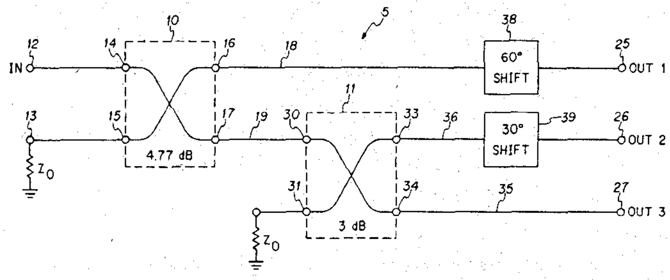
4,323,863 Apr. 6, 1982

N-Way Power Divider/Combiner

Inventor: Robert J. Weber.
Assignee: Rockwell International Corp.
Filed: Sept. 27, 1979.

Abstract—An *n*-way power divider, particularly useful where $n \neq 2^x$, includes an input and a plurality of outputs. The power applied to the input is coupled to the outputs, and phase shifters are associated with at least some of the outputs. The phase shift provided by each of the phase shifters is determined such that the reflected power waves from each of the outputs appearing at the input cancel. Because the circuit is reciprocal, it can also be used as a signal combiner with appropriately phased power-wave vectors at the inputs.

4 Claims, 6 Drawing Figures



Asian Abstracts

Papers from Journals Published in Australia, India, and Japan

Compiled by Prof. E. Yamashita, University of Electro-Communications, Tokyo, 182 Japan.

The periodicals investigated are: 1) Transactions of the Institute of Electronics and Communication Engineers of Japan (Trans. IECEJ), 2) Journal of the IECEJ, 3) Journals of the Institution of Engineers (JIE (India)), Electronics and Telecommunication Engineering Division (Part ET), 4) The Journal of Electrical and Electronics Engineering, Australia, and 5) Australian Telecommunication Research (ATR).

As for the Japanese papers in the Trans. IECEJ, which carry volume numbers J64B or J64C, single-page English summaries (1/4 page for Letters) will be found in the "Transactions of IECEJ, Section E", issued in the same month, where "E" denotes English. Papers carrying volume number E64 are papers written originally in English and will be found in Section E. These issues are published from the IECEJ, Kikai Shinko Kaikan, 3-5-8 Minato-ku, Tokyo 105, Japan.

The full translations of some Japanese papers will appear in Electronics and Communications in Japan, published by Scripta Publishing Co., 7961 Eastern Avenue, Silver Spring, MD 20910.

At the beginning of 1981, the Institution of Radio and Electronics Engineers, Australia, and the Electrical College of the Institution of Engineers, Australia, ceased to publish their separate journals. The former's Proceedings and the latter's Transactions were combined into a single journal, The Journal of Electrical and Electronics Engineering, Australia.

Active Microwave Devices

1

CW-CH_3F Metallic Waveguide Laser at 496 μm, by Y. Kokubo, S. Yoshimori, and M. Kawamura (Faculty of Engineering, Tokyo Institute of Technology, Tokyo, 152 Japan): *Trans. IECEJ*, vol. J64-C, no. 1, pp. 16–23, January 1981.

The optimization of a CW 496-μm optically pumped CH_3F laser with a metallic waveguide is discussed. The dominant oscillation is of the TE_{11} mode and the optimum waveguide diameter is 10 mm.

2

Amplification Characteristics of Injection-Locked Oscillator Having an Opposite Phase Self-Injection Circuit, By Y. Iida and M. Morita (Faculty of Engineering, Kansai University, Suita, 564 Japan): *Trans. IECEJ*, vol. J64-B, no. 4, pp. 287–294, April 1981.

The steady-state and transient response of the injection-locked oscillator having an additional circuit of opposite phase self-injection are described. Experimental results on an *X*-band Gunn diode oscillator are given.

3

The Optimum Cavity Length with CH_3F Metallic Waveguide Laser (Letters), by Y. Kokubo and M. Kawamura (Faculty of Engineering, Tokyo Institute of Technology, Tokyo, 152 Japan): *Trans. IECEJ*, vol. J64-C, no. 6, pp. 398–399, June 1981.

The optimum length of a metallic waveguide used in a CH_3F laser to produce the maximum output power is discussed theoretically, and the results of experiments are shown.

4

A Microwave Multiple-Diode Ladder Oscillator, by K. Fukui and S. Nogi (School of Engineering, Okayama University, Okayama-shi, 700 Japan): *Trans. IECEJ*, vol. 64-B, no. 8, pp. 816–823, August 1981.

A high-power microwave oscillator is proposed which is composed of a series connection of several waveguide sections having a pair of diode-mounts placed symmetrically with the waveguide axis.

5

Response of Pb Thin Film Microbridge Josephson Device Under Microwave and Millimeter Wave Radiations (Letters), by S. Yoshimori and M. Kawamura (Faculty of Engineering, Tokyo

Institute of Technology, Tokyo, 152 Japan): *Trans. IECEJ*, vol. E64, no. 10, pp. 669–670, October 1981.

The Pb thin-film Josephson device on a Si substrate was fabricated by the electron lithography method. The fractional order Shapiro steps of the current–voltage characteristics of the device were experimentally observed under the radiation of 10-GHz and 50-GHz waves.

6

Analysis and Compensation of TWT Nonlinearities Based on Complex Power Series Representation, by T. Nojima and Y. Okamoto (Yokosuka Electrical Communication Laboratory, N.T.T., Yokosuka, 238-03 Japan): *Trans. IECEJ*, vol. J64-B, no. 12, pp. 1449–1456, December 1981.

A simple power series expansion is proposed to describe the input–output nonlinearities of a traveling tube amplifier. A predistortion circuit to compensate amplitude and phase nonlinearities in a wide range of operating conditions is described.

Passive Microwave Devices

1

An Adaptive Cross Polarization Compensator Using Two 90° Phase Shifters, by H. Yuuki, K. Inagaki, M. Yamada, and N. Baba (Research and Development Laboratories, K.D.D., Ltd., Tokyo, 153 Japan), and S. Endo (Transmission System Department, K.D.D., Tokyo, 160 Japan): *Trans. IECEJ*, vol. J64-B, no. 1, pp. 46–53, January 1981.

Large XPD degradation in satellite communication links due to rain has been sufficiently compensated by the small movement of 90° phase shifters. The XPD after the compensation has reached to 35 dB.

2

Shielded TM_{010} Dielectric Rod Resonator, by Y. Kobayashi, K. Kojima, and S. Yoshida (Faculty of Engineering, Saitama University, Urawa-shi, 338 Japan): *Trans. IECEJ*, vol. J64-B, no. 2, pp. 119–125, February 1981.

The characteristics and design method of shielded dielectric rod resonators are discussed in detail. The optimum dimensions to obtain the highest Q is determined and a temperature-stabilized configuration is proposed.

3

Circulator's Effect on the Noise-Temperature Performance of a Reflection-Type Amplifier, by M. Kajikawa (Nippon Electric Co., Ltd., Yokohama-shi, 226 Japan): *Trans. IECEJ*, vol. J64-B, no. 2, pp. 134–141, February 1981.

The noise generation from a reflection-type amplifier with a circulator is analyzed since the degradation of noise characteristics is a serious problem in satellite communication systems.

4

Dielectric Resonators and Their Applications, by N. A. McDonald and M. L. Majewski (Department of Communication and Electronic Engineering, Royal Melbourne Institute of Technology, Australia), JEEE(Australia), vol. 1, no. 1, pp. 54–61, March 1981.

The use of recently developed high-Q, high-permittivity, temperature-compensated ceramic materials in dielectric resonators is described and some filter applications of such resonators are given.

5

Slot-Line Hybrid Ring (Letters), by H. Ogawa and M. Aikawa (Yokosuka Electrical Communication Laboratory, N.T.T., Yokosuka, 238-03 Japan): *Trans. IECEJ*, vol. J64-B, no. 4, pp. 312–317, April 1981.

A slot-line hybrid ring is proposed and the results of experiments on a 20-GHz hybrid ring using a 0.3-mm Alumina substrate are described.

6

$\lambda/8$ Directional Couplers Constructed from Two-Tandem Connected $\lambda/4$ Directional Couplers (Letters), by K. Ohue (Yokosuka Electrical Communication Laboratory, N.T.T., Yokosuka, 238-03 Japan): *Trans. IECEJ*, vol. J64-B, no. 4, pp. 344–345, April 1981.

A method to construct a $\lambda/8$ directional coupler by using two $\lambda/4$ directional couplers is proposed. Experimental results on a strip-line directional coupler at 750 MHz indicate good agreement with theory.

7

Resonant Modes for a Shielded Dielectric Rod Resonator, by Y. Kobayashi, N. Fukuoka, and S. Yoshida (Faculty of Engineering, Saitama University, Urawa-shi, 338 Japan): *Trans. IECEJ*, vol. J64-B, no. 5, pp. 433–440, May 1981.

A dielectric rod resonator is treated which is placed symmetrically in a cylindrical conductor-cavity or between two parallel conductor plates. Calculated resonant frequencies based on the power series expansion method agree well with experimental values.

8

Quarter-Wavelength Coupled Variable Band-Pass Filter Using Varactor-Diodes (Letters), by S. Toyoda (Faculty of Engineering, Osaka Institute of Technology, Osaka, 535 Japan): *Trans. IECEJ*, vol. J64-B, no. 6, pp. 564–565, June 1981.

The variable band-pass filter is composed of two quarter-wavelength coupled band-pass filters connected in parallel with coaxial power dividers. The pass-bandwidth can be varied from 730 MHz to 1220 MHz.

9

Composition and Analysis of a New Waveguide Resonator Filter with Dielectric Loading, by A. Fukusawa (Oki Electric Industry Co. Ltd., Tokyo, 108 Japan): *Trans. IECEJ*, vol. J64-B, no. 7, pp. 643–650, July 1981.

A new waveguide filter is proposed which is composed of dielectric rods with central thin conductor placed between two parallel conductor plates. Experimental data of the filter at 850 MHz are shown.

10

Perturbation Analysis on the Corrugated Dielectric Waveguide, with Application to Millimeter Wave Filters, by T. Ohira, M. Tsutsumi, and N. Kumagai (Faculty of Engineering, Osaka University, Suita-shi, 565 Japan): *Trans. IECEJ*, vol. J64-B, no. 7, pp. 659–665, July 1981.

The first-order Bragg interactions between electromagnetic TM waves in a corrugated dielectric slab waveguide are discussed from a theoretical and experimental point of view.

11

Synthesis of Circular Polarization with Nonresonant Slots in the Narrow Wall of a Rectangular Waveguide, by H. Seki and N. Goto (Faculty of Engineering, Tokyo Institute of Technology, Tokyo, 152 Japan): *Trans. IECEJ*, vol. J64-B, no. 9, pp. 1000–1007, September 1981.

The configuration of a waveguide slot array to yield circularly polarized waves is theoretically described by solving simultaneous integral equations. The results of experiments show the axial ratio of 0.2 dB at the S-band frequencies.

12

A Simple Hand-Made Radio-Wave Absorber in Millimeter and Microwave Region (Letters), by K. Hayashi, K. Arai, and Y. Ida (Faculty of Technology, Kanazawa University, Kanazawa, 920 Japan): *Trans. IECEJ*, vol. J64-B, no. 9, pp. 1043–1044, September 1981.

A radio-wave absorber consisting of stratified resistive sheets is described. The results of experiments at 35 GHz show the transmission and reflection coefficient of -30 dB.

13

Canonical Representation and Figure of Merit of Circulator, by K. Araki and Y. Naito (Faculty of Engineering, Tokyo Institute of Technology, Tokyo, 152 Japan): *Trans. IECEJ*, vol. E64, no. 9, pp. 583–590, September 1981.

This paper describes a complete analysis of a circulator in reference to "circuit invariance". The figure of merit of a circulator can be derived by means of the circuit invariance.

14

A Design and Experiments of the Pyramidal Absorber with Good Reflection Characteristics at Both Normal and Oblique Incidence, by M. Ono and Y. Sugai (Faculty of Engineering, Yamagata University, Yamagata-shi, 992 Japan): *Trans. IECEJ*, vol. J64-B, no. 10, pp. 1069–1076, October 1981.

The empirical design formula in a previous paper is improved to represent actual reflection characteristics more accurately and to show agreement with experimental results.

15

Performance of Millimeter-Wave Detector Using Hot Carriers in Semiconductor, by K. Kikuchi (Department of Electrical Engineering, National Defense Academy, Yokosuka-shi, 239 Japan), and S. Furukawa (Graduate School at Nagatsuda, Tokyo Institute of Technology, Yokohama-shi, 227 Japan): *Trans. IECEJ*, vol. J64-C, no. 10, pp. 658–665, October 1981.

A millimeter-wave detector is described which is using the thermoelectric effect due to hot carriers in *P*-type Germanium. It is found that the voltage sensitivity of the hot carrier diode at 100 GHz is proportional to the 3rd power of the spreading resistance.

16

Experiments on the Broad-Band Operation of Stripline *Y* Circulators Loaded with a Pair of Coaxially Combined Bi-ferrite Composites, by T. Nagao, Z. Tanaka, and K. Umatani (Department of Electrical Engineering, National Defense Academy, Yokosuka-shi, 239 Japan): *Trans. IECEJ*, vol. J64-B, no. 11, pp. 1196–1203, November 1981.

The composite was made of a thin annular ferrite and a thick disk ferrite. Experimental results show the frequency band of 40 percent with the 20-dB isolation and the insertion loss of 0.6 dB.

17

A Design of Square Waveguide Polarizer with Metal Pieces and Its Applications to a Circularly Polarized Small Primary Feed, by N. Toyama (NHK Technical Research Laboratories, Tokyo, 157 Japan): *Trans. IECEJ*, vol. J64-B, no. 12, pp. 1441–1448, December 1981.

This paper describes the design and performance of a circular-polarizer comprising two metal pieces on the diagonal corners of a square waveguide. The propagation constant of the waveguide is given with the finite element method.

Transmission Lines and Waveguides

1

The Filter Characteristics of Millimeter Wave in a Permittivity-Modulated Dielectric Slab Waveguide, by C. Surawatpunya, M. Tsutsumi, and N. Kumagai (Faculty of Engineering, Osaka University, Suita, 565 Japan): *Trans. IECEJ*, vol. E64, no. 3, pp. 188–194, March 1981.

The filter characteristics of a dielectric slab waveguide with the sinusoidal variation of permittivity are discussed. Experimental results on the waveguide in the millimeter-wave region are consistent with theory.

2

Propagation Constant in Hollow Circular Cylinder Surrounded by Two Lossy Layers, By Y. Yamaguchi and T. Abe (Faculty of Engineering, Niigata University, Niigata, 950-21 Japan), and M. Tsuchida (Faculty of Engineering, Tokyo Institute of Technology, Tokyo, 152 Japan): *Trans. IECEJ*, vol. J64-B, no. 4, pp. 312–317, April 1981.

The propagation characteristics of the HE_{11} and TE_{01} mode in a circular waveguide surrounded by two lossy layers are discussed to investigate basic properties of electromagnetic wave transmission in tunnels.

3

Characteristics of the Dominant Mode in a Dielectric Tape Line, by T. Wakabayashi and Y. Mihara (Faculty of Engineering, Tokai University, Hiratsuka, 259-12 Japan): *Trans. IECEJ*, vol. J64-B, no. 5, pp. 377–384, May 1981.

Electromagnetic wave propagation along a dielectric tape line is discussed. The computed attenuation factor and field distribution of the dominant mode are compared with experimental results.

4

Experimental Verification for Attenuation Characteristics in a Lossy Dielectric-Lined Circular Waveguide (Letters), by Y. Yamaguchi and T. Abe (Faculty of Engineering, Niigata University, Niigata, 950-21 Japan): *Trans. IECEJ*, vol. J64-B, no. 6, pp. 550–551, June 1981.

The attenuation constants of the HE_{11} and the TE_{01} mode decrease oscillatorily with increasing frequency theoretically and experimentally.

5

Analysis of Coplanar Strip Lines on an Anisotropic Substrate Using Galerkin's Method, by Y. Hayashi, T. Kitazawa, and S. Sasaki (Faculty of Engineering, Kitami Institute of Technology, Kitamishi, 090 Japan): *Trans. IECEJ*, vol. J64-B, no. 7, pp. 666–673, July 1981.

Various formulas of the quasi-TEM modes and the hybrid modes of the coplanar strip lines on an anisotropic substrate are derived by using Galerkin's method.

6

An Analysis of Coplanar Waveguides with Finite Conductor Thickness—Computation and Measurement of Characteristic Impedance, by K. Koshiji, E. Shu, and S. Miki (Faculty of Science and Technology, Science University of Tokyo, Noda-shi, 278 Japan): *Trans. IECEJ*, vol. J64-B, no. 8, pp. 854–861, August 1981.

Laplace's equation is solved by means of the successive over-relaxation method to find the guide parameters of a coplanar waveguide with finite conductor thickness.

7

Propagation Characteristics of The Dominant Mode in Tunnels with Elliptical Section, by Y. Yamaguchi (Faculty of Engineering, Niigata University, Niigata, 950-21 Japan): *Trans. IECEJ*, vol. J64-B, no. 9, pp. 1032–1038, September 1981.

The propagation constants of the even- and odd-mode are calculated from the numerical solution of characteristic equations. The results of model experiments at 7–12 GHz are shown.

8

Analysis of the Guided Modes in the Anisotropic Dielectric Rectangular Waveguides, by M. Ohtaka (Faculty of Engineering, Fukui University, Fukui-shi, 910 Japan): *Trans. IECEJ*, vol. J64-C, no. 10, pp. 674–681, October 1981.

The guided modes of dielectric waveguides with rectangular anisotropic core are analyzed with the vector variational method. It is found that the guided modes are hybrid and their field vectors are almost parallel to the principal axes.

9

A Method for Analyzing Guided Modes of Dielectric Waveguides of Arbitrary Cross-Section Shape, by N. Morita and Y. Kume (Faculty of Engineering, Osaka University, Suita-shi, 565 Japan): *Trans. IECEJ*, vol. J64-C, no. 10, pp. 690–699, October 1981.

The method is based on the extended boundary condition method. Some numerical results of the dispersion characteristics are presented for two cases of cross-section shape.

Microwave Field and Circuit Theory

1

An Analysis of Unbounded Field Problems by Finite-Element Method, by S. Washisu (Asahikawa Technical College, Asahikawa-shi, 070 Japan), I. Fukai and M. Suzuki (Faculty of Engineering, Hokkaido University, Sapporo-shi, 060 Japan): *Trans. IECEJ*, vol. J64-B, no. 1, pp. 1–7, January 1981.

This paper proposes an improved finite element method to solve unbounded field problems. The reflection coefficients of open-ended waveguides are estimated and compared with other theoretical results.

2

Adaptation of Bergeron's Method to Complicated Boundary Problems, by N. Yoshida, I. Fukai, and J. Fukuoka (Faculty of Engineering, Hokkaido University, Sapporo, 060 Japan): *Trans. IECEJ*, vol. E64, no. 7, pp. 455–462, July 1981.

The method can be used for solving problems of dispersive media with complicated boundary geometry. A problem of a cold plasma radiated by a cylindrical reflector is shown as an example.

3

A Numerical Analysis of an Arbitrarily-Shaped Planar Circuits (Letters), by M. Kominami, K. Yoshizumi, K. Narita, and K. Rokushima (Faculty of Engineering, University of Osaka Prefecture, Sakai, 591 Japan): *Trans. IECEJ*, vol. J64-B, no. 7, pp. 727–728, July 1981.

A new method based on mode matching is applied to the analysis of a multi-port planar circuit to determine the field distribution and impedance matrix of the circuit.

4

Computer Analysis of Microwave Planar Circuit with Impedance Matrix, by H. Jiu-Pang, T. Anada, and H. Kaneko (Faculty of Engineering, Kanagawa University, Yokohama-shi, 221 Japan): *Trans. IECEJ*, vol. J64-B, no. 9, pp. 986–999, September 1981.

The characteristic mode impedance and the mode impedance of the planar circuit are defined, expressed with Green's function for appropriate boundary conditions, and applied to the analysis of a corner-cut right-angle bend.

5

Two New Solutions in Cylindrical Coordinates of Electromagnetic Fields of Axially Traveling Waves and Some Applications, by T. Shimizu (Advanced Development Laboratory, Matsushita Communication Industrial Co., Ltd., Yokohama-shi, 223 Japan): *Trans. IECEJ*, vol. J64-B, no. 10, pp. 1061–1068, October 1981.

The two new solutions of Maxwell's equations are derived for waves traveling along the z axis of the cylindrical coordinates. These solutions can be applied to the analysis of cladded optical fibers.

6

Some Difficulties in Homogeneous Multilayer Approximation Method and Their Remedy, by T. Hosono and S. Yamaguchi (College of Science and Technology, Nihon University, Tokyo, 101 Japan): *Trans. IECEJ*, vol. J64-B, no. 10, pp. 1115–1122, October 1981.

It is pointed out that the homogeneous multilayer approximation method for solving electromagnetic field problems does not work under two conditions. An improved method is proposed.

7

Application of Bergeron's Method to Anisotropic Media, by N. Yoshida, I. Fukai, and J. Fukuoka (Faculty of Engineering, Hokkaido University, Sapporo-shi, 060 Japan): *Trans. IECEJ*, vol. J64-B, no. 11, pp. 1242–1249, November 1981.

Nodal equations are derived from the fundamental kinetic equations of magnetic dipoles in magnetized ferrite and treated with the use of Bergeron's equations.

8

Electromagnetic Fields in Twisted Coordinate System, H. Yabe (Junior Technical College of Electro-Communications, Chofu-shi, 182 Japan), and Y. Mushiake (Faculty of Engineering, Tohoku University, Sendai-shi, 980 Japan): *Trans. IECEJ*, vol. J64-B, no. 12, pp. 1313–1319, December 1981.

Electromagnetic fields with helicoidal polarization are theoretically discussed. The vector wave equations in the twisted coordinate system are examined to treat waves whose plane of polarization rotates with the coordinate axis.

9

An Analysis of Electromagnetic Unbounded Field Problems by Boundary Element Method, by S. Washisu (Asahikawa Technical College, Asahikawa-shi, 070 Japan), and I. Fukai (Faculty of Engineering, Hokkaido University, Sapporo-shi, 060 Japan): *Trans. IECEJ*, vol. J64-B, no. 12, pp. 1359–1365, December 1981.

Reflection coefficients of open-ended parallel plane waveguides are estimated with the method, and compared with the results of the finite element method and rigorous solutions.

Microwave Integrated Circuits

1

Nonreciprocal Devices in Open-Boundary Structures for Millimeter-Wave Integrated Circuits, by M. Muraguchi and Y. Naito (Faculty of Engineering, Tokyo Institute of Technology, Tokyo, 152 Japan): *Trans. IECEJ*, vol. J64-B, no. 7, pp. 604–611, July 1981.

Novel nonreciprocal devices of a directional coupler type, a pillbox type, and a junction type, are proposed for the use in millimeter-wave integrated circuits. Experimental data at 60 GHz are shown.

Microwave Thermal Effects

1

Study on Microwave Thermography—Application to the Estimation of Subcutaneous Temperature Profiles, by M. Miyakawa (Electrotechnical Laboratory, Ibaraki-ken, 305 Japan): *Trans. IECEJ*, vol. E64, no. 12, pp. 786–792, December 1981.

A mathematical model of a human tissue was made by adopting the dielectric properties of biological media to take a general view of radiation from the human body. A radio meter of five frequencies up to 10 GHz was designed based on the model.

Microwave Holography

1

Experimental Study of Reflection-Perturbation-Proof Characteristics of Object-Scanning Microwave Holography (Letters), by K. Hayashi, Y. Ida, and K. Arai (Faculty of Technology, Kanazawa University, Kanazawa, 920 Japan): *Trans. IECEJ*, vol. J64-B, no. 11, pp. 1291–1292, November 1981.

A quasi real-time holographic system was constructed by using numerically connected and horizontally aligned 64-antennas at the *X*-band frequencies. An appreciable improvement in reconstructed image was recognized.

Optical Fibers

1

Accuracy of the Group Velocity of the Step-Index Fiber Modes Evaluated by the Scalar Approximation Technique (Letters), by K. Morishita, N. Kumagai, and Y. Obata (Faculty of Engineering, Osaka University, Suita-shi, 565 Japan): *Trans. IECEJ*, vol. J64-B, no. 1, pp. 87–88, January 1981.

This paper discussed the maximum possible errors of the group delay of typical multimode and single-mode fibers evaluated by the scalar approximation method.

2

Refractive Index Profiling of Graded-Index Fibers to Attain a 100-MHz Bandwidth at a Fiber Length of 100 Km, by Y. Daido (Fujitsu Laboratories Ltd., Kawasaki, 211 Japan): *Trans. IECEJ*, vol. E64, no. 1, pp. 13–20, January 1981.

This paper proposes a method for calculating the transfer function of transmission lines composed of multimode optical fibers with arbitrary index profiles. A result of calculations suggests that a 100-MHz bandwidth for a fiber of 100-Km length can be expected.

3

Low Loss Zero-Dispersion Single-Mode Fibers in the 1.5 μm Wavelength Region (Letters), by M. Miya, A. Kawana, Y. Terunuma, T. Hosaka, and Y. Ohmori (Ibaraki Electrical Communication Laboratory, N.T.T., Ibaraki, 311-19 Japan): *Trans. IECEJ*, vol. E64, no. 1, pp. 32–33, January 1981.

The effect of relative refractive index differences of single-mode optical fibers on the wavelength of zero-dispersion was investigated. A single-mode fiber with the minimum loss and minimum dispersion at 1.5 μm was experimentally realized.

4

Analysis of Anisotropic Single-Mode Fibers, by K. Kusano and S. Nishida (Research Institute of Electrical Communication, Tohoku University, Sendai-shi, 980 Japan): *Trans. IECEJ*, vol. J64-C, no. 3, pp. 165–172, March 1981.

The polarization characteristics of several anisotropic single-mode fibers are analyzed in detail by introducing left- and right-handed circularly polarized waves. It is pointed out that a 45° Faraday rotator can be constructed by using gyrotropical fibers of reasonable length.

5

Polarization Properties of Optical Waves in a Twisted Elliptical Fiber, by K. Kusano and S. Nishida (Research Institute of Electrical Communication, Tohoku University, Sendai-shi, 980 Japan): *Trans. IECEJ*, vol. J64-C, no. 3, pp. 173–179, March 1981.

The polarization rotation and coupling effects of a twisted elliptical fiber are analyzed in detail. Theoretical conclusions derived in this paper are consistent with experimental results.

6

Polarization, Characteristics of Twisted Single-Mode Optical Fiber, by Y. Namihira, M. Kudo, and Y. Mushiake (Faculty of Engineering, Tohoku University, Sendai-shi, 980 Japan): *Trans. IECEJ*, vol. J64-C, no. 3, pp. 180–187, March 1981.

The results of experiments indicate that the cross-polarization component to incident polarization is generated in a twisted single-mode fiber. A general formula of the tensor permittivity for a twisted fiber with elliptical core is derived to explain this effect.

7

Transmission Characteristics of Long-Length VAD Fibers, by S. Sudo, M. Kawachi, T. Edahiro, and K. Chida (Ibaraki Electrical Communication Laboratory, N.T.T., Ibaraki, 319-11 Japan): *Trans. IECEJ*, vol. E64, no. 3, pp. 175–180, March 1981.

The transmission loss and bandwidth of long (11.0–30.4 Km) VAD fibers have been measured with the back scattering technique. Some of measured values are: 0.54 dB/Km and 2.55 GHz-Km at 1.3 μm.

8

The Theoretical and Experimental Study of Mode-Coupled Graded Index Fibers Based on Scattering Matrix Method, by H. Kajioka (Research Laboratory, Hitachi Cable Ltd., Hitachi, 319-14 Japan): *Trans. IECEJ*, vol. E63, no. 3, pp. 203–209, March 1981.

This paper describes an analytical treatment of mode-coupled graded-index fibers based on the scattering matrix method. The mode coupling parameters of the fibers are defined and used to determine the characteristics of long spliced fibers at the wavelength of 1.3 μm and 0.85 μm.

9

Mode Analysis in a Few Modes Parabolic-Index Fiber (Letters), by M. Tateda and S. Seikai (Ibaraki Electrical Communication Laboratory, N.T.T., Ibaraki, 319-11 Japan): *Trans. IECEJ*, vol. E64, no. 9, pp. 608–609, September 1981.

The mode power distribution in a parabolic-index optical fiber of 1-Km length has been measured by the far-field pattern method and the pulse method.

10

Initial Fiber Deformation Effect on Excess Loss of Jacketed Optical Fiber at Low Temperature (Letters), by T. Yabuta, N. Yoshizawa, and N. Kojima (Ibaraki Electrical Communication Laboratory, N.T.T., Ibaraki, 319-11 Japan): *Trans. IECEJ*, vol. J64-B, no. 10, pp. 1149–1150, October 1981.

The phenomenon of excess-loss increase at low temperature is theoretically studied by using a structure model.

11

Condition of Unchangeable Polarization for a Single-Mode Optical Fiber in Pulse Wave Transmission, by K. Kusano and S. Nishida (Research Institute of Electrical Communication, Tohoku University, Sendai-shi, 980 Japan): *Trans. IECEJ*, vol J64-C, no. 10, pp. 630–637, October 1981.

This paper describes the conditions of unchangeable polarization for the pulse-wave transmission along a single-mode optical fiber with nonuniform and noncircular core.

12

Bending Loss Formula for Step-Index Optical Fiber and Their Applicable Regions, by K. Kusano and S. Nishida (Research Institute of Electrical Communication, Tohoku University, Sendai-shi, 980 Japan): *Trans. IECEJ*, vol. J64-C, no. 10, pp. 638–644, October 1981.

The bending loss of the LP modes is related to orientation angles, propagation constants, and the ratio of amplitudes and phase differences between propagating mode fields.

13
Transmission Characteristics of Optical Fibers at High Temperature, by R. Yamauchi and K. Inada (Telecommunication Research and Development Department Division, The Fujikura Cable Works, Ltd., Sakura-shi, 285 Japan): *Trans. IECEJ*, vol. J64-C, no. 12, pp. 835–842, December 1981.

The transmission characteristics of silica-based optical fibers at high temperature were studied by heating the fibers up to about 700°C. The optical noise power traveling through a heated fiber was also examined.

Optical Waveguides Other Than Fibers

1
Some Design Considerations for Circular Bends of Optical Slab Waveguides, by S. Sawa and K. Ono (Faculty of Engineering, Ehime University, Matsushima-shi, 790 Japan): *Trans. IECEJ*, vol. J64-C, no. 2, pp. 69–75, February 1981.

The transition loss of multi-mode and single-mode fibers at a circular bend can be considerably reduced by introducing a mode transducer near the bend section.

2
Design Considerations for Tapered Optical Slab Waveguides (Letters), by K. Ono and S. Sawa (Faculty of Engineering, Ehime University, Matsuyama, 790 Japan): *Trans. IECEJ*, vol. J64-C, no. 3, pp. 213–214, March 1981.

The design conditions of tapered optical slab waveguides are derived using an analogy with the circular bends of optical beam waveguides.

3
Equivalent Network Analysis of Dielectric Thin-Film Waveguides for Optical Integrated Circuits (Letters), by M. Koshiba and M. Suzuki (Faculty of Engineering, Hokkaido University, Sapporo, 060 Japan): *Trans. IECEJ*, vol. E64, no. 4, pp. 266–267, April 1981.

An equivalent network approach is applied to the problems of wave propagation in dielectric thin-film waveguides. Calculated dispersion characteristics by this approach agree well with those by numerical methods.

4
Propagation Characteristics of Optical Guided-Waves on ZnO/SiO_2/Si Waveguide (Letters), by Y. Nakagawa, M. Kanda, and N. Maruoka (Faculty of Engineering, Yamanashi University, Kofu, 400 Japan): *Trans. IECEJ*, vol. J64-C, no. 10, pp. 710–711, October 1981.

The phase and attenuation constant of propagation modes of the waveguide are estimated theoretically and compared with experimental results based on the dc effect of the surface acoustic waves.

Optical Devices

1
Broad-Band Guided-Wave Light Intensity Modulator, by M. Izutsu and T. Sueta (Faculty of Engineering Science, Osaka University, Toyonaka-shi, 560 Japan): *Trans. IECEJ*, vol. J64-C, no. 4, pp. 264–271, April 1981.

A broad-band optical modulator is described which is using a Ti-diffused *Z*-cut $LiNbO_3$ optical waveguide and an asymmetric strip line. The modulator has the $1/\sqrt{2}$ bandwidth of 11.2 GHz, and requires the power of 130 mW for 88-percent intensity modulation.

2
Impulse Response of a Contradirectional Coupler, by S. Takai, T. Mishima, and I. Sakuraba (Faculty of Engineering, Hokkaido University, Sapporo, 060 Japan): *Trans. IECEJ*, vol. J64-C, no. 5, pp. 361–368, May 1981.

The impulse response of optical components such as contradirectional couplers and corrugated waveguide filters is analyzed based on a coupled-mode theory.

3
Lower Mode Excitation in the Coupling of Semiconductor Lasers into Multimode Fibers with Tapered Hemispherical Ends (Letters), by H. Kuwahara and Y. Daido (Fujitsu Laboratories, Ltd., Kawasaki, 211 Japan): *Trans. IECEJ*, vol. E64, no. 9, pp. 612–613, September 1981.

Modal power distribution in the fiber can be determined by measuring the dependence of connection loss on the displacement of a butt joint.

4
Optical Wavelength Filters Using Lossy Waveguide Coupling, by M. Kobayashi and H. Terui (Ibaraki Electrical Communication Laboratory, N.T.T., Ibaraki-ken, 319-11 Japan): *Trans. IECEJ*, vol. J64-C, no. 10, pp. 666–673, October 1981.

This paper describes two novel optical wavelength filters composed of lossy waveguide couplers with a uniform or tapered coupling region based on a coupled mode theory.

5
Modulation Characteristics of AlGaAs DH Lasers in Frequency Region of 6 to 10 GHz (Letters), by M. Yamada and H. Yamada (Faculty of Technology, Kanazawa University, Kanazawa, 920 Japan): *Trans. IECEJ*, vol. E64, no. 10, pp. 673–674, October 1981.

The direct modulation characteristics of the laser light with microwaves were examined using a Fabry–Perot interferometer. The mechanism of this modulation can be explained by the driving of the injected carrier density.

6
Analysis of Fiber-Type Isolator Characterized by Elliptically Deformed Fiber Core, by K. Kusano and S. Nishida (Research Institute of Electrical Communication, Tohoku University, Sendai-shi, 980 Japan): *Trans. IECEJ*, vol. J64-C, no. 11, pp. 725–731, November 1981.

A fiber-type isolator is described which is composed of a polarizer, an analyzer, and a 45° Faraday rotator with a gyro-anisotropic optical fiber. The effect of core deformation on the isolation and insertion loss of the isolator is theoretically analyzed.

Measurements

1
Measurement Method of Mode-Conversion Coefficient at Optical Fiber Splice (Letters), by H. Shinohara and S. Hatano (Ibaraki Electrical Communication Laboratory, N.T.T., Ibaraki, 319-11 Japan): *Trans. IECEJ*, vol. J64-C, no. 5, pp. 369–370, May 1981.

Mode-conversion coefficients are determined from the change of modal distribution and the selective excitation of a mode group at a splice point. The results of measurements are given.

2
Laser Stabilization for Baseband Frequency Response Measurement of Multimode Optical Fibers, by T. Tanifuji, T. Horiguchi, and M. Tokuda (Ibaraki Electrical Communication Laboratory,

N.T.T., Ibaraki, 319-11 Japan), K. Miyake (Totsuka Works, Hitachi Ltd., Yokohama, 224 Japan), and T. Fukuzawa (Central Research Laboratory, Hitachi Ltd., Kokubunji, 185 Japan): *Trans. IECEJ*, vol. E64, no. 6, pp. 426–430, June 1981.

A far-end measurement instrument of baseband frequency response was designed and constructed. Optimum coupling conditions between a fiber and a laser facet are given. Automatic control circuits of power and temperature applied to the laser to attain the sufficient stabilization of frequency are described.

3

Measurement of Millimeter-Wave Reflection Coefficients by Using a T-Junction, by T. Iwasaki, A. Nagatsuka, and T. Nemoto (Electrotechnical Laboratory, Ibaraki-ken, 305 Japan): *Trans. IECEJ*, vol. J64-B, no. 8, pp. 745–752, August 1981.

A method for measuring the reflection coefficient without tuning and frequency conversion is proposed. The measurement setup is composed of a *T*-junction and a power meter. Experimental results at 34.0 GHz show the validity of this method.

4

Measurement of Power Reflection at the Exit End of an Optical Fiber by the Sinusoidal Modulation of Light Intensity (Letters), by T. Iwasaki (Electrotechnical Laboratory, Ibaraki-ken, 305 Japan): *Trans. IECEJ*, vol. J64-C, no. 10, pp. 704–705, October 1981.

Sinusoidally modulated incoherent light is reflected at an end of an optical fiber and superimposed to leaking waves in a directional coupler. The reflection modulus can be estimated from the detector response to the resultant light.

5

Splice Loss and Optical Fiber Loss Measurements of Optical Transmission Line Using Backscatter Method, by M. Tokuda, M. Nakahira, K. Omote, T. Horiguchi, and M. Matsumoto (Ibaraki Electrical Communication Laboratory, N.T.T., Ibaraki-shi, 319-11 Japan): *Trans. IECEJ*, vol. J64-B, no. 12, pp. 1457–1464, December 1981.

Three methods for evaluating splice losses and fiber losses are examined and compared with the conventional cutback method.

Others

1

Microwave Systems for Public Networks—Trends in the World and in India, by K. Swaminathan (Telecommunications Research Centre, P.T. Department, New-Delhi, India), *JIE.*(India), pt.ET, vol. 62, no. ET1, pp. 18–21, August 1981.

A review of the basic elements of a typical microwave system is given to understand and appreciate the strides made in the area of microwave systems and the state-of-the-art.

2

Experimental Investigations of Compressed Log Periodic Dipole Antennae, by P. S. Bhatnagar and M. D. Singh (Central Electronic Engineering Research Institute, Pilani, India), *JIE.*(India), pt.ET, vol. 62, no. ET2, pp. 52–53, December 1982.

The compressed LPD antenna has been fabricated on an alumina substrate using thick-film technology for the reception of microwaves over the frequency band of 2 to 10 GHz. The performance of the antenna has been compared with that of a conventional LPD antenna.