; **Department of Electronics Engineering, InHa University; ***Department of Information and Communication, Jaeneung College; ****Department of Information and Communication, InHa University): *JKICS*, vol. 26, no. 7B, pp. 907–915, July 2001.

In this paper, a stacked square microstrip patch antenna was designed, manufactured and tested for IMT-2000 system (down link: 1.885 GHz∼2.025 GHz, up link: 2.11 GHz∼2.2 GHz). To apply IMT-2000 system, which has different forward and reverse link bands, we designed a dual-band operated antenna.

We determined antenna parameters through optimization procedure. With the parameters, We manufactured a stack square microstrip patch antenna and measured its characteristics with HP 8510c network analyzer. The measured results are as follows: resonant frequency of 1.8745 GHz and 2.2 GHz, bandwidth of up to 10.2% and 7.8%, return loss of -18 dB and -27 dB, respectively. High gain of simulated result is ranged to 8 dB$\sim$10 dB.

(77) Design of Slot-Coupled Back-to-Back Microstrip Phased Array Antenna With Symmetrical SSAIP Configuration, by T.-H. Kim*, K.-S. Jun** (*Selim Co., Ltd.; **College of Electronic and Information Engineering, KyungHee University): *JKICS*, vol. 26, no. 9B, pp. 1189–1195, Sept. 2001.

A slot-coupled back-to-back microstrip phased array antenna has been proposed. This antenna takes the configuration of a symmetrical SSAIP (Strip, Slot, Air, Inverted Patch). It has a bidirectional radiation pattern in horizontal plane and 25° main beam squint toward ground plane. The configuration of the antenna can be applied to the directional antenna of the base station or repeater for the two-sector cell site. The phase of each array element is controlled by the phase shifter, which is able to tilt a beam approximately from 15° to 35° according to circumstances of the street. The antenna analysis is based on the cavity model and the design is achieved using Ensemble. The measurement is performed in frequency range from 1.885 GHz to 2.2 GHz covering up-link and down-link of IMT-2000. Experimental results have shown that the impedance bandwidth is approximately 21% and the average error of pointing angles is $\pm 0.37°$.

(78) Resonant Frequency in Rectangular Microstrip Patch Antenna on Anisotropic Substrates With Airgap and Permittivity Superstrate, by J. H. Yoon*, S. M. Lee*, K. S. Kwak** (*Department of Electronics Engineering, Inha University; **School of Information Communication, Inha University): *JKICS*, vol. 26, no. 11B, pp. 1600–1606, Nov. 2001.

Resonant frequency in rectangular microstrip patch antenna on anisotropic substrates with airgap and superstrate are analyzed. Dyadic Green function is derived for selected anisotropic material by constitutive relation. From these results, integral equations of electric fields are formulated using Fourier transform in space region. The electric field integral equations are discretized into the matrix form by applying Galerkin's moment method. Sinusoidal functions are selected as basis functions because they resemble in the actual standing wave on the patch. To verify the validity of numerical result, we compare our result with existing one and get a good agreement between them. From the numerical results, the resonant frequency in the variation of air gap, patch length and anisotropy ratio are presented and analyzed.

(79) Design of ISM-Band Folded Dipole Active Integrated Antenna, by J.-H. Lee, J.-S. Seo (Department of Electrical and Electronics Engineering, Yonsei University): *JKICS*, vol. 26, no. 11B, pp. 1612–1619, Nov. 2001.

This paper examines the design, implementation characteristics of a folded dipole active integrated antenna. Our goal was to minimize the physical size of RF circuit and its insertion loss, and to make the high frequency tuning easier by directly integrating the ISM (Industrial Scientific and Medical) band power amplifier and antenna. Non-linear model has been used for highly accurate simulation of the power amplifier. The maximum power level was found by using the Load pull method before an impedance matching was achieved. It is found that the total power-added efficiency (PAE) including the driving amplifier was 31.5% and that the transmit power was 13.7 dBm. We also found that the proposed scheme with the smaller antenna as compared with the existing dipole antenna has 23.7 dB total gain including the antenna gain. The suppression of the second harmonic signal to the fundamental signal with respect to the fundamental signal was found to be more than 30 dBc.

(80) A Broadband Microstrip Array Antenna for PCS/IMT-2000 Base-Station, by T.-W. Kim*, J.-H. Choi** (*LG Electronics Co., Ltd.; **Division of Electrical and Computer Engineering, Hanyang University): *JKICS*, vol. 26, no. 11B, pp. 1620–1627, Nov. 2001.

In this paper, a broadband microstrip antenna for PCS and IMT-2000 service is designed. To obtain the broadband characteristics of an antenna, we utilized the multi-layered structure composed of two foam material layers, parasitic element and aperture coupled feeding network. The broadband characteristic is obtained by changing the size of parasitic element and the height of foam materials. In addition to that, the usage of metal layer at the distance of from feed-line, back radiation is reduced. The bandwidth of a single element for VSWR less than 1.3 is about 550 MHz. The bandwidth of a designed 1×4 array antenna for VSWR less than 1.3 is about 460 MHz. The gain of a designed array antenna is about 11.15$\sim$12.15 dBi and the front-to-back ratio is about 30 dB.

(81) A Ston Wideband Microstrip Array Antennas Using the Parallel Coupled Lines, by J. I. Kim*, M. G. Han**, Y. J. Yoon** (*Electronics and Telecommunication Research Center; **Department Electrical and Electronic Engineering, Yonsei University): *JKICS*, vol. 26, no. 12B, pp. 1724–1732, Dec. 2001.

In this paper, a technique for increasing the bandwidth of microstrip array antennas using the parallel coupled lines on a single layer is presented. Four types of wideband microstrip array antenna are designed and the characteristics of each type are analyzed. In addition, an iterative method using a distributed network is proposed to design the parallel coupled lines as a wideband impedance matching network. Measurements show that the proposed antennas provide wider bandwidths $\sim$1.7 times those of conventional microstrip array antennas, while the sizes of proposed antennas are the same as that of a conventional array. And low cross-polarization level can be obtained through symmetrical locations of the parallel coupled lines section.

(82) Performance of Adaptive Array Antenna at PHS Basestation, by H. Yoshinaga*, M. Taromaru**, Y. Akaiwa* (*Graduate School of Information Science and Electrical Engineering, Kyusyu University, Fukuoka-shi, 812-8581 Japan; **Kyusyu Matsushita Electric Co., Ltd., Fukuoka-shi, 814-0001 Japan): *IEICE Trans. Commun.*, vol. J84-B, no. 3, pp. 505–513, Mar. 2001.

Adaptive array antenna with widely spaced antenna elements is investigated. Conventional adaptive array antenna systems often assume a narrow spacing of antenna elements such as 1/2. In this spacing, however, received signals have high correlation at a base station so we cannot get the spatial diversity effect. In this paper, we show that, at a base station for PHS, the adaptive array antenna with wide element spacing has better bit error rate performance owing to spatial diversity effect than the one with narrow element spacing under co-channel interference and multi-path fading. In addition, we show that performance in down-link also, not only in up-link, can be improved with the adaptive antenna system at a base station since PHS is a TDD system.

(83) A Two-Beam Waveguide Slot Array With Sidelobe Suppression, by Y. Kimura, H. Shinoda, K. Watanabe, J. Hirokawa, M. Ando (Department of Electrical and Electronic Engineering, Tokyo Institute of Technology, Tokyo, 152-8552 Japan): *IEICE Trans. Commun.*, vol. E84-B, no. 4, pp. 1070–1078, Apr. 2001.

A low sidelobe two-beam waveguide slot array is designed and measured. The antenna structure should be symmetrical for realizing two symmetrical beams which imposes restriction in slot design for the sidelobe and the gain. The slot coupling distribution is optimized numerically for side-lobe suppression under the condition of the structural symmetry. The first side-lobe level is minimized for the specific antenna efficiency in the continuous source model. This synthesis is reinforced by the full wave slot analysis using the method of moments. The design is confirmed by experiments using a one-dimensional array at 12 GHz and the good agreements between the predictions and the measurements are observed.

(84) Adaptive Array Antenna for Mobile Communications, by N. Nakajima (University of Electro-Communications, Department of Human Communication, 1-5-1 Chofugaoka, Chofu-shi, 182-8585 Japan): *IEICE Trans. Commun.*, vol. J84-B, no. 4, pp. 666–679, Apr. 2001.

Because of the increase of portable telephones, shortage of the frequency spectrum becomes serious problem. Transmission technologies improved spectrum efficiency up to now. However, further remarkable improvement seems to be difficult. Adaptive phased array antenna is one of the most promising technologies that solve this problem. Although adaptive antenna was well developed theoretically, practical problems remained to be solved. In this paper, effort was made to clarify the all kinds of practical problems in the adaptive antenna for mobile communication applications. Recent R&D results in Japan are also presented.

(85) Vector Evaluated GA-ICT for Novel Optimum Design Method of Arbitrarily Arranged Wire Grid Model Antenna and Application of GA-ICT to Sector-Antenna Downsizing Problem, by T. Maruyama, T. Hori (Wireless Systems Innovation Laboratory, NTT Network Innovation Laboratories, Nippon Telegraph and Telephone Corporation, Yokosuka-shi, 239-0847 Japan): *IEICE Trans. Commun.*, vol. E84-B, no. 11, pp. 3014–3022, Nov. 2001.

This paper proposes the Vector Evaluated GA-ICT (VEGA-ICT), a novel design method that employs the Genetic Algorithm (GA) to obtain the optimum antenna design. GA-ICT incorporates an arbitrary wire-grid model antenna to derive the optimum solution without any basic structure or limitation on the number of elements by merely optimizing an objective function. GA-ICT comprises the GA and an analysis method, the Improved Circuit Theory (ICT), with the following characteristics. 1) To achieve optimization of an arbitrary wire-grid model antenna without a basic antenna structure, the unknowns of the ICT are directly assigned to variables of the GA in the GA-ICT. 2) To achieve a variable number of elements, duplicate elements generated by using the same feasible region are deleted in the ICT. 3) To satisfy all complex design conditions, the GA-ICT generates an objective function using a weighting function generated based on electrical characteristics, antenna configuration, and size. 4) To overcome the difficulty of convergence caused by the nonlinearity of each term in the objective function, GA-ICT adopts a vector evaluation method. In this paper, the novel GA-ICT method is applied to downsize sector antennas. The calculation region in GA-ICT is reduced by adopting cylindrical coordinates and a periodic imaging structure. The GA-ICT achieves a 30% reduction in size compared to the previously reported small sector antenna, MS-MPYA, while retaining almost the same characteristics.

(86) Characteristic Analysis of Large Bandwidth Dual-Offset Microstrip-Fed Printed Slot Antenna Using FDTD Method, by Y.-W. Jang (Department of Electronics Communication Engineering, Keukdong College, 38 Danpyung-Ree, Kamgok-Myun, Eumsung-Kun, Chungbuk 369-850, Korea): *IEICE Trans. Commun.*, vol. E84-B, no. 11, pp. 3072–3074, Nov. 2001.

A dual-offset microstrip-fed slot antenna having large bandwidth studied in this paper. The proposed antenna is analyzed by the Finite Difference Time Domain (FDTD) method. In this case, two offsets and other design parameters of the antenna lead to the good impedance matching over a wide frequency band. The experimental bandwidth is approximately 1.587 octave (-10 dB $\geq S_{11}$). And the experimented data for the impedance loci, the radiation patterns, and gain of the antenna are also described. The measured results are relatively in good agreement with the FDTD results.

(87) Development of Uniformly Steerable BFN for Phased Array Fed Reflector Antennas on the Engineering Test Satellite VIII, by Y. Matsumoto*, T. Ide**, N. Hamamoto**, A. Sugiura*, M. Okumura*** (*Research Institute of Electric Communication, Tohoku University, Sendai-shi, 980-8577 Japan; **Communications Research Laboratory, Koganei-shi, 184-8795 Japan; ***Komukai Operations, Toshiba Corporation, Kawasaki-shi, 212-8581 Japan): *IEICE Trans. Commun.*, vol. J84-B, no. 12, pp. 2296–2304, Dec. 2001.

A newly developed BFN (Beam Forming Network) for a phased array fed satellite reflector antenna is described. A phased array fed antenna has a feed array placed at a defocus position, and excitation weight for the array is controlled by a BFN. The BFN described here has an unique architecture by which excitation weight for beam steering can be sheared by multiple beams. This architecture enables simple and effective calibration of beam pointing errors caused by mechanical, thermal, or electrical environment in satellite orbit. The BFN also has a self-calibration function to reduce excitation weight errors caused by thermal environment. The BFN will be

equipped on the Japanese Engineering Test Satellite VIII (ETS-VIII) as a key component of a large deployable antenna system for mobile communication and broadcasting mission, and will be launched in the year of 2003.

(88) Receiving Properties of the Slot Antennas on the Substrate Which Absorbs the Irradiated Electromagnetic Wave, by Y. Abe, Y. Ohkubo, Y. Yasuoka (Department of Electrical and Electronic Engineering, National Defense Academy, Yokosuka-shi, 239-8686 Japan): *IEICE Trans. Electron.*, vol. J84-C, no. 3, pp. 230–232, Mar. 2001.

Receiving properties of thin-film slot antennas fabricated on a fused quartz substrate were investigated at 2.5 THz. It was found that the experimental data such as antenna patterns and power gain were agree with the theory taking into account that the irradiated submillimeter wave is multi-reflected in the substrate absorbing with $\alpha = 13\ \mathrm{cm}^{-1}$.

(89) A Simple and Cost-Effective Bidirectional Antenna Using a Probe Excited Circular Ring, by S. Kosulvit*, M. Krairiksh*, C. Phongcharoenpanich*, T. Wakabayashi** (*Faculty of Engineering and Research Center for Communications and Information Technology, King Mongkut's Institute of Technology Ladkrabang, Bangkok 10520, Thailand; **School of Engineering, Tokai University, Hiratsuka-shi, 259-1292 Japan): *IEICE Trans. Electron.*, vol. E84-C, no. 4, pp. 443–450, Apr. 2001.

This paper presents a simple and cost-effective bidirectional antenna using a probe excited circular ring. The structure of the antenna is simple i.e., a linear electric probe surrounded by the circular ring. The principle of the antenna design is easy and straightforward. A choice of the ring radius is first chosen to achieve the condition that only the dominant mode can be propagated. Furthermore, it is found that for a specific ring radius, the radiation patterns of the antenna are varied as the ring width. Then, the optimum ring width that provides the maximum directivity is determined. The criterion of the selection of the ring width for various ring radii is illustrated as the guidelines for the antenna design. The fabricated antennas at the operating frequency of 1.9065 GHz are measured and compared with the theoretical predictions. It is apparent that these results are in reasonable agreement. The bidirectional pattern with the gain of 5.4 dBi over the bandwidth of 17% is obtained. Moreover, the antenna can be easily fabricated with the low production cost. Therefore, this antenna is suitable for installing at the base station in the street cell.

(90) Low Loss Magnetic Plate Application for Increasing Radiation Efficiency of Cellular Telephones, by E. Hankui*, T. Nakamura**, O. Hashimoto*** (*NEC Corporation, EMC Engineering Center, Kawasaki-shi, 216-8555 Japan; **Toda Kogyo Corporation, R&D Division, Otake-shi, 739-0652 Japan; ***Aoyama Gakuin University, Tokyo, 157-8572 Japan): *IEICE Trans. Electron.*, vol. E84-C, no. 6, pp. 814–822, June 2001.

A low loss magnetic plate positioned near an antenna is proposed to increase radiation efficiency of cellular phones. This magnetic plate is used to control the nearby magnetic field around the cellular phone's antenna, and this field controlling is shown to be effective for the improvement of radiation efficiency and far-field pattern. As for the material design of the plate, a magnetic plate having high μ_r' and low μ_r'' (complex relative permeability: $\mu_r = \mu_r' - j\mu_r''$) is found to be effective for achieving high performance. In our sample fabrication, a low loss magnetic sample with $\mu_r = 5.7 - j0.7$ at 900 MHz is realized. It is demonstrated that this low loss sample contributes to increased efficiency and improved far-field characteristics.

IV. Microwave/Lightwave Propagation and Scattering

(1) Calculation of Scattering Cross Section at the Interior Resonance Based on the Singular Value Decomposition, by Y.-F. Sun and S.-J. Xu (University of Science and Technology of China, Hefei, P.R.C.): *AES*, vol. 29, pp. 958–960, July 2001.

Surface integral equation formulations have been widely used for the analysis of electromagnetic scattering problems; however, the wrong calculated results would be given using the method of moments at the discrete resonant frequencies. Based on the electric field integral equation, the singular value decomposition technique is used for finding out the current of the resonant mode, and the current distribution of the nonresonant mode can be obtained by filtering out the resonant mode current using the orthogonalized method. The scattering cross section is calculated for an infinitely long, perfectly conducing circular cylinder at the interior resonance, and the obtained results are in good agreement with the analytical results.

(2) Spaceborne Synthetic Aperture Radar Image Simulation of Natural Ground Scene, by J. Chen, Y.-Q. Zhou and C.-S. Li (Beijing University of Aeronautics and Astronautics, Beijing, P.R.C.): *AES*, vol. 29, pp. 1202–1205, Sept. 2001.

Spaceborne synthetic aperture radar (SAR) image simulation methods are investigated. A new method is proposed based on fractal theory, facet model and clutter scattering characteristic model. Digital elevation model of a natural terrain is used in computer simulation. The simulation results demonstrate that the stochastic properties and special geometric distortion phenomena of natural ground scene spaceborne SAR image are reflected in the simulated images. The simulation method is suitable for verification of SAR satellite system scenario, and it has significant importance to realize the optimization of system scenario of SAR satellite.

(3) Research on Rail-UWB-SAR, by W.-G. Chang, D.-N. Liang and Z.-M. Zhou (NUDT, Changsha, P.R.C.): *AES*, vol. 29, pp. 1213–1216, Sept. 2001.

Rail-UWB-SAR system has such merits as controllable, repeatable, and low-cost, and is an effective means to study UMB SAR. A new experiment method to solve LFM radar rangee "dead" area, bistatic SAR was presented. The bistatic SAR imaging algorithm was studied. The feasibility of the experiment method was confirmed by experiment results. The accuracy of Rail system was analyzed. Also, the disadvantage and its application were discussed.

(4) Electromagnetic Scattering From Time-Varying Fractal Sea Surface Considering the Distribution of Sea Power Spectrum, by L.-X. Guo and Z.-S. Wu (Xidian University, Xi'an, P.R.C.): *AES*, vol. 29, pp. 1287–1289, Sept. 2001.

A normalized band-limited Weierstrass fractal model is presented for modeling the time-varying rough sea surface. In particular, the Pierson–Moskowitz spectrum is incorporated into

this model to represent a fully developed sea surface. The solution of the scattering field from this fractal surface is studied based on Kirchhoff theory, and the effect of the incident angle on the backscattering cross section is discussed. The relationship between the fractal dimension of the time series of the backscattering cross section and the fractal dimension of the sea surface is given.

(5) Application of Preconditioned Conjugate Gradient Method to RCS Analysis of Large Dipole-Array Antennas, by H.-X. Zhou, W. Hong and C.-M. Ton (Southeast University, Nanjing, P.R.C.): *AES*, vol. 29, pp. 1601–1604, Dec. 2001.

The preconditioned conjugate gradient method (PCG) for solving triple Toeplitz linear systems is put forward and is combined with the fast Fourier transform (FFT). The combining algorithm, called PCGFFT, is applied to RCS analysis of large dipole-array antennas. Because of the preconditioner, the condition number of the coefficient matrix is largely improved. The numerical results show that PCGFFT reduces the need for computer memory, speeds the iteration and enhances the convergence.

(6) Analysis of Airborne Radar Clutter at L-Band HH Polarization, by S.-F. Kang*, Z.-Z. Zhang* and D.-B. Ge** (*China Research Institute of Radiowave Propagation, Qingdao, P.R.C.; **Xidian University, Xi'an, P.R.C.): *AES*, vol. 29, pp. 1608–1610, Dec. 2001.

Based on the active calibration of airborne radar, clutter characteristics of typical terrain (plain, hill, mountain and compound terrain) are measured at L-band HH polarization. Effects of the airplane postures on antenna pattern are modified. Analysis results of constant γ models, exponent model and four probability distributions are compared with data. It shows that γ model with index n and Weibull distribution, K distribution agree with the measured data and their statistical fitting parameters are also given.

(7) The Domain Decomposition FDTD Algorithm (DD-FDTD) and Its Application in Scattering Problems, by F. Xu, W. Hong and C.-M. Tong (Southeast University, Nanjing, P.R.C.): *AES*, vol. 29, pp. 1642–1645, Dec. 2001.

The domain decomposition FDTD method (DD-FDTD) is presented for solving complex problems and improving the accuracy of solutions. Based on this idea, the original domain is decomposed into several sub-domains according to the features of the problem. In each sub-domain, the conformal meshes are created in local coordinates and the FDTD computation is carried out independently in local meshes and local time step, and there is no stability concern. In the iteration procedure of FDTD, the data are exchanged between adjacent sub-domains with overlapped meshes. A suitable data-exchanging scheme proposed integrates the sub-domains and leads to a more exact solution. This greatly increased the calculation efficiency. A 2-D scattering problem is calculated by using this method and the accuracy of the solution validates the usefulness and exactness of this method.

(8) Using the MRTD Based on Coifman Scaling Functions to Solve the Problem of Scattering, by X.-C. Wei and C.-H. Liang (Xidian University, Xi'an, P.R.C.): *AES*, vol. 29, pp. 1668–1670, Dec. 2001.

A new method of multiresolution time-domain analysis is proposed, which is based on Coifman compactly supported scaling functions with some number of vanishing moments. The highly linear dispersion properties of the method are investigated and compared with conventional FDTD method. The problem of scattering from two-dimensional conducting cylinders is analyzed in order to demonstrate the advantages of this method over conventional FDTD scheme with respect to memory requirements and execution time.

(9) Study of Electromagnetic Compatibility of Antenna System in Airborne Nacelle Jammer, by X.-Y. Cao*, J. Gao**, C.-H. Liang*, G.-X. Dai** and S.-C. Zhen** (*Xidian University, Xi'an, P.R.C.; **Air Force Engineering University Missile Institute, Sanyuan, P.R.C.): *AES*, vol. 29, pp. 1710–1712, Dec. 2001.

Electromagnetic Compatibility problem of antenna system in airborne nacelle jammer is studied. Many methods used in computational electromagnetics, such as Spectral-Domain Approach etc., are applied in the predicting analysis and the design of antenna system. It is shown by experimental test that performance of the receiving and transmitting antenna system in airborne nacelle jammer is up to, or even surpasses the target designed.

(10) Scattering Analysis of PBG Structures Using FDTD Method, by Y.-Q. Fu and N.-C. Yuan (NUDT Changsha, Hunan, P.R.C.): *AES*, vol. 29, pp. 1729–1730, Dec. 2001.

Photonic band-gap structures constructed with dielectric materials have been studied. FDTD method is adapted to execute the numerical simulation. The scattering characteristics of one and two dimension all dielectric PBG structures have been computed, including different incident angles. The reflection coefficients have been given.

(11) Prediction of Propagating From Outdoor to Indoor Sites by Using Ray-Tracing Method, by Z. Ji, B.-H. Li and H.-X. Wang (Shanghai Jiaotong University, Shanghai, P.R.C.): *JCIC*, vol. 22, pp. 114–119, Mar. 2001.

By using features of reflection and refraction by objects of building, a patched model combined with ray tracing technique is presented. The accuracy of prediction has been improved. The software that can give the path loss of any site inside the building has also been developed. Results of calculation agree well with measurement.

(12) Method of Scattering Center Estimation by Radar Target Frequency Response Data in Clutter Environment, by W.-D. Jiang, Z.-P. Chen, Z.-W. Zhuang and G.-R. Guo (National University of Defense Technology, Changsha, P.R.C.): *JIMW*, vol. 20, pp. 111–116, Apr. 2001.

The simulation methods of radar clutter with given amplitude distribution and power spectrum were described, and the simulation results of radar clutter were given. A scattering center model of frequency domain of radar target was presented under the clutter environment and its solution method was studied. The experimental results of simulation data and the measurement data of aircraft scale model were given.

(13) FMCW Short-Range Radar of 3 mm Wave Band, by G.-W. Lou, X.-G. Li and W. Wu (Nanjing University of Science and Technology, Nanjing, P.R.C.): *JIMW*, vol. 20, pp. 117–119, Apr. 2001.

3 mm wave band FMCW short-range radar was studied, including the calculation of its detecting range, the design of its parameters and the analysis of its ranging precision. In addition, the measured results of the 3 mm FMCW short-range radar developed by the authors were presented.

(14) The Domain Decomposition Method for EM Scattering Analysis of Arbitrary Finite Dielectric Cylinders, by J. Wang and W. Hong (Southeast University, Nanjing, P.R.C.): *JAS*, vol. 19, pp. 135–139, June 2001.

The domain decomposition method (DDM) is used to analyze the EM scattering problems from inhomogeneous and anisotropic dielectric 3-D objects. A relaxed iterative procedure is presented for accelerating the iterative procedure. Good agreement between the results calculated by DDM and those in the literature verifies the accuracy of DDM. Finally, the DDM is also applied to calculate the specific absorption rate distribution in human body illuminated by electromagnetic waves. The conclusions drawn from this paper are consistent with those from other papers.

(15) Application of Preconditioned Conjugate Gradient Method to the RCS Analysis of Dipole-Array Antennas, by H.-X. Zhou, C.-M. Tong and W. Hong (Southeast University, Nanjing, P.R.C.): *JAS*, vol. 19, pp. 145–148, June 2001.

To obtain the RCS of dipole-array antennas, the system of electric field integral equations is turned into a linear algebra system whose coefficient matrix is a symmetric block Toeplitz complex matrix by using Calerkin method with pulse basis functions. The linear algebra system is solved by a combination of the preconditioned conjugate gradient method with the fast Fourier transform. The above method reduces the need for computer memory, speeds the iteration and enhances the convergence.

(16) A Fast Frequency Sweeping Method for RCS Computation Based on AWE Technique, by C.-M. Tong, W. Hong and J. Wang (Southeast University, Nanjing, P.R.C.): *JAS*, vol. 19, pp. 206–209, Sept. 2001.

The method of moments (MOM) in conjunction with the asymptotic waveform evaluation (AWE) technique is applied to predict the RCS of an arbitrarily shaped two-dimensional perfect electric conductor (PEC) cylinder over a frequency band. The electric field integral equation of a 2-D PEC cylinder is solved by using MOM to obtain the equivalent surface current on the PEC cylinder. In the AWE technique, the equivalent surface current at a given frequency is expanded in the desired frequency band in a Taylor's series. By using the rational function, the surface current is obtained at any frequency within the frequency range, which is in turn used to calculate RCS of the 2-D PEC cylinder.

(17) Analyzing and Simulating the Scattering Function of Multipath Dispersion Channel in Urban Mobile Communications, by H.-B. Zhu and W. Cao (Nanjing University of Posts and Telecommunication, Nanjing, P.R.C.): *JEIT*, vol. 23, pp. 313–320, Apr. 2001.

The scattering function is one of most important mathematical methods describing time-frequency dispersion channel performance. The paper researches the scatter function and its mathematical models of multipath dispersion channel in urban microcellular mobile communications, then simulates and analyzes the scattering function model of mobile channels with different dispersions.

(18) A New Method for RCS Prediction of Complex Objects—Curved Surface Pixel Method, by H.-S. Ang, Y.-Z. Shu, J.-J. Zhou, T.-B. Zhang and Y. Peng (Nanjing University of Aeronautics and Astronautics, Nanjing, P.R.C.): *JEIT*, vol. 23, pp. 962–969, Oct. 2001.

A new method for computing high-frequency RCS of objects with complex configuration, called Curved Surface Pixel (CSP) method, is presented. The distinction between CSP method and GRECO method is described. Several different approaches of the pixel methods are analyzed. Many computation examples for spheroid, ellipsoid, cone, missile mode and aircraft mode show that the CSP method has advanced computation accuracy.

(19) An Improved IPO Method Applied to the Analysis of EM Scattering From a Large Open-Ended Cavity, by Y.-B. Yan, D.-B. Ge, X.-C. Nie and S.-Y. Shi (Xidian University, Xi'an, P.R.C.): *JM*, vol. 17, pp. 35–39, Mar. 2001.

It is found that the convergence becomes worse, when the iterative physical optic (IPO) method is applied to the computation for electromagnetic scattering of a complex large open-ended cavity. To overcome this difficulty, some modifications, such as the under-relaxation iterative method, succession iterative method, and Gauss–Seidel iterative method are introduced to the commonly used IPO scheme. Examples are given to demonstrate the availability of presented modifications.

(20) Parallel Computation of 3-D Scattering Problems Based on Domain Decomposition Method, by J. Wang, Z.-Y. Ding and W. Hong (Southeast University, Nanjing, P.R.C.): *JM*, vol. 17, pp. 7–11, June 2001.

In this paper, several PCs constitute a parallel system by using the PVM (Parallel Virtual Machine) and the DDM (Domain Decomposition Method) is used to analyze the 3-D electromagnetic scattering problem on this parallel system. The scattering characteristic of the conductive and dielectric pillars is computed and the results show that the computational efficiency is improved by using the parallel computation.

(21) Using Preconditioning to Accelerate the Computing in Wavelets-MoM, by X.-C. Wei, X.-W. Shi and C.-H. Liang (Xidian University, Xi'an, P.R.C.): *JM*, vol. 17, pp. 12–17, June 2001.

In this paper, the problem of EM scattering is highly efficiently solved by using preconditioning which is related with the scarcity of the impedance matrix in wavelets-MoM. The effect of sampling density on this method is discussed. It is found through numerical examples of two-dimensional conducting cylinders that this method is very effective in accelerating computing and reducing execution time compared to the method presented in the literature.

(22) A Global Optimization Reconstruction Method to Microwave Tomography, by X. Gong* and Y.-M. Wang** (*Jiangxi University of Finance and Economics, Nanchang, P.R.C.; **Zhejiang University, Hangzhou, P.R.C.): *JM*, vol. 17, pp. 47–53, June 2001.

An optimization method, which is similar to TABU search but doesn't need TABU list, is proposed to reconstruct microwave tomography. A dielectric object is illuminated with microwave and the complex permittivity image of object's cross section is

reconstructed from the scattering data detected by the receivers around the object. In the paper, integral equations are transferred into matrix equations by moment method and the problem is iteratively solved. Numerical simulation results show the feasibility and efficiency of this method.

(23) Application of Combination of Sub-Object Division and High-Frequency Methods to Prediction of Near-Field Scattering, by H.-T. Gao, H.-Y. Ke, J.-C. Hou and S.-C. Wu (Wuhan University, Wuhan, P.R.C.): *JM*, vol. 17, pp. 54–59, June 2001.

This paper presents the combination of sub-object division and high-frequency methods for analysis of the radar cross section of extremely complex targets, in which near-field scattering of some complex electrically large objects is calculated carefully by using the method of sub-object division, the physical optics method, method of shooting bouncing rays and other high-frequency methods.

(24) Electromagnetic Scattering From fBm Rough Surface Using Perturbation Method, by L.-X. Guo, and Z.-S. Wu (Xidian University, Xi'an, P.R.C.): *JM*, vol. 17, pp. 60–66, June 2001.

A two-dimensional fractional Brown motion (fBm) fractal model is presented for describing the natural rough surface. The small perturbation method is considered, and an expression of the normalized radar cross-section from this fractal surface is obtained. Numerical results of the backscattering radar cross section for natural rough surface with different fractal dimension are given.

(25) Performance Analysis of a Dual Antenna Handset Under Co-C.nel Interference and Fading Environment, by C. Yu and G.-Y. Wen (UESTC of China, Chengdu, P.R.C.): *CJRS*, vol. 16, pp. 177–181, June 2001.

A simulation approach is presented, which combines the outdoor radio propagation model and the eigen-driven patterns of handset antenna elements and combining schemes of receiving signals, to investigate the performance of a dual antenna handset under co-channel interference and multi-path fading environment. The performance of a dual monopole handset system with optimum combining was studied, and the influence of co-channel interference, the mutual coupling of antenna elements and handset body is also analyzed.

(26) Numerical Simulation of Bistatic Scattering From Rough Sea Surface With a Ship Presence at Low Grazing Angle Incidence, by Z.-X. Li and Y.-Q. Jin (Fudan University, Shanghai, P.R.C.): *CJRS*, vol. 16, pp. 231–240, June 2001.

A hybrid approach of the generalized forward–backward method (GFBM) with spectral accelerate algorithm (SAA) and Monte Carlo method was developed. It was applied to numerical simulation of bistatic scattering from one-dimensional conducting sea surface with a ship presence under the TE and TM tapered wave incidence at low grazing angle (LGA). Numerical simulations of bistatic scattering at LGA show the functional dependence upon polarization, frequency, observation angle, sea surface wind speeds, ship location and other parameters.

(27) Range Profile Recognition of Radar Target Based on Discriminant Vector Subspace, by D.-Y. Zhou and W.-L. Yang (University of Electronic Science and Technology of China, Chengdu, P.R.C.): *CJRS*, vol. 16, pp. 252–255, June 2001.

An approach of radar target recognition is proposed. The discriminable vector subspace is constructed by optimal discriminant analysis on the training dataset and the number of this subspace dimensions does not depend on the number of target classes. Therefore, in the sense of separability of classes, the extracted features by this approach are superior to those by eigenimages and canonical subspace methods. The simulated experimental results on three radar targets show that this method is effective.

(28) Monte Carlo Method of Predicting Random Electromagnetic Interference, by H.-Q. Hu and J.-S. Zhao (University of Electronic Science and Technology of China, P.R.C.): *CJRS*, vol. 16, pp. 280–282, June 2001.

The Monte Carlo method is used in prediction of electromagnetic interference. A probability model or random process was first set up and its parameter was let equals to solution of the problems. Then the simulation method by computer was studied. On the basis of the analysis, the probability calculation of random interference was simplified and the reliability of receivers for electromagnetic compatibility could be evaluated.

(29) Application of FMM to Electromagnetic Scattering From a Homogeneous Cylinder of Arbitrary Cross Section, by Z.-Y. Ding and W. Hong (Southeast University, Nanjing, P.R.C.): *CJRS*, vol. 16, pp. 283–286, Sept. 2001.

The method of moments is accelerated by the fast multipole method (FMM) and applied to solve the integral equation with respect to the equivalent currents on the surface of dielectric cylinder, and then the electromagnetic scattering analysis of the dielectric cylinder. After FMM acceleration, both the computing time and memory needs are reduced from $O(N^2)$ to $O(N^{3/2})$ without increasing the complexity of implementation.

(30) The Scattering by Gaps and the Multiple Scattering Between Gaps and Edges, by Z.-L. Zhang and W.-L. Ni (School of Communication, Shanghai, P.R.C.): *CJRS*, vol. 16, pp. 301–305, Sept. 2001.

With the increasing development of RCS reduction techniques, the gaps where two component structures come together can become a dominant contributor to the scattering behavior of a target. In this paper, not only the contribution of a gap on a target to the backscattering, but also the contribution of the interaction of gaps and edges is analyzed.

(31) Study of Scattering by Truck on Ground, by P.-G. Liu, K.-C. Liu, J.-G. He, J.-X. Yin and H.-Y. Tan (National University of Defense Technology, Changsha, P.R.C.): *CJRS*, vol. 16, pp. 306–309, Sept. 2001.

A model for truck upon ground is described in time domain. The method takes two steps: the first calculates the scattering of ground, the second step calculates the scattering of targets by imposing the scattering wave got at first step upon the targets. A truck model is studied and the scattering waves and RCS in UHF band are calculated. Good agreements between calculated and experimental results are obtained.

(32) On the Evaluation of the Complex Ray Expansion Accuracy of Incident Plane Wave, by W.-L. Zhao*,**, H.-P. Du*, Y.-Z. Ruan** and Y.-J. Mao* (*Chongqing University of Post and Telecommunication, Chongqing, P.R.C.; **University

of Electronic Science and Technology of China, Chengdu, P.R.C.): *CJRS*, vol. 16, pp. 473–478, Dec. 2001.

Based on the formula of complex ray expansion of incident plane wave and a novel parameter transformation, a single-variable formula on simulation accuracy for complex ray expansion of incident plane wave is given. The simulation accuracy is discussed and a method is proposed for evaluating the simulation accuracy of complex ray expansion of incident plane wave.

(33) Finite Element Method of Solving Diffraction Problem of Dielectric Optical Grating, by W.-P. Qin and D.-G. Fang (Nanjing University of Science and Technology, Nanjing, P.R.C.): *CJRS*, vol. 16, pp. 479–483, Dec. 2001.

The finite element formulation incorporated with periodic boundary condition is presented for solving diffraction problem of dielectric optical gratings. The method is applied to study the diffraction characteristics of transmission type optical gratings with rectangular and right-triangle shapes in the case of incidence of TE polarization plane wave. The required computational resources are small since the size of space domain to be solved is about only a single cell of the dielectric periodic structure.

(34) Radar Backscattering Characteristics of Fog, by Z.-W. Zhao*,**, L.-K. Lin**, Q.-S. Dong** and Z.-S. Wu* (*Xidian University, Xi'an, P.R.C.; **China Research Institute of Radiowave Propagation, Qingdao, P.R.C.): *CJRS*, vol. 16, pp. 498–502, Dec. 2001.

Based on Gamma distribution model of fog-drip size derived from the empirical relation of visibility and water content for advection and radiation fogs, the relations between radar reflectivity factor and fog visibility or water content are proposed. As an example, the radar backscattering characteristics at 94 GHz is given. Finally, based on moist fog parameters derived from terrestrial millimeter-wave attenuation data and visibility, the backscattering characteristics of moist fog are discussed, and the results show that the radar reflectivity factor of moist fog approximately corresponds to that of moderate and heavy rain.

(35) An Approach of Source Equivalence for the Fast Analysis of High Frequency Radio Wave Problems via Uniform Geometrical Theory of Diffraction, by D.-P. Lin, H.-T. Chou, Y.-W. Lin and H.-Y. Chen (Yuan-Ze University, Taoyuan, P.R.C.): *JCIE*, vol. 24, pp. 723–733, Nov. 2001.

This paper describes a valid approach based on an equivalent representation of a source in terms of relatively few but simple elements that can be further modeled by an equivalent point source as required in UTD solutions. The source representation is obtained through a best guess from the available source information, and has potential to improve the efficiency and applicable areas of UTD to the greatest possible extent. Numerical examples are presented to validate the proposed approach.

(36) A Study on Interference Analysis Between Base Stations With FDD and TDD Modes for IMT-2000, by I.-K. Rhee*, H.-S. Lee**, J.-K. Lee*, K.-C. Shin*, K.-T. Kim* (*Department of Electronic Engineering, Hannam University; **ETRI): *JKEES*, vol. 12, no. 1, pp. 11–17. Jan. 2001.

This paper introduces an interference analyzer based on the statistical approach called the Monte Carlo methodology which has been chosen as one of the interference analyzing techniques in ITU-R. Furthermore, using the interference analyzer developed in this paper with modified Hata model, computer simulation is performed to examine probability of interference affecting between the base stations with FDD and TDD modes for IMT-2000. Through the simulation results, it is confirmed that two different systems with FDD/TDD modes of same frequency bands can be simultaneously used in a cell without significant interference, under the parameter conditions specified in this paper.

(37) EMC Design of Communication System on the Basis of EMC Design Rule, by H.-B. Park, J.-S. Park, S.-H. Lee, S.-H. Kang (LG Electronics Inc.): *JKEES*, vol. 12, no. 1, pp. 77–83, Jan. 2001.

We analyzed the mechanism of EM emission in telecommunication system and extracted the dominant parameter in EMC design. The I/O cable, ventilation hole and shield design of chassis are important EMC design issues in telecommunication systems. Because telecommunication systems have much more I/O cables than other electronic products, EMC design of I/O cable is very important in telecommunication systems. Therefore by the method of experimentation and simulation, EM coupling mechanism of I/O cable was analyzed and the design rules for low emission was extracted. On the base of these EMC design rules, EMC design of telecommunication system was executed without complex redesign or debug. The result obtained by these methods was shown in this paper.

(38) Numerically Efficient Evaluation of MoM Matrix in Conjunction With the Closed-Form Green's Functions in Analysis of Multi-Layered Planar Structures, by Y.-S. Lee*, B.-C. Kim*, Y.-K. Cho** (*School of Electronic Engineering, Kumoh National University of Technology; **School of Electrical and Electronic Engineering, Kyungbook National University): *JKEES*, vol. 12, no. 1, pp. 92–98, Jan. 2001.

When analyzing the scatting problem of multi-layered planar structures using closed-form Green's function, one of the main difficulties is that the numerical integrations for the evaluation of diagonal matrix elements converge slowly and are not so stable. Accordingly, even when the integration for the singularity of type e^{-jkr}/gamma, corresponding to the source dipole itself, is performed using such a method, this difficulty persists in the integration corresponding to the finite number of complex images. In order to resolve this difficulty, a new technique based upon the Gaussian quadrature in polar coordinates for the evaluation of the two-dimensional generalized exponential integral is presented. Stability of the algorithm and convergence is discussed. Performance is demonstrated for the example of a microstrip patch antenna.

(39) An Analysis on the Result of CE/CS Test on the KOMPSAT-I ETB, by S.-B. Lim, Y.-S. Chun (Space Division, KARI): *JKEES*, vol. 12, no. 2, pp. 184–192, Feb. 2001.

In this paper, we analyze the result of the conduced emission and susceptibility tests performed on the KOMPSAT-I ETB Platform. The ETB platform consists of the EM (Engineering Model) boxes developed to perform the electrical functional test. During the conducted emission test, we measured the instant waveform in time domain when each switch was turn on, and spectrum of the noise in the frequency range of 10 Hz up to 100 MHz for the steady state of the ETB. During the conducted

susceptibility test, no malfunction and no serious damage of the electronic box were observed when a simulated noise waveform was applied to the DC power bus. The simulated waveform was obtained by adding the 6 dB-system margin to the worst case waveform measured from the conducted emission. This test was performed as co-development of the KOMPSAT-I with TRW in USA.

(40) Polarization-Independent Bragg Blazing and Simultaneous Bragg and Off-Bragg Blazing in a Periodic Strip Grating Structure Over a Grounded Dielectric Slab, by U. H. Cho*, Y. K. Cho** (*Division of Computer and Information Telecommunication, Kyungdong College of Techno-Information; **Department of Electronic Engineering, Kyungpook National University): *JKEES*, vol. 12, no. 2, pp. 193–198, Feb. 2001.

The electromagnetic scattering characteristics by a periodic strip grating on a grounded dielectric slab are examined from the viewpoints of both the reflection grating and the leaky wave antenna problems. Numerical results for polarization-independent Bragg blazing and simultaneous Bragg and off-Bragg blazing phenomena are given and some discussions on the properties such as complex propagation constants, radiation patterns and scattering characteristics are presented.

(41) The Prediction and Analysis of the Propagation Characteristics in Indoor Environments Using the SBR/Image Method, by H.-K. Son*, C.-Y. Kim*, S.-J. Kim** (*Electronics and Telecommunications Research Institute; **Department of Electronics, Kyungpook National University): *JKEES*, vol. 12, no. 2, pp. 199–207, Feb. 2001.

In this paper, the technique of prediction and analysis on the characteristics of propagation in indoor environment is presented. This technique needs no reception sphere commonly used in 3D-ray tracing scheme, and thereby it lends us easy code realization. The validity of developed code is verified by comparing with the values of image methods and measurement. The developed technique applied to the structure of rectangular corridor with the iron door and we calculated the path loss for the variation of the iron door angle. The path loss decreased about 15 dB at the distance of 30 m from the iron door and the delay spread increased approximately by four times. Based on the computation, we confirmed that indoor propagation in PCS is heavily affected by the iron door in corridor.

(42) Performance Analysis of Noncoherent Transmit Diversity System Over Correlated Rayleigh Fading Channel, by M.-K. Yeo, Y.-Y. Han (Department of Electronic Communication Engineering, Hanyang University): *JKEES*, vol. 12, no. 2, pp. 208–216, Feb. 2001.

Signal Fading due to multipath propagation severely impairs the performance of high speed mobile communication systems. Effective diversity scheme for fading channel is STTD (Space Time Transmitter Diversity) method. This scheme is very simple and using 2 transmit antennas and 1 receive antenna provides a diversity order of two [1], [2]. In this paper, we derive the new probability density function of the envelope of the received signal over correlated Rayleigh fading channel. Using the new pdf of the envelope we analyze the performance of noncoherent M-ary FSK, DPSK and ASK STTD (Space Time Transmitter Diversity) a system on correlated Rayleigh fading channel.

(43) Field Distribution Characteristics of a Reverberation Chamber With Different Conditions of Diffuser Arrangement, by K.-S. Lee*, J.-G. Rhee*, S.-Y. Chung** (*Department of Electronic Communication Radio Science and Engineering, Hanyang University; **EMC Laboratory, RRL.): *JKEES*, vol. 12, no. 2, pp. 227–233, Feb. 2001.

Electromagnetic field characteristics of Reverberation chamber which could be applicable for an alternative test facility of electromagnetic interference and radiated electromagnetic susceptibility have been investigated. To obtain the required field uniformity of reverberation chamber, Schroeder method Quadratic Residue Diffuser was designed to be applied to chamber. In this paper, 3 different types of diffusers depending on diffuser's periodic direction have been used to investigate field characteristics of each type by using FDTD numerical method. The results show all 3 types of reverberation chambers have below ± 3 dB tolerance of field uniformity characteristics, and the symmetrical, type 3, structure show better results among them.

(44) Development of Frequency Aliasing Resolution of SAR Data by Using Wrap Around Removal Technique, by I.-P. Hong*, D.-L. Cho*, H.-K. Park** (*Agency for Defence Development; **Yonsei University): *JKEES*, vol. 12, no. 2, pp. 234–244, Feb. 2001.

SAR interferometry technique providing various geographic information is the latest technology generating the precision height information by using phase data of radar. The frequency aliasing phenomenon of SAR data results from unfocusing the Doppler center frequency to the center and is one of the main noise sources. Therefore, this paper describes the development of frequency aliasing resolution module which is one of the main processing modules among the whole interferometry processing. The wrap around removal technique used by this paper for aliasing resolution is proved very effective by experiment and it's implementation method can be used for real applications.

(45) Effects of Partial-Band Noise Interference on the Performance of Hybrid DS/SFH-MSK Spectrum System in Rayleigh Fading Channel, by Y.-Y. Kim, B.-R. An, H.-G. Ryu (Department of Electronic Engineering, Chungbuk National University): *JKEES*, vol. 12, no. 2, pp. 251–256, Feb. 2001.

An error probability analysis is performed for a hybrid DS/SFH spread-spectrum system using minimum shift keying (MSK) modulation. The channel is assumed to be a Rayleigh fading channel with partial-band noise interference. Expressions are derived for the bit error rate (BER) in the context of Rician and Rayleigh fading channels, as a function of the average signal-to-noise ratio (SNR) Eb/No, the average signal-to-interference ratio (SJR) Eb/Nj and channel parameters. As a result, in the fading channel with large Rician factor, K, which denotes the ratio of power of the direct and the diffused components, the partial-band interference is the worst case. On the other hand, in Rayleigh fading channel ($K = 0$), the full-band interference (=1) brings the system to the worst case. Performance comparisons among various channels show that the factor K has much large effect on overall performance. For example, in conditions of =0.1 and BER = 10-2, the system in Rician channel with $K = 10$ requires more 1.9 dB

SNR than that in AWGN channel, whereas it is less 5 dB SNR than that in the Rayleigh channel with $K = 0$.

(46) A FDTD Analysis for the Slanted Metallic Boundaries, by Y.-K. Lee, H.-B. Yoon (Department of Electronics Engineering, Dongguk University): *JKEES*, vol. 12, no. 2, pp. 278–284, Feb. 2001.

In this paper, the slanted metallic boundaries is analyzed for the triangular cell grid method and compared with staircase approximation. Specially, this paper is derived an error range to the angle of inclination between the metal and the dielectric from the triangular cell grid method. That result, when the angle of inclination is from 30° to 60°, the triangular cell grid method improves the accuracy, the computer memory and time requirement in comparison with the staircase approximation. But, out of this range, we do not expect the accuracy because a side of cell size lengthen.

(47) Performance Analysis of 16QAM System in a Composite Electromagnetic Interference Environment, by K.-Y. Cho*, S.-E. Cho**, J.-S. Roh***, H.-J. Kang****, S.-J. Cho***** (*Electronics and Telecommunications Research Institute; **Department of Computer and Communication Engineering, Sunchon National University; ***Department of Information Communication Engineering, Seoil College; ****Department of Electrical and Electronic Engineering, Dongshin University; *****Department of Telecommunication and Information Engineering, Hankuk Aviation University): *JKEES*, vol. 12, no. 2, pp. 285–292, Feb. 2001.

In this paper, the analysis model of a composite electromagnetic interference environment is proposed, and the composite interference consists of three types, i.e., impulse, sinusoidal, and rectangular type. Also, we have derived the p.d.f. of the amplitude of the composite interference. And using a derived p.d.f., we have evaluated the performance of 16QAM (Quadrature Amplitude Modulation) system in a composite electromagnetic interference environment. From the results, it is known that when impulse type interference is weaker than the others, the shape of p.d.f. is dominantly governed by the power component ratio of sinusoidal and rectangular type interference. On the other hand, when impulse type interference is stronger, the effect of the other two interference becomes insignificant. Also, It is shown that the smaller both impulsive index (A) and the mean power component ratio (Γ') in impulse type interference are, the worse the performance of 16QAM system is.

(48) Electromagnetic Shielding Characteristics of Polyaniline and Its Mixtures, by J.-J. Park*, I.-H. Im*, B.-S. Choi** (*SAMWHA Capacitor Co., Ltd. R&D Center; **Electrical Department, KyoungMoon College): *JKEES*, vol. 12, no. 2, pp. 293–298, Feb. 2001.

EB-NMP free standing film is manufactured from NMP solution of polyaniline (emeraldine base; EB). Also ES (emeraldine salt; EB·HCl) film is manufactured by doping of EB-NMP film with 1 mole HCl aqueous solution. And EB-mixture films containing conductor (carbon black, graphite, Ag etc.) are prepared. In this study, electromagnetic interference shielding efficiency (EMI SE) of ES free standing film ($\sigma = 5$ S/cm, $t = 0.14$ mm) is 23∼25 dB in the frequency range of 10 MHz∼1 GHz. ES-mixture (carbon black, graphite, Ag, etc.) films, polyaniline film doped camphorsulfonic acid (CSA) show higher EMI SE (30∼34 dB, 36∼42 dB, 44∼52 dB, 34∼43 dB) property than that of ES free standing film, respectively.

(49) ISAR Imaging of Airplane-Like Targets by Matrix Pencil Method, by J.-h. Yoo, K.-I. Kwon, Y.-H. Lee (Agency for Defense Development): *JKEES*, vol. 12, no. 2, pp. 299–307, Feb. 2001.

This paper presents a experimental study of Inverse Synthetic Aperture Radar (ISAR) imaging using Matrix Pencil (MP) method. A series of measurement for two types of target model was done in a Compact Range (CR) facility. The first target is a set of distributed slim cylinders to get a ISAR image of point-like scatterers. The second is UAV model representing a complex real target. The results show that ISAR images by MP method are better than by conventional FFT method under the realistic measurement conditions.

(50) Optimal Perturbation of Null Points Inherent to Riccati Solution and Control of Coupling in Nonuniform Coupled-Lines, by E. J. Park (School of Electronic Engineering, Kumoh National University of Technology, Pohang, Korea): *JKEES*, vol. 38-TC, no. 3, pp. 105–113, Mar. 2001.

A method is newly presented to synthesize the model impedances satisfying the desired coupling factor of a reflective (or backward) coupled-line. The synthesis is achieved by optimal perturbations of repeating null points of lobes inherent to the solution of the first order nonlinear differential equation for coupling. It is based on the synthesis method of nonlinear source distribution functions for the prescribed space factor pattern in the one-dimensional array antenna. Here, the conventional synthesis method for the even distribution function is extended to the odd case. Resulting modal impedances will have continuously varying profiles. The design procedure of asymmetrical and symmetrical couplers corresponding to the even and odd distribution functions, is examplified to show the generalization and the simplicity of the proposed method.

(51) Design and Implementation of the Transmit and Receive Equipments for Wide Band Signals of a Spaceborne High Resolution Synthetic Aperture Radar, by M. H. Ka*, B. T. Jeon**, S. Y. Kim** (*Department of Electrical and Electronic Engineering, Yonsei University, Seoul, Korea; **Agency for Defense Development): *JKEES*, vol. 38-TC, no. 3, pp. 114–120, Mar. 2001.

In general, the realization of spaceborne system is constrained by its space environment. In this paper, we suggest chirp stitching technique which generates and processes wideband radar signal with minimum hardware, design and implement transmit/receive equipments and operating programs to satisfy the requirement of this spaceborne high resolution SAR (Synthetic Aperture Radar). We apply the top-down design approach to this system , and divide hardware into equipment module and circuit levels, and software into SR (Software Requirement), AD (Architecture Design), DD (Detailed Design) and spaceborne high resolution SAR. We, at first, test the hardware functions, confirm the wideband handling capability of this system with 85 MHz wideband signals generated from two 42.5 MHz narrow signal, and show that this system can be used in spaceborne high resolution SARS.

(52) Correlation Algorithm for High-Precision Measurement in FM-CW Radar Level Meters, by J. M. Kim*, Z. S.

Lim*, J. C. Chun**, T. S. Kim**, J. R. Kim***, W. S. Park**** (*Research Institute of Industrial Science and Technology; **Department of Computer and Communications Engineering, Uiduk University, Gyeongju, Korea; ***Department of EECS, Pusan University of Foreign Studies, Pusan, Korea; ****Department of Electronics and Electrical Engineering, Pohang University of Science and Technology, Pohang, Korea): *JKEES*, vol. 38, no. 4, pp. 160–166, Apr. 2001.

In this paper, for the microwave level meter based on the FM-CW radar, we analyze the spectrum correlation of beat signals and propose a measurement algorithm using the theory. For industrial applications, level meters must have high precision, which requires a good linearity of VCO. But, in practice, it is very complicated or very expensive to make VCO linear enough to be acceptable in the industrial field. We propose a measurement algorithm using the fact that there exists a peak in the spectrum correlation of beat signals when range difference is sufficiently small. This makes it possible to determine the range difference in a precise manner even using a practical VCO. We present some experimental results to show the validity of this algorithm.

(53) Performance Analysis of Multi-Carrier DS-CDMA System in Multipath Rician Fading Channel, by Y.-C. Kim*, J.-S. Roh**, C.-H. Oh***, S.-J. Cho* (*Department of Telecommunication and Information Engineering, Graduate School of Hankuk Aviation University; **Department of Information and Communication Engineering, Seoil College; ***Department of Information and Communication Engineering, Korea University of Technology and Education): *JKEES*, vol. 12, no. 3, pp. 378–390. Apr. 2001.

In this paper, it is analyzed that the error performance of a Multi-Carrier DS-CDMA system in a single cell with multipath Rician fading and multiple access interference (MAI) and the error performance of the system is compared with that of a Single-Carrier DS-CDMA system. Moreover, the convolutional coding techniques with code rate of 1/2, 1/3, and 1/4 are adopted in order to improve the error performance degraded by the multipath fading and MAI and performance improvement through the coding techniques is analyzed. As a result, it is shown that the number of users in each system can be determined by the number of branches of the rake receiver in a Single-Carrier DS-CDMA system and the number of carriers in a Multi-Carrier DS-CDMA system. Furthermore, the convolutional coding should be chosen with considering the trade-off between coding gain and a power limitation in a Multi-Carrier DS-CDMA system. In case of increasing the number of carriers, the processing gain is decreased but the error performance is improved through the effect of frequency diversity and the system can be possibility implemented due to the low chip rate.

(54) Performance Analysis of Multicarrier CDMA System With M-ary Orthogonal Signaling in Multipath Fading Channel, by K.-S. Park, H.-R. Kim, N. Kim, S.-K. Park (Department of Computer and Communication Engineering, Chungbuk National University): *JKEES*, vol. 12, no. 3, pp. 391–400. Apr. 2001.

In this paper, the performance of a multicarrier CDMA system applying M-ary orthogonal signaling and adaptive subchannel allocation scheme is analyzed for forward links in Rayleigh fading channel. Also, the effect of error caused by subchannel allocation is analyzed. In the proposed system, each DS waveform is transmitted over the subchannel having the biggest fading among L subchannels. Considering M-ary orthogonal signaling and 4 subchannels, the BER of 10-3 is satisfied if SNRs are 7.33 dB, 5.33 dB, and 4.47 dB for $k = 1$, 2, and 3, respectively. Therefore, SNR is decreased as k is increased. If the error of subchannels exists, the BER of 10-3 is met if SNR is 8.18 dB in the absence of M-ary orthogonal signaling. So, a required SNR is declined about 0.85 dB. Adding the M-ary orthogonal signaling with $k = 4$, it is observed that the multicarrier CDMA system has performance improvement because a required SNR is 5.44 dB.

(55) Partially Coherent MC-CDMA Downlink Performance in Rayleigh Fading Channels, by N.-S. Kim (Chongju University Computer and Communication Engineering): *JKEES*, vol. 12, no. 3, pp. 470–477. Apr. 2001.

Multicarrier code-division multiple access (MC-CDMA) is one of the promising technique for high capacity wireless communication. However the carrier phase error and frequency offset cause the performance degradation of MC-CDMA due to the inter-carrier interference. In this work, downlink performance of the partially coherent MC-CDMA is analytically derived in Rayleigh fading channels. The bit error rate sensitivity by combining method, Maximal ratio combining (MRC) and Equal gain combining (EGC), is compared as functions of phase errors, multi-user interference, and received signal-to-noise ratio. The results show that the susceptibility for the effect of the phase errors of MC-CDMA with MRC is more robust than that with EGC. However, it is also noticed that the performance degradation of EGC and MRC is negligible for loop SNR's of above 15 dB and above 10 dB, respectively.

(56) Estimation of Microwave Path Loss and Cross-Polarization Coupling in a Simple Urban Area, by Y. Oh*, C.-H. No**, H.-J. Sung***, B.-H. Lee****, Y.-G. Koo* (*Department of Electronics and Electrical Engineering, Hong-Ik University; **Etronics Corporation; ***Pantech Co., Ltd.; ****Gifone Korea Inc., Ltd.): *JKEES*, vol. 1, no. 1, pp. 30–36, May 2001.

Whereas it is well known that microwave propagation around corners of urban area is estimated well by the uniform geometrical theory of diffraction (UTD), it is not clear how much depolarization occurs at a given receiver position and how much transmission through walls affects to total path loss. This paper presents the results of the ray tracing simulation to answer these questions. Simulations of microwave propagation around corners were performed for various line-of-sight (LOS) and out-of-sight (OOS) positions of a receiver, by summing the electrical fields of reflected, diffracted and transmitted rays coherently. Since height difference between transmitter and receiver, as well as ground plane, causes depolarization, the ray tracing simulation estimates the cross-polarization coupling. It was found that the cross-polarization coupling decreases as receiver moves away from transmitter. Another part of the study focused on the signal transmitted through building walls of the corner. It was found that the transmitted field is dominant at OOS region when the conductivity of the walls is low (for example, lower than 0.01 S/m). The simulation results of the ray tracing technique in this

study agreed well with an experimental measurement around corners.

(57) A Deterministic Ray Tube Method for an Indoor Propagation Prediction Model, by C.-G. Suh*, H.-W. Koh*, H.-W. Son**, N.-H. Myung** (*EE Department, Kwangwoon University; **EE Department, KAIST): *JKEES*, vol. 1, no. 1, pp. 48–53, May 2001.

This paper presents a new 3-D ray tracing technique based on the image theory with newly defined ray tubes. The proposed method can be applied to indoor environments with arbitrary building layouts and has high computational efficiency compared to the precedent methods resorting to the ray launching scheme. Its predictions are in good agreement with the measurements.

(58) Dyadic Green's Function for an Unbounded Anisotropic Medium in Cylindrical Coordinates, by K. Li*, S.-O. Park*, W.-Y. Pan** (*School of Engineering, Information and Communications University; **China Research Institute of Radiowave Propagation): *JKEES*, vol. 1, no. 1, pp. 54–59, May 2001.

The dyadic Green's function for an unbounded anisotropic medium is treated analytically in the Fourier domain. The Green's function, which is expressed as a triple Fourier integral, can be next reduced to a double integral by performing the integration over the longitudinal Fourier variable or the transverse Fourier variable. The singular behavior of Green's dyadic is discussed for the general anisotropic case.

(59) A Theoretical Analysis of Thermic Endfire Interstitial Applicator, by J.-K. Park*, H.-J. Eom** (*Electronics and Telecommunications Research Institute; **Department of Electrical Engineering, Korea Advanced Institute of Science and Technology): *JKEES*, vol. 1, no. 1, pp. 60–62, May 2001.

A novel approach for modeling the thermic endfire interstitial applicator is presented. A hypothetical semi-infinite circular cylinder is added in the endfire direction in order to facilitate the theoretical modeling approach. The Fourier transform and mode-matching technique is utilized to obtain a solution in fast-convergent series. Numerical computations for the input impedance are performed to check the validity of the theoretical model.

(60) MLFMA for Capacitance Extraction Using Adaptive Triangular Mesh, by H. Kim, C.-H. Ahn (School of EECS, Yeungnam University): *JKEES*, vol. 1, no. 1, pp. 78–82, May 2001.

For fast capacitance computation, a simple mesh refinement technique on MLFMA (Multi-Level Fast Multipole Algorithm) is proposed. The triangular meshes are refined mainly in the area which has heavy charge density. The technique is applied to the capacitance extraction of three dimensional conductors. The results show good convergence with comparable accuracy. An adaptive technique concerned with MLFMA is useful to reduce computation time and the number of elements without additional computational efforts in large three dimensional problems.

(61) FDTD Analysis of Lightning-Induced Voltages on Shielded Telecommunication Cable With Multipoint Grounding, by J.-C. Ju*, H.-Y. Lee**, D.-C. Park***, N.-S. Chung**** (*Department of Electronics Engineering, Chungnam National University; **Access Network Lab, Korea Telecommunication; ***Department of Radio Science and Engineering, Chungnam National University; ****Korea Research Institute of Standards and Science): *JKEES*, vol. 1, no. 1, pp. 88–94, May 2001.

In this paper, the lightning-induced voltages on shielded twisted-pair wires with multipoint grounding on cable sheath are calculated by using finite-difference time domain (FDTD) method. The equivalent single-wire line that represents a bundle of twisted-pair wires is adopted for computational efficiency. A finitely conducting ground is also taken into account in both lightning electromagnetic field calculations and surge propagation along the shielded cable for a practical simulation. It is found that multipoint additional grounding on cable sheath provides more shielding effectiveness especially in the early time response of the lightning-induced voltages. From this study, the requirements for lightning surge protection devices in a telecommunication subscriber cable can be established.

(62) A Study on Fabrication and Evaluation of Ferrite Electromagnetic Wave Absorber, by D. I. Kim*, J.-Y. Bae*, J.-Y. Son*, Y.-S. Won**, J.-M. Song*** (*Department of Radio Sciences and Engineering, Korea Maritime University; **Department of Electronics and Communication Engineering, Korea Maritime University; ***JResearch Institute of Industrial Technology, Korea Maritime University): *JKEES*, vol. 1, no. 1, pp. 95–99, May 2001.

According to the progress of the electronic industry and radio communication technologies, mankind might enjoy its abundant life. On the other hand, many social problems such as EMI, and unnecessary electromagnetic wave occur due to the increased use of electromagnetic wave. Therefore, the organizations such as CISPR, FCC, ANSI, etc. have provided the standard of electromagnetic wave environment for the countermeasure of the EMC. It had been required that the absorbing ability of an electromagnetic wave absorber is more than 20 dB, the bandwidth of which is required through 30 MHz to 1000 MHz for satisfying the international standard about an anechoic chamber for EMI/EMS measurement. From November of 1998, however, the CISPR11 has accepted the extended frequency band from 1 GHz to 18 GHz additionally in the bandwidth of EMI measurement [1]. In this paper, we proposed a new type absorber satisfying the above requirements and carried out broadband design using the equivalent material constants method. Futheremore, the experiments were carried out over the frequency band from 30 MHz to 2 GHz, and hence, the validity of the proposed design theory was confirmed.

(63) Minimum Duration Outage of a DS-CDMA Cellular System Due to Cell Traffic Intensity, by N.-S. Kim (Computer and Communication Engineering, Chungju University): *JKEES*, vol. 12, no. 4, pp. 570–575, June 2001.

The minimum duration outage probability of a cellular system is defined the probability that the received signal level is hold under minimum required threshold duration. This definition is more realistic compared to the outage probability which is the received signal strength level is below predefined threshold level. Especially, in a DS-CDMA cellular system the received signal-to-interference ratio is a function of cell traffic, while the former researches are only considered the minimum

duration outage probability independent of the cell traffic. We noticed that the minimum outage probability is rapidly increases as cell traffic increase.

(64) Comparison Between Path-Loss Prediction Models for Wireless Telecommunication System Design, by M. Jeong, B. Lee (The Graduate School of Information and Communication, Kyunghee University): *JKEES*, vol. 12, no. 4, pp. 586–593, June 2001.

In this paper, we present the useful curves which compare Cost231-Hata model to Cost231-Walfisch–Ikegami model. These curves enable us to describe Okumura's purely qualitative environment such as urban and suburban in terms of quantitative equivalent building height and street width. This kind of curves can be a good reference when Okumura–Hata (including Cost231-Hata) curves are modified for use in other cities (or countries). We also compare the recent ITU-R model with the Okumura–Hata (OH) model to finally see that ITU-R curves are practically based on OH's suburban area and have been extended to cover longer Tx antenna heights and distances.

(65) Effects of Group Delay and Non-Linear Characteristics in Ka-Band High Data Rate Satellite Communication System, by Y.-W. Kim*, D.-C. Park** (*ETRI; **Department of Radio Science and Engineering, Chungnam National University): *JKEES*, vol. 12, no. 4, pp. 600–610, June 2001.

The effects of group delay and nonlinear characteristics on high data rate (HDR) satellite channel are presented in this paper. Based on the modeling of group delay and nonlinear characteristics the system performances which provide various data rate services were analyzed in Ka-band satellite channel. As the transmission data rate is increased, the degradation due to these channel characteristics is severely increased. The linear component of group delay and the AM–AM component of nonlinear characteristics severely affect the system performance. To efficiently provide the various service via the same transmission system it is necessary to equalize the primary impairment factors. The optimum operating points of HDR satellite transmission system are implemented by considering the analyzed results on channel characteristics.

(66) Performance Analysis of a Multi-Carrier DS-CDMA/BPSK Signal With Hybrid SC/MRC-L_c/L Diversity Reception in Multipath Fading Channel, by Y.-C. Kim, S.-J. Cho (Department of Telecommunication and Information Engineering, Graduate School of Hankuk Aviation University): *JKEES*, vol. 12, no. 4, pp. 630–643, June 2001.

In this paper, the performance of a Multi-Carrier DS-CDMA system with Hybrid SC/MRC-L_c/L diversity in the multipath Rayleigh fading environment is analyzed and compared with that of a Wideband DS-CDMA system. Each carriers of the number of the input diversity branches in the Multi-Carrier DS-CDMA system is L and among L, the branches of L_c are chosen to be maximum-ratio-combined. And the diversity outputs are coherent-detected and despread by the correlator of each carrier. As the result, we have known that the structure of the Wideband DS-CDMA system with Hybrid SC/MRC-L_c/L diversity reception becomes simple due to no synchronization of bit or phase and in terms of the error performance, the performance of Hybrid SC/MRC-L_c/L diversity is better than that of selection diversity, but worse than that of MRC diversity. Moreover, the performance of a Multi-Carrier DS-CDMA system is better than that of a Wideband DS-CDMA system in multipath Rayleigh fading channel since Hybrid SC/MRC-L_c/L diversity can obtain gain from each diversity branch. In case four carriers are used and required BER is 10^{-6} in wireless data communication, Hybrid SC/MRC-2/4 diversity can increase more 17 users than Hybrid SC/MRC-2/3 diversity because the better input branches can be selected through increase of input branches.

(67) A Study on Performance Improvement of Adaptive SLC System Using Eigenanalysis Method, by S.-Y. Kim*, S.-C. Jung*, B.-S. Lee** (*Korea Aerospace Industries; **Department of Telecommunication and Information Engineering, Hankuk Aviation University): *JKEES*, vol. 12, no. 5, pp. 694–704, Aug. 2001.

In this work, we evaluate the performance of eigencanceler which can suppress directional interferences and noise effectively while maintaining specified beam pattern constraints. The constraints and optimal weight vector of eigencanceler vary by using interference and noise or desired signal, interference and noise as array input signal. From the analysis results in the steady state, We show that weight vectors in each case are simplified the form of projection equation that belongs to desired subspace orthogonal to interference subspace and eigencanceler has the better performance than DMI method through mathematical analysis and simulation.

(68) A Study on Indoor Propagation Modeling Using Patch Scattering Model, by W. C. Seok*, J. W. Kim**, J. H. Seok***, J. W. Lim***, Y. J. Yoon** (*LG Electronics Inc., Research Engineering; **Department of Electrical Electronic Engineering, Yonsei University; ***Radio Research Laboratory, Ministry of Information and Communication): *JKEES*, vol. 12, no. 5, pp. 722–733, Aug. 2001.

In this paper, we proposed the image-based 3D ray-tracing indoor propagation model using patch scattering model which can calculate the scattering phenomenon of the indoor structures. A patch scattering model for modeling indoor structures defines a scattering phenomenon by using RCS (Radar Cross Section) about rectangular patch without complex calculation, for example generating image antennas about each indoor structures. RCS is simply defined as a ratio of scattering power to incident power, and we use bistatic RCS which is simplified numerically by Physical Optics. Also, a simple indoor compensation factor is defined as empirical constant from measured data instead of complex numerical expression because basic patch scattering model cannot include important multipath components, so we can use patch scattering model in indoor environment using indoor compensation factor.

(69) A Study on the Measurement and Analysis of Radio Interferences From China, by Y.-H. Kang*, J.-K. Pack**, S.-S. Lee***, H.-S. Lee*** (*School of Electronic and Information Engineering, Kunsan National University; **Radio Science and Engineering, Chungnam National University; ***Radio Science Section, ETRI): *JKEES*, vol. 12, no. 5, pp. 740–746, Aug. 2001.

Radio interferences have been a frequent problem on the TRS service, which has been in operation in the southern coastal area of Korea since 1994. By Korea-Japan joint analysis, the main

reasons of the radio interferences are due to the radio ducting signal from the seaside of Japan. As the mobile services become spreading in China as well as Japan, interference problems between Korea and China will occur more frequently in various frequency bands. Therefore, in this paper we propose a method for measurement and analysis of the radio interference signal, and summarize the measurement results of interference from China, which was performed to solve the interference problem between Korea and China.

(70) Field Uniformity Analysis of Reverberation Chamber With Asymmetric Structure, by S.-Y. Chung*, J.-G. Rhee**, H.-J. Rhee* (*EMC Laboratory, RRL; **Department of Electronic Communication Radio Science and Engineering, Hanyang University): *JKEES*, vol. 12, no. 5, pp. 837–843, Aug. 2001.

Conventional reverberation chamber has a rectangular structure including mode stirrers or mode-tuned stirrers to obtain the field uniformity inside the chamber. This paper explained the way to improve the field uniformity in an asymmetric structure instead of conventional rectangular structure with right-angled planes. Two types of asymmetric structure were considered. One was an asymmetric reverberation chamber using Quadratic Residue Diffuser and the other was an asymmetric chamber with oblique enclosure including fixed Randomly Made Diffusers. The FDTD simulation method was used to analyze the field homogeneous characteristics of these asymmetric reverberation chambers.

(71) Penetrated Electric Fields and Resonant Frequencies Inside Metallic Enclosure With Aperture Exited by an External Dipole Source, by S. Hwangbo*, K.-C. Kim** (*Home N/W Team, Samsung Electronics, Telecommunication R&D Center; **School of Electrical and Electronics Engineering, Yeungnam University): *JKEES*, vol. 12, no. 6, pp. 939–947, Oct. 2001.

This paper presents the penetrated electric fields and resonant frequencies inside a metallic enclosure with aperture excited by an external dipole source. In the theoretical analysis, integral equations for the current distribution and electric field distributions on the aperture are solved by applying Galerkin's method of moments. The results show that the electric fields inside metallic enclosure is maximum at the near the aperture and resonant frequencies are the same as calculated of the enclosure without aperture. To verify the theoretical analysis the electric field inside enclosure and resonant frequencies are compared with the experimental results.

(72) A Study of Accuracy Improvement for Scattering Analysis of FMM Method, by Y.-J. Kim*, Y.-K. Cho**, H. Son** (*Agency of Defense Development; **School of Electronics Engineering, Kyungpook National University): *JKEES*, vol. 12, no. 6, pp. 972–982, Oct. 2001.

FMM (Fast Multipole Method) is suitable numerical method for radar cross section calculation of arbitrary large conducting bodies due to reduction of computation time. The accuracy of the numerical results, however, can influenced by selection of grouping method and segment length, in particular, for the case that cross section of the scatter is of the narrow width elliptical type. So, we describe the FMM method which can be deal effectively with such difficulties for both TM and TE polarization case. In order to check the present method, the results are compared with those obtained by Method of Moments.

(73) Design and Properties of Microwave Absorbing Structures Composed of Fiber Reinforced Composites, by S.-Y. Kim, S.-S. Kim (Department of Materials Engineering, Chungbuk National University): *JKEES*, vol. 12, no. 6, pp. 1002–1008, Oct. 2001.

The absorbing structure composed of multi-layered fiber reinforced composite materials was designed and microwave absorbing properties are investigated. On the basis of transmission line theory, the theoretical equations to predict the reflection loss and the appropriate composite material for each functional layer are suggested. The most significant result of this study is the successful design and fabrication of triple-layered composite laminates which has the superior microwave absorbing properties (more than 10 dB in 4∼12 GHz range), without using the ferrite filler in the impedance transforming layer. In the two-layered composite laminate (absorber/substrate), however, the use of ferrite filler (about 40 wt%) in the absorbing layer is necessary to obtain the certain level of microwave absorbance. By combining the glass-fiber composite with ferrite filler and carbon-fiber composite substrate, the microwave absorbing properties more than 10 dB in 4∼12 GHz frequencies can be obtained.

(74) A Study of EM Wave Penetration and Scattering of Open Cylindrical Cavity, by Y. J. Kim*, Y. K. Cho** (*Agency for Defence Development; **School of Electronics Engineering Kyungpook National University, Deagu, Korea): *JKEES*, vol. 38-TC, no. 11, pp. 449–456, Nov. 2001.

Field penetration and scattering characteristics of two dimensional open cylindrical cavity is studied. Exact analysis for this sort of structure is not achieved even if there are unusual phenomena of field penetration and scattering with cavity and aperture size. In this paper, we calculate a wide range of open cavity characteristics by using of FMM method, which is extended method of MOM. We find external mode of open cylindrical cavity corresponding to internal mode of closed cavity. The characteristics of resonance and scattering of this region is different compare with non-resonant area. The result of study will apply to the EM wave shielding and RCS control.

(75) Correlating Fully Anechoic Chamber to Open Area Test Site Measurements by the Normalized Site Attenuation, by T.-W. Kang*, B.-W. Kim**, Y.-C. Chung***, H.-T. Kim**** (*Korea Research Institute of Standards and Science, Electromagnetics Group; **Department of Electronics Engineering Sogang University; ***Expan Electronics Components Corporation; ****Department of Electrical and Electronic Engineering Pohang, University of Science and Technology): *JKEES*, vol. 1, no. 2, pp. 126–130, Nov. 2001.

The performance of a fully anechoic chamber (FAC) for radiated emission (RE) measurements has been evaluated using the normalized site attenuation (NSA). To do this, the antenna factor (AF) of a set consisting of nearly identical antennas has been calibrated at an open area test site (OATS). Appropriate correlation factor (CF) between the chamber and the OATS has been calculated. Results show that the performance of the chamber is fairly good with respect to the ANSI-limit except 41∼66 MHz for vertical polarization and near 900 MHz for horizontal polarization.

(76) Complex Permittivity Extraction of Blood Glucose at Microwave Frequency, by Y. C. Jeong, H. s. Lee, J. h. Kim (Electrical and Engineering and Computer Science, Division of Electrical Engineering, KAIST): *JKEES*, vol. 1, no. 2, pp. 139–145, Nov. 2001.

In this paper, a coaxial sample holder is proposed with its de-embedding and parameter extraction procedure. The S-parameters were measured up to 1 GHz using network analyzer, HP8753D, and N-type connector together with the de-embedding of N-type connector. The proposed de-embedding procedure is performed to extract electrical parameters of blood glucose, which gives the permittivity of blood glucose. We also analyzed the error of extracted parameters, which are caused by instrument error and geometrical error. Using these error analyzes, we reduced the error factors of extracted parameters. We extracted electrical parameters of glucose samples through these all extraction procedure and confirmed the possibility of glucose diagnosis system based on microwave system.

(77) Radiation Characteristics of Finite Strip-Grating Loaded Dielectric-Coated Coaxial Waveguide With Finite Periodic Thick Slots, by J.-P. Kim*, C.-W. Lee** (*Communication Satellite Department, Korea Aerospace Research Institute; **School of Electronic and Electrical Engineering, Kyungpook National University): *JKEES*, vol. 1, no. 2, pp. 161–165, Nov. 2001.

The radiation characteristics of leaky wave emanated from finite strip-grating loaded dielectric coated coaxial waveguide with finite periodic thick slots are investigated theoretically. The rigorous integral equations are derived for the proposed structure using the Fourier transform, mode expansion, and sine series expansion of the electric current on metallic strips, and the simultaneous linear equations are obtained. The effects of finite strip-grating loading on a dielectric-coated coaxial waveguide with finite periodic thick slots are examined in terms of radiation characteristics.

(78) Polarizability for a Circular Aperture Near a Conducting Plane, by Y. B. Park, I. H. Kim, H. J. Eom (Department of Electrical Engineering, Korea Advanced Institute of Science and Technology): *JKEES*, vol. 1, no. 2, pp. 173–175, Nov. 2001.

A polarizability for a circular aperture near a conducting plane is derived. The Hankel-transform and mode-matching is used to obtain a simple series solution. The presented series solution is fast convergent so that it is very efficient for numerical computations.

(79) On the Forced Resonant Characteristics of Partially Filled Electrically Small Cavity With Loaded Reactance, by K.-C. Kim (School of Electrical Engineering and Computer Science, Yeungnam University): *JKEES*, vol. 1, no. 2, pp. 176–181, Nov. 2001.

This paper presents the forced resonant characteristics of an electrically small cavity partially filled with dielectric material. The method of moments with Galerkins procedure is used to determine the forced resonant characteristics of the small cavity. In order to obtain the equations of the external reactance gives rise to the forced resonance at a given frequency, the cavity with external reactance can be treated as two-port network which has the admittance parameters. Numerical results show that the forced resonance, series or parallel resonance, can be obtained by the controlling the external reactance. To verify the availability of the theoretical analysis, experiments are carried out for the bakelite as the material by measuring the length of external reactance at operating frequencies.

(80) Parasitic Impedance Extraction of FC-PGA Package Pin Using the Static Fast Multipole Method, by J.-n. Cheon*, J. Lee**, S. Uh*, H.-d. Kim* (*Division of Electrical and Computer Engineering, Hanyang University; **Hyundai Motor Company): *JKEES*, vol. 12, no. 7, pp. 1076–1085, Dec. 2001.

In this paper, the FMM (Fast Multipole Method) combined with GMRES (Generalized Minimal RESidual Method) matrix solver is used to extract the parasitic impedance for complicated 3-D structures in uniform dielectric materials which limit the use of MoM (Method of Moment) due to its large computation time and memory requirement. This algorithm is a fast multipole-accelerated method based on quasistatic analysis and is very efficient for computing impedance between conductors. This paper proved the accuracy and efficiency of the FMM by comparing with MoM in simple examples. Finally the parasitic impedance of FC-PGA (Flip Chip Pin Grid Array) Package pins has been extracted by this algorithm and we have considered the possibility of the EMI/EMC problem caused by the signal interference.

(81) Haar-Wavelet-Based Compact 2D MRTD for the Efficient Dispersion Analysis of the Waveguide Structures, by J. Cheon, S. Uh, H. Park, H. Kim (Department of Electrical and Computer Engineering, Hanyang University): *JKEES*, vol. 12, no. 7, pp. 1131–1138, Dec. 2001.

This paper presents the new Compact 2D Haar-wavelet-based MultiResolution Time-Domain method (MRTD) as an accelerating algorithm for the conventional Compact 2D Finite-Difference Time-Domain method (FDTD). To validate this algorithm, we analyzed the dispersion characteristics of the hollow rectangular waveguide and dielectric slab-loaded rectangular waveguide. The results of the proposed method are very well agreed with those of both the conventional analytic method and the Compact 2D FDTD method. The CPU time for analysis of this method is reduced to about a half of the conventional Compact 2D FDTD method. The proposed method is valuable as a fast algorithm in the research of dispersion characteristics of waveguide structures.

(82) Application of the Inverse Scattering Theory to the Design of the Tapered Impedance-Matching Line, by C.-H. Song, S.-S. Lee (Division of Electronic and Computer Engineering, Hanyang University): *JKEES*, vol. 12, no. 7, pp. 1139–1146, Dec. 2001.

A tapered impedance-matching line is designed by an inverse scattering method for the one-dimensional medium. The phase compensation factor (PCF) is introduced in order to reduce the error in the inverse scattering process to reconstruct the permittivity profile. By estimating the permittivity profile of the virtual one-dimensional dielectric medium whose reflection characteristic is the same as that of the specified matching line, the matching line is synthesized. The method can be used to design impedance-matching lines with arbitrary passband characteristics without any equivalent circuit analysis. The inevitable errors in the method using the time-domain reflection coefficient

can be avoided by using the frequency-domain reflection coefficient.

(83) SAR Analysis for Test Positions of Mobile Phone, by H.-D. Choi*, A.-K. Lee*, K.-Y. Cho*, H.-T. Oh** (*Electronics and Telecommunications Research Institute; **Radio Research Laboratory): *JKEES*, vol. 12, no. 7, pp. 1199–1205, Dec. 2001.

There has been an increase in the public concern about possible health risks by electromagnetic exposure from mobile phones. Recently, several SAR measurement procedures have been proposed to demonstrate the compliance of mobile phone with safety limits. To determine the maximum localized SAR of a test mobile phone, the electric field distribution is measured in the head phantom with simulated tissue liquid using the probe. The important parameters in SAR measurement are the E-field probe, the shape and size of phantom, the electrical parameters of simulated tissue liquid, and test position, etc. Therefore, in order to setup the measurement standard, the studies on these factors are required. In this paper, the effects of the maximum localized SAR on the test positions of mobile phones were analyzed by the numerical computation and the SAR measurement. From the results, the worst condition of commonly used positions was determined and the touch and tilted positions were adopted as test positions of the domestic SAR measurement standard.

(84) Accurate SSN Analysis Using Wideband Decoupling Capacitor Model, by K.-J. Son*, D.-K. Kwon*, H.-Y. Lee*, C.-S. Choi**, J.-G. Byun** (*Department of Electronics Engineering, Ajou University; **Computer and Internet System Division, Samsung Electronics Co., Ltd.): *JKEES*, vol. 12, no. 7, pp. 1048–1056, Dec. 2001.

Decoupling capacitors are commonly used to reduce the effect of SSN propagated through parallel power and ground planes in high-speed multilayer printed circuit boards (PCBs). In this paper, we introduced a simple high frequency measurement and proposed a wideband (50 MHz$\sim$3 GHz) equivalent circuit model for decoupling capacitor considering high frequency parasitic effects. The proposed model can be easily combined with the SPICE model of power supply planes for SSN analysis. The circuit simulations with the proposed model show good agreement with the measurement results. Also, we expect to accurately analyze the noise reduction effect as a function of value and location using the proposed model of decoupling capacitor.

(85) Characteristic Analysis of Buried Scatterers Using the Correlation Coefficient of Scattered Signals Under the Noisy Environment, by D. H. Kim, P. D. Cho (Technology Standard Research Team, Standard Research Center, ETRI, Daejeon, Korea): *JKICS*, vol. 26, no. 3B, pp. 266–272, Mar. 2001.

A simple buried scatterers detection method using ground penetrating radar is investigated. Basic idea is based on the understanding of the difference of scattered signals from various scatterers and employs the disagreement of those signals to detect the specific buried scatterers using correlation function. We use the Debye model for the formulation of underground medium which shows lossy and dispersive characteristics for the variation of operating frequency. In addition, FDTD method is adopted for three dimensional electromagnetic wave propagation simulation.

(86) A Study on Cell Planning for High Density Area of Buildings in Micro Cellular Network, by C. Y. Yun*, S. S. Bae*, M. H. Lee**, Y. H. Oh* (*Department of Electronic Engineering, Kwangwoon University, Seoul, Korea; **Korea Telecom Freetel Co., Ltd.): *JKICS*, vol. 26, no. 4A, pp. 500–505, Apr. 2001.

Wireless communication in urban of high density area, it is importance of accurately predicted microwave characteristics in optimization of wireless communication networks through base station placement and cell designs. In the dense urban environment, signals cannot always transit in the line-of-sight between the transmitting and receiving antennas because of the natural and artificial interference surrounding the receiver. The CCIR model is a microwave prediction model which utilizes shadowing by the building characteristics in urban areas. The CCIR model does not consider terrain conditions in calculating building density and because we calculate only the lateral contributions of the spacial separation between the transmitting and receiving antennas, the error increases proportionally to the transmitting antenna height. With the same density, the single shadowing by building and multi-building shadowing turns out identical, and in order to achieve effective performance we must take the trouble to apply a cumbersome correction factor corresponding to the regional characteristics. In this paper, we propose a microwave prediction model that settles these problems. In the proposed model we have compared and analyzed the prediction results of the model which determines the correlation among transmitting and receiving distance, building material, and building width, which are most influential in the Line-Of-Sight, to the prediction results of the CCIR model. Compared with measurements, the proposed model has made improvements from the CCIR model.

(87) EM Wave Scattering by Bianisotropically Coated Multilayer Cylinder With an Impedance Sheet [I], by S.-J. Eom*, J. H. Yoon**, H. C. Lee***, K.-S. Kwak**** (*Samsung Total Technique Institute, Korea; **Department of Electronics Engineering, Inha University, Inchon, Korea; ***Department of Information Communication, Chodang University, Korea; ****Department of Information Communication Graduation, Inha University, Inchon, Korea): *JKICS*, vol. 26, no. 4B, pp. 383–390, Apr. 2001.

In this paper, electromagnetic wave scattering from a bianisotropically coated cylinder is formulated by using wave functions for bianisotropic media and boundary-value method. The cross section of the cylinder is made of a conducting core, a lossless dielectric layer which is both electrically magnetically bianisotropic, and a bianisotropic impedance sheet. The solutions to arbitrary polarization angles are presented in two-dimensional. This paper presents an exact solution to the problem of scattering by a long composite circular cylinder using the boundary method. The validity of this solution is verified by comparing numerical results with those in literature. The numerical results for various geometrical and electrical parameters on bistatic scattering cross-section are presented.

(88) EM Wave Scattering by Bianisotropically Coated Multilayer Cylinder With an Impedance Sheet [II], by

S.-J. Eom*, J. H. Yoon**, H. C. Lee***, K.-S. Kwak**** (*Department of M-Application Project Team, Samsung Total Technique Institute, Korea; **Department of Electronic Engineering, Inha University, Inchon, Korea; ***Department of Information Communication, Korea; ****Department of Information Communication Graduation, Inha University, Inchon, Korea): *JKICS*, vol. 26, no. 4B, pp. 391–399, Apr. 2001.

In this paper, electromagnetic wave scattering by a bian-isotropically coated cylinder is formulated by using wave functions for bianisotropic media and boundary-value method. The cross section of the cylinder is made of a conducting core, a lossless dielectric layer which is both electrically magnetically bianisotropic, a bianisotropic impedance sheet and a different uniaxial bianisotropic coating. The solutions to arbitrary polarization angles are presented in two-dimensional. This paper presents an exact solution to the problem of scattering by a long composite circular cylinder using the boundary method. The validity of this solution is verified by comparing numerical results with those in literature. The numerical results for various geometrical and electrical parameters ion bistatic scattering cross-section are presented.

(89) A Study on Characterization of Stimulated Brillouin Scattering in Single-Mode Optical Fiber, by Y. O. Han, P. S. Choi, J. J. Eun (Department of Electronics, Changwon University): *JKICS*, vol. 26, no. 12B, pp. 1703–1711, Dec. 2001.

Stimulated Brillouin scattering (SBS) is one of dominant phenomena in wavelength division multiplexing (WDM) optical transmission systems because it occurs at a relatively low-power level. Therefore, to increase the transmission distance when the input power is launched high, SBS has to be considered. In a WDM system, it is desirable to pack the channels as closely together as possible in order to maximize the number of channels, and so the effect of stimulated Brillouin scattering must be considered further. The Brillouin gain spectrum (BGS) contains important information about the SBS threshold as well as the Brillouin frequency shift, the Brillouin spontaneous linewidth, and the gain coefficient. In this paper, we observed the stimulated Brillouin scattering signal experimentally in standard 1550-nm optical transmission system. The experimental result is compared with the theoretical one. Besides, the measured Brillouin frequency shift of 10.8825 GHz agreed with the theoretical value of 10.9 GHz. To see that the stimulated Brillouin scattering plays a critical role in the WDM optical transmission systems,we also measured the Brillouin gain spectrum to characterize the implication of the SBS in the design of such lightwave systems. The Brillouin gain coefficient was 1.5430 $\times$ 10-11 m/W experimentally.

(90) OFDM System Using Cross-Handed Circular Polarization, by B.-O. Kim*, D.-H. Ha** (*Korea Institute of Maritime and Fisheries Technology; **Division of Electronics and Telecommunication Engineering, Pukyong University): *JKICS*, vol. 26, no. 12B, pp. 1741–1746, Dec. 2001.

This paper proposes the OFDM system that uses circularly polarized waves for improving the system performance. The circular polarization has the characteristic that it cannot receive the waves which are reflected by odd times. Using this characteristic, a modified OFDM system that uses the cross-handed circular polarization (XCP-OFDM) is newly proposed. By using the characteristic of circular polarization, it is clearly seen that the system performance of XCP-OFDM can be improved to a great extent. This is due to a reduction of the interferences caused by reflected waves and inter-channel interference. Both theoretical analysis and system simulation results are described.

(91) A Ray-Tracing-Based Characterization and Verification of the Spatio–Temporal Channel Model for Future Wideband Wireless Systems, by H. Zhu*, J.-i. Takada**, K. Araki**, T. Kobayashi*** (*Interdisciplinary Graduate School of Science and Engineering, Tokyo Institute of Technology, Tokyo, 152-8550 Japan; **Graduate School of Science and Engineering, Tokyo Institute of Technology, Tokyo, 152-8552 Japan; ***YRP Mobile Telecommunications Key Technology Research Laboratories Co., Ltd., Yokoyuka-shi, 239-0847 Japan): *IEICE Trans. Commun.*, vol. E84-B, no. 3, pp. 644–652, Mar. 2001.

A proper design and analysis of future wideband wireless communication systems require an accurate radio channel model. This model is claimed to characterize both the spatial and temporal channel characteristics. This paper investigates the spatio–temporal channel modeling based on a ray-tracing approach. The temporal channels are characterized by a delay profile. The statistical median and fading-fluctuation range of delay profiles are predicted from ray tracing by incorporating the random phase approach. A high level of agreement between predicted results and measured ones is observed in the verification. The spatio–temporal channel impulse response (CIR) predicted from ray tracing is also transformed to have limited band-width and limited beam-width characteristics. The applicability of this transformation is also verified by the comparison with measurement. These verifications prepare the ground for the use of ray-tracing approaches to evaluate system performance in real environments.

(92) Propagation Characteristics of ELF/VLF Electromagnetic Waves in the Martian Ionosphere and the Possibility for Detection of Martian Atmospherics by NOZOMI Observations, by T. Okada*, S. Yagitani**, I. Nagano**, T. Imachi**, M. Mukaino*, Y. Kasaba***, H. Matsumoto**** (*Toyama Prefectural University, Toyama-ken, 939-0398 Japan; **Kanazawa University, Kanazawa-shi, 920-8667 Japan; ***Institute of Space and Astronautical Science, Sagamihara-shi, 229-8510 Japan; ****Radio Science Center for Space and Atmosphere, Kyoto University, Uji-shi, 611-0011 Japan): *IEICE Trans. Commun.*, vol. E84-B, no. 3, pp. 653–659, Mar. 2001.

A feasibility study has been made of the detection possibility of radio wave noises, i.e., Martian atmospherics, emitted from discharges in the Martian atmosphere during large dust storms. The spacecraft NOZOMI, which was launched in 1998, is to be placed on an elliptic orbit around Mars with perigee of 150–200 km. An onboard-equipment LFA (Low Frequency Plasma wave Analyzer) has capability to measure the low frequency plasma waves in the frequency range from 10 Hz to 32 kHz. In order to know if the LFA can detect the atmospheric radio noises, the propagation characteristics of electromagnetic waves through the Martian ionosphere are studied theoretically by using a full-wave method. The ionosphere is modeled as

a magneto-ionic medium based on the recent observations of magnetic anomaly by Mars Global Surveyor spacecraft, and the atmospheric constituent and electron density by Viking observations. Our calculation shows that the waves at frequencies less than a hundred hertz can propagate with low attenuation and reach to altitudes above 200 km in the whistler-mode in the regions of magnetic anomalies in the dayside ionosphere. It is shown that the radio noises emitted from electric discharge in an intense dust storm, with the intensity over -30 dBV/m/$\sqrt{\text{Hz}}$ at the ionospheric entry point, can be sensed by the LFA. The observational identification of Martian atmospherics will contribute to the physical study of charge/discharge process in the Martian atmosphere.

(93) Mathematical Derivation of Modified Edge Representation for Reduction of Surface Radiation Integral, by K.-i. Sakina, S. Cui, M. Ando (Department of Electrical and Electronic Engineering, Tokyo Institute of Technology, Tokyo, 152-8552 Japan): *IEICE Trans. Electron.*, vol. E84-C, no. 1, pp. 74–83, Jan. 2001.

Modified Edge Representation (MER) empirically proposed by one of the authors is the line integral representation for computing surface radiation integrals of diffraction. It has remarkable accuracy in surface to line integral reduction even for sources very close to the scatterer. It also overcomes false and true singularities in equivalent edge currents. This paper gives the mathematical derivation of MER by using Stokes' theorem; MER is not only asymptotic but also global approximation. It proves remarkable applicability of MER, that is, to smooth curved surface, closely located sources and arbitrary currents which are irrelevant to Maxwell equations.

(94) On Leaky-Wave Approach of Rigorous Modes Coupled in Multilayered Periodic Waveguides, by K.-C. Ho*, Y.-K. Kim** (*Department of Electronic Engineering, Halla University, Wonju, San 66, Korea; **Department of Electronic Engineering, Kon-Kuk University, Mojin-Dong 93-1, Seoul, Korea): *IEICE Trans. Electron.*, vol. E84-C, no. 1, pp. 84–95, Jan. 2001.

The field supported by multilayered periodic waveguides is well characterized by only one or two discrete leaky waves, rather than by a more complicated field representation that includes continuous spectra. The rigorous leaky-modes coupled in multilayered geometry can be then treated by relatively simpler and analytic model that describes the operation of practical optoelectronic devices in terms of leakage effects. To complement our modeling, we discuss and emphasize novel mathematical formulations based on the field orthogonality conditions of TE and TM modes coupled in multilayered periodic structures. In addition, to show the validity of our approach we numerically evaluate new physical meanings to illustrate quantitatively and rigorously the coupling efficiency of grating-assisted directional couplers (GADCs). The results reveal that the systematic and effective technique yields phenomenologically useful interpretations.

(95) Fast Image Reconstruction of Dielectric Cylinders Using Optical Regularization Parameter, by M. Tanaka, K. Ogata (Faculty of Engineering, Oita University, 700 Dannoharu, Oita-shi, 870-1192 Japan): *IEICE Trans. Electron.*, vol. J84-C, no. 1, pp. 54–55, Jan. 2001.

A novel method for choosing the optimal regularization parameter used in the Levenberg–Marquardt method has been proposed. It is confirmed from the numerical results for a stratified circular cylinder consisting of two concentric homogeneous layers that our method shows much faster convergence than the conventional generalized cross-validation method.

(96) Ray Tracing Analysis of Large-Scale Random Rough Surface Scattering and Delay Spread, by K.-Y. Yoon*, M. Tateiba*, K. Uchida** (*Department of Computer Science and Communication Engineering, Kyushu University, Fukuoka-shi, 812-8581 Japan; **Faculty of Information Engineering at Fukuoka Institute of Technology, Fukuoka-shi, 811-0295 Japan): *IEICE Trans. Electron.*, vol. E84-C, no. 2, pp. 267–270, Feb. 2001.

We have discussed a ray tracing method to estimate the scattering characteristics from random rough surface. It has been shown from the traced rays that the diffracted rays dominate over the reflected rays. For the field evaluation, we have used the Fresnel function for the diffracted coefficient and the Fresnel's reflection coefficients. Numerical examples have been carried out for the scattering characteristics of an ocean wave-like rough surface and the delay spared characteristics of a building-like surface. In the present work we have demonstrated that the ray tracing method is effective to numerical analysis of a rough surface scattering.

(97) Equivalent Circuit Analysis for the Shift Angle of Square Beam Resonator in a Piezoelectric Vibratory Gyroscope With Forced Vibration, by Y. Kuriyama*, H. Kakinuma** (*Department of Control Engineering, Gunma Polytechnic College, Takasaki-shi, 370-1213 Japan; **Department of General Technical Development, Taiyou Yuden Co., Ltd., Gunma-gun, Gunma-ken, 370-3345 Japan): *IEICE Trans. Electron.*, vol. J84-C, no. 2, pp. 121–126, Feb. 2001.

We have made equivalent circuit analysis for the piezoelectric vibratory gyroscope using flexural vibration of a resonator with a square cross section. We already analyzed a shift angle (change in the vibrating direction) quantitatively by Finite Element Method. The aim of this paper is to obtain the validity of this FEM analytical results and to make much cleaner an effect of shift angle of the resonator with steady-state forced vibration. The results obtained by equivalent circuit analysis agree well with the analytical results by FEM. Furthermore, we could reveal the relation better between shift angle with free vibration and that with forced vibration.

(98) Qualitative Analysis in Engineering Electromagnetics: An Application to General Transmission Lines, by M. Tayarani, Y. Kami (Faculty of Electro-Communications, University of Electro-Communications, Chofu-shi, 182-8585 Japan): *IEICE Trans. Electron.*, vol. E84-C, no. 3, pp. 364–375, Mar. 2001.

Fuzzy inference abilities were implemented to electromagnetic problems for the first time by the authors. After very successful results of applying the developed fuzzy modeling method to input impedance of a general monopole antenna, in this paper classifying the engineering electromagnetic problems simply, we apply the abilities of the proposed fuzzy inference method to make a qualitative model for transmission lines as a general example for a certain category of problems. The

proposed approach starts from observing the problem through the window of human direct understandings and uses some parameters (as calculation base) evaluated basic for modeling process. It is shown that because of using this novel view point, a very simple fuzzy system based on new parameters may model the behavior of a transmission line in general form. The knowledge of each variable can be extracted and saved as simple curves individually, through continuing to make several models considering the desired variable as parameter. Finally, it is shown that the proposed method works even in highly nonuniform transmission line cases without changing in structure and complexity.

(99) Scattering Analysis of Large Scale Cavities Using the Non-Standard FDTD Method, by T. Ohtani*, H. Kudo**, Tatsuya Kawashima** (*Mitsubishi Heavy Industries, Ltd., Nagoya-shi, 455-8515 Japan; **Kitami Institute of Technology, Kitami-shi, 090-8507 Japan): *IEICE Trans. Electron.*, vol. J84-C, no. 4, pp. 237–244, Apr. 2001.

The non-standard FDTD (NS-FDTD) method has been developed to overcome the phase error of the FDTD method. However, the method has been restricted only to isotropic grids. In this paper, the NS-FDTD method is extended to be able to handle nonisotropic grids using newly proposed FD Laplacians. The method was applied to the analysis of radar cross section of large scale cavities. And the results were compared with other methods. As a result, it is shown that the NS-FDTD method has much higher accuracy than the FDTD method in both isotropic and non-isotropic grids. Furthermore, this paper shows that the NS-FD method used in the method is equivalent to the phase velocity correction technique.

(100) Coupling of Electromagnetic Wave Between Metallic Waveguides and Photonic Crystal Waveguides in Microwave Region, by Y. Kokubo, D. Takemoto, T. Kawai, I. Ohta (Department of Electronics, Faculty of Engineering, Himeji Institute of Technology, Himeji-shi, 671-2201 Japan): *IEICE Trans. Electron.*, vol. J84-C, no. 4, pp. 324–325, Apr. 2001.

Coupling efficiency will be good between metallic waveguides and 2D photonic crystal waveguides in microwave region if we use born antennas. This paper suggests that coupling efficiency is relatively good under suitable conditions without horn antennas which are not so easy to setup as butt joint.

(101) FDTD Analysis of Iris-Coupled Waveguide Bandpass Filter, by D. Ikuta, S. Harada, Y. Iida (Faculty of Engineering, Kansai University, Suita-shi, 564-8680 Japan): *IEICE Trans. Electron.*, vol. J84-C, no. 4, pp. 332–334, Apr. 2001.

In this paper, an iris-coupled waveguide bandpass filter (BPF) is analyzed using the finite-difference time-domain (FDTD) method with new technique of grid arrangement near conductor corners. It is shown that the characteristics of BPF with relative bandwidth 1.3 percent can be calculated with proper accuracy.

(102) Concept and Evaluation of a 2-D FDTD Formulation Based on Expanded Wave Equation Approach, by K. Ichige, H. Arai (Division of Electrical and Computer Engineering, Yokohama National University, Yokohama-shi, 240-8501 Japan): *IEICE Trans. Electron.*, vol. E84-C, no. 7, pp. 981–993, July 2001.

This paper presents a novel concept of a Two-Dimensional (2-D) Finite-Difference Time-Domain (FDTD) formulation for the numerical analysis of electromagnetic fields. FDTD method proposed by Yee is widely used for such analysis, although it has an inherent problem that there exist half-cell-length and half-time-step distances between electric and magnetic field components. To dissolve such distances, we begin with the finite-difference approximation of the wave equation, not Maxwell's equations. Employing several approximation techniques, we develop a novel algorithm which can condense all field components to equidistant discrete nodes. The proposed algorithm is evaluated in comparison with several conventional algorithms by computer simulations.

(103) Band Structures for Modulated Superlattices With Symmetric Gaussian Potential Profile, by K. Asakura*, M. Suzuki**, H. Sanada**, N. Nagai** (*Division of Electronics and Information Engineering, Graduate School of Engineering, Hokkaido University, N-13 W-8, Sapporo-shi, 060-8628 Japan; **Research Institute for Electronic Science, Hokkaido University, N-12 W-6, Sapporo-shi, 060-0812 Japan): *IEICE Trans. Electron.*, vol. J84-C, no. 7, pp. 574–583, July 2001.

Based on numerous simulation results, this paper inductively derives the fact that Gaussian superlattices have an energy band structure composed of three types of bands, i.e., passbands with the transmission probability nearly equal to 1, stopbands with the transmission probability nearly equal to 0, and quasipassband in which there exist many sharp resonant levels. This paper also shows that some regularity can be found in the difference in band structures of Gaussian superlattices and periodic superlattices. According to the regularity found, it is possible to estimate the band structure of Gaussian superlattices without calculating them from those of periodic superlattices. The energy band classification derived may give an effective index for designing energy filters of electron waves.

(104) Modeling the Physical Optics Currents in a Hybrid Moment-Method-Physical-Optics Code, by J. M. Taboada, F. Obelleiro, J. L. Rodríguez, J. O. R. López (Departamento de Tecnoloxías das Communicacións, Universidade de Vigo, Campus Universitario S/N, 36200 Vigo, Spain): *IEICE Trans. Electron.*, vol. E84-C, no. 9, pp. 1207–1214, Sept. 2001.

This paper shows a comparison between several procedures to represent the Physical Optics (PO) current density into a hybrid Moment-Method-Physical-Optics (MM-PO) code. Some numerical results demonstrate that a set of basis functions suitable for the Method of Moments (MM) may be inappropriate to model the PO currents. A new evaluation of the PO operator is proposed. The radiation can be analytically determined and, since it includes a linear interpolation of the phase, it can be applied over large triangular domains. This allows a drastic reduction of the computational cost, maintaining or even improving the level of accuracy.

(105) Scattering of Electromagnetic Wave by Large Open-Ended Cavities With Surface Impedance Boundary Conditions, by M. Tadokoro*, K. Hongo** (*Yokohama Rubber Co., Ltd., Hiratsuka-shi, 254-8601 Japan; **Department of Information Science, Toho University, Funabashi-shi, 274-8510 Japan): *IEICE Trans. Electron.*, vol. E84-C, no. 10, pp. 1583–1587, Oct. 2001.

The boundary integral equation (BIE) on interior walls with surface impedance conditions is implemented to the iterative physical optics method and how to treat the singularities involved in the BIE of an impedance cavity is described. Singular integrals over a rectangular region can be represented by simple elementary functions.

V. Microwave Medical/Biological Applications

(1) Improvement and Clinical Application of Medical External Microwave Radiator, by Y.-Y. Gao* and Y.-Q. Miao*, H.-S. Qian** (*Shanghai Second Medical University, Shanghai, P.R.C.; **Nanjing Great Microwave Electronics Laboratory, Nanjing, P.R.C.): *JIMW*, vol. 20, pp. 143–146, Apr. 2001.

In view of the problems in the clinical application of microwave external radiator, the needle-shaped waveguide excited radiator in the model of coaxial-waveguide transition was replaced by a tapered Archimedian spirals radiator. It improves the standing wave ratio, reduces the volume and weight of the radiator and decreases the microwave leak. The result is satisfactory with clinical practices.

(2) Experimental Study of Apoptosis and Its Molecular Mechanisms of Nasopharyngeal Carcinoma Cell Induced by Millimeter Wave Irradiation, by Y.-P. Wang, S.-L. Yuan, X.-H. Chen, Y. Yang, Y. Song and N.-Y. Chen (West China University of Medical Science, Chengdu, P.R.C.): *JIMW*, vol. 20, pp. 283–286, Aug. 2001.

The effect of millimeter wave radiation on the nasopharyngeal carcinoma cell line CNE_1 cell proliferation and apoptosis and the expression of related genes were studied by using cell count, light microscopy and the flow cytometry (FCM). By millimeter wave radiation with 1 mW/cm^2 power density at frequency 42.2 GHz and wave length 7.1 mm on CNE_1 cells for duration of 30 min/day for 4 days, cell proliferation and cloning formation were inhibited markedly, and cell apoptosis was induced. FCM also revealed that the inhibiting effect of CNE_1 proliferation by millimeter wave was probably associated with the up-regulation of P21 and the down-regulation of Cyclin D_1. The molecular mechanism of apoptosis inducing may be p53-independent and c-Myc-dependent. The up-regulation of c-Myc and Fas and down-regulation of Bcl-2 may play an important role in the process of apoptosis.

(3) Research on Temperature Responding Mechanism of Different Vegetable Oils During Microwave Irradiation, by G.-Y. Zhang, L. Li, S.-Y. Guo and M.-Y. Cai (South China University of Technology, Guangzhou, P.R.C.): *JM*, vol. 17, pp. 44–49, Mar. 2001.

The changes of temperature responding mechanism with different microwave parameters in vegetable oils were investigated. It was found that the temperature–time curves and their linearity could be affected greatly by the microwave radiation intensity. As a result, a serial of mathematical models were established to describe the relationships between temperature of the oils and irradiating time at different microwave radiation intensities, and the temperature measurement properties with T-thermocouple during microwave irradiation were also discussed.

(4) Study on the Screening High Yield Xylanase Producing Strain *Aspergillus Niger* by Microwave Mutagenesis, by Y.-Q. Li (Zhejiang University, Hangzhou, P.R.C.): *JM*, vol. 17, pp. 50–53, Mar. 2001.

A high yield xylanase producing strain *A. niger* HD-3.6 was screened out from its parent strain *A. niger* HD-3 by microwave irradiation. Its fermentation unit increases by 43.3% from 15 000 μ/ml to 21 500 μ/ml and its properties of highly producing xylanase remained stable after many times of subcultures and storage for two months. The mechanism of microwave effects was also discussed.

(5) Several Methods for High Power Microwave Frequency Diagnosis, by H.-J. Wang, W.-H. Huang and G.-Z. Liu (Northwest Institute of Nuclear Technology, Xi'an, P.R.C.): *JM*, vol. 17, pp. 62–66, Mar. 2001.

Several methods such as filter, dispersive line, and heterodyne for high power microwave frequency diagnosis are introduced and discussed. It shows by analysis and comparison that three methods above mentioned have their unique characteristics and applicability, and therefore should be chosen according to user's needs.

(6) Analysis of Current Density Distribution and *In Vitro* Exposure System for ELF Exposed Cell Experiments, by D.-G. Kim, J.-S. Jung, J.-M. Ahn (Department of Information and Communication, Hallym University): *JKEES*, vol. 12, no. 1, pp. 84–91, Jan. 2001.

In *in vitro* cell experiments for the biological assessment of electromagnetic (EM) field, exposure system (ES) must be analyzed in terms of current density (J) and induced electric field intensity (E). Although in uniform B field, E and J in the sample medium are not distributed uniformly because of conductivity in sample dish. Thus, the precise estimation for E and J induced by uniform ELF within sample media is very important keys for successful in *in vitro* experiments. In this paper, we designed *in vitro* ELF ES with electromagnetic analysis using MATLAB simulator. Then we calculated from the measured B field to verify induced E and J distribution for random locations of cells within media in two cases of samples existence or not. ES with B field ranging from 0 to 20 G consists of Helmholz coil and current generator based on the microprocessor. Also, we developed ELF ES for each B field generation as uniform and non-uniform modes.

(7) Computation of Temperature Rising by Absorbed Power Radiated From a Portable Phone, by S.-H. Lee, C.-Y. Kim, S.-J. Kang (Department of Electronics, Kyungpook National University): *JKEES*, vol. 12, no. 3, pp. 409–416. Apr. 2001.

Absorbed power of the human head radiated from a 900 MHz portable phone and temperature rise are computed using FDTD (Finite-Difference Time-Domain) method. For this computation the 5 layered media for the human head modeling and the monopole antenna attached to metallic box for the portable phone are used. To reflect the real circumstances typical sizes of human heads and portable phones are considered in the calculation. The length of monopole antenna is 8.15 cm, and the output power of a phone is 600 mW. Under the predetermined model the distribution of 1 g , 10 g averaged SAR and temperature rise rate over the human head are calculated,

from which it was found that the position of maximum SAR is near at the head skin surface, not deep places far into the head. The position of the highest temperature is located far from the head skin more than that of the maximum SAR occurred. The averaged SAR and temperature along the distance between the head and phone are calculated according to separation distance between the head and phone.

VI. Lasers and Other Devices

(1) Circuit Modeling of Quantum Well Semiconductor Lasers for Modulation Response and Noise, by L.-H. Mao*, W.-L. Guo*, H.-D. Chen** and R.-H. Wu** (*Tianjin University, Tianjin, P.R.C.; **Chinese Academy of Science, Beijing, P.R.C.): *JCIC*, vol. 22, pp. 38–42, Jan. 2001.

A small signal circuit model of a quantum well semiconductor laser (QWLD) is presented. It can be used as a computer aided design (CAD) model in a QWLD system. The model includes the high-speed modulation characteristics and noise of the QWLD. The modulation response and noise of a QWLD are simulated by using this model. The simulated results are compared with the published simulation and experiment results.

(2) Automatic Measurement System of Sub-Millimeter Wave Laser, by X. Zhang, H.-H. Liang, P. Zhang, X.-Z. Luo and R.-M. Qiu (Zhongshan University, Guangzhou, P.R.C.): *JIMW*, vol. 20, pp. 455–458, Dec. 2001.

An automatic measurement system of sub-millimeter wave laser was introduced, in which a single-chip machine played an important part. This system automatized measurement and used double-path emendation to increase veracity and reliability of measurement. The system was used to measure the spectrum of miniature optically pumped NH3 laser, demonstrating the high performance of the system.

(3) The Effects of Pumping Perturbation on the Stability of Er-Doped Fiber Laser, by S.-L. Yan, S.-B. Wu, X.-H. Sun and M.-D. Zhang (Southeast University, Nanjing, P.R.C.): *JAS*, vol. 19, pp. 131–134, June 2001.

The effects of instantaneous state of Er-doped fiber laser are studied. The expressions in indicating the photon population density perturbations with time in Er-doped fiber laser are given. The fluctuation functions of photon population density under pumping perturbations are solved at the first order approximation. Furthermore, the properties of the white noise and the resonance effects are discussed in detail.

(4) Design and Properties of Microwave Absorbing Structures Composed of Fiber Reinforced Composites, by S.-Y. Kim, S.-S. Kim (Department of Materials Engineering, Chungbuk National University): *JKEES*, vol. 12, no. 6, pp. 1002–1008, Oct. 2001.

The absorbing structure composed of multi-layered fiber reinforced composite materials was designed and microwave absorbing properties are investigated. On the basis of transmission line theory, the theoretical equations to predict the reflection loss and the appropriate composite material for each functional layer are suggested. The most significant result of this study is the successful design and fabrication of triple-layered composite laminates which has the superior microwave absorbing properties (more than 10 dB in 4∼12 GHz range), without using the ferrite filler in the impedance transforming layer. In the two-layered composite laminate (absorber/substrate), however, the use of ferrite filler (about 40 wt%) in the absorbing layer is necessary to obtain the certain level of microwave absorbance. By combining the glass–fiber composite with ferrite filler and carbon–fiber composite substrate, the microwave absorbing properties more than 10 dB in 4∼12 GHz frequencies can be obtained.

(5) An Analysis of GACC Optical Filter With Tapered Coupling Coefficient Distribution, by W. S. Choi*, C. G. Jeoung*, S. Y. Kim*, S. R. Rho**, D. H. Shon***, Y. J. Kang* (*Department of Electronics, Wonkwang University Iksan, Korea; **Department of Information and Communication, Chongin College, Chongup, Korea; ***Department of Electric, Electronic and Communication, Kunjang College, Gunsan, Korea): *JKICS*, vol. 26, no. 1B, pp. 28–36, Jan. 2001.

In many applications of optical communication systems, much lower levels of side-lobes are required so that cross-talk between adjacent channels can be avoided. In general uniform type optical filter, the important cause of the high side-lobes comes from the abrupt square coupling coefficient Hence, if we can somehow change the shape it, the side-lobes should be significantly reduced. In this paper, we have theoretically investigated the performance of grating-assisted coupler optical filters with various coupling coefficient distributions. From the computer simulation, the SSRs of the 1-stage and 2-stage uniform type GACC optical filters are about −9 dB and −18 dB, respectively, also the SSRs of the tapered GACC optical filters are about −22 dB and −45 dB, respectively.

(6) The Improvement of Eye Safety for the Optical Wireless Transmitter of Short-Range Infrared Wireless Communication System, by D. S. Lee, M. S. Lee (Department of Engineering, Information and Communication University, Daejeon, Korea): *JKICS*, vol. 26, no. 2B, pp. 134–138, Feb. 2001.

This paper studies the use of a microlens array in short-range infrared wireless communications. Eye safety, a major issue of short-range infrared wireless communications, restricts the amount of power that can be transmitted and thus, reduces the system speed and range because the short-range infrared wireless communication system is normally power margin limited. The microlens array allows more optical power to be launched safely because it can transform a point source, such as a laser diode, into a multi-point source. The improvement of eye safety is evaluated by comparing maximum permissible exposure along propagation distance and the safe launch powers for microlens array sources are also calculated.

(7) Spatio-Angular Multiplexing Method Using Moving Window and Double-Focusing Lens, by C. Y. Park*, S. G. Kim**, E. S. Kim* (*Department of Electronic Engineering, Kwangwoon University, Seoul, Korea; **Department of Electric Engineering, Hoseo, University, Asan, Korea): *JKICS*, vol. 26, no. 3B, pp. 280–287, Mar. 2001.

In this paper, we proposed a new spatio-angularly multiplexed holographic memory system using moving windows and double-focusing lens, which can eliminate crosstalk due to two neighboring moving windows in the vertical direction of the conventional MW holographic memory system, and demonstrated its feasibility through optical experiments.

(8) WDM Output Shared Buffer, by Y.-s. Kwak*, S. Shin** (*Corminet Ins., Korea; **Department of Electronics and Information Communication Engineering, Seoul, Korea): *JKICS*, vol. 26, no. 4B, pp. 410–417, Apr. 2001.

A novel optical output shared buffer that handles multiple WDM channel is introduced. If the crosstalk of the arrayed-waveguide-grating used in the buffer is lower than 33 dB, UP TO 8 WDM channels can be buffered simultaneously with system performance of BER 10-9.

(9) Packet Error Rates of an All-Optical Packet Switching Node in Slotted Ring Networks Depending Upon Optical Pulse Shapes, by J.-B. Oh, J.-D. Shin, B.-G. Kim (Department of Information Communication and Electronics Engineering, Soungsil University, Seoul, Korea): *JKICS*, vol. 26, no. 5B, pp. 529–536, May 2001.

Packet error rates of an all-optical packet switching node in a slotted ring network, which uses a fiber-optic delay-line matched filter as the optical packet address processor, have been investigated for the various input optical pulse shapes of Gaussian, super-Gaussian, and RZ rectangular. As the bit rate increases packet error rates increase for all pulse shapes with enhanced shot-noise effect. At a packet error rate of 10-9 and identical bit rates, peak pulse power increases in the order of Gaussian, super-Gaussian, and RZ rectangular shape. The pulse energy, however, is almost the same for all shapes. Gaussian pulses with broader width, which have reduced bandwidth resulting in reduced noise, shows higher power penalty due to fluctuation in correlation pulse levels caused by ISI for different address codes. It is necessary to keep the root-mean-square width of Gaussian pulses less than $1/(4B)$ in order to have negligible ISI effects.

(10) Holographic Wavelength Demultiplexing for WDM System, by G.-w. Nam*, N. Kim*, K.-y. Lee**, B.-m. Cho**, H.-j. Lee**, W.-s. Seo** (*Department of Electricity and Electronics Engineering, Choongbuk University, Choongbuk, Korea; **Department of Electronics Engineering, Sunchoun University, Sunchoun, Korea; ***Department of Optical Multiplex Team, ETRI, Daejun, Korea): *JKICS*, vol. 26, no. 5B, pp. 537–544, May 2001.

For WDM (wavelength-division multiplexing) optical communication systems, demultiplexing scheme is proposed and experimentally demonstrated using the narrow-band filtering and demultiplexing properties of volume holographic gratings formed in photorefractive Fe–LiNbO3 crystal. The determination parameters of volume holographic filters such as center-wavelength, channel spacing, and pass-band properties are considered. As a proof of concept, we report the demultiplexing of three channels by Bragg diffraction from volume reflection gratings. From the experimental results, the measured pass-bands of each channels are 0.34 nm, 0.45 nm, and 0.43 nm at 1591.35 nm, 1590.53 nm, and 1588.91 nm center-wavelengths, respectively. Also, The cross-talk suppression is achieved by 34.95 dB for channel spacing of 0.8 nm.

(11) Optical ATM Cell Decompressor Using Gain-Transparent SOA Switch, by K.-w. Jeong, S.-h. Ahn, J.-r. Lee, S.-w. Yi, J. Eom (Department of Electronic Engineering, KangWon University): *JKICS*, vol. 26, no. 7B, pp. 901–906, July 2001.

In this paper, a new optical ATM cell decompressor using a gain-transparent Semiconductor Optical Amplifier (SOA) switch is proposed. It's less hardware, simple control and an use of gain-transparent SOA satisfy conditions required for ultra-high throughput capacity. We have made a decompression experiment for 4-bits optical compressed cells, and got a good result consistent with it's operation principle. It could be an essential element for photonic switching systems including TDM method and also optical packet network.

(12) Holographic 1×8 Demultiplexer for WDM Optical Transmission System, by J.-W. An*, N. Kim*, C.-W. Shin**, K.-Y. Lee**, S.-H. Jeon*** (*College of Electrical and Electronic Engineering, ChungBuk University; **Department of Electronic Engineering, SunChon University; ***Department of Electronic Engineering, Inchon University): *JKICS*, vol. 26, no. 8B, pp. 1048–1056, Aug. 2001.

Holographic multi-channel demultiplexer for the wavelength-division multiplexing optical transmission system is proposed, and experimental results are presented. To record the multiple holographic grating channels in the photorefractive LiNbO3: Fe crystal, angular multiplexing and exposure time schedule are used. Specially, we enhance the uniformity of each channel by use of the recycling technique in the exposure time schedule. To verify the proposed scheme we have designed the 8-channel demultiplexer with a channel spacing of 0.8 nm in the wavelength region around 1590 nm. From the experimental results, we have observed the diffraction efficiency of 0.8$\sim$0.92%, 3 dB pass-band of 0.38$\sim$0.45 nm, channel spacing of 0.7$\sim$0.89 nm, and crosstalk suppression more than -26.98 dB.

(13) A Gain-Clamped Erbium-Doped Fiber Amplifier (GC-EDFA) for WDM Optical Packet Switching System, by C.-R. Yang*, H.-Y. Hwang*, H.-H. Hong*, H.-g. Kim*, H.-W. Kim** (*Electronics and Telecommunications Research Institute, DaeJeon, Korea; **Department of Electronic Engineering, ChungNam University): *JKICS*, vol. 26, no. 9B, pp. 1203–1208, Sept. 2001.

A dual-stage gain-clamped erbium doped fiber amplifiers (GC-EDFA) having pump laser diode and 16-channel wavelength division multiplexing (WDM) of 0.8 nm spacing in C band of 1545$\sim$1560 nm wavelength was demonstrated to be used in the burst packet mode optical switching system through experimental setup.

(14) A Design of High Speed Infrared Optical Data Link IC, by S.-I. Lim*, H.-R. Jo*, Y.-Y. Chai**, J.-S. Lyu*** (*School of Electronics and Communication and Computer, Seokyeong University; **Department of Electronics, Keimyung University; ***Opto-pro Co., Ltd.): *JKICS*, vol. 26, no. 12B, pp. 1695–1702, Dec. 2001.

This paper describes a design of CMOS infrared (IR) wireless data link IC which can be used in IrDA (Infrared Data Association) application from 4 Mb/s to 100 Mb/s. The implemented chip consists of variable gain transimpedance amplifier which has a gain range from 60 dB to 100 dB, AGC (automatic gain control) circuits, AOC (automatic offset control) loop, 4 PPM (pulse position modulation) modulator/demodulator and DLL (delay locked loops). This infrared optical link IC was implemented using commercial 0.25 μm 1-poly 5-metal CMOS process. The chip consumes 25 mW at 100 Mb/s with 2.5 V

supply voltage excluding buffer amplifier. The die area of prototype IC is 1.5 mm $\times$ 1 mm.

(15) Ultrafast Model-Locked Laser Diodes, by Y. Ogawa, S. Arahira, Y. Katoh, D. Kunimatsu (*Components Division, Oki Electric Industry Co., Ltd., 550-1 Higashiasakawa, Hachioji-shi, 193-8550 Japan): *IEICE Trans. Electron.*, vol. J84-C, no. 1, pp. 1–10, Jan. 2001.

Mode-locked laser diodes are very promising as optical pulse sources with high performance in future optical communication networks. Especially, passively mode-locked monolithic laser diodes can generate ultrafast optical pulses exceeding the electrical limitation. In this paper, we describe ultrafast and highly stabilized optical pulse generation using mode-locked laser diodes. High repetition optical pulses are generated by means of shortening the cavity length. Narrowing the pulse width of the mode-locked laser diodes is also discussed. Furthermore, stabilization of high repetition frequency optical pulse train with sub-harmonic synchronous mode-locking is described.

(16) Radiation Characteristics Analysis of Broad Area Laser Diodes and the Proposal of Improvement Methods, by N. Morimoto*, T. Toda**, T. Takano** (*Department of Electrical Engineering, Graduate School of Engineering, The University of Tokyo, 7-1-1 Hongo, Bunkyo-ku, Tokyo, 113-8654 Japan; **The Institute of Space and Astronautical Science, 3-1-1 Yoshinodai, Sagamihara-shi, 229-8510 Japan): *IEICE Trans. Electron.*, vol. J84-C, no. 1, pp. 17–24, Jan. 2001.

Broad area lasers observed in multiple peaks cause a significant degradation of FFP, and it makes pointing of optical antenna difficult in wireless optical communications. In this paper, we clarify that the phase distribution in the lateral direction of lasers is important for controlling NFP and FFP. For that purpose, we propose to introduce a modified facet to calibrate phase variation. The calculation reveals that FFP becomes single peak with side lobe suppression ratio of -13.4 dB. The modulation of the stripe pattern is also proved to be effective to correct FFP through the control of carrier distribution.

(17) Optically-Fed Radio Access Point Module for a Fiber-Radio Downlink System, by S.Fukushima, H. Fukano, K. Yoshino, Y. Matsuoka, S. Mitachi, K. Takahata (NTT Photonics Laboratories, Atsugi-shi, 243-0124 Japan): *IEICE Trans. Electron.*, vol. E84-C, no. 2, pp. 271–273, Feb. 2001.

A compact optically-fed radio access point module was developed that consists of a uni-traveling-carrier refracting-facet photodiode, a patch antenna, and an optical input interface. An output power from the photodiode was 1.4 dBm at a frequency of 5.88 GHz without any bias voltage.

(18) Physical Contact (PC) Conditions of Liquid-Crystalline Polymer Ferrules for Optical Fiber Connection, by Y. Shuto*, S. Yanagi*, H. Sato**, M. Ohno*, S. Sumida*, S. Tohno* (*NTT Photonics Laboratories, 162 Shirakata Shirane, Tokai-mura, Naka-gun, Ibaraki-ken, 319-1193 Japan; **NTT Electronics Corporation, 6705-2 Naka-machi, Naka-gun, Ibaraki-ken, 311-0122 Japan): *IEICE Trans. Electron.*, vol. J84-C, no. 2, pp. 127–135, Feb. 2001.

Endface parameters of SC- and MU-type plastic ferrules were theoretically studied on the basis of the elastic contact theory. Parameter ranges allowable for stable PC (Physical Contact) connection of plastic ferrules were determined by considering ferrule-endface deformation due to plasticity and thermal stress. These parameter ranges were wider than those of conventional zirconia ferrules.

(19) Operation of Injection-Seeded Terahertz Parametric Oscillation, by K. Imai*, S. Sugawara**, J. Shikata**, K. Kawase*, H. Minamide*, H. Ito*,** (*Photodynamics Research Center, RIKEN, 519-1399 Aramaki Aoba, Aoba-ku, Sendai-shi, 980-0868 Japan; **Research Institute of Electrical Communication, Tohoku University, 2-1-1 Katahira, Aoba-ku, Sendai-shi, 980-8577 Japan): *IEICE Trans. Electron.*, vol. J84-C, no. 3, pp. 184–191, Mar. 2001.

We report the narrow linewidth operation of terahertz-wave parametric generation (TPG) and terahertz-wave parametric oscillation (TPO) using $LiNbO_3$ crystals pumped with Q-switched Nd : YAG lasers. Output of a continuous-wave Yb : fiber laser was injected into TPG and TPO. We obtained the spectral narrowing of the terahertz-wave and the improvement of the input–output characteristics by injection seeding of a TPG. The spectral linewidth of the terahertz-wave was dramatically reduced by injection seeding of a TPO pumped with a single longitudinal mode Nd : YAG laser. The spectral linewidth was less than 200 MHz which was the resolution limit of the measurement.

(20) Characteristics of a Practical Optical Fiber Reflective Sensor, by S.-H. Sun*, W.-M. Zheng*, J.-G. Li** (*Department of Automation Measurement and Control Engineering, Harbin Institute of Technology, China; **Harbin Institute of Large Electrical Machinery HEC, 150040, China): *IEICE Trans. Electron.*, vol. E84-C, no. 4, pp. 427–432, Apr. 2001.

This paper describes the evaluation of a fiber-optic reflective displacement sensor that is compensated for variations in light source intensity, pressure, temperature and opacity of ambient medium. Additionally, the distance information is averaged over several points on the target surface, which reduces signal fluctuations due to inhomogeneities. Furthermore, a practical optical fiber reflective sensor model of measuring oil film thickness for thrust bearing is set up in this paper. Actual measurements were made with HEC 3000 tons' thrust bearing and the results were in good agreement with theoretical calculations.

(21) All-Optical Clock Extraction at 160 Gbit/s With Monolithic Mode-Locked Laser Diodes, by R. Schreieck, M. Kwakernaak, H. Jäckel (Electronics Laboratory, Swiss Federal Institute of Technology Zürich (ETHZ), Gloriastr.35, CH-8092 Zürich, Switzerland): *IEICE Trans. Electron.*, vol. E84-C, no. 6, pp. 841–844, June 2001.

We demonstrate all-optical clock recovery at 160 Gbit/s by injection locking of a 10 GHz mode-locked laser diode. Effective locking in a range of 10 MHz is observed for average input powers around -10 dBm. The timing jitter is analyzed for data rates between 10 Gbit/s and 160 Gbit/s. Beyond 40 Gbit/s, the high frequency timing jitter of the slave laser becomes of prime importance and has to be taken into account since it degrades the performance of a subsequent receiver. Increasing power penalties are found, especially beyond 80 Gbit/s.

(22) Symmetric Mach–Zehnder Type All-Optical Switches and Ultrafast All-Optical Signal Processing, by K. Tajima, S. Nakamura, Y. Ueno (System Devices and

Fundamental Research, NEC Corporation, 34 Miyukigaoka, Tsukuba-shi, 305-8501 Japan): *IEICE Trans. Electron.*, vol. J84-C, no. 6, pp. 435–450, June 2001.

We present Symmetric Mach–Zehnder (SMZ) type all-optical switches: an SMZ all-optical switch, a polarization-discriminating SMZ (PD-SMZ) all-optical switch, and a delayed interference signal wavelength converter (DISC). These switches are capable of ultrafast, low control power, and low chirp switching, which is not restricted by slow relaxation of highly efficient nonlinearities. High repetition operation is also possible for these switches. Then, error-free demultiplexing from 168 to 10.5 Gbit/s is demonstrated, in which a hybrid-integrated SMZ (HI-SMZ) is used as a demultiplexer. In pulse regeneration experiment, the signal pulses at 84 Gbit/s are regenerated by the PD-SMZ and the regenerated pulses are demultiplexed to 10.5 Gbit/s by the HI-SMZ to verify penalty-free operation. Also presented is error-free all-optical wavelength conversion at 168 Gbit/s using the DISC.

(23) Numerical Analysis of Ultra-Short Pulse Wavelength-Conversion Characteristics of $LiNbO_3$ Waveguide Nonlinear-Optic Devices, by H. Ishizuki, T. Suhara, H. Nishihara (Department Electronics, Graduate School Engineering, Osaka University, 2-1 Yamadaoka, Suita-shi, 565-0871 Japan): *IEICE Trans. Electron.*, vol. J84-C, no. 6, pp. 462–470, June 2001.

We numerically analyzed picosecond-pulse wavelength-conversion characteristics of $LiNbO_3$ waveguide nonlinear-optic devices by beam-propagation method. Characteristics in various types of wavelength-conversion using second-order nonlinearities such as second harmonic generation (SHG), difference-frequency generation (DFG), sum-frequency generation, and cascaded SHG/DFG were evaluated in terms of pulse shape, width, and conversion efficiency. Numerical results are useful for estimating device performance and optimizing a device design.

(24) Long-Term Reliability of Plastic Ferrules for Single-Mode Fiber-Optic Connectors, by Y. Shuto, S. Yanagi, M. Ohno, H. Sato, S. Sumida, S. Tohno (NTT Photonics Laboratories, Nippon Telegraph and Telephone Corporation, Ibaraki-ken, 319-1193 Japan): *IEICE Trans. Electron.*, vol. E84-C, no. 7, pp. 1002–1009, July 2001.

We examined the creep properties and hazard rates of plastic ferrules to ensure the long-term reliability of optical fiber connections. The endface deformation ΔL had to be smaller than 3 μm to keep the insertion-loss and return-loss fluctuation to acceptable levels in the worst case of random concatenation of similarly deformed plastic ferrules. From the fluctuation data, we estimated the time-to-failure t_f at which the ΔL value became 3 μm. We estimated the acceleration parameters, median lifetimes ξ, and hazard rates λ by using t_f values based on Weibull statistics. The ξ values decreased rapidly with increasing temperature and relative humidity. We found we could expect small λ values of <0.1 FIT (FIT $= 10^{-9}$/hour) and of 1 FIT for 20 years in a normal atmosphere (25 °C/50% RH) and in a more severe case of 25 °C/90% RH, respectively.

(25) High-Speed Self-Aligned SiGe HBT and Application to Optical Fiber-Link ICs, by H. Shimamoto*, E. Ohue**, K. Oda**, R. Hayami**, M. Tanabe*, T. Masuda**, N. Shiramizu**, F. Ara-Kawa*, K. Ohhata*, M. Kondo**, T. Harada***, K. Washio** (*Musashino Office, Hitachi Device Engineering, Co., Ltd., 1-280 Higashi-Koigakubo, Kokubunji-shi, 185-8601 Japan; **Hitachi, Ltd., Central Research Laboratory, 1-280 Higashi-Koigakubo, Kokubunji-shi, 185-8601 Japan; ***Hitachi, Ltd., Device Development Center, 326 Imai, Ome-shi, 198-8512 Japan): *IEICE Trans. Electron.*, vol. J84-C, no. 8, pp. 625–634, Aug. 2001.

A high-speed self-aligned selective-epitaxial-growth (SEG) SiGe heterojunction bipolar transistor (HBT), with poly-Si assisted self-aligned SEG(PASS) structure, was developed. The SiGe HBTs exhibited a cutoff frequency of 122 GHz, a peak maximum oscillation frequency of 163 GHz and an ECL gate delay time of 5.5 ps. As applications for these SiGe HBTs, various IC's for optical-fiber link systems have been developed. These include a preamplifier with a bandwidth of 45 GHz, limiting amplifier with a again of 32 dB, 1/4 static frequency divider with a maximum operating frequency of 60 GHz, 1 : 4 demultiplexer with a decision circuit are for use in a 40 GHz optical receiver.

(26) Development of Radio Wave Transmitting System Using Optical Modulator for Digital Television Broadcasting, by K. Haeiwa*, Y. Takeuchi*, Y. Toba**, S. Torihata**, S. Tanizawa***, Y. Ozaki*** (*Engineering Administration Department, Japan Broadcasting Corporation, Tokyo, 150-8001 Japan; **Tokin Corporation, Tsukuba-shi, 305-0875 Japan; ***NHK Integrated Technology, Tokyo, 150-0041 Japan): *IEICE Trans. Electron.*, vol. J84-C, no. 8, pp. 666–672, Aug. 2001.

We have developed a radio wave transmitting system using optical modulator for Digital Terrestrial Television Broadcasting. The features of this newly developed system using optical fiber cables as transmission line, are no use of electrical power line at the receiving point and multi digital television waves (OFDM signals) transmission. This system is effective for construction of SFN (Single Frequency Network), since transmitting and receiving point can be easily separated (about 6 km). In this paper, we describe main points of development which are sensitivity improvement of optical modulator, noise reduction of laser, realization of long distance transmission etc., and result of transmission experiments for multi OFDM signals.

(27) Origin of Group Delay Ripple in Chirped Fiber Bragg Gratings and Its Effective Reduction Method, by T. Komukai, T. Inui, M. Nakazawa (*NTT Network Innovation Laboratories, NTT Corporation, Yokosuka-shi, 239-0847 Japan): *IEICE Trans. Electron.*, vol. J84-C, no. 8, pp. 673–680, Aug. 2001.

In this paper, we investigated the origin of group delay ripple in a chirped fiber Bragg grating in detail. Comparing devices realized with a chirped phase mask method and a mechanical chirping method, we found that the groupo delay ripples are mainly caused by the phase errors of chirped phase masks. We demonstrated an almost ripple-free chirped fiber Bragg grating by inserting a beam containing a 100 mm-long, phase-error-free uniform grating into S-shaped groove formed on a plastic substrate. The amplitude of the group delay ripple was as small as 3 ps around the center wavelength.

(28) Characterization of the Feedback Induced Noise in Semiconductor Laser Under Superposition of High Frequency Current, by M. Yamada, S. Yamamura, T. Okamoto (Optical Communication Laboratory, Department of Electrical and Electronic Engineering, the Faculty of Engineering, Kanazawa University, Kanazawa-shi, 920-8667 Japan): *IEICE Trans. Electron.*, vol. E84-C, no. 10, pp. 1588–1596, Oct. 2001.

Characteristics of the optical feedback noise in semiconductor lasers under superposition of the HF (High Frequency) current were experimentally examined and theoretically analyzed. The feedback noise was mostly suppressed by superposition of HF current, but still remained when frequency of the HF current coincided with a rational number of the round trip time period for the optical feedback in experimental measurement. Theoretical analysis was also given to explain these characteristic based on the mode competition theory of the semiconductor laser.

VII. Optical Fibers/Waveguides

(1) Influence of the Chirp on Interaction Between Optical Solitons in Twin-Core Coupling Fibers, by L. Feng, J.-X. Li and Q.-Y. Feng (Inner Mongolia University, Huhehaote, P.R.C.): *JCIC*, vol. 22, pp. 100–105, Feb. 2001.

The interaction between optical solitons with linear chirp in twin-core coupling fibers is studied by using variational principle and the expression of the chirp evolving is obtained. The results show that the chirp increases the interaction between optical solitons in twin-core coupling fibers. A new scheme is also put forwarded about how to decrease the interaction between optical solitons.

(2) Cross-Phase Modulation Effect in IM-DD Multichannel Dense Wavelength Division Multiplexed Optical Fiber Transmission Systems, by X. Zhu* and R.-J. Lin** (*Shanghai Jiaotong University, Shanghai, P.R.C.; **Shanghai University, Shanghai, P.R.C.): *JCIC*, vol. 22, pp. 47–53, Aug. 2001.

The influence of cross-phase modulation (XPM) on the performance of dense wavelength division multiplexed (DWDM) optical fiber transmission systems is studied. A system model which describes arbitrary modulated signals transmitting through XPM channels is established, and the XPM-induced system optical power penalty under different system conditions is calculated.

(3) Investigating the Gain of Multi-Pumping Broadband Raman Amplifier, by Z. Wang and S.-S. Jian (Northern Jiaotong University, Beijing, P.R.C.): *JCIC*, vol. 22, pp. 110–117, Nov. 2001.

Both Gaussian and Lorenz approximation are used to investigate the gain properties of multi-pumping broadband Raman amplifier, and some schemes for flattening the gain are presented. All the results show that the flatness of the gain spectrum is closely related to the pumping frequency grid. By researching the Raman amplifiers based on G.652, G.653, G.655 fiber and large effective area nonzero dispersion flattening fiber, it has been found that the Raman gain is associated with the fiber type and its transmission properties, especially decreasing with the effective core area increasing.

(4) Study on the Electric Current Sensor of Fiber Bragg Grating, by D.-J. Feng, G.-Y. Kai, Q.-D. Zhao and X.-Y. Dong (Nankai University, Tianjin, P.R.C.): *JIMW*, vol. 20, pp. 241–243, Aug. 2001.

A new electric current sensor based on a fiber Bragg grating tuned by a magnetostrictive material rod was obtained. The fiber Bragg grating was firmly clung on a magnetostrictive rod that was put into the central part of a solenoid. The rod was elastically lengthened along the direction of the magnetic field, so the Bragg wavelength of the fiber Bragg grating was changed when the uniform magnetic field in the solenoid increased. The relationship between the electric current in the solenoid and the change of wavelength is basically linear. The wavelength range of linear tuning is about 0.9 nm, and its tuning sensitivity is about 0.001 nm/mA.

(5) Development of a Cavity Stabilized Gunn Oscillator at 24 GHz, by J.-N. Kim, I. S. Kim (EM Wave Engineering Laboratory, School of Electronics and Information, KyungHee University): *JKEES*, vol. 12, no. 2, pp. 176–183, Feb. 2001.

A cavity stabilized Gunn oscillator at 24 GHz has been developed with WR-42 waveguide structure by HFSS simulation. The oscillator has been optimized by using a circular iris and cap resonator structure. This oscillator needs 4.5 V DC voltage/1.2 A current and produces a maximum +21.27 dBm RF power at 24.0675 GHz.

(6) Design for a Single-Layer Feeder Waveguide Array Using π-Junctions With the Inductive Wall, by K.-S. Min, K.-W. Kim, D.-C. Kim, H.-G. Lim (Department of Radio Sciences and Engineering, College of Sciences and Engineering, Korea Maritime University): *JKEES*, vol. 12, no. 2, pp. 257–267, Feb. 2001.

This paper presents a design for a single-layer feeder waveguide array using π-junctions with the inductive wall. The feed structure consists of a single waveguide placed on the same layer as radiating waveguide and is characterized by the unit divider, called a π-junction. This π-junction with an inductive wall splits part of the power into two branches waveguide through one coupling window, and can excite densely arrayed waveguide at equal phase and amplitude. The power dividing characteristics of the cascade of π-junctions are analyzed by Galerkin's method of moments. The numerical results show reasonable agreement with the experimental results. From the optimum simulation results based on the feeder waveguide using π-junction, we obtained the scattering matrices of the feeder divided power at 3.95 GHz.

(7) Compensation of Chromatic Dispersion and Self Phase Modulation in Long-Haul Optical Transmission System Using Mid-Span Optical Phase Conjugator, by S.-R. Lee, Y.-H. Lee (School of Electronic, Telecommunication and Computer Engineering, Hankuk Aviation University): *JKEES*, vol. 12, no. 4, pp. 576–585, June 2001.

In this paper, we investigated the method of compensation for optical pulse shape distortion due to both chromatic dispersion and SPM (self phase modulation) in a single mode fiber. We selected MSSI (mid-span spectral inversion) as compensation method using OPC (optical phase conjugator). We used EOP (eye-opening penalty) parameter in order to evaluate the efficiency of waveform distortion compensation. In this paper,

we induced optimum pump power level in optical phase conjugator through analytic method of computer simulation. And we investigated input signal power range being able to maintain stable reception performance under the condition of optimum pump power. We verified the possibility of high performance optical transmission system realization through the inducement and application of optimum pump power, input signal power and in-line amplifier spacing, because power control is important in the compensation for optical pulse distortion.

(8) Wideband WDM Transmission Through the Power Symmetry Method in the Mid-Span Spectral Inversion, by S. R. Lee, Y. H. Lee (School of Electronic, Telecommunication and Computer Engineering, Hankuk Aviation University): *JKEES*, vol. 12, no. 7, pp. 1157–1166, Dec. 2001.

In this paper, we investigated the degree of compensation for optical pulse shape distortion due to both chromatic dispersion and SPM (self phase modulation) in high speed optical transmission system with dispersion shift fiber. We adopted the power symmetric MSSI (mid-span spectral inversion) as compensation method. We used EOP (eye-opening penalty) parameter in order to evaluate the compensation efficiency of distorted optical pulse. We evaluated input signal power range being able to maintain stable reception performance in the case of various chirp parameter of modulated optical pulse. And, in order to verify the applicable to wideband WDM system, we evaluated the wavelength range being able to maintain stable reception performance through the EOP calculation of various dispersion coefficient of first fiber $D11$. We showed that proposed MSSI is effective compensation method to down chirped optical pulse transmission rather than up chirped optical pulse transmission in anomalous dispersion range. And we showed that this method have possibility of relative high power transmission and wideband transmission in WDM system.

(9) A Study on the Evaluation Method of Optical Fiber Splice Losses Using OTDR by Uni-Directional Backscattering Measurement, by B. G. Lee*, S. G. Oh**, B. D. Choi***, M. S. Kim**** (*Department of Electronic Engineering, Graduate School of Pukyong National University, Busan, Korea; **Access Network Laboratory of Korea Telecom, Daejeon, Korea; ***Busan Telephone Office of Korea Telecom; ****Department of Electronic, Computer Science and Information Communication Engineering, Pukyong National University, Busan, Korea): *JKICS*, vol. 26, no. 1B, pp. 21–27, Jan. 2001.

In this dissertation through interpreting the detection principle of backscattering light in optical fiber by backscattering method and the theory of connection loss, we induced the correction principle of connection loss according to simplex backscattering method and to verify the accurate of correction value of connection loss measured by simplex backscattering method, we compared it with the arithmetical average value generated by duplex backscattering method through the experiment. From the comparison analysis, we confirmed the correction values by simplex backscattering method has errors within the range of ± 0.03 dB compared with the arithmetical average value by duplex backscattering method and this errors value is lower than that of OTDR, ± 0.05 dB$\sim$0.1 dB. So it means the errors value has no problem in the evaluation of connection loss of optical fiber. We make clear that the evaluation of connection loss of optical fiber was worked to products of same company.

(10) Simulation of Optical Amplified Transmission System Using Propagation Parameter Mapping, by Y. Kim, Y. Lee, M. Lee, J. Yu, J. Park (Department of Electronic Engineering, Korea University): *JKICS*, vol. 26, no. 7B, pp. 884–890, July 2001.

In this paper, we propose a propagation parameter mapping method which helps to evaluate the performance of in-line optical amplified transmission line efficiently. This method gives the transmission line model with mapped parameters for simplified simulation. It has been shown in the results that the proposed mapping method can describe the propagation behavior of optical pulses with only less than 3% difference in eye-opening ratio but with calculation time reduction to 34.72% of the normal method.

(11) Dispersion Distributed Fiber Optic Cable for Large-Capacity DWDM System, by E.-d. Park*, D.-u. Lee*, H.-y. Park*, D.-w. Kim*, Y.-C Chung**, H. Son***, Y.-k. Cho**** (*LG Cable; **School of Electronics, Korea Advanced Institute of Science and Technology; ***Department of Electronics, Kyungpook University; ****Department of Electronics, Kyungpook University, Professor): *JKICS*, vol. 26, no. 10B, pp. 1343–1352, Oct. 2001.

The trend toward higher bit rate, narrower channel spacing and wider passband width in lightwave communication has increased interest in dispersion management that is to reduce dispersion penalty in high bit rate and suppress nonlinear effects simultaneously. New method of dispersion distribution during cable manufacturing process for dispersion management was exploited for the first time to suppress nonlinear effects induced signal distortion. We fabricated dispersion distributed cable which involves alternating sections of standard single mode fiber (SSMF) and newly designed negative dispersion fiber (NDF). It is shown that the fabricated cable keep the average dispersion value of an entire cable length close to zero while the local dispersion is around 17 ps/km/nm as absolute value. Moreover, the developed cable had good optical and mechanical properties and the feasibility of this cable for practical use was confirmed.

(12) High Speed RZ-Format Transmission Using Very Short Pulses and the Chromatic Dispersion of the Transmission Fiber, by S.-G. Park, J. M. Jeong (Division of Electrical and Computer Engineering, Hanyang University): *JKICS*, vol. 26, no. 11B, pp. 1607–1611, Nov. 2001.

The dependence of the performance of 40-Gb/s optical transmission using short pulses on the fiber chromatic dispersion is numerically studied. When very short pulses are used, the wide spectrum of the optical signal and the chromatic dispersion of the fiber interact in such a way that results in the reduction of nonlinear impairments of the transmission performance. The degree of this reduction is determined by the combined effects of chromatic dispersion of the fiber and the strength of the optical signal and the transmission distance. When 3 ps-long pulses were used for the transmission, the eye-closure penalty was highest with the dispersion $D = 4$ ps/nm/km.

(13) Long-Term Reliability of Plastic Split Alignment Sleeves for Single-Mode Fiber-Optic Connectors, by Y. Shuto, H. Sato, S. Yanagi, M. Ohno, S. Sumida, S. Tohno (NTT Photonics Laboratories, Nippon Telegraph and Telephone Corporation, Ibaraki-ken, 319-1193 Japan): *IEICE Trans. Electron.*, vol. E84-C, no. 1, pp. 96–101, Jan. 2001.

We examined the creep properties and hazard rates of plastic split alignment sleeves to ensure the long-term reliability of optical fiber connections. It required a gauge retention force F_r of more than 200 gf to suppress the fluctuation in the insertion loss of a plastic sleeve. From the fluctuation data, we estimated the time-to-failure t_f at which the F_r value became 200 gf. We estimated the acceleration parameters, median lifetimes ξ, and hazard rates λ by using the t_f values based on the Weibull statistics. The ξ values decreased rapidly with increasing temperature and relative humidity. Small λ values of <0.01 FITs and of 1 FITs were expected for 20 years in a normal atmosphere (25 °C/50% RH) and in a more severe case of 25 °C/90% RH or 45 °C/50% RH.

(14) A Fluorescence Spectrum at 1.3 μm of Bismuth Doped Silica Glass With 0.8 μm Excitation and Its Applications for Optical Communications, by Y. Fujimoto, M. Nakatsuka (Institute of Laser Engineering, Osaka University, 2-6 Yamada-oka, Suita-shi, 565-0871 Japan): *IEICE Trans. Electron.*, vol. J84-C, no. 1, pp. 52–53, Jan. 2001.

We discovered a new broad fluorescence at 1.25 μm (FWHM: 300 nm) from a bismuth doped silica glass with 0.8 μm excitation. This luminescent material is promising for a core-fiber material of optical amplifier.

(15) Modal-Matching Analysis of Loss in Bent Graded-Index Optical Slab Waveguides, by M. Mirianashvili*, K. Ono**, M. Hotta*** (*California Eastern Laboratories, Santa Clara, CA 95054 USA; **Faculty of Engineering, Ehime University, Matsuyama-shi, 790-8577 Japan; ***Faculty of Engineering, Yamaguchi University, Ube-shi, 755-8611 Japan): *IEICE Trans. Electron.*, vol. E84-C, no. 2, pp. 238–242, Feb. 2001.

Loss analysis in bent graded-index optical slab waveguides is given using the modal-matching method. The conformal mapping replaces curved structure by an equivalent straight waveguide with a modified index profile. For this planar waveguide structure, the normal modes are calculated using a multilayer approximation method. The wave incident on the bend is expanded initially into a finite set of normal modes of the equivalent straight structure, and the transverse fields are matched across the junction. The numerical results show the loss formation in the graded-index waveguides and its dependence of the effective index of the corresponding straight waveguide.

(16) Tapered Velocity Couplers Composed of Nonlinear Waveguides for Limiting Optical Power, by T. Kitamura, T. Yabu, M. Geshiro, S. Harada, S. Sawa (College of Engineering, Osaka Prefecture University, Sakai-shi, 599-8531 Japan): *IEICE Trans. Electron.*, vol. E84-C, no. 4, pp. 421–426, Apr. 2001.

This paper proposes an optical power limiter composed of serially connected two tapered velocity couplers consisting partly of nonlinear material. The method of device designing is explained and it is exemplified that the optical output can be regulated stably to a prescribed value over a wide range of optical input. The device performance is simulated by means of FD-BPM algorithm.

VIII. Special Issues Related to Microwave Theory and Techniques

(1) *IEICE TRANS. COMMUN.*, vol. E84-B, no. 7, July 2001, is special issue on Adaptive Array Antenna Techniques for Advanced Wireless Communications.

(1.1) Advances in Adaptive Antenna Technologies in Japan, by Y. Ogawa, T. Ohgane (Graduate School of Engineering, Hokkaido University, Sapporo-shi, 060-8628 Japan): pp. 1704–1712.

(1.2) Optimal Antenna Selection in MIMO Systems With Space–Time Block Coding, by A. Paulraj*, D. Gore** (*Department of Electrical Engineering at Stanford University, USA; **Information Systems Laboratory, Stanford University, USA): pp. 1713–1719.

(1.3) Transmit Diversity Scheme With Power Control for Wireless Communications, by P. Fan, J. Li, Z. Cao (State Key Laboratory on Microwave and Digital Communications, Department of Electronic Engineering, Tsinghua University, Beijing, 100084, China): pp. 1720–1726.

(1.4) Adaptive Array for Reducing High-Power CCI on Asynchronous TDD Systems, by K. Nishimori, K. Cho, Y. Takatori, T. Hori (NTT Network Innovation Laboratories, Yokosuka-shi, 239-0847 Japan): pp. 1727–1734.

(1.5) A Spatial Domain Interference Canceler Using a Multistage Adaptive Array With Precise Timing Estimation, by T. Nishimura*, Y. Tanabe*, T. Ohgane*, Y. Ogawa*, Y. Doi**, J. Kitakado** (*Graduate School of Engineering, Hokkaido University, Sapporo-shi, 060-8628 Japan; **Hypermedia Research Center, SANYO Electric Co., Ltd., Gifu, 503-0195 Japan): pp. 1735–1742.

(1.6) Adaptively Sampled Near-Field Smart Array Antenna for Indoor Wireless Communications, by G. Abreu, R. Kohno (Faculty of Engineering, Yokohama National University, Yokohama-shi, 240-8501 Japan): pp. 1743–1759.

(1.7) Field Test Results for a Beam and Null Simultaneous Steering S/T-Equalizer in Broadband Mobile Communication Environments, by T. Asai, S. Tomisato, T. Matsumoto (Wireless Laboratories, NTT DoCoMo, Inc., Yokosuka-shi, 239-8536 Japan): pp. 1760–1767.

(1.8) A Combination of Two Adaptive Algorithms SMI and CMA, by R. Yonezawa, I. Chiba (Information Technology R&D Center, Mitsubishi Electric Corporation, Kamakura-shi, 247-0056 Japan): pp. 1768–1773.

(1.9) A Modified DCMP Algorithm for SDMA Receiver in Base Station of Broadband Fixed Wireless Access Systems, by H. Kasami, S. Obayashi, H. Shoki (Corporate R&D Center, Toshiba Corporation, Kawasaki-shi, 212-8582 Japan): pp. 1774–1780.

(1.10) Generalization of MUSIC Using Extended Array Mode Vector for Joint Estimation of Instantaneous DOA and Angular Spread, by J.-S. Jeong, K. Sakaguchi, K. Araki, J.-i. Takada (Graduate School of Science and Engineering, Tokyo Institute of Technology, Tokyo, 152-8552 Japan): pp. 1781–1789.

(1.11) Adaptive Beamforming of ESPAR Antenna Based on Steepest Gradient Algorithm, by J. Cheng, Y. Kamiya, T. Ohira (ATR Adaptive Communications Research Laboratories, Kyoto-fu, 619-0288 Japan): pp. 1790–1800.

(1.12) An Optical Waveguide With High Birefringence and Birefringence Dispersion for Optical Beamforming Network in Multibeam Array Antenna, by W. Hu, K. Inagaki, T. Ohira (ATR Adaptive Communications Research Laboratories, Kyoto-fu, 619-0288 Japan): pp. 1801–1807.

(1.13) A Remote Calibration for a Transmitting Array Antenna by Using Synchronous Orthogonal Codes, by M. Oodo, R. Miura (Wireless Innovation Systems Group, Yokosuka Radio Communications Research Center, Communications Research Laboratory, Yokosuka-shi, 239-0847 Japan): pp. 1808–1815.

(1.14) Data Access Control for CDMA Systems With Adaptive Antennas, by Y. Hara (YRP Mobile Telecommunications Key Technology Research Laboratories Co., Ltd., Yokosuka-shi, 239-0847 Japan): pp. 1816–1822.

(1.15) Comparison of Coherent Adaptive Antenna Array Diversity and Multi-Beam Receivers for Packet Transmission in W-CDMA Reverse Link, by N. Nakaminami, S. Tanaka, T. Ihara, M. Sawahashi (Wireless Laboratories, NTT DoCoMo, Inc., Yokosuka-shi, 239-8536 Japan): pp. 1823–1834.

(1.16) Fast Two-Step Beam Tracking Algorithm of Coherent Adaptive Antenna Array Diversity Receiver in W-CDMA Reverse Link, by T. Ihara*, S. Tanaka*, M. Sawahashi*, F. Adachi** (*Wireless Laboratories, NTT DoCoMo, Inc., Yokosuka-shi, 239-8536 Japan; **Department of Electrical and Communication Engineering, Graduate School of Engineering, Tohoku University, Sendai-shi, 980-8579 Japan): pp. 1835–1848.

(1.17) Experiments on Decision Feedback Type Coherent Adaptive Antenna Array Diversity Receiver in W-CDMA Reverse Link, by S. Tanaka, H. Taoka, T. Ihara, M. Sawahashi (Wireless Laboratories, NTT DoCoMo, Inc., Yokosuka-shi, 239-8536 Japan): pp. 1849–1860.

(1.18) Transmitting Array Antenna Beamforming Based on Goal Programming for Forward Link of DS-CDMA System, by T. Aoki, N. Hirano, R. Kohno (Faculty of Engineering, Yokohama National University, Yokohama-shi, 240-8501 Japan): pp. 1861–1870.

(1.19) Experiments of DOA Estimation by DBF Array Antenna at 2.6 GHz, by K. Mori, Y. Inoue, K. Ichige, H. Arai (Division of Electrical and Computer Engineering, Yokohama National University, Yokohama-shi, 240-8501 Japan): pp. 1871–1875.

(2) *IEICE TRANS. COMMUN.*, vol. E84-B, no. 9, September 2001, is special issue on Innovation in Antennas and Propagation for Expanding Radio Systems.

(2.1) IMT-2000 and Beyond IMT—Radio Technologies Toward Future Mobile Communications, by F. Watanabe (KDDI Corporation, Tokyo, 163-8002 Japan): pp. 2341–2347.

(2.2) European Smart Antenna Test-Bed—Field Trial Results, by M. Beach*, C. Simmonds**, P. Howard***, P. Darwood**** (*University of Bristol, Bristol, BS8 1UB, UK; **Toshiba TREL, Bristol, BS1 4ND, UK; ***IP Wireless Inc., Chippenham, SN14 6RZ, UK; ****SP Communications, Sydney, Australia 2038): pp. 2348–2356.

(2.3) Review of Propagation Results From the Advanced Communications Technology Satellite (ACTS) and Related Studies, by D. V. Rogers*, R. K. Crane** (*Communications Research Centre Canada, 3701 Carling Avenue, Ottawa, Canada K2H 8S2; **School of Meteorology, University of Oklahoma, Norman, OK, USA 73 019): pp. 2357–2368.

(2.4) Millimeter-Wave Slotted Waveguide Array Antenna Manufactured by Metal Injection Molding for Automotive Radar Systems, by K. Sakakibara*, T. Watanabe*, K. Sato*, K. Nishikawa*, K.-y. Seo** (*Toyota Central Research and Development Laboratories, Inc., Aichi-ken, 480-1192 Japan; **Kojima Press Industry Co., Ltd., Aichi-ken, 470-0207 Japan): pp. 2369–2376.

(2.5) Low Sidelobe Single-Layer Slotted Waveguide Arrays at 76 GHz Band, by Y. Kimura*, K. Fukazawa*, J. Hirokawa*, M. Ando*, N. Goto** (*Department of Electrical and Electronic Engineering, Ando and Hirokawa Laboratory, Tokyo Institute of Technology, Tokyo, 152-8552 Japan; **Department of Electronic Engineering, Takushoku University, Hachioji-shi, 193-8585 Japan): pp. 2377–2386.

(2.6) High-Efficiency, Dielectric Slab Leaky-Wave Antennas, by T. Teshirogi*, Y. Kawahara*, A. Yamamoto*, Y. Sekine*, N. Baba**, M. Kobayashi*** (*Research Laboratory, Anritsu Corporation, Atsugi-shi, 243-8555 Japan; **Technology Center, Anritsu Corporation, Atsugi-shi, 243-8555 Japan; ***Info Solutions, Anritsu Corporation, Atsugi-shi, 243-8555 Japan): pp. 2387–2394.

(2.7) Millimeter Wave Antennas With Gaussian Radiation Patterns, by R. Sauleau*, P. Coquet**, K. Shinohara***, J.-P. Daniel****, N. Hirose***, T. Matsui*** (*Laboratoire ART/Equipe Antennes et Technologies, FRE CNRS 2272, Université, de Rennes 1, 35 042 Rennes Cedex, France; **Ecole Normale Supérieure de Cachan, Antenne de Bretagne, Campus de Ker Lann, 35 170 Bruz, France; ***Communications Research Laboratory, Ministry of Posts and Telecommunications, Koganei-shi, 184-8795 Japan ; ****Company gAntennes Processh, 4 rue Nationale, 35235 Thorigné-Fouillard, France): pp. 2395–2406.

(2.8) Cylindrical Multi-Sector Antenna With Self-Selecting Switching Circuit, by T. Seki, T. Hori (NTT Network Innovation Laboratories, Yokosuka-shi, 239-0847 Japan): pp. 2407–2412.

(2.9) Fourier Optical Processing Beamforming Network Using Optical Waveguide Arrays and Lens for Transmission and Reception, by T. Akiyama, K. Inagaki, Y. Mizuguchi, T. Ohira (ATR Adaptive Communications Research Laboratories, Kyoto-fu, 619-0288 Japan): pp. 2413–2420.

(2.10) Numerical Study of the Small Multi-Panel Reconfigurable Reflector Antenna's Performance, by S. Phermphoonwatanasuk, C. Waiyapattanakorn (Department of Electrical Engineering, Chulalongkorn University, Phyathai Road, Patumwan, Bangkok 10330, Thailand): pp. 2421–2435.

(2.11) Beam Forming Network Design for Cluster Feeding of Highly Functional Scanning Antenna, by F. Kira, T. Hori (NTT Network Innovation Laboratories, Yokosuka-shi, 239-0847 Japan): pp. 2436–2442.

(2.12) A Three-Port 180-Degree Antenna Hybrid: Design and Applications, by Y.-H. Chou, S.-J. Chung (Department of Communication Engineering, National Chiao Tung University, 1001 Ta Hsueh Rd., Hsinchu, Taiwan 300, R.O.C.): pp. 2443–2450.

(2.13) Novel Design Method for Antennas for Selection Diversity on Wireless Terminals, by S. Sekine*, N. Odachi*, O. Shibata*, H. Shoki*, Y. Suzuki** (*Corporate Research and Development Center, Toshiba Corporation, Kawasaki-shi, 212-8582 Japan; **Department of Electrical and Electronic Engineering, Tokyo University of Agriculture and Technology, Koganei-shi, 184-8588 Japan): pp. 2451–2459.

(2.14) A Polarization Diversity PIFA on Portable Telephone and the Human Body Effects on Its Performance, by K. Meksamoot*, M. Krairiksh*, J.-i. Takada** (*Faculty of Engineering and Research Center for Communications and Information Technology, King Mongkut's Institute of Technology Ladkrabang, Bangkok 10520, Thailand; **Graduate School of Science and Engineering, Tokyo Institute of Technology, Tokyo, 152-8552 Japan): pp. 2460–2467.

(2.15) A Folded Loop Antenna System for Handsets Developed and Based on the Advanced Design Concept, by Y. Kim*, H. Morishita*, Y. Koyanagi**, K. Fujimoto*** (*Department of Communications Engineering, National Defense Academy, Yokosuka-shi, 239-8686 Japan; **Personal Communication Division, Matsushita Communication Industrial, Yokohama-shi, 223-8639 Japan; ***FAIS, University of Tsukuba, Tsukuba-shi, 305-0062 Japan): pp. 2468–2475.

(2.16) Triple-Bands Broad Bandwidth Dipole Antenna With Multiple Parasitic Elements, by T. Fukasawa, H. Ohmine, K. Miyashita, Y. Chatani (Information Technology R&D Center, Mitsubishi Electric Corporation, Kanagawa-ken, 247-8501 Japan): pp. 2476–2481.

(2.17) Bidirectional Rod Antennas Comprising a Narrow Patch and Parasitic Elements, by K. Cho*, T. Hori*, K. Kagoshima** (*NTT Network Innovation Laboratories, Yokosuka-shi, 239-0847 Japan; **Department of Media and Telecommunications, Ibaraki University, Hitachi-shi, 316-8511 Japan): pp. 2482–2489.

(2.18) A Low-Profile Bi-Directional Cavity Antenna With Broadband Impedance Characteristics, by A. Yamamoto, H. Iwai, T. Matsuyoshi, K. Ogawa (Devices Development Center, Matsushita Electric Industrial Co., Ltd., Osaka-shi, 571-8501 Japan): pp. 2490–2497.

(2.19) The Efficiency-Fractional Bandwidth Product (EB) of Small Dielectric Loaded Antennas and the System EB, by I. Ida*, T. Sekizawa*, H. Yoshimura**, K. Ito** (*Graduate School of Science and Technology, Chiba University, Chiba-shi, 263-8522 Japan; **Faculty of Engineering, Chiba University, Chiba-shi, 263-8522 Japan): pp. 2498–2506.

(2.20) Performance Analysis of Subband Arrays, by Y. Zhang*, K. Yang**, M. G. Amin*, Y. Karasawa*** (*Department of Electrical and Computer Engineering, Villanova University, Villanova, PA 19085, USA; **ATR Adaptive Communications Research Laboratories, Kyoto-fu, 619-0288 Japan; ***Department of Electronic Engineering, University of Electro-Communications, Chofu-shi, 182-8585 Japan): pp. 2507–2515.

(2.21) A Novel Configuration for Realizing Automatic Calibration of Adaptive Array Using Dispersed SPDT Switches for TDD Systems, by K. Nishimori, K. Cho, Y. Takatori, T. Hori (NTT Network Innovation Laboratories, Yokosuka-shi, 239-0847 Japan): pp. 2516–2522.

(2.22) An Adaptive Array Antenna Steered by IF Local Signal Phase Shifters for K-Band Broadband Fixed Wireless Access Base Station, by S. Obayashi, O. Shibata, H. Kasami, H. Shoki, Y. Suzuki (Corporate Research and Development Center, Toshiba Corporation, Kawasaki-shi, 212-8582 Japan): pp. 2523–2529.

(2.23) Propagation Characteristics of 60-GHz Millimeter Waves for ITS Inter-Vehicle Communications, by A. Kato*, K. Sato*, M. Fujise*, S. Kawakami** (*Communications Research Laboratory, Yokosuka-shi, 239-0847 Japan; **Sony/Tektronix Corporation, Tokyo, 141-0001 Japan): pp. 2530–2539.

(2.24) Earth–Space Rain Attenuation Model Based on EPNet-Evolved Artificial Neural Network, by H. Yang, C. He, H. Zhu, W. Song (Shanghai Jiao Tong University, Shanghai 200030, China): pp. 2540–2549.

(2.25) Validation of Equivalent Received Bandwidth to Characterize Received Signal Level Distribution Through Experiment and Simulation, by Hiroaki Nakabayashi*, Jiang Yan*, Hironari Masui**, Masanori Ishii**, Kozo Sakawa**, Hiroyuki Shimizu**, Takehiko Kobayashi**, Shigeru Kozono* (*Chiba Institute of Technology, Electronic Engineering, Narashino-shi, 275-0016 Japan; **YRP Mobile Telecommunications, Key Technology Research Laboratories Co., Ltd., Yokosuka-shi, 239-0847 Japan): pp. 2550–2559.

(2.26) Fast Inversion Method for Electromagnetic Imaging of Cylindrical Dielectric Objects With Optimal Regularization Parameter, by M. Tanaka, K. Ogata (Faculty of Engineering, Oita University, Oita-shi, 870-1192 Japan): pp. 2560–2565.

(2.27) Computer Experiments on a Three-Wave Coupling in Association With Microwave Power Transmission in Space Plasma, by H. Usui*, H. Matsumoto*, R. Gendrin**, T. Nishikawa* (*Radio Science Center for Space and Atmosphere, Kyoto University, Uji-shi, 611-0011 Japan; **Institut Pierre Simon Laplace, Paris University, 4 Place Jussieu, 75 252 Paris, France): pp. 2566–2573.

(2.28) Analysis of Chiral Multilayer Printed Structures, by P. Pirinoli*, R. E. Zich** (*Faculty of Electronical Engineering, Politecnico di Torino, Torino, Italy; **Faculty of Electrical Engineering, Politecnico di Milano, Milano, Italy): pp. 2574–2582.

(2.29) Analysis of Backscattering Enhancement for Complex Targets in Continuous Random Media for H-Wave Incidence, by H. El-Ocla, M. Tateiba (Department of Computer Science and Communication Engineering, Kyusyu University, Fukuoka-shi, 812-8581 Japan): pp. 2583–2588.

(2.30) Line Integral Representation for Diffracted Fields in Physical Optics Approximation Based on Field Equivalence Principle and Maggi–Rubinowicz Transformation, by K.-i. Sakina*, M. Ando** (*Department of Computer Engineering, Hakodate National College of Technology, Hakodate-shi, 042-8501 Japan; **Department of Electrical and

Electronic Engineering, Tokyo Institute of Technology, Tokyo, 152-8550 Japan): pp. 2589–2596.

(2.31) Effects of a Parasitic Wire on Coupling Between Two Slot Antennas, by T. Morioka*, K. Komiyama*, K. Hirasawa** (*National Institute of Advanced Industrial Science and Technology, Tsukuba-shi, 305-8568 Japan; **University of Tsukuba, Tsukuba-shi, 305-8577 Japan): pp. 2597–2603.

(2.32) Radiation From Bent Transmission Lines, by S. Lee, M. Hayakawa, N. Ishibashi (Department of Electronic Engineering, University of Electro-Communications, Chofu-shi, 182-8585 Japan): pp. 2604–2609.

(2.33) TEM-Mode E-Field Uniformity in a GTEM Cell, by S. Ishigami, K. Harima, Y. Yamanaka (Electromagnetic Compatibility Group, Communications Research Laboratory, Yokosuka-shi, 239-0847 Japan): pp. 2610–2617.

(2.34) Evaluation of Electric-Field Uniformity in a Reverberation Chamber for Radiated Immunity Testing, by K. Harima, Y. Yamanaka (Communications Research Laboratory, Koganei-shi, 184-8795 Japan): pp. 2618–2621.

(3) *IEICE TRANS. ELECTRON.*, vol. E84-C, no. 1, January 2001, is special issue on Superconductive Electronics.

(3.1) Fabrication Technology for Nb Integrated Circuits, by H. Numata, S. Tahara (Fundamental Research Laboratories, System Devices and Fundamental Research, NEC Corporation, Tsukuba-shi, 305-8501 Japan): pp. 2–8.

(3.2) Boolean Single Flux Quantum Circuits, by Y. Okabe, C. K. Teh (Department of Electronic Engineering, Research Center for Advanced Science and Technology, The University of Tokyo, Tokyo, 153-8904 Japan): pp. 9–14.

(3.3) A Hybrid Switch System Architecture for Large-Scale Digital Communication Network Using SFQ Technology, by S. Yorozu, Y. Kameda, S. Tahara (Fundamental Research Laboratories, NEC Corporation, Tsukuba-shi, 305-8501 Japan): pp. 15–19.

(3.4) Numerical Study of the Effect of Parasitic Inductance on RSFQ Circuits, by M. Maezawa (Electrotechnical Laboratory, Tsukuba-shi, 305-8568 Japan): pp. 20–28.

(3.5) Bit Error Rate Measurement of a Measuring System Designed for Superconducting Digital Circuits, by K. Shimaoka*, S. Tokunaga*, M. Nemoto*, I. Yoshida*, A. Fujimaki**, H. Hayakawa** (*Sanyo Electric Co., Ltd. Tsukuba Research Center, Tsukuba-shi, 305-0074 Japan; **Department of Quantum Engineering, Nagoya University, Nagoya-shi, 464-8603 Japan): pp. 29–34.

(3.6) Development of Superconducting Tunnel Junctions for the Detection of X-Rays and Heavy Ions, by H. M. Shimizu, T. Ikeda, H. Kato, K. Kawai, H. Miyasaka, T. Oku, W. Ootani, C. Otani, H. Sato, Y. Takizawa, H. Watanabe (RIKEN (The Institute of Physical and Chemical Research), Wako-shi, 351-0198 Japan): pp. 35–42.

(3.7) Biological Immunoassay With High T_c Superconducting Quantum Interference Device (SQUID) Magnetometer, by K. Enpuku, T. Minotani (Department of Electronics, Kyusyu University, Fukuoka-shi, 812-8581 Japan): pp. 43–48.

(3.8) Proposal of a Digital Double Relaxation Oscillation SQUID, by H. Myoren, M. Nakamura, T. Iizuka, S. Takada (Faculty of Engineering, Saitama University, Urawa-shi, 338-8570 Japan): pp. 49–54.

(3.9) Switching Device Based on RF-Field-Driven High-T_c SQUID, by T. Kondo*, Y. Mizugaki**, K. Saito**, K. Nakajima**, T. Yamashita*** (*Sendai National College of Technology, Sendai-shi, 989-3124 Japan; **Research Institute of Electrical Communication, Tohoku University, Sendai-shi, 980-8577 Japan; ***New Industry Creation Hatchery Center, Tohoku University, Sendai-shi, 980-8579 Japan): pp. 55–60.

(3.10) Intrinsic Josephson Junction Arrays on $Bi_2Sr_2CaCu_2O_8 + x$ Single Crystals and Their Possible Applications at 100 GHz, by H. Wang*, J. Chen*, K. Nakajima*, T. Yamashita**, P. Wu*** (*Research Institute of Electrical Communication, Tohoku University, Sendai-shi, 980-8577 and the CREST, Japan Science and Technology Corporation (JST), Kawaguchi-shi, Japan; **New Industry Creation Hatchery Center, Tohoku University, Sendai-shi, 980-8579 Japan and the CREST, Japan Science and Technology Corporation (JST), Kawaguchi-shi, Japan; ***Department of Electronic Science and Engineering, University of Nanjing, Nanjing 210093, China): pp. 61–66.

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(4.29) New Planar Lightwave Circuit (PLC) Platform Eliminating Si Terraces and Its Application to Opto-Electronic Hybrid Integrated Modules, by T. Yamada*, T. Hashimoto*, T. Ohyama*, Y. Akahori*, A. Kaneko**, K. Kato**, R. Kasahara*, M. Ito* (*NTT Photonics Laboratories, Ibaraki-ken, 319-1193 Japan; **NTT Electronics Corporation, Tokyo, 150-0043 Japan): pp. 685–692.

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(5.1) Making Practical High Frequency Electromagnetic Simulators—Past, Present and Future, by J. C. Rautio (Sonnet Software, 1020 Seventh North Street, Ste. 210 Liverpool, NY 13088, USA): pp. 855–860.

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(5.5) A Comprehensive Nonlinear GaAs FET Model Suitable for Active and Passive Circuits Design, by K. Fujii*, F. M. Ghannouchi**, T. Yakabe***, H. Yabe*** (*Agilent Technologies, Inc., 3175 Bowers Ave., MS88A Santa Clara, CA 95054, U.S.A.; **Electrical and Computer Engineering Department, Ecole Polytechnique de Montreal, Succ. Centre-Ville, Montreal, Quebec H3C 3A7, Canada; ***Department of Communications and Systems Engineering, University of Electro-Communications, Chofu-shi, 182-8585 Japan): pp. 881–890.

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(6) *IEICE TRANS. ELECTRON.*, vol. E84-C, no. 9, September 2001, is special issue on Optoelectronic Packaging Technologies in the 21st Century.

(6.1) Development of Optical Surface Mount Technology, by O. Mikami*,**, T. Uchida*** (*Department of Communications Engineering, School of Information Technology and Electronics, Tokai University, 1117 Kitakaname, Hiratsuka-shi, 259-1292 Japan; **Future Science and Technology Joint Research Center, Tokai University, 1117 Kitakaname, Hiratsuka-shi, 259-1292 Japan; ***Research Institute of Science and Technology, Tokai University, 2-28 Tomigaya, Shibuya-ku, Tokyo, 151-0063 Japan): vol. J84-C, no. 9, pp. 715–726.

(6.2) Opto-Electronics Packaging Technology for Intra Cabinet, by O. Ibaragi, K. Kumai, Y. Okabe, A. Ichimura, T. Mikawa (Electronic System Integration Technology Research Department, Association of Super-Advanced of Electronics Technology (ASET), 3-9-11 Midori-cho, Musashino-shi, 180-8585 Japan): vol. J84-C, no. 9, pp. 727–735.

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(6.4) Current Research and Development of Polymer Optical Waveguide Materials, by T. Kaino (Institute of Multidisciplinary Research for Advanced Materials, Tohoku University, 2-1-1 Katahira, Aoba-ku, Sendai-shi, 980-8577 Japan): vol. J84-C, no. 9, pp. 744–755.

(6.5) RHiNET-2/SW: High-Speed Network Switch Implemented With Parallel Optical Interconnection for Parallel Computing System, by S. Nishimura*, T. Kudoh**, H. Nishi**, J. Yamamoto**, K. Harasawa***, S. Fukuda***, Y. Shikichi***, S. Akutsu*** (*RWCP Optical Interconnection Hitachi Laboratory, (c/o Central Research Laboratory, Hitachi, Ltd.), Kokubunji-shi, 185-8601 Japan; **RWCP Parallel and Distributed System Architecture Laboratory, (c/o RWCP Tsukuba Research Center), Tsukuba-shi, 352-0004 Japan; ***Hitachi Communication Systems Inc., Yokohama-shi, 244-0003 Japan): vol. J84-C, no. 9, pp. 756–765.

(6.6) Optical Intra-Cabinet Interconnections, by S. Karashima, A. Ichimura, J. Sasaki, O. Ibaragi (Electronic System Integration Technology Research Department, Association of Super-Advanced Electronics Technologies, NTT Musashino R&D Center, 3-9-11 Midori-cho, Musashino-shi, 180-8585 Japan): vol. J84-C, no. 9, pp. 766–773.

(6.7) Study of Fiber Management for Optical Board Integration, by M. Kobayashi*, S. Asakawa*, M. Hirayama*, Y. Abe*, Y. Hida*, T. Kominato*, T. Goh*, T. Kawai**, S. Sumida* (*NTT Photonics Laboratories, NTT Corporation, Tokai-mura, Ibaraki-ken, 319-1193 Japan; **NTT Network Innovation Laboratories, NTT Corporation, Yokosuka-shi, 239-0847 Japan): vol. J84-C, no. 9, pp. 774–783.

(6.8) Inter-Chip Optical Interconnection Using Planar Type Photonic Circuit and Optoelectronic Integrated Devices, by T. Takamori, H. Wada, H. Sasaki, T. Kamijoh (Optical Interconnection Oki Laboratories, 550-5 Higashisakawa, Hachioji-shi, 193-8550 Japan): vol. J84-C, no. 9, pp. 784–792.

(6.9) Large-Tolerant "OptoBump" Interface for Interchip Optical Interconnections, by Y. Ishii, Y. Arai (NTT Telecommunications Energy Laboratories, NTT Corporation, 3-1 Morinosato-Wakimiya, Atsugi-shi, 243-0198 Japan): vol. J84-C, no. 9, pp. 793–799.

(6.10) Optoelectronic Chip on Film (OE-COF) Packaging Technology, by H. Takahara, S. Ishibashi, S. Ishizawa, H. Hirata, N. Koshoubu, H. Tsunetsugu (NTT Telecommunications Energy Laboratory, NTT Corporation, 3-1 Atsugi-shi, 243-0198 Japan): vol. J84-C, no. 9, pp. 800–806.

(6.11) 2-Dimensional Parallel Optical Interconnect Module Formation Based on Micro-Optical Bench Concept, by Y. Aoki, Y. Shimada, F. Koyama, K. Iga (Microsystem Research Center, P&I Laboratory, Tokyo Institute of Technology, 4259 Nagatsuta, Midori-ku, Yokohama-shi, 226-8503 Japan): vol. J84-C, no. 9, pp. 807–813.

(6.12) Wide-Band Optical Receiver Module for Optical Video Transmission System Employing Wide-Band FM Modulation Scheme, by H. Tougou*, K. Ooura**, M. Kobayashi***, K. Nojima*, N. Ohashi*, M. Tanaka*, H. Negishi***, H. Asano*, S. Kitaji* (*Network Solution Laboratory, Matsushita Communication Industrial Co., Ltd.,

600 Saedo-cho, Tsuzuki-ku, Yokohama-shi, 224-8539 Japan; **Process and Production Equipment Development Department, Matsushita Communication Industrial Co., Ltd., 600 Saedo-cho, Tsuzuki-ku, Yokohama-shi, 224-8539 Japan; ***Communication Systems Division, Matsushita Communication Industrial Co., Ltd., 600 Saedo-cho, Tsuzuki-ku, Yokohama-shi, 224-8539 Japan): vol. J84-C, no. 9, pp. 814–821.

(6.13) Simple Packaging Technologies for Optical Transceiver Module Adaptable to Large Core-Diameter Fiber Link, by A. Ishizuka, K. Nakajima, H. Koyano (Fujitsu Laboratories Ltd., 10-1 Morinosato-Wakamiya, Atsugi-shi, 243-0197 Japan): vol. J84-C, no. 9, pp. 822–830.

(6.14) Design and Characterization of 1.3/1.55 μm Optical Transceiver Using Straight Waveguide and Double-Filter Photodiode, by H. Nakanishi, T. Okada, J. Shinkai, Y. Iguchi, A. Yamaguchi, N. Yamabayashi, Y. Kuhara (Sumitomo Electric Industries, Ltd., 1-1-3 Shimaya, Konohana-ku, Osaka-shi, 554-0024 Japan): vol. J84-C, no. 9, pp. 831–838.

(6.15) Optical Properties and Reliability of Plastic Split Alignment Sleeves for Single-Mode MU/SC Conversion Adaptors, by Y. Shuto*, S. Yanagi*, M. Ohno*, S. Iwano**, H. Sato***, S. Sumida*, S. Tohno* (*NTT Photonics Laboratories, NTT Corporation, 162 Shirakata Shirane, Tokai-mura, Naka-gun, Ibaraki-ken, 319-1193 Japan; **NTT Advanced Technology Corporation, 3-35-1 Shimo-renjaku, Mitaka-shi, 181-0013 Japan; ***NTT Electronics Corporation, 6705-2 Naka-machi, Naka-gun, Ibaraki-ken, 311-0012 Japan): vol. J84-C, no. 9, pp. 839–847.

(6.16) Determination of a Structure of One-Dimensional Dual-Periodic Photonic Crystal From an Energy Spectrum, by T. Ueta (Institute of Media and Information Technology, Chiba University, 1-33 Yayoi-cho, Inage-ku, Chiba-shi, 263-8522 Japan): vol. J84-C, no. 9, pp. 848–855.

(6.17) A Consideration on Transient Responses in MSW Saturation for a Signal-to-Noise Enhancer, by T. Kuki, T. Nomoto, Y. Utsumi (NHK Science and Technical Research Laboratories, 1-10-11 Kinuta, Setagaya-ku, Tokyo, 157-8510 Japan): vol. J84-C, no. 9, pp. 856–863.

(6.18) Mechanism of Electroluminescence in Organic Thin Film Devices, by K. Imai (Corporate R&D Laboratories, Pioneer Corporation, 6-1-1 Fujimi, Tsurugashima-shi, 350-2288 Japan): vol. J84-C, no. 9, pp. 864–871.

(6.19) Surface Passivation of Epitaxial Multi-Layer Structures for InP-Based High Speed Devices by an Ultrathin Silicon Layer, by Y.-G. Xie*, K. Takahashi**, H. Takahashi**, J. Chao*, S. Kasai**, H. Hasegawa*,** (*Research Center for Integrated Quantum Electronics, Hokkaido University, Sapporo-shi, 060-8628 Japan; **Graduate School of Electronics and Information Engineering, Hokkaido University, Sapporo-shi, 060-8628 Japan): vol. J84-C, no. 9, pp. 872–882.

(6.20) Silane Adsorption Processes on SiGe Surfaces, by N. Kamakura*,**, A. Seyama*, M. Shinohara*, Y. Kimura*, M. Niwano* (*Research Institute of Electrical Communication, Tohoku University, 2-1-1 Katahira, Aoba-ku, Sendai-shi, 980-8577 Japan; **RIKEN/Spring-8, 1-1-1 Kouto, Mikazuki-cho, Sayo-gun, Hyogo-ken, 679-5148 Japan): vol. J84-C, no. 9, pp. 883–887.

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