Asia–Pacific Abstracts

Papers from Journals Published in Australia, India, China, Korea, and Japan in 1996

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The periodicals investigated are 1) *Journal of Electrical and Electronics Engineering* (*JEEE*), Australia, 2) *Journal of the Institution of Electronics and Telecommunication Engineers* (*JIETE*), India, 3) *Acta Electronica Sinica* (*AES*), China, 4) *Journal of China Institute of Communications* (*JCIC*), China, 5) *Journal of Infrared and Millimeter Waves* (*JIMW*), China, 6) *Journal of Applied Science* (*JAS*), China, 7) *Journal of Electronics* (*JE*), China, 8) *Journal of Microwaves* (*JM*), China, 9) *Journal of the Chinese Institute of Engineering* (*JCIE*), Taiwan, China, 10) *Journal of the Korean Institute of Telematics and Electronics* (*JKITE*), Korea, 11) *Journal of the Korean Institute of Communication Science* (*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 papers published in *JKITE* and *JKICS* have been investigated by Prof. J.-W. Ra, Department of Electrical Engineering, Korean Advanced Institute of Science and Technology, Taejon, 305-701, Korea.

As for the Japanese papers in the *Trans. IEICE* that carry volume numbers J79-B-II and J79-C-I, short English summaries are found in the *IEICE Trans. Commun.*, vol. E79-B and *IEICE Trans. Electron.*, vol. E79-C, issued in the same month. Papers carrying volume numbers E79-B and E79-C are papers originally written in English. These issues are published by the IEICE 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 Technica, Inc., John Wiley & Sons, Inc., 605 Third Avenue, New York, NY 10158 USA. The 1995 issues (nos. 5 and 6) of the *JIETE* which were not available last year are included in the present Asia-Pacific Abstracts. Also, the 1996 issues (nos. 5 and 6) of the *JIETE* are not available in Japan at the deadline of the Asia-Pacific Abstracts and will be reported next year. The Australian Telecommunication Research (ATR), Australia has ceased publication in 1996.

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).

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I. Solid-State Microwave Devices and MMIC's

(1) Microwave Oscillation of GaAs/AlAs Heterostructure Intervalley Transferred Electron Devices, by F.-S. Xue*, Y.-M. Deng**, and C.-R. Zhang** (*National Lab. for Superlattices, Beijing, P.R.C.; **Nanjing Electronic Devices Institute, Nanjing, P.R.C.): *AES*, vol. 24, pp. 17–21, Feb. 1996.

The heterostructure intervalley transferred electron devices produced by a band mixing quantum well composed of direct gap GaAs and indirect gap AlAs is introduced. It can produce up to 320 mW at 8-mm wave band with the highest conversion efficiency of 8%. Under the pulse operation the largest output power of 2 W with efficiency of 10% has been achieved. The heterostructure intervalley transferred electron effect and its devices have been thoroughly analyzed.

(2) The Omni-Automatic Design of MIC MES FET Amplifiers, by M. Li, H.-H, Y.-H. Li, and Y.-S. Wu (Tianjin University, Tianjin, P.R.C.): *AES*, vol. 24, pp. 83–85, Feb. 1996.

A procedure for omni-automatic design of MIC MES FET amplifiers is presented. All the initial considerations and the topology of matching networks, which usually must be determined by designer himself, can be computer-aided determined automatically by this knowledge-based intelligent design method, therefore, the design quality is improved.

(3) MM-Wave Wide-Band Ultralinear Sweep Source, by X.-H. Yun, C.-H. Yun, B.-H. Zhou, and G.-C. Zhang (Nanjing University of Science and Technology): *AES*, vol. 24, pp. 100–102, Feb. 1996.

The millimeter-wave wide-bandwidth ultra-linear sweeping technique is studied, the new theory consisting of phase-locked technique and delay-line to improve the linearity is presented, the design principle of phase-locked sweeping loop (PLSL) is deduced, and the nondispersion delay line, digital phase-locked loop, monolithic microwave components, and high-performance millimeter-wave components are used. The sweeping source's main performance indexes are as follows: Bandwidth is 500 MHz, linearity is superior to 0.01%.

(4) The Study of 3 mm Wave Low Phase Noise PLL System, by J.-F. Bao, Y.-S. Cheng, J.-F. Zhu, and J.-B. Yu (University of Electronic Science and Technology of China, Chengdu, P.R.C.): *AES*, vol. 24, pp. 91–93, Mar. 1996.

The problems of high stability and low phase noise of 3-mm-wave source are solved by use of PLL. It is measured

that when Fourier frequency is 1 kHz and offset carrier is 92. 7 GHz, the phase noise of 3-mm-wave PLL source is −75 dBc/Hz. Spurious is lower than −55 dBc and output power is higher than 10 mW.

(5) Analysis of Millimeter Wave Gunn Harmonic Oscillators by a Circuit Model, by J.-P. XU (Nanjing University of Aeronautics and Astronautics, Nanjing, P.R.C.): *JIMW*, vol. 15, pp. 221–228, June 1996.

By applying the describing function method, the circuit performance of millimeter-wave second harmonic oscillators was investigated based on a large signal model of GaAs Gunn diode at harmonic frequencies. The oscillation frequency and the output power were calculated as the functions of the nonlinear characteristic and the external circuit parameters. The deduced conclusions are in coincidence with the experiments.

(6) Investigation of 3-mm Wave Wideband Varactor-Tuned Harmonic Oscillator, by Y. Fan, Z.-D. Wu, and X.-H. Tang (University of Electronic Science and Technology of China, Chengdu, P.R.C.): *JAS*, vol. 14, pp. 422–426, Dec. 1996.

Based on the principle of "electronically tuning the fundamental frequency and extracting the second harmonic," the paper proposes a circuit model for the wide-band series varactor-tuned harmonic oscillator. At W-band the electronic tuned bandwidth of 15% is achieved within which the minimum power is 5 mW and the maxmum over 17 mW. The electronic tuned bandwidth of over 5 mW is found to be 13 GHz.

(7) Millimeter-Wave Finline-Microstrip Oscillator, by Q. Xue, L.-J. Xue, and W.-G. Lin (University of Electronics Science and Technology of China, Chengdu, P.R.C.): *JE*, vol. 18, pp. 87–89, Jan. 1996.

A new millimeter-wave integrated oscillator and design method are introduced. By combining finline and microstrip transmission line, this oscillator has more than 3.0-GHz mechanical tuning bandwidth and over 70.0-mW output power.

(8) Design of Push-Push Oscipliers Using Even-Odd Mode Analysis, by H. K. Ju, M. S. Song, and S. J. Lim (Electronics and Telecomm. Research Inst., Taejon, Korea): *JKICS*, vol. 21, no. 2, pp. 514–525, Feb. 1996.

A push-push Osciplier (osillator+multiplier) has been analyzed by the even–odd mode analysis method. A 10-GHz DRO, an Osciplier using 10-GHz DRO design method and an Osciplier using even–odd mode analysis method were designed, fabricated, and tested to verify this method. The measured results verified the validity of the analysis method using even–odd mode analysis.

(9) An Analysis of Arbitrarily Shaped Planar Circulators, by J. S. Chung*, B. W. Kim*, D. S. Chun**, S. W. Yun*, and I. S. Chang* (*Dept. Elec. Eng., Sogang Univ., Seoul, Korea; **Elec. and Telecomm. Research Inst., Taejon, Korea): *JKITE*, vol. 33-A, no. 5, pp. 803–811, May 1996.

Planar circulators with arbitrarily shaped ferrite resonators are analyzed. Resonant frequencies, field distributions, and the RF voltage distributions, etc. are obtained by finite-element method (FEM) and Green's function. The experimental data for the designed circulator using hexagonal resonator in the 850-MHz frequency range agree well with the simulated data.

(10) X-band AlGaAs/GaAs Power HBTs, by J. W. Lee*, W. N. Kim**, M. S. Kim**, B. U. Ihn**, J. H. Shin**, K. J. Yoon***, Y. S. Suh****, and B. M. Kim** (*Photonics Devices Lab., System IC R&D Lab., Hyundai Electronics Industries Co. Ltd., Yeecheon, Korea; **Dept. of Electronic and Electrical Eng. and Microwave Appl. Research Center, Pohang, Korea; ***Electronics and Telecomm. Research Inst., Taejon, Korea; ****Dept. of Elec. Eng., Youngnam Univ., Taegu, Korea): *JKITE*, vol. 33-A, no. 8, pp. 1614–1623, Aug. 1996.

AlGaAs/GaAs HBT's have been fabricated by using SABM (Self-Aligned Base Metal) process technique. The Cr layer deposited on the top of the emitter μmetal increased self-align yield and the thick gold plating layer covering the entire emitter region remarkably improved the electrical and thermal characteristics of the devices.

(11) The Injection-Locking Coupled Oscillators for the Active Integrated Phased Array Antenna, by K. H. Kim*, D. H. Lee*, Y. G. Rye**, S. M. Lee***, E. D. Oh****, and U. H. Hong** (*Dept. of Radio Science & Eng./(Inst. of New Tech.), Kwangun Univ., Seoul, Korea; **Dept. of Elec. Eng., Chungju National Univ., Chungju, Korea; ***Dept. of Elec. Eng. Chungnam Univ., Taejon, Korea; ****Dept. of Elec. Eng., Taejon National Univ. of Tech., Taejon, Korea): *JKICS*, vol. 21, no. 9, pp. 2364–2372, Sept. 1996.

This paper deals with the design and development of an Injection-Locking Coupled Oscillator (ILCO), which functions like a phase-shifter in the Active Integrated Phased Array Antenna (AIPAA). This linear array two-element ILCO consists of two Injection-locking hair-pin resonator oscillators (ILHRO's) and a unilateral amplifier. Each ILCO gives good frequency stability and lower AM, FM, and PM noise characteristics in the mutual coupling locking mode.

(12) Design and Fabrication of the Surface Mountable VCO Operating at 3 V for PCS Handset, by K. W. Yeom (Dept. of Radio Science and Eng., Chungnam National Univ., Taejon, Korea): *JKICS*, vol. 21, no. 3, pp. 784–794, Mar. 1996.

The design and the fabrication of the surface-mountable voltage-controlled oscillator is described for local oscillator in PCS (WACS/TDMA) handset. The fabricated VCO shows tuning range over 50 MHz, phase noise −100 dBc/Hz at the 100-kHz frequency offset, and 0-dBm output power with the consumption of 22 mA at 3 V.

(13) The Single-Stage Transmission-Type Injection-Locked Oscillator was Designed and Fabricated for the Active Integrated Phased Array Antenna, by D. H. Lee*, K. H. Kim**, and U. S. Hong** (*Dept. of Electronic Comm. Eng. Kwangwoon Univ., Seoul, Korea; **Dept. of Radio Science and Eng. Kwangwoon Univ., Seoul, Korea): *JKICS*, vol. 21, no. 3, pp. 763–770, Mar. 1996.

The single-stage transmission-type Injection-Locked Oscillator (STILO) was designed and fabricated for the Active Integrated Phased Array Antenna (AIPAA) system. The locking bandwidth of STILO with 11.5-MHz bandwidth is much better than that of the Injection-Locked Dielectric Resonator Oscillator (ILDRO). And the STILO has the improved noise characteristics in AM, FM, and PM.

(14) Study for Generation of Standard EM Field Using 8 Ports-Variable Wave Impedance Generator, by J. H. Yun (ETRI, Taejon, Korea): *JKICS*, vol. 21, no. 3, pp. 771–783, Mar. 1996.

A design technique of 8 ports variable wave impedance generator (8P-VWIG) is described. The 8P-VWIG is shown to have good performance with the VSWR of less than 1. Four at any frequency of interest below which higher order mode begin to propagate. The 8P-VWIG is designed based on the concept of an expanded multi-transmission line (8 channel).

(15) Design and Fabrication of MMIC VCO for Double Conversion TV Tuner, by I. G. Hwang*, J. U. Yang*, C. S. Park*, H. M. Park*, H. S. Kim**, and K. S. Yoon*** (*Elec. and Telecomm. Research Institute, Korea; **Dept. of Information Communication Eng., Taejon National Univ. of Technology, Taejon, Korea; ***Dept. of Information Eng., Korea University, Seoul, Korea): *JKITE*, vol. 33-A, no. 7, pp. 1319–1324, July 1996.

An MMIC VCO which can be used in a double conversion TV tuner is designed, fabricated, and measured. The VCO is designed using the small-signal design method and fabricated using ETRI GaAs MMIC Foundry. The 3×200 μm gate width MESFET with 1 μm gate length is used for an active device, and MIM capacitors, spiral inductors, and thin film resistors are used as passive elements.

(16) A Q-Band High Gain, Low Noise Variable Gain Amplifier Using Dual Gate AlGaAs/InGaAs Pseudomorphic HEMTs, by T. Kashiwa*, T. Katoh*, N. Yoshida*, H. Minami*, T. Kitano*, M. Komaru*, N. Tanino*, T. Takagi*, and O. Ishihara** (*Optoelectronic and Microwave Devices Laboratory, Mitsubishi Electric Corporation, Itami-shi, 664 Japan; **High Frequency & Optical Semiconductor Division, Mitsubishi Electric Corporation, Itami-shi, 664 Japan): *Trans. IEICE*, vol. E79-C, pp. 573–579, Apr. 1996.

A Q-band high gain and low noise Variable Gain Amplifier (VGA) module using dual gate AlGaAs/InGaAs pseudomorphic HEMT's has been developed. The VGA module has a gain of more than 20 dB from 41 to 52 GHz and a maximum gain of 24.5 dB at 50 GHz. A gain control range of more than 30 dB is achieved in the same frequency range. A phase deviation is less than 10 degrees in 10-dB gain control range. A minimum noise figure of 1. 8 dB with an associated gain of 22 dB is achieved at 43 GHz and the noise figure is less than 2.5 dB with associated gain of more than 20 dB from 41 to 46 GHz when biased for low noise figure.

(17) 60-GHz Virtual Common-Drain-Biased Oscillator Design Using an Empirical HEMT Model, by K. Shirakawa*, Y. Kawasaki*, M. Shimizu*, Y. Ohashi*, T. Saito*, N. Okubo*, and Y. Daido** (*Fujitsu Laboratories Ltd., Wireless Communication Systems Laboratories, Kawasaki-shi, 211 Japan; **Kanazawa Institute of Technology, Information and Computer Engineering Division, Kanazawa-shi, 921 Japan): *Trans. IEICE*, vol. E79-C, pp. 1144–1151 Aug. 1996.

We studied a 0.15-μm InGaP/InGaAs/GaAs pseudomorphic HEMT operating under a negative drain bias, using a parameter extraction technique based on an analytical parameter transformation. The bias-dependent data of small-signal equivalent circuit elements was obtained from S-parameters measured at up to 62.5 GHz at various bias settings. We included our large-signal model in a commercially available harmonic-balance simulator as a user-defined model, and designed a 60-GHz MMIC oscillator.

(18) Stability of Terminated Two Port Networks, by Y. Miwa (Osaka Institute of Technology, Osaka-shi, 535 Japan): *Trans. IEICE*, vol. E79-C, pp. 1171–1176 Aug. 1996.

The purpose of this letter is to investigate the stability of the active two-port networks having some restrictions on load and source terminations, and the stability conditions having two inequalities have been obtained. As the terminations making the active two-port networks stable can be obtained from these inequalities, these stability conditions are very useful for designing high-frequency amplifiers, especially, tuned amplifiers.

(19) Distributed Type FET T/R Switch, by Y. Iyama*, S. Chaki**, and O. Ishida* (*Mitsubishi Electric Corporation, Information Technology R & D Center, Kamakura-shi, 247 Japan; **Mitsubishi Electric Corporation, Optoelectronic & Microwave Devices R & D Laboratory, Itami-shi, 664 Japan) (vol. J79-C-I, No. 8, pp. 330–338): *Trans. IEICE*, vol. E79-C, pp. 1181, Aug. 1996.

This paper describes a novel high-power broad-band T/R switch employing both hybrid couplers and FET's as artificial transmission line elements. By switching the state of the FET's, the characteristic impedance of the transmission line can be changed and switching performance is accomplished. A fabricated 4–18-GHz frequency band T/R switch has insertion loss of 2.8 dB and rated power of 28 dBm over the bandwidth.

(20) Hot-Carrier Aging Simulations of a Voltage Controlled Oscillator, by N. Koike*, H. Nishimura*, M. Takeo*, T. Morii**, and K. Tatsuuma* (*Kyoto Research Laboratory, Matsushita Electronics Corporation, Kyoto-shi, 601 Japan; **Semiconductor Research Center, Matsushita Electric Industrial Co., Ltd., Moriguchi-shi, 570 Japan): *Trans. IEICE*, vol. E79-C, pp. 1285–1288, Sept. 1996.

Hot-carrier degradation of a voltage-controlled oscillator (VCO) was investigated by a reliability simulator known as BERT. The appropriate monitor of VCO frequency degradation shifts from the saturated drain current of an NMOSFET to linear drain current with an increase in VCO input voltage. The degradation of the VCO drastically increases with a small reduction in initial oscillation frequency.

(21) Modeling on Statistical Distribution of Optimal Noise Figure in Pulse-Doped GaAs MESFET's, by N. Shiga (Optoelectronics R&D Laboratories, Sumitomo Electric Industries, Ltd., Yokohama-shi, 244 Japan): *Trans. IEICE*, vol. E79-C, pp. 1442–1448, Oct. 1996.

Process-related variation of optimal noise figures (F_o) in pulse-doped GaAs MESFET's is discussed in this paper. The statistical distribution of the optimal noise figure is modeled by using the Gaussian approximation of the distribution in gate length; the probability density function of F_o is derived. A comparison between the calculated results by the derived probability density function and the measured distribution of F_o showed good agreement.

(22) A Power-Combining System of Four Oscillators Using an Eight-Port Hybrid, by I. Ohta, T. Kawai, and Y. Kokubo (Faculty of Engineering, Himeji Institute of Technology, Himeji-shi, 671-22 Japan): *Trans. IEICE*, vol. E79-C, pp. 1449–1454, Oct. 1996.

This paper treats a new-type power-combining system of four oscillators equally coupled to one another through an eight-port hybrid. This system is marked by easy analyzability and adjustability from its symmetrical construction. In addition, a combined power from the four oscillators is distinguishably delivered to an arbitrary port of four output ports, and hence can be switched in four ways. Experimental corroboration is also presented.

(23) A Novel Technique of Harmonic Rejection of the Sequential Type PLL Phase Detector and Its Application to Single-Loop Frequency Synthesis, by S. K. Sen, S. Sarkar, and P. K. Gupta (Saha Institute of Nuclear Physics, Sector-1, Block-AF, Bidhannagar, Calcutta-700 064, India): *Trans. IEICE*, vol. E79-C, pp. 1467–1471, Oct. 1996.

This letter demonstrates that, under certain condition, the harmonic content of a rectangular pulse train is reduced by a considerable extent in the presence of another equal frequency pulse train of opposite polarity. The condition for maximum harmonic rejection is derived. It is also shown that this technique can, very effectively, be applied to reduce the harmonic content of a sequential phase detector (PD) output.

(24) Phased-Array Behavior of a One-Dimensional Mutually Coupled Oscillator System Controlled by Injection Signals, by T. Kagawa*, S. Nogi**, M. Sanagi**, and K. Fukui*** (*Dept. of Electrical Engineering, Niihama National College of Technology, 7-1 Yagumo-cho, Niihama-shi, 792 Japan; **Dept. of Electrical and Electronic Engineering, Okayama University, 3-1-1 Tsushima-Naka, Okayama-shi, 700 Japan; ***Dept. of Medical Informatics, Kawasaki University of Medical Welfare, 288 Matsushima, Kurashiki-shi, 701-01 Japan) (vol. J79-C-I, no. 11, pp. 428–438): *Trans. IEICE*, vol. E79-C, pp. 1628, Nov. 1996.

Phased array behaviors of one-dimensional mutually coupled oscillator systems which have injection-locking signals of different phases at both the ends are discussed. Analysis of the transient response of the system-injected PSK signals shows that this array can yield a PSK output wave. The results of experiments at X-band using systems of waveguide oscillators and arrays of active patch antennas almost agreed with the analytical ones.

(25) A New GaAs Negative Voltage Generator for a Power Amplifier Applied to a Single-Chip T/R-MMIC Front-End, by K. Yamamoto*, K. Maemura**, N. Kasai*, Y. Yoshii**, Y. Miyazaki**, M. Nakayama***, N. Ogata***, T. Takagi*, and M. Otsubo* (*Optoelectronic and Microwave Devices Laboratory, Mitsubishi Electric Corporation, Itami-shi, 664 Japan; **High Frequency & Optical Semiconductor Division Mitsubishi Electric Corporation, Itami-shi, 664 Japan; ***Information Technology R&D Center, Kamakura-shi, 247 Japan.): *Trans. IEICE*, vol. E79-C, pp. 1741–1750, Dec. 1996.

A new GaAs negative voltage generator suitable for biasing a GaAs MESFET power amplifier has been successfully developed and applied to a 1.9-GHz single-chip transmit/receive (T/R)-MMIC front-end including a power amplifier, a T/R-switch, and so on. With 20–500-MHz external input signals of more than -15 dBm, the generator produces negative voltages from -1.0 to -2.6 V for a wide range of supply voltages from 1.6 to 4.6 V. The current consumption is as low as 3.2 mA at 3 V. When a 22-dBm output is delivered through the power amplifier biased by the generator, low spurious outputs below -70 dBc are achieved, and gate-bias voltage deviations are suppressed to within 0.06 V even when a gate current of -140 μA flows through the amplifier.

(26) Simple Small-Signal Model for 3-Port MOS Transistors, by Y. Niitsu (ULSI Device Engineering Lab., TOSHIBA Corporation, R&D Center, 1, Komukai-Toshiba-cho, Saiwai-ku, Kawasaki-shi, 210 Japan): *Trans. IEICE*, vol. E79-C, pp. 1760–1765, Dec. 1996.

The inclusion of the nonquasi-static effect is crucial in the simulation of the microwave circuits for MOS transistors. This report proposes a simple model which includes this effect in small-signal simulation. The simulated results are consistent with the measured data up to a frequency that is 30 times higher frequency than the cutoff frequency.

II. Transmission-Lines and Passive Microwave Devices

(1) Transmission Matrix Analysis of Cascaded Discontinuities in the Center Conductor of Microstripline, by K. Srinivas Rao* and V. M. Pandharipande** (*Dept. of Electronics & Communication Engineering, CBIT, Osmania University, Hyderabad 500 075, India; **Dept. of Electronics & Communication Engineering, Osmania University, Hyderabad 500 007, India): *JIETE*, vol. 42, pp. 69–76, Mar.–Apr. 1996.

The transmission and reflection properties of the network consisting of a cascade connection of discontinuities in the center conductor of microstripline are analyzed employing transmission matrix approach. Computed and measured values of transmission and reflection coefficients are compared in the lower microwave frequency band. The cascaded discontinuities are proposed to be used in improving the skirt selectivity of the band stop filters.

(2) Research on mm-Wave Double Staggered Ladder Coupling Chain, by Y.-B. Gong, Y.-D. Zhou, Y.-L. Mo, and J.-H. Sun (University of Electronic Science and Technology of China, Chengdu, P.R.C.): *AES*, vol. 24, pp. 19–22, Mar. 1996.

A new type of mm-wave TWT slow-wave system double-staggered ladder circuit is analyzed by means of the 3-D finite-element method and the cavity field average value method, the dispersive characteristics and the 3-D field distribution are obtained. An experimental result is fit well to the theoretical one.

(3) Submillimeter Bistability and Multi-Stability in Antiferromagnets, by Y.-F. Wang, Q. Wang, and J.-S. Bao (Shanghai University, P.R.C.): *AES*, vol. 24, pp. 23–26, Mar. 1996.

The analysis of the transmission property of submillimeter wave in nonlinear antiferromagnetic slabs is presented. The influence of the different dielectric constants of the three layers on the bi- and multi-stabilities are discussed in detail.

(4) Electrical Performance of Multiconductor Interconnects for MCM with Perforated Reference Planes, by Z.-Y. Xue and Z.-F. Li (Shanghai Jiaotong University, Shanghai, P.R.C.): *AES*, vol. 24, pp. 65–67, Mar. 1996.

A quasistatic approach is demonstrated for the equivalent transmission-line characterization of multiconductor interconnects for multichip-module (MCM) with perforated reference planes by using the method of lines. The proposed method can be used to extract effective transmission line parameters for multiconductor interconnects. The results of some examples are also given.

(5) Propagation Analysis of Rectangular Chirowaveguides Using the Edge-Element Method, by J. Fang, Y.-M. Xiao, and W.-Y. Yin (Xi'an Jiaotong University, Xi'an, P.R.C.): *AES*, vol. 24, pp. 71–73, Mar. 1996.

Propagation characteristics of chirowaveguides have been calculated using a generalization of the electric and magnetic fields. The edge-element method has been used, therefore no any spurious modes exist. The rectangular chirowaveguides are considered, and the effect of chirality mode admittance and size of chirowaveguides on cutoff frequency is studied.

(6) The Propagating Characteristics of Hybrid Modes in Faraday Chirowaveguides, by W.-Y. Yin*, W. Wan*, and W.-B. Wang** (*Northwestern Polytechnical University, Xi'an, P.R.C.; **Xi'an Jiaotong University, Xi'an, P.R.C.): *AES*, pp. 82–84, Mar. 1996.

The Propagating Characteristics of Hybrid Modes in Faraday Chirowaveguides are studied. The transverse field components are expressed in terms of the longitudinal field components. Numerical results are presented for the dispersion and attenuation behaviors of different hybrid modes using the Müller's method of calculating roots, and the effects of different constitutive parameters on the propagating characteristics are considered.

(7) Numerical Simulation Method of Microwave Pulse Couplings into Narrow Slots, by H.-Q. Yu, J.-G. Wang, Y.-S. Chen, and R.-Y. Fan (Northwest Institute of Nuclear Technology, Xi'an, P.R.C.): *AES*, vol. 24, pp. 120–123, Mar. 1996.

The FDTD algorithm is used to stimulate microwave pulse couplings into narrow slots which have depths much narrower than one FDTD cell. The dependence is presented for the microwave pulse coupling on the carrier frequency of incident wave, polarization direction, cavity wall and conductivity, and slot sizes. Simulation results show that there are resonant and enhancement effect occurred in the processes of microwave pulse couplings into narrow slots.

(8) Synthesis of Lossless Nonuniform Transmission Lines by the Method of Characteristics, by J.-F. Mao and Z.-F. Li (Shanghai Jiaotong University, Shanghai, P.R.C.): *AES*, vol. 24, pp. 22–25, May 1996.

Lossless nonuniform transmission lines are synthesized by the method of characteristics in the time-domain. Given m sample values of the time-domain reflection (TDR) response at m time points, the characteristic impedance profile of a lossless nonuniform line represented by m uniform sections can be obtained. The m uniform sections may be different in length, but have a delay time equal to the relevant sample time interval. The TDR response is not split into incident and reflective waves, which makes the synthesis method more simple and efficient than the traditional synthesis methods based on the scattering parameter theory.

(9) Calculation of Electron Power Absorption in Microwave ECR Plasma, by Y.-T. Yang, Y.-F. En, and Q. Sun (Xidian University, Xi'an, P.R.C.): *AES*, vol. 24, pp. 110–113, Sept. 1996.

The microwave power coupling and the power absorption by electron in ECR system are discussed. It is discovered that the distribution of static magnetic field in ECR resonance cave, the total pressure, and the microwave power are the decisive factors for providing high-energy electrons. These conditions decide the range of parameters in ECRCVD thin-film deposition processes. The practical deposition research of SiN thin film by ECRCVD has been made. The experimental results are consistent with the numerical calculation.

(10) Microwave Probe Method to Research Plasma Density of Arc-heated Tunnel, by J.-X. Cao*, H.-B. Zhao*, Y.-J. Lin**, J.-X. Zhang**, J.-X. Wang**, G.-R. Chen**, D. Li**, Y.-H. Dong**, W. Wu**, and Y.-Q. Jiang** (*University of Science & Technology of China, Hefei, P.R.C.; **Box 7201, Beijing, P.R.C.): *AES*, vol. 24, pp. 41–43, Sept. 1996.

The paper describes a kind of microwave probe survey system which can be used to measure plasma density variation of arc-heated tunnel. It also gives plasma shaping of arc-heated tunnel flow field. Experimental result of thermal ionization degree material of magneto-generation.

(11) Measurement of Complex Permittivity of Multilayered Dielectric Samples by means of an Electromagnetic Open Resonator, by J. Xia* and C.-H. Liang** (*Beijing Institute of Technology, Beijing, P.R.C.; **Xidian University, Xi'an, P.R.C.): *AES*, vol. 24, pp. 60–63, Sept. 1996.

A new method for the measurement of complex permittivity of multilayered dielectric samples at millimeter-wave and submillimeter-wave bands by means of an electromagnetic open resonator is proposed. At Ka band an electromagnetic open resonator dielectric measurement system is designed and constructed using a specially machined open resonator set, and measurements on some multilayered dielectric samples are made. The results are in good agreement with the criterion values.

(12) An Iteration Conjugate Gradient Method for Reconstruction of 2-D Lossy Dielectric Object, by S.-Y. Shi and D.-B. Ge (Xidian University, Xi'an, P.R.C.): *AES*, vol. 24, pp. 95–98, Sept. 1996.

An iteration algorithm is proposed to reconstruct the complex permittivity of a 2-D inhomogeneous lossy dielectric object from the measured scattered fields. The object is illuminated successively by TM plane waves of different angles of incident, and the scattered fields are measured at a measurement line. Starting from Born approximation, the coupled matrix equations are solved iteratively. The computer simulations show the feasibility of the proposed reconstruction scheme.

(13) Theoretical Analysis of Fin Line with Anisotropic Substrate, by L. Hu, B. Jin, S.-Q. Chen, and W.-G. Lin (University of Electronic Science & Technology of China, Chengdu, P.R.C.): *AES*, vol. 24, pp. 119–124, Sept. 1996.

The theoretical analysis of fin line with anisotropic substrate is researched rigorously for the first time. In the spectral domain, the general dependences are determined including wave vector, polarization properties, and scalar wave equations on the major axis in the bifringent plates, and the field solutions and G matrices of the fin line with Z-cut and Y-cut crystal substrates are given.

(14) Edge-Element Analysis of Dispersion Characteristics of Anisotropic Guided-Wave Structures, by S.-J. Xu and L.-J. Zhang (University of Science & Technology of China, Hefei, P.R.C.): *AES*, vol. 24, pp. 79–82, Dec. 1996.

Dispersion characteristics of anisotropic guided-wave structures are analyzed by edge-element method. The approach can be applied to the case in which the permittivity tensor matrix is full, and no spurious solutions appeared in calculation. An eigenvalue equation which can provide direct solution for the propagation constant is also derived. Computed results of anisotropic microwave line and rectangular dielectric waveguide agree well with data given in the literature.

(15) The Neural Network Model of Microstrip Discontinuity, by W. Wu, Q.-R. Yang, H. Gu, and J. Y. Zhou (Southeast University, Naijing, P.R.C.): *AES*, vol. 24, pp. 85–87, Nov. 1996.

The multilayer perceptron is introduced to characterize the microstrip discontinuity by describing S-parameters. The size of microstrip and the frequency are defined as the input samples of the multilayer perceptron, and the S-parameters are determined as the desired output samples. As the perceptron has been trained with the back propagation algorithm, The S-parameters of the microstrip at any arbitrary sizes and frequencies can be obtained quickly from the perceptron.

(16) High-Order Mixed-Edge Rectangular Element Analysis for Lossy Dielectric Waveguide, by X.-Q. Sheng and S.-J. Xu (University of Science & Technology of China, Hefei, P.R.C.): *AES*, vol. 24, pp. 70–73, Sept. 1996.

A High-Order Mixed-Edge Rectangular Element method is proposed for analysis of lossy dielectric guiding structures. The emphasis is laid on the investigation of the space construction of High-Order Mixed-Edge Rectangular Element and the explicit form of the shape function is given. The method provides a direct solution for propagation constants without the spurious solutions. The calculation of the dispersion for the dominant mode in a lossy dielectric loaded waveguide verify the accuracy and efficiency of the present method.

(17) Properties of Slotted Coaxial Line with Elliptic Cross-Section, by B.-S. Wang and B. Lin (Dalian Maritime University, Dalian, P.R.C.): *AES*, vol. 24, pp. 111–113, June 1996.

The properties of the elliptically coaxial line with slotted outer conductor are studied by means of conformal transformations. The capacitance per unit length and characteristic impedance are given.

(18) Rigorous Analysis for Strip-type Circular Polarizer, by S.-J. Xu and Y.-J. Zhang (University of Science & Technology of China, Hefei, P.R.C.): *AES*, vol. 24, pp. 53–55, Mar. 1996.

A strip-type circular polarizer consisting of multiplanar periodic surfaces is investigated by combination of scattering parameters of each periodic surface. The scattering parameter of every surface is analyzed by the Galerkin method in spectral domain and the entire domain basis functions are selected. The calculated VSWR and axis ratio of the circular polarizer agree quite well with the experimental results.

(19) A Fast Algorithm for Analyzing Periodic Structures Combining Method of Lines with FFT and Diakoptic Technique, by Y. Long, D.-G. Fang, and H.-Q. Zhu (Nanjing University of Science and Technology, Nanjing, P.R.C.): *AES*, vol. 24, pp. 1–4, June 1996.

A new fast algorithm is presented by combining method of lines (MoL) with FFT and diakoptic technique. In order to calculate the impedance elements by FFT, the Helmholtz equation of infinite period with oblique incidence is transformed to a new one. Then the current on the metal strip is calculated by using diakoptic technique. Compared with conventional MoL, the new algorithm presented is more powerful. Numerical results computed are in good agreement with those published.

(20) The Filter Modeling of a Rectangular Dielectric Post in a Rectangular Waveguide, by Y.-J. Xie, C.-H. Liang, and Z.-Y. Lei (Xidian University, Xi'an, P.R.C.): *JCIC*, vol. 17, pp. 109–113, Mar. 1996.

The equivalent filter modeling of a rectangular dielectric post in a rectangular waveguide is obtained through the variational expression of input impedance, and armed with the network the insight into the resonance mechanisms and the transformation between modes is gained. The reflection coefficient expressed in components of network is in good agreement with the results in the literature.

(21) Dispersion Characteristics of Microstrip Lines Under Principal Axes Rotation of Anisotropic Substrates, by S.-X. Qi and S.-S. Qiu (South China University of Technology, Guangzhou, P.R.C.): *JCIC*, vol. 17, pp. 107–112, July 1996.

The FDTD method is applying to analyze the dispersion properties of open and shielded microstrip lines whose substrate permittivity and permeability tensors are rotated simultaneously. Results indicate that propagation properties can be considerably changed by the angle misalignment of $[\epsilon]$ and $[\mu]$ tensors.

(22) Analytical Expressions of MTL's chain parameters, by H.-C. Shu, X.-Y. Chen, X.-M. Xu, and C. B. Xu (Harbin Institute of Technology, Harbin, P.R.C.): *JCIC*, vol. 17, pp. 114–120, Sept. 1996.

Based on the theory of TL, the analytical expressions of the chain parameters of n-wire coupled TL, the formulas of the chain parameters of symmetrical 3-line and (a) symmetrical 2-line and the method to obtain their wave parameters are presented.

(23) 3 mm Y-Junction Waveguide Circulator with a Ferrite Sphere, by D.-G. Zhang*, S.-W. Yang*, and X.-H. Tang** (*Shenzhen University, Shenzhen, P.R.C.; **University of Electronic and Technology, Chengdu, P.R.C.): *JIMW*, vol. 15, pp. 461–464, Dec. 1996.

A 3-mm waveguide Y-junction circulator with a ferrite sphere was developed. Based on the derived operating modes and operating frequencies of the waveguide circulator, a numerical solution of the operation characteristics of the novel

waveguide circulator was given. Good agreement between the analytical results and experimental measurements was observed.

(24) 3-D Edge-Element Analysis for Scattering Characteristics of II-VI Semiconductor Materials with GAPS, by X.-Q. Sheng*, S.-J. Xu*, P. Greiner**, C. R. Becker**, and R. Geick** (*University of Science & Technology of China, Hefei, P.R.C.; **Physikalisches Institute der Universität, Am Hubland, Germany): *JIMW*, vol. 15, pp. 401–406, Dec. 1996.

The scattering characteristics of semiconductor materials filled in the waveguide with gaps were analyzed with the 3-D edge-element method. Since the method starts from the variation of functional directly, it avoid the difficulties met in other methods of solving the eigenvalue and eigenfunction for very thin lossy dielectric loaded waveguide. The comparisons between the calculated results and experimental data confirm the effectiveness, reliability, and accuracy of the method.

(25) *W*-Band Higher-Order Mode Broadband Waveguide *Y*-Junction Circulators, by W.-B. Dou and Z.-L. Sun (Southeast University, Nanjing, P.R.C.): *JIMW*, vol. 15, pp. 397–400, Oct. 1996.

It was found that there are dual higher order modes which have the same circulation direction at W band based on the calculation of boundary value of electromagnetic field. The udal modes are close to each other. They can be used to realize dual-frequency circulator, or to get broadband performance by partially staggering them. Experiments verified the theoretical prediction. A broadband waveguide junction circulator at W-band was developed. The performance of 8-GHz bandwidth with 18-dB isolation was obtained by staggering the dual higher order modes.

(26) Analysis of Electromagnetic Wave Propagation in Multilayer Mediums Containing Anisotropic Material, by W.-B. Dou and Z.-L. Sun (Southeast University, Nanjing, P.R.C.): *JIMW*, vol. 15, pp. 229–232, June 1996.

An Analysis of electromagnetic wave propagation in multilayer mediums containing anisotropic region were presented. This structure can be used as a quasi-optical Faraday rotator and as either an isolator or circulator when combined with other quasi-optical components. It also can be used as a radiation aperture to realize the beam scanning or change of polarization by means of changing the direction and strength of the biased magnetic field. The calculated and experimental results of Faraday rotation were given.

(27) Wave Reflection from the Multiple-Slab-Generalized Fractal Layers, by L.-J. Chen, C.-H. Liang, and X.-W. Shi (Xi'an, P.R.C.): *JAS*, vol. 14, pp. 1–6, Mar. 1996.

The reflection and transmission spectra of oblique-incident waves at a multiple-slab-generalized fractal layer which consists of a fractal set are studied. A generalized method, with self-similarity, is used for this purpose. The generalized formulae as well as a new type of reflection and transmission spectra, i.e., the self-similar spectra, are obtained.

(28) Calculation of Effective EM Parameters of Random Mixture Containing Ellipsoidal Particles with Delectic Coating Layers, by S.-Z. Liu and C.-M. Qiu (University of Electronic Science & Technology of China, Chengdu, P.R.C.): *JAS*, vol. 14, pp. 64–72, Mar. 1996.

A new procedure is used to derive the extended electromagnetic mixing formulas. The corresponding formulas for the ellipsoidal particles having multilayered enclosure is obtained, and the effects of particles on the effective EM parameters are analyzed.

(29) MM-Band Dual-Porlarized Network, by T.-M. Yao, L.-F. Qi, and J.-J. Mao (National Defence University of Science and Technology, Changsha, P.R.C.): *JAS*, vol. 14, pp. 231–238, June 1996.

Two mm-band dual-polarizers of excellent properties are discussed. Various circuits are composed of them; some excellent properties (VSWR, polarized isolation, ellipticity, etc.) are obtained from testing results.

(30) Finite-Difference Approximations in Frequency-Domain for Mur's Conditions and Its Applications, by J. Chen, W. Hong, and Y.-Y. Chen (Southeast University, Nanjing, P.R.C.): *JE*, vol. 18, pp. 281–291, May 1996.

Novel finite-difference approximations of Mur's conditions are presented in frequency-domain. Combined with the FD-TD equations deduced, the new conditions are convenient and effective to solve EM problems of inhomogeneous anisotropic media. By use of the compressed storage sparse matrix technique and iteration algorithm, the computer memories demanded are decreased and the CPU time is shortened. RCS of cylinders and rectangular posts are given with several kinds of media. The results of cylinders are in good agreement with those of MM.

(31) Millimeter-Wave Bandstop and Directional Filters Using Planar Whispering-Gallery Modes Dielectric Resonators and Microstrip Line, by J.-Q. Wu, G. Liu, and S.-G. Liu (University of Electronic Science and Technology of China, Chengdu, P.R.C.): *JE*, vol. 18, pp. 184–188, Mar. 1996.

This paper reports the utilization of a new type of planar whispering-gallery modes dielectric resonators and microstrip line for the design of Ka-band bandstop and directional filters. The analysis is based on the traveling wave ring resonator. Experimental results of bandstop and directional filters in Ka-band are given, which show how such are suitable for use in millimeter-wave microstrip integrated circuits.

(32) The Transmission Characteristics of High-Order Hybrid Modes in a Waveguides of Bianisotropic Lossy Slab, by W.-Y. Yin* and W.-B. Wang** (*Northwestern Polytechnical University, Xi'an, P.R.C.; **Xi'an Jiaotong University, Xi'an, P.R.C.): *JE*, vol. 18, pp. 171–177, Mar. 1996.

The transmission characteristics of high-order hybrid modes in a bianisotropic lossy slab bounded by perfectly conducting planes are investigated, and the transverse field components are also expressed in terms of the longitudinal field components of hybrid modes. Numerical results are presented to demonstrate the effects of anisotropy, lossless, and different constitutive parameters on the dispersion and field-distribution behavior.

(33) A Study of Characteristics of Waveguide with Arbitrary Cross-Section via Non-Orthogonal Finite-Difference Frequency-Domain Method, by L. Zhao (Southeast University, Nanjing, P.R.C.): *JE*, vol. 18, pp. 50–57, Jan. 1996.

A finite-difference frequency-domain (FD-TD) method in nonorthogonal coordinate is presented for the eigenvalue problems of waveguide. The numerical discrete mesh of the algorithm can fit the arbitrary boundary well. The cutoff frequencies of modes of waveguides are calculated via given eigenvalue equation. The results show good agreement with those from other source.

(34) FEM with Similarity Discretization for Solving Electrostatic Field Problems, by X.-Q. Dong and T.-Y. An (East China Normal University, Shanghai, P.R.C.): *JM*, vol. 12, pp. 15–21, Mar. 1996.

A new finite-element method-similarity discretization FEM for electrostatic problems is presented. The computing process of the potential distribution obtained simultaneously in the conventional FEM is replaced by a "step by step" recurrence relation. Only some small stiffness matrices are necessary to be dealt with. As a result the computer memory and CPU time are reduced significantly.

(35) Analysis of Axisymmetric Resonant Cavites by Using B-Spline Finite-Element Method, by R.-L. Li*, G.-Z. Ni*, and J.-H. Yu** (*Zhejiang University, Hangzhou, P.R.C.; **Chongqing University, Chongqing, P.R.C.): *JW*, vol. 12, pp. 96–102, June 1996.

The B-spline finite-element method, which employs biquadratic B-spline functions as basic functions, is applied to analyze axisymmetric modes of resonant cavities. The B-spline finite-element equations in cylindrical coordinates are formulated first, and then the method is extended to spherical coordinates to avoid the subdivision errors of the spherical cavities. Usefulness and feature of the present method are confirmed through the analysis of a cylindrical cavity, a PETRA accelerating cavity, and a spherical cavity.

(36) Theoretical Analysis on the Perfectly Matched Layer (PML) Absorbing Boundary Condition, by B. Chen*, D.-G. Fang*, X.-M. Chen** (*Nanjing University of Science and Technology, Nanjing, P.R.C.; **Nanjing Electronic Devices Institute, Nanjing, P.R.C.): *JM*, vol. 12, pp. 107–115, June 1996.

This paper gives the derivation of formulas of perfectly matched layer (PML) boundary condition by using the spectral domain method. The computational results show that the reflection coefficient caused by PML boundary condition may be lower than -80 dB. The derivation given is general for an arbitrary microstrip structure and may give the insight on the absorbing mechanism.

(37) The Study of Computational Efficiency of Adaptive Multi-Grid Method, by C.-F. Wang and D.-G. Fang (Nanjing University of Science and Technology, Nanjing, P.R.C.): *JM*, vol. 12, pp. 175–178, Sept. 1996.

The adaptive multi-grid method of solving the integral equation is given by introducing the adaptive control technique of iterative transform between coarse and fine grids in the multi-grid method. As an example, the wire antenna is analyzed by using the adaptive multi-grid method and the computational efficiency is studied.

(38) Multi-Level Recursive Wavelet Algorithm and Its Application in Computational Electromagnetics, by Y.-M. Song and D.-G. Fang (Nanjing University of Science and Technology, Nanjing, P.R.C.): *JM*, vol. 12, pp. 253–258, Dec. 1996.

The multi-level recursive wavelet algorithm for efficiently solving the sparse matrix equation resulted from the wavelet expansion. It takes advantage of the multiresolution representation of the wavelet domain impedance matrix. The original matrix equation is converted into a set of equations with smaller size which needs less CPU time to solve. The application of this algorithm in computational electromagnetics is presented by solving a two-dimensional scattering problem.

(39) Design and Implementation of Dual-Mode Cavity Filter with a Chebyshev Response, by S. C. Kim* and U. S. Hong** (*Dept. of Electronic Comm. Eng. of Kwangwoon Univ., Seoul, Korea; **Dept. of Radio Science Eng. of Kwang-Woon Univ./Institute of New Tech., Seoul, Korea): *JKICS*, vol. 21, no. 2, pp. 505–513, Feb. 1996.

The dual-mode bandpass filters with a Chebyshev response are designed and manufactured at Ku-band as well as K-band. Manufactured filters are resonated by two independent orthogonal TE_{113} circular-cavity modes and characterized by 4-pole Chebyshev function. The measured experimental results of a 12.5-GHz dual-mode filter have a 1.2–dB insertion loss in the passband and 65-dB out-of-rejection, and a 19.25-GHz filter has a 1.55-dB insertion loss and 70-dB out-of-rejection. These experimental results show good agreements with the design specifications.

(40) Analysis of the Strip Type Waveguide Mount Backed by the Dielectric Substrate, by M. J. Park*, S. T. Han**, and S. W. Nam* (*Seoul National Univ., Seoul, Korea; **Daeduk Observatory, Taejon, Korea): *JKICS*, vol. 21, no. 9, pp. 2505–2513, Sept. 1996.

This paper presents the analysis of the impedance characteristic of the strip-type waveguide mount backed by the dielectric substrate using the matching and induced EMF method. The calculated results have been verified through comparison with the results by other numerical methods. The effect of some structure parameters such as the width of the substrate and the gap size on the mount impedance is investigated.

(41) CAD Design of Miniaturized Dielectric Filter with Attenuation Poles, by M. Q. Lee*, S. W. Nam*, K. W. Yeom**, and S. Y. Hong** (*Dept. of Elec. Eng., Seoul National Univ., Seoul, Korea; **Dept. of Radio Science & Eng., Chungnam National Univ., Taejon, Korea): *JKICS*, vol. 21, no. 9, pp. 2481–2493, Sept. 1996.

An efficient implementation technique of coupling circuit parameters is presented. This technique uses a linear mapping function between the circuit parameter domain and EM parameter domain to save the high computational time of EM simulator. A narrow band asymmetric filter with a transmission zero is designed and fabricated through these technique in 1900-MHz band.

(42) Design of Monopulse Feeder Using Corrugated E-plane Horn, by J. H. Lee and S. W. Nam (Seoul National Univ., Seoul, Korea): *JKICS*, vol. 21, no. 8, pp. 2099–2108, Aug. 1996.

The performance of the E-plane monopulse feeder is shown to be improved by using corrugated horn and multimode de-

sign. The proposed multimode corrugated horn is analyzed by the mode-matching technique. An E-plane monopulse feeding horn is designed and fabricated to show the performance of the multimode corrugated horn. The experiment agrees quite well with the theoretical analysis. The results can be used in the design of monopulse type tracking antenna.

(43) Moment Method Analysis of the Moreno Directional Coupler, by M. J. Park*, D. I. Jeon**, B. C. Ahn***, and S. W. Nam* (*Dept. of. Elec. Eng., Seoul National Univ., Seoul, Korea; **LG, Seoul, Korea; ***Chungbuk National Univ., Cheongju, Korea): *JKICS*, vol. 21, no. 7, pp. 1842–1849, July 1996.

This paper presents a full-wave, moment method analysis of a Moreno directional coupler with two crossed-slots between two crossed rectangular waveguides. The overall structure is divided into several rectangular waveguides and cavities by the use of the equivalence principle to the complex slot regions. The numerical results are compared with measurements to verify the correctness of the present analysis.

(44) A Design of Voltage-Controlled Hair-Pin Resonator Oscillator for the Use of Clock Recovery/Data Regeneration Circuit in 10-Gbps SDH Fiber Optic Systems, by Y. N. Yon***, S. Y. Lee***, J. Y. Lee***, T. W. Yoo**, M. S. Park**, and U. S. Hong* (*Dept. of Radio & Eng., Inst. of New Tech., Kwangwoon Univ., Seoul, Korea; **Optical Transmission Section, ETRI, Taejon, Korea; ***Dept. of Electronic Comm. & Eng., Ins. of New Tech., Kwangwoon Univ., Seoul, Korea): *JKICS*, vol. 21, no. 5, pp. 1304–1316, May 1996.

A VCO (Voltage-Controlled Oscillator) in use of clock recovery/data regeneration circuit for 10-Gbps fiber optic receivers was developed. The improved hair-pin resonator with a parallel coupled lines was used as a resonance part. A hair-pin resonator has a relatively flat reactance versus frequency and wide band frequency tuning range.

(45) A Study on the Small Duplexer Using Dual-Mode Filter for Ku-Band Satellite Communication, by D. H. Yoo*, K. W. Yu**, S. C. Kim*, J. Y. Lee*, and U. S. Hong*** (*Dept. of Electronic & Eng. of Kwangwoon Univ., Seoul, Korea; **Dept. Satellite Comm. Tech. Group Payload System Section, ETRI, Taejon, Korea; ***Dept. of Radio Science & Eng. of Kwangwoon Univ., Ins. of New Tech., Seoul, Korea): *JKICS*, vol. 21, no. 4, pp. 1048–1058, Apr. 1996.

A small duplexer is designed and implemented using a H-plane T-junction and Transmitting/Receiving filter with a dual mode cavity resonator for Ku-band. Transmitting (TX) filter is designed at center frequency 12.5 GHz and Receiving (RX) filter, at center frequency 14.5 GHz. Both filters have a 100-MHz bandwidth. The responses of filter with H-plane T-junction nearly coincide with that of filter itself.

(46) Design of Antireflection Coatings on the Facets of a Multilayered Structure Waveguide Device, by Y. K. Kim*, B. G. Kim*, and H. R. Choo** (*Dept. of Electronic & Eng. of Kwangwoon Univ., Seoul, Korea; **ETRI, Taejon, Korea): *JKICS*, vol. 21, no. 7, pp. 1850–1860, July 1996.

We present the results for the design of antireflection (AR) coatings on facets of a multilayered structure waveguide device. We conclude that the extended method or VFLM should be used for the design of AR coatings on facets of a device required for the facet reflectivity less than 10^{-3}.

(47) Design of the Harmonic Rejection Waveguide Low-pass Filters by Synthesis Method, by J. S. Park*, J. B. Lim*, and J. H. Lee** (*Dept. of Elec. Eng., Kookmin Univ., Seoul, Korea; **Div. of Satellite Comm. at Payload System Section, ETRI, Taejon, Korea): *JKITE*, vol. 33-A, no. 10, pp. 2023–2031, Oct. 1996.

A very efficient CAD algorithm is proposed where Rhodes formulae are combined with distributed low-pass prototype filter in order to design the corrugated waveguide harmonic rejection filters accurately. A 13-section tapered corrugated lowpass filter has been designed by the proposed algorithm and fabricated. The experimental results are in good agreement with calculated results.

(48) The Design of 85–115-GHz Band SIS Mixer for the Observing Cosmic Radio Waves, by S. T. Han*, H. R. Kim*, C. H. Lee*, J. A. Park**, H. S. Jung*, G. D. Kim*, T. S. Kim*, and D. C. Park*** (*TRAO, Korea Astronomy Observatory, Taejon, Korea; **Dept. of Physics, Ehwa Women Univ., Seoul, Korea; ***Dept. of Radio Science and Eng., Chungnam National Univ., Taejon, Korea): *JKITE*, vol. 33-A, no. 6, pp. 1040–1048, June 1996.

We have evaluated the theoretical conversion loss and noise temperature of mixer using the quantum mixer theory. The average receiver noise temperature of manufactured receiver with this mixer is about 30 K (DSB). The receiver noise temperature is much lower than that of receiver with a mixer using mechanical tuning backshort.

(49) A Microstrip Rotman Lens for Broad-Band Active Phased Array Transmitter, by J. R. Park, J. H. So, C. S. Lee, and S. G. Kim (Agency for Defense Development, Teajon, Korea): *JKITE*, vol. 33-A, no. 9, pp. 1766–1772, Sept. 1996.

This paper presents a design of microstrip Rotman lens for a broad-band active linear phased array transmitter. Each microstrip port is modeled as a two-dimensional aperture antenna within TEM propagating parallel plate. The measured transmission coefficients and radiation patterns of a phased-array antenna having traveling-wave tube amplifiers (TWTA) show good agreements with the numerical calculations.

(50) Wideband Dielectric Modeling and Transmission Analysis of FR-4 Composite Substrate with Different Composition Ratio, by J. K. Hong*, S. I. Kim**, and H. Y. Lee** (*LG Information & Comm., Ltd., Seoul, Korea; **School of Electrical and Elec. Eng., Ajou Univ., Seoul, Korea): *JKITE*, vol. 33-A, no. 12, pp. 2341–2346, Dec. 1996.

We modeled the complex dielectric constant and analyzed the propagation characteristics of a FR-4 composite substrate with different compositions. We have found that the propagation loss and velocity increase with the volume fraction of FR-4 resin above 1 GHz.

(51) 10-Gbit/s Timing Recovery Circuit Using Temperature Compensated Dielectric Resonator Filter, by J. H. Song, T. W. Yoo, and M. S. Park (Optical Transmission Section, ETRI, Taejon, Korea): *JKITE*, vol. 33-A, no. 4, pp. 644–649, Apr. 1996.

A timing recovery circuit of 10-Gbit/s optical receiver is described. The circuit consists of a passive NRZ-to-PRZ

circuit, a dielectric resonator filter (DRF) and a narrow band amplifier. These experimental results show that the circuit is suitable for 10-Gbit/s lightwave transmission system.

(52) Environmental Test of Wideband Waveguide Input Filter in Ku-Band Satellite Transponder, by K. W. Yu and K. R. Park (Div. of Satellite Comm., ETRI, Taejon, Korea): *JKITE*, vol. 33-A, no. 4, pp. 650–657, Apr. 1996.

This paper is intended to provide a description of the input filter for KOREASAT communication transponder. The filter trade-off studies including antenna subsystem characteristics to determine the optimum electrical configuration to meet all requirements are performed. The standardized environmental tests are performed to confirm satisfactory performance of the filter with respect to the requirements of vibration and thermal vacuum shocks.

(53) The Study of Artificially Soft and Hard Surfaces Using Periodic Strip Loaded with Two Layered Dielectric Slabs over a Ground Plane, by J. H. Ko*, S. C. Kang*, J. M. Kim*, Y. K. Cho**, and H. Son** (*Div. of Satellite Comm. Tech., ETRI, Taejon, Korea; **Dept. of Elec. Eng., Kyungpook National Univ., Taegu, Korea): *JKITE*, vol. 33-A, no. 10, pp. 2013–2022, Oct. 1996.

Scattering problem of electromagnetic waves by period strip grating with dielectrics over a ground plane in case of oblique incidence and arbitrary polarization is analyzed. Some numerical results of arbitrary soft and hard surfaces using the structure filled with single dielectric slab between periodic strip grating and ground plane are compared with previous results.

(54) Analysis of Multiple Coupled Microstrip Lines on a Magnetized Ferrite Substrate, by Y. C. Moon, S. W. Yun, and I. S. Chang (Dept. of Elec. Eng., Sogang Univ., Seoul, Korea): *JKITE*, vol. 33-A, no. 5, pp. 793–802, May 1996.

The propagation characteristics of the dominant modes in multiple coupled microstrip lines on a magnetized ferrite substrate are analyzed. With the numerical results, multi-port impedance parameters as well as scattering parameters are derived from nonreciprocal transmission line equations.

(55) Implementation of a Modified $\mathrm{TE}_{113}/\mathrm{TM}_{012}$ Trip-Mode Waveguide Bandpass Filter, by K. W. Chung, J. H. Lee, K. R. Park, and J. M. Kim (Div. of Satellite Comm., ETRI, Taejon, Korea): *JKITE*, vol. 33-A, no. 11, pp. 2216–2223, Nov. 1996.

A modified $\mathrm{TE}_{113}/\mathrm{TM}_{012}$ trip-mode bandpass filter is implemented by using a modified inter-cavity iris in which the number of slots are reduced up to 50%. The measured data of two filters, which are the modified filter and conventional one, are compared. Experimental result shows that the characteristics of the novel triple-mode filter matches well that of the conventional filter.

(56) A Design of Single Side-band Filter for Millimeter Wave using Martin-Puplett Interferometer, by S. T. Han*, H. R. Kim*, C. H. Lee*, J. A. Park**, H. S. Jung*, G. D. Kim*, T. S. kim*, and D. C. Park*** (*TRAO, Korea Astronomy Observatory, Taejon, Korea; **Dept. of Physics, Ehwa Women Univ., Seoul, Korea; ***Dept. of Radio Science and Eng., Chungnam National Univ., Taejon, Korea): *JKITE*, vol. 33-A, no. 4, pp. 664–671, Apr. 1996.

The design method of 85–115-GHz band single side-band filter using the principle of Martin–Puplett interferometer is described. From the test results, not only the ratio of image signal rejection of 19 dB is obtained, but also the theoretical and experimental results of center frequency of pass-band and rejection-band show the validity of the theory. This manufactured filter was installed on 100-GHz band SIS (Superconductor Insulator Superconductor) receiver for observing cosmic radio waves and tested.

(57) Development of Duplexer Filters Using High Dielectric Constant Ceramic Resonators, by K. B. Lee*, Z. H. Lee*, K. B. Kim**, and H. G. Lee* (*Korea Electronics Technology Institute, Korea; **DAEWOO Electronics, Korea): *JKITE*, vol. 33-A, no 3, pp. 408–416, Mar. 1996.

The purpose of this study is to develop the miniaturized duplexer filter for mobile communications using high dielectric constant $(\epsilon_r > 100,\ 180)$ ceramic resonators. Developed duplexer filter was formed to have Tx frequency band at 836.5 ($\pm$12.5) MHz and Rx frequency band at 881.5 ($\pm$12.5) MHz. Insertion loss at Tx frequency band was 1.41 and 1.46 dB, insertion loss at Rx frequency band was 3.49 and 3.65 dB, respectively.

(58) Wideband Propagation Characteristics Analysis of a Microstrip Transmission Line on FR-4 Composite Substrate, by J. K. Hong, Y. G. Kim, and H. Y. Lee (Dept. of Electrical Eng. Ajou Univ., Suwon, Korea): *JKITE*, vol. 33-A, no. 2, pp. 221–229, Feb. 1996.

We analyzed wideband propagation characteristics of a microstrip transmission line based on FR-4 composite substrate using the wideband complex dielectric constant model and the phenomenological loss equivalence method. This wideband analysis can be helpful to characterize high-speed and high-density transmission lines associated with the wideband dielectric characteristics.

(59) A Study on Design of Optimal Structure of TEM Cell for the Characteristic Impedance Matching and Analysis of the Electric Field Distribution, by S. Y. Chung and J. G. Rhee (Dept. of Electronic Eng. Hanyang Univ., Seoul, Korea): *JKITE*, vol. 33-A, no. 7, pp. 1297–1308, July 1996.

The analysis of the electric field distribution for TEM Cell which is matched with 50 Ω is performed. Quasistatic approximations are used to calculated the field strength of the internal field of TEM Cell. The result of the improved method for analysis of the electric field is compared with that of R. J. Spigel. And the improved method for characteristic impedance and the results of numerical analysis are shown.

(60) A Single-Layer Power Divider for a Slotted Waveguide Array Using π-Junctions with an Inductive Wall, by T. Takahashi, J. Hirokawa, M. Ando, and N. Goto (Faculty of Engineering, Tokyo Institute of Technology, Tokyo, 152 Japan): *Trans. IEICE*, vol. E79-B, pp. 57–62, Jan. 1996.

The authors propose a waveguide π-Junction with an inductive wall. Galerkin's method of moments is applied to analyze it and small reflection and desired power division ratio is realized. Good agreement between the calculated result and the measured one verifies the design of a unit π-Junction. A 16-way power divider consisting of 8 π-Junctions is designed at 11.85 GHz and the characteristics are predicted.

(61) The FDTD Analysis on Permittivity Measurement Using Rectangular Cavity Resonator, by O. Hashimoto and T. Abe (College of Science & Engineering Aoyama Gakuin University, Tokyo, 157 Japan): (vol. J79-B-II, no. 9, pp. 616–618): *Trans. IEICE*, vol. E79-B, p. 1410, Sept. 1996.

In this paper, we describe an application of the Finite-Difference Time-Domain (FDTD) method to a problem of cavity resonator measurement of material permittivity and a quantitative estimation of error in such a measurement via use of perturbation method. It is shown in this paper that the error in the permittivity estimation increases with the size of dielectric material and that is has a positive correlation with the material permittivity.

(62) Traveling-Wave Microwave Power Combiner, by S. Nogi, T. Shimura, and K. Fukui (Faculty of Engineering, Okayama University, Okayama-shi, 700 Japan) (vol. J79-C-I, no. 1, pp. 25–33): *Trans. IEICE*, vol. E79-C, p. 139, Jan. 1996.

Microwave power combining using traveling-wave-type waveguide power divider/combiner structures is discussed. Analyzes are carried out for two types of power-combining systems: (A) systems with this structure only as a combiner, and (B) divider-combiner systems with two identical structures. Perfect power-combining conditions are given, and broadband characteristics are shown for both the types.

(63) A Study on the Magnetostatic Wave Delay Line Using the YIG Film, by K. Okubo*, Vishnu PRIYE**, and M. Tsutsumi** (*Faculty of Computer Science and System Engineering, Okayama Prefectural University, Soja-shi, 719-11 Japan ; **Faculty of Engineering and Design, Kyoto Institute of Technology, Kyoto-shi, 606 Japan) (vol. J79-C-I, no. 1, pp. 34–35): *Trans. IEICE*, vol. E79-C, p. 140, Jan. 1996.

The magnetostatic forward volume wave delay line of the microstrip line type was newly proposed using Yttrium Iron Garnet film. The long group delay characteristics more than 0. 8 μs were observed with low insertion loss of 21 dB and propagating loss of 34 dB/μs in the 100-μm-thick film of 17 mm length at 2. 94 GHz.

(64) A Magnetostatic Wave Radiation Impedance of Symmetric Slotline in Signal-to-Noise Enhancer, by H. Asao, M. Miyazaki, H. Oh-hashi, and O. Ishida (Mitsubishi Electric Corporation, Information Technology R&D Center, Kamakura-shi, 247 Japan) (vol. J79-C-I, no. 2, pp. 53-60): *Trans. IEICE*, vol. E79-C, p. 252, Feb. 1996.

A magnetostatic wave (MSW) radiation impedance of symmetric slotline in S/N enhancer, having yttrium iron garnet films and dielectrics with high dielectric constant on both sides of slotline conductor, is analyzed below threshold input power level. Using the analytical results, the attenuation constants of slotline and the improvements of S/N enhancement are discussed.

(65) Efficient Characterization of Complex H-Plane Waveguide π-Junction and Cross-Junctions, by Z. Ma and E. Yamashita (Dept. of Electronic Engineering, University of Electro-Communications, Chofu-shi, 182 Japan): *Trans. IEICE*, vol. E79-C, pp. 444–452, Mar. 1996.

An efficient full-wave approach for the accurate characterization of a H-plane waveguide π-junction with an inductive post and a waveguide cross-junction is proposed. By employing the port reflection coefficient method (PRCM), the analysis and solution procedures of these complex waveguide junctions are greatly simplified and only the calculation of field reflections caused by the simplest waveguide step-junction discontinuities are required.

(66) Band-Pass Filters Mounted with Cylindrical Dielectric Resonators in Cutoff Waveguides, by S. Toyoda, and H. Hamada (Faculty of Engineering, Osaka Institute of Technology, Osaka-shi, 535 Japan) (vol. J79-C-I, no. 5, pp. 145–147): *Trans. IEICE*, vol. E79-C, p. 720, May 1996.

In this paper, new bandpass filters mounted with cylindrical dielectric resonators in the cutoff waveguide are proposed and tested. The height of the cutoff waveguide is 5 mm. The input and output side of this cutoff waveguide are connected to a waveguide which tapers gradually from the rectangular waveguide of standard dimensions. The operating frequency is in the 9-GHz band. Good frequency characteristics of the filters are obtained.

(67) Steps Approximate Analysis of Linear and Raised Cosine Tapered Microstrip Lines by Waveguide Model, by H. Shirasaki (*Faculty of engineering, Tamagawa University, Machida-shi, 194 Japan) (vol. J79-C-I, no. 8, pp. 303–309): *Trans. IEICE*, vol. E79-C, p. 1181, Aug. 1996.

Return loss properties of microstrip line tapers of linear and raised cosine types are analyzed by the waveguide model. The taper part is divided into steps, and the efficient relative permittivity and the efficient width are considered in every step part. The scattering coefficients are obtained in every step part by the mode matching method. Then, the scattering coefficient of each step are joined together by the generalized scattering matrix method. By obtaining characteristic charts, the taper shape that the return loss in a utilization band is large are obtained. Lastly, the circuits of tapers arranged symmetrically for the input and output division are analyzed.

(68) A Synthesis Method of Low-Loss Y Branches for Use in Dielectric-Waveguide Circuits and Its Experiments, by M. Tsuji, R. Nasu, and H. Shigesawa (*Faculty of engineering, Doshisha University, Kyoto-fu, 610-03 Japan) (vol. J79-C-I, no. 8, pp. 310–319): *Trans. IEICE*, vol. E79-C, p. 1181, Aug. 1996.

In this paper, we show a new design method for a compact and low-loss dielectric-waveguide Y branch of open structure. The key of this method is to synthesize an optimized Y branch of open type by using the corresponding two types of shielded model. This method can reduce greatly the CPU time for discontinuity analysis and Y-branch synthesis. Design examples in the millimeter-wave and optical regions are demonstrated, and the experiments that we took prove the effectiveness of our method.

(69) Design of Dielectric Multi-Layer Bandpass Filters Using Arbitrary Thickness of Layers, by I. Wakabayashi and K. Miyauchi (*Faculty of engineering, Science University of Tokyo, Shinjuku-ku, Tokyo, 162 Japan) (vol. J79-C-I, no. 8, pp. 320–329): *Trans. IEICE*, vol. E79-C, p. 1181, Aug. 1996.

Applying the general design principle of dielectric multilayer bandpass filters, which has been proposed in a previous paper, this paper presents and discusses an actual design method, design examples, design error and number of layers, when dielectric layers of arbitrary thickness are employed in design of Butterworth and Chebyshev filters at optical wavelength. The results are compared with those of filters in which only dielectric layers of fundamental thickness are employed.

(70) Metal Mesh Couplers Using Evanescent Waves at Millimeter and Submillimeter Wavelengths, by J. Bae*, J. C. Chiao**, D. B. Rutledge***, and K. Mizuno**** (*Research Institute of Electrical Communication, Tohoku Univ., Sendai-shi, 980-77 Japan; **Optical Networking System and Testbeds, Bell Communication Research, 311 Newman Springs Road, Red Bank, NJ 07701-5699, USA ; ***Photodynamics Research Center, The Institute of Physical and Chemical Research, 19-1399 Aza-Koeji, Nagamachi, Sendai-shi, 980 Japan) (vol. J79-C-I, no. 9, pp. 370–377): *Trans. IEICE,* vol. E79-C, p. 1290, Sept. 1996.

A metal mesh evanescent wave coupler which makes use of a evanescent wave coupling between a metal mesh and a dielectric plate has been developed as a quasioptical component for millimeter and submillimeter wavelengths. The transmission properties based on the coupling effect of evanescent waves in the coupler have been investigated experimentally and theoretically at millimeter frequencies. The evanescent wave coupling effect can change a coupling coefficient of the coupler greater than 70% by changing the spacing between the mesh and the silicon plate less than $\lambda/140$ at 53 GHz.

(71) Waveguide Bandpass Filter of Millimeter Waves Using Two Ferrite Chips, by H. Hasegawa, H. Shimasaki, and M. Tsutsumi (Faculty of Engineering and Design, Kyoto Institute of Technology, Kyoto-shi, 606 Japan): *Trans. IEICE,* vol. E79-C, pp. 1472–1474, Oct. 1996.

This paper describes the properties of a TE_{10} metal waveguide filter using two polycrystalline ferrite chips at millimeter-wave frequencies. The frequency response of the filter has been analyzed using the mode-matching technique, and optimized by the computer technique. The bandpass filter characteristics with high dynamic range more than 30 dB was obtained with insertion loss of 1.5 dB and good magnetically tunable response is observed with a quality factor of 200, which agrees considerably well with predicted values.

(72) Propagation Characteristics of Microstrip Line with Semiconductor Substrate under Laser Spot Illumination, by Y. Horii* and M. Tsutsumi** (*Faculty of Informatics, Kansai University, 2-2-1 Ryozenji-cho, Takatsuki-shi, 569-11 Japan; **Kyoto Institute of Technology, Faculty of Engineering and Design Matsugasaki, Sakyo-ku, Kyoto-shi 606 Japan) (vol. J79-C-I, no. 10, pp. 389–395): *Trans. IEICE,* vol. E79-C, p. 1475, Oct. 1996.

In this paper, scattering parameters of an optically controlled microstrip gap, which is fabricated on the microstrip line based on the semiconductor substrate, are analyzed theoretically using the (FD) 2TD method, and evaluated numerically in respect of the diameter of the laser spot, position of illumination, and the thickness of plasma. It is shown that optical control of wide frequency range can be achieved by using the laser spot with large diameter. Experimental results examined for the frequency range of 6–9 GHz are reported and are phenomenologically agreed with the theoretical ones.

(73) Optimum Design of the Waveguide-Shielded Dielectric Image-Guide Transition by the Vector FEM, by T. Mizuno, M. Tsuji, and H. Shigesawa (*Faculty of Engineering, Doshisha University, Tanabe, Kyoto-fu, 610-03 Japan) (vol. J79-C-I, no. 10, pp. 406–408): *Trans. IEICE,* vol. E79-C, p. 1476, Oct. 1996.

We show here a new design approach based on 3-D finite-element method for a compact and low-loss transition between metal waveguide and rectangular dielectric one. The synthesized transition realizes the reduction of about 10 dB at maximum in return loss. The experiments prove the effectiveness of our method.

(74) FVTD Analysis of Two-Dimensional Bended Waveguide and Horn Antenna, by K. Uchida*, K. Shiotsuki**, and T. Noda* (*Faculty of Engineering at Fukuoka Institute of Technology, Fukuoka-shi, 811-02 Japan ; **Nippon COMSYS Corporation, Tokyo, 108 Japan): *Trans. IEICE,* vol. E79-C, pp. 1618–1624, Nov. 1996.

This paper is concerned with a point-oriented finite volume time domain (FVTD) method in the Cartesian coordinate system and its application to the analysis of electromagnetic wave propagation in a bended waveguide as well as radiation from and receiving by a horn antenna with a flange of arbitrary angle. The perfectly matched layer (PML) is used for the absorbing boundary conditions (ABC's). The boundary conditions for a perfect conductor not well suited to the Cartesian coordinate system are also proposed.

(75) An FVTD Version of Berenger Absorbing Boundary Condition for a Lossy Medium, by K. Uchida*, Kyung-Koo Han**, K. Ishii***, T. Matsunaga*, and Gi-Rae Kim**** (*Faculty of Engineering at Fukuoka Institute of Technology, Fukuoka-shi, 811-02 Japan; **Faculty of Engineering at Kyushu University, Fukuoka-shi, 812-81 Japan; ***Kaho Engineering High School, Kaho, Fukuoka-shi, 820-02 Japan ; ****Masan Junior College, Korea): *Trans. IEICE,* vol. E79-C, pp. 1625–1627 Nov. 1996.

This paper is concerned with the perfectly matched layer (PML) for a lossy medium in terms of a finite volume time domain (FVTD) method based only on the Cartesian coordinate system. In this point-oriented FVTD method, there are no spatial differences between electric and magnetic fields. Numerical examples are given for the electromagnetic wave propagation in two-dimensional tunnels with bends and branches.

(76) Variation of Resonance Frequency of Disk Resonator Coupled with External Circuit, by J. Hwang*, T. Ueno*, Y. Tomabech**, and K. Matsumura* (*Faculty of Engineering, Utsunomiya University, 2753 Ishiimachi, Utsunomiya-shi, 321 Japan; **Faculty of Education, Utsunomiya University, 350 Mine-machi, Utsunomiya-shi, 321 Japan) (vol. J79-C-I, no. 11, pp. 420–427): *Trans. IEICE,* vol. E79-C, p. 1628, Nov. 1996.

This paper presents a new analytical method on resonance characteristics of a dielectric disk resonator that operates on Whispering Gallery mode with external circuit. In a calcula-

tion of the resonance characteristics of the disk resonator, a perturbation of resonance frequencies by the external circuit is considered and evaluated. We also perform experiments to investigate the analytical results. As the result, we find that the perturbation of the resonance frequency depends on a difference of propagation constant between the exciting guided mode and the Whispering Gallery mode.

(77) Ladder Grounded Coplanar Line, by M. Konno (Materials & Devices Research Labs., Toshiba R&D Center, Kawasaki-shi, 210 Japan) (vol. J79-C-I, no. 11, pp. 439–445): *Trans. IEICE*, vol. E79-C, p. 1628, Nov. 1996.

A novel high-speed transmission line, named the ladder grounded co-planer line (LGCL), is presented. The LGCL can be made without any changes of the conventional GaAs IC process. This paper presents measured and calculated results of the characteristics impedance and transmission loss of the LGCL fabricated on GaAs substrate by conventional IC process. The high performance of the 20-GHz GaAs LSI employing the LGCL are demonstrated.

(78) A Design Method of Directional Couplers of Twofold Symmetrical Structure, by I. Ohta, T. Kawai, and Y. Kokubo (Dept. of Electronics, Faculty of Engineering, Himeji Institute of Technology, 2167 Shosha, Himeji-shi, 671-22 Japan) (vol. J79-C-I, no. 12, pp. 484–486): *Trans. IEICE*, vol. E79-C, p. 1777, Dec. 1996.

This paper describes a matching problem of twofold reflection-symmetric directional couplers with four identically matching circuits at each port on the basis on the power-split ratio and the equivalent admittance expressed in terms of the eigenadmittances of their original circuit without the matching circuits, and presents a generalized design method of such couplers.

III. Microwave Antennas

(1) Design of a High-Performance, Mid-Sized, X-Band Earth Station Antenna, by T. S. Bird, FIEAust., M. A. Sprey, K. J. Greene, and G. L. James (CSIRO Division of Radiophysics, PO Box 76 Epping NSW 2121): *JEEE*, vol. 16, pp. 57–64, Mar. 1996.

The reflector antenna and feed system of an 11-m-diameter earth station that operates in circular polarization at X-band is described. The reflector optics are required to have high G/T sidelobes that satisfy the CCIR recommendation and low mismatch at the feed. The feed system is required to have high isolation between the transmit and receive ports (>40 dB) at the center of the band. This isolation is achieved by minimizing reflections from all components forward of the polarizer. The measured performance of the reflector and feed system is described.

(2) Dielectric-loaded Pyramidal Horns, by S. K. Palit* and W Perris** (*Advanced Telecommunications Research Center, School of Electronics Engineering and Applied Physics, University of Canberra, PO Box 1, Belconnen, Act 2616. Currently working in the Dept. of Electrical and Computer Systems Engineering, Monash University, PO Box: 197, Caulfield East, Vic-3145; **Final year B.Sc. Eng. student at the University of Canberra, Belconnen, Act-2616): *JEEE*, vol. 16, pp. 139–146, June 1996.

This paper describes the step approximation method of analysis of solid dielectric-loaded metallized horns. The field components of a hybrid-mode $[\mathrm{HE}_{mn}]$ were derived and the mode transformation from $[\mathrm{HE}_{mn}]$ to TE^{x}_{mn} was realized and is reported in the paper. By using proper boundary conditions two characteristic equations were derived which yielded phase constants. The far field expressions were derived using Schelkunoff's Equivalence Principle. The computed radiation patterns were compared with the measured ones and they are found to be in good agreement. The transmission coefficients, copolar, and crosspolar radiation levels were also measured for solid dielectric, dielectric slab-loaded, and empty horns to ascertain their relative merits as high-performance feed for satellite dish antennas. It is suggested that the slab-loaded dielectric horn is a viable substitute for corrugated horns.

(3) 3-D Contour Technique for Curved Surfaces in FDTD Method and Its Applications to Cassegrain Antenna System, by S.-X. Song, B.-Q. Gao, and M.-Y. Sun (Beijing Institute of Technology, Beijing, P.R.C.): *AES*, vol. 24, pp. 48–52, Sept. 1996.

A 3-D contour technique for curved surfaces in FDTD method is presented. It has been used in modeling the parabolid and Cassegrain antenna system. The near-field distributions obtained are in good agreement with the values from other method and measured values.

(4) Analysis and Optimization of Curvilinear Dipole Arrays with Finite-Size Plate-Reflectors, by J.-H. Wang*, L. Ren**, and S.-S. Jian* (*Northern Jiaotong University, Beijing, P.R.C.; **Southwest Jiaotong University, Chengdu, P.R.C.): *AES*, vol. 24, pp. 53–59, Sept. 1996.

The characteristics of the curvilinear dipole arrays with finite-size plate-reflectors are calculated by a hybrid method which combines the method of moment and the UTD, and the dipole shapes and the array structures of some antennas are optimized for maximum gains.

(5) Theory and Experiment of Rectangular Microstrip Antenna with Dielectric Cover, by G. Liu* and S.-S. Zhong** (*Fudan University, Shanghai, P.R.C.; **Shanghai University, Shanghai, P.R.C.): *AES*, vol. 24, pp. 99–101, Sept. 1996.

Rectangular microstrip antennas with dielectric cover have been investigated theoretically and experimentally. A full-wave analysis model is developed to analyze microstrip antennas with dielectric cover. Formulas for the input impedance and radiation pattern of antenna are given. Practical microstrip antenna problems, such as the effect of superstratum on resonant frequency and input impedance, are discussed. The numerical results have been verified by the experimental results.

(6) A Novel Unit for Phased-Array Antenna, by H.-L. Zheng, Y.-Z. Yin, and N.-H. Mao (Xidian University, Xi'an, P.R.C.): *AES*, vol. 24, pp. 106–108, Sept. 1996.

A novel unit for phased-array antennas, of which the current can be detected, is presented. A small-loop antenna is introduced on using it for a prober and its effection is discussed to the characteristics of the unit and array. On the tested results, the conclusion can be obtained that the performance of new

model unit is almost the same as that of the which is without the detecting antenna.

(7) Research on V-Slpt Antenna, by J.-H. Wang*, L. Ren**, and S.-S. Jian* (*Northern Jiaotong University, Beijing, P.R.C.; **Southwest Jiaotong University, Chengdu, P.R.C.): *AES*, vol. 24, pp. 21–27, Dec. 1996.

The V-slot antenna with arbitrary included angles are analyzed by moment method and by using dyadic Green's function of wedges of second kind. The slots are cut in the V-curved plates and are fed in the center by two wires. The field distributions on slots and the far field patterns in H-plane both of theory and experiment are given.

(8) Mode-matching Analysis of the Reflection Characteristics for Conical Horn Antennas with Small Flaring Angle, by S.-J. Xu*, F. Wang*, N.-X. Yi**, and Y. Zhong** (*University of Science & Technology of China, Hefei, P.R.C.; **Xi'an Institute of Space Radio Technology, Xi'an, P.R.C.): *AES*, vol. 24, pp. 16–20, Dec. 1996.

The reflection characteristics of conical horn antenna are investigated by a new method which combines rigorous mode-matching approach with the multimode network theory. The radiation problem is transformed into a transmission problem which is met in the traditional analysis. As a result, the calculation procedure is greatly simplified. The validity and accuracy of the present method is verified by comparison of the calculated and the experiment results for the conical horn antenna.

(9) A Study of Cross-Polarization Properties of a Parabolic Torus Reflector Antenna, by B. Du*, K.-Z. Yang**, and S.-S. Zhong* (*Shanghai University, Shanghai, P.R.C.; **The Fifty fourth Institute, Ministry of Electronics Industry, Shijiazhuang, P.R.C.): *AES*, vol. 24, pp. 12–16, Dec. 1996.

The cross-polarization radiation field formulas for a parabolic torus reflector are derived using physical optics. The cross-polarization properties of the torus antenna are deeply investigated with these formulas. Some significant conclusions and numerical results are obtained, which lay a theoretical foundation for this type of antenna realizing the low cross-polarization property.

(10) A Simple Method for Resonant Frequency of Rectangular Microstrip Antennas with Multidielectric layers, by G. Liu*, S.-S. Zhong*, and Y,Zhang** (*Shanghai University, Shanghai, P.R.C.; **no. 14 Research Institute, China Academy of Launch Vehicle Technology, Beijing, P.R.C.): *JCIC*, vol. 17, pp. 94–97, Mar. 1996.

A simple method is presented to predict the resonant frequency of rectangular microstrip antennas with multidielectric layers. A set of closed-form expressions of the effective permittivity is derived first for the multilayer microstrip. Then the theoretical resonant frequency and its numerical results are obtained based on a generalized transmission line model of the rectangular microstrip antenna with multilayers. Present results are in very good agreement with those of the full-wave analysis and experimental results in the literature.

(11) The Development of GPS/GLONASS Compatible Microstrip Antenna, by J.-B. Zhang (Tianjin Institute of Technology, Tianjin, P.R.C.): *JCIC*, vol. 17, pp. 125–128, May 1996.

The compatible microstrip antenna which can receive GPS and glonass satellite positioning signals is developed. The experimental data and the practical application show that the performance of the antenna is excellent.

(12) A Study of Gain and Sidelobe Properties of a Parabolic Torus Reflector Antenna, by B. Du*, K.-Z. Yang**, S.-S. Zhong*** (*Shanghai University, Shanghai, P.R.C.; **The Fifty Fourth Institute, Ministry of Electronics Industry, Shijiazhuang, P.R.C.,; ***Shanghai University, Shanghai, P.R.C.): *JCIC*, vol. 17, pp. 48–54, July 1996.

The parametric equation and radiation field formulas for a parabolic torus reflector antenna are given. The gain and radiation properties of the antenna are investigated by using the above formulas. The calculated radiation patterns of a practical antenna are given and compared with measured ones, and good agreement has been found.

(13) Study of a Broadband Millimeter-Wave Omnidirectional Antenna, by L.-Y. Shen and X.-M. Qing (University of Electroic Science and Technology of China, Chengdu, P.R.C.): *JIMW*, vol. 15, pp. 341–346, Oct. 1996.

A broadband millimeter-wave omnidirectional asymmetrical biconical horn antenna was investigated. A ridge waveguide-coax line transition structure was designed to solve the feed problem of biconical horn antenna in millimeter-wave band and to meet the engineering requirement that the input port of antenna must be a waveguide. The measurement data of omnidirectivity and input VSWR in the 26–40-GHz band show good agreement with the design.

(14) Studies on a New Type of Millimeter-Wave Integrated Antenna, by C.-F. Ye*, G. Liu**, and W.-X. Zhang*** (*Shanghai Tiedao University, Shanghai, P.R.C.; **Fudan University, Shanghai, P.R.C.; *** Southeast University, Nanjing, P.R.C.): *JIMW*, vol. 15, pp. 338–342, Oct. 1996.

A new type of millimeter-wave integrated circuit antenna with high gain and simple structure designed based on the Fresnel zone plate was introduced. With the spectrum domain analysis, the formulas for radiation field and curves for antenna gain were discussed. Zoning of the plate considering the extra phase change from substrate was given hereafter.

(15) FSS Subreflector Antenna with Small RCS, by L. Feng, S.-H. Deng, Y.-Z. Ruan, and Y.-L. Hu (University of Electronic Science and Technology of China, Chengdu, P.R.C.): *JAS*, vol. 14, pp. 227–232, June 1996.

A Cassegrain antenna with frequency selective subreflector is introduced, and the measured radiation patterns and radar cross section (RCS) of the antenna are given. In comparison with ordinary metallic subreflector, this antenna obtains similar radiation pattern and about 20 dB of RCS reduction. This technique can be applied to ordinary dual reflector antennas by simply changing the subreflector into FSS.

(16) Study on the Wide-Band and High-Gain Microstrip Antenna Element, by D.-M. Yao and J.-M. Cai (National University of Defence Technology of China, Changsha, P.R.C.): *JE*, vol. 18, pp. 526–531, Sept. 1996.

A novel three-layers microstrip antenna element that has the advantages of wide-band and high-gain is proposed. The characteristic equation and the frequency characteristic formulas of the input Voltage Stand Wave Radio (VSWR) are obtained

by using the spectral domain method and equivalent circuit method, respectively. With the aid of the numerical results, a C-band microstrip antenna element with bandwidth of 16% (VSWR; 1. 5) or 25% (VSWR; 2) and gain of 10.2–11.3 dB is developed, which are much larger than the bandwidth of 5–6% and the gain of 6–7 dB of the common microstrip antenna element.

(17) Analysis of Mutual Coupling of Conformal Arrays on Arbitrary Surfaces with Revolutional Symmetry, by S.-L. Chai and D.-M. Yao (National University of Defence Technology, Changsha, P.R.C.): *JE*, vol. 18, pp. 627–631, Nov. 1996.

The mutual coupling of conformal array on arbitrary surfaces with revolutional symmetry is presented. The concept "equivalent" simplifies the array model in the method of equating arrays with unequal elements to arrays with the same elements in each ring. The method of decomposing the arbitrary excitation of arrays into a term of intrinsic excitations avoids the inversion of large matrixes and so largely reduces the computer time.

(18) A New Method Circular Microstrip Antenna, by Y.-Z. Wang, C.-W. Su, S.-M. Lin, and W.-B. Wang, (Xi'an JiaoTong University, Xi'an, P.R.C.): *JE*, vol. 18, pp. 632–637, Nov. 1996.

A modified circular microstrip antenna is researched, and a new method named for equivalent ellipse is presented to calculate the pattern, axial ratio, and partial power gain. The theoretical results agree well with the experimental data.

(19) The Study on the Chiro-Omega Dipole Antenna, by W.-Y. Yin and W.-B. Wang (NorthWestern Polytechnical University, Xi'an, P.R.C.): *JE*, vol. 18, pp. 292–297, May 1996.

The possibility of using chiro-omega media as the substrates of microstrip antennas is discussed. With the help of the generalized spectral domain-exponential matrix technique, the farfield behavior of dipole antennas is analyzed in detail, which is located on the surface of one-layer, two-layer chiro-omega substrates, respectively. The lossy effects of chiro-omega substrates are taken into consideration.

(20) Antenna-Mode Scattering Component and RCS Reduction, by L. Feng, S.-H. Deng, Y.-Z. Ruan, and Y.-L. Hu (University of Electronic Science and Technology of China, Chengdu, P.R.C.): *JE*, vol. 18, pp. 185–193, May 1996.

Three kinds of antenna's RCS are discussed and the measured antenna's RCS reduction by the method of minimizing the mode scattering component are given. The experimental results show that the RCS reduction is about 10–15 dB both in the operating band and outside the band.

(21) Kirchhoff's Faltung Formula of Complex Aperture and Complex Ray Simulation of Aperture Radiation, by D.-Z. Yao (University of Electronic Science and Technology of China, Chengdu, P.R.C.): *JE*, vol. 18, pp. 99–103, Jan. 1996.

The Kirchhoff's faltung formula of a complex aperture is proposed as a new method for radiation from a plane aperture. It is based on the idea of analytic extension that the original aperture field is extended to a complex plane, and then the Kirchhoff's faltung formula makes up a rigorous representation of the radiation from a plane aperture. Numerical calculations confirm its effectiveness and correctness.

(22) Analysis and Design of a New Kind of Slot Antenna Fed by Rectangular Waveguide, by Z.-Z. Zhang, H.-Z. Wang, and K.-S. Chen (Zhejiang Univ., Hangzhou, P.R.C.): *JM*, vol. 12, pp. 42–49, Mar. 1996.

This paper analyzes the reflecting and radiating properties of a new kind of slot antenna with transverse slots located on a disk terminating a rectangular waveguide. Both external and internal mutual coupling of the two symmetrical or unsymmetrical transverse slots are included in two integral equations. This kind of slot antenna for C-band is designed and tested, and the experimental results agree well with the theoretical predictions.

(23) Design of Large Thinned Phased-Array Antenna and Study on its Sidelobe Level, by X.-R. Shu, H.-Q. Yan, and Y.-C. Guo (Nanjing Research Institute of Electronics Technology, Nanjing, P.R.C.): *JM*, vol. 12, pp. 169–174, Sept. 1996.

The design of large thinned phased-array antenna and its sidelobe level are studied. Computations are made for 3 aperture sizes, 30 reference aperture amplitude distributions, and 9 thinned rates with random number of long period. 45 000 arrangements of elements over thinned aperture and their 3-D patterns in full space are calculated. The mathematical regression method is used to obtain the formula for estimating the sidelobe level with high accuracy.

(24) Study on the Interaction Between Scatterer and Aperture Antenna in the Scatter's Near Zone, by X.-D. Wang, Y.-S. Zhang, W.-B. Wang, and X.-Y. Zhang (Xi'an Jiaotong University, Xi'an, P.R.C.): *JM*, vol. 12, pp. 315–319, Dec. 1996.

The interaction between scatter and aperture antenna situated in the scatter's near zone is studied and simulated by using the FDTD method. The numerical model with axial symmetry in cylindrical coordinates is chosen as an example for different distances between the scatter and the antenna, and the numerical results of electric field distribution on the antenna's aperture are obtained. The application range of physical optics method in computing surface current on the scatter is also given.

(25) Analysis of Aperture Coupled Stacked Microstrip Array Antenna, by B. J. Jang*, Y. K. Lee*, H. W. Moon**, Y. J. Yoon***, and H. K. Park*** (* Dept. of Elec. Eng., Yonsei Univ., Seoul, Korea; **Korea Telecom, Seoul, Korea; ***Dept. of Radiation Eng., Yonsei Univ., Seoul, Korea): *JKICS*, vol. 21, no. 3, pp. 753–762, Mar. 1996.

Aperture-coupled stacked microstrip array antennas are proposed and their operating characteristics are analyzed based on analytical results. By introducing an N-port equivalent network, the impedance matrix of an array of N-element slot-coupled patches is evaluated directly from its network current matrix of order N^2. Numerical results show mutual coupling, radiation pattern, active reflection coefficient versus scan angle, radiation efficiency, and active element gain pattern.

(26) A Study on the Series-Fed Microstrip Array Antenna with Coupling-Slots, by B. J. Jang*, D. S. Kim*, H. W. Moon**, Y. J. Yoon***, and H. K. Park*** (*Dept. of Elec. Eng., Yonsei Univ., Seoul, Korea; **Korea Telecom,

Seoul, Korea; ***Dept. of Radiation Eng., Yonsei Univ., Seoul, Korea): *JKICS*, vol. 21, no. 2, pp. 495–504, Feb. 1996.

Series-fed microstrip array antennas with coupling-slots are proposed and their operating characteristics are analyzed based on analytical and experimental results. Using the results of the full-wave analysis, the Chebyshev array antennas consisting of eight elements are designed and fabricated. Experiment results show that the series-fed array antenna designed by adjusting the slot position relative to the feeder is superior to that designed by slot length.

(27) A Study on the Microstrip Array Antenna for KOREASAT DBS Reception, by J. S. Jun S. R. Lee, and Y. H. Lee (Dept. of Aviation & Information Comm. Hankuk Aviation Univ., Goyang, Korea): *JKICS*, vol. 21, no. 9, pp. 2514–2528, Sept. 1996.

The paper discusses the design of the optimal KOREASAT DBS (Direct Broadcasting Satellite) reception microstrip antenna. Experimental results for a 16 $\times$ 16 array antenna of size 35 $\times$ 35 cm are also described. Its gain is over 28 dB in the frequency range of 11. 7 $\sim$ 12.0-GHz DBS band. The measured NHK broadcasting C/N ratio of 16 $\times$ 16 array antenna is over 10 dB in Pusan.

(28) Design and Fabrication of the GPS Antenna System Including RF-Stage, by S. I. Hong*, J. H. Lee**, K. S. Byon***, and M. Y. Chung**** (*Dept. of Electronic Comm., Pusan Jr. College, Pusan, Korea; **LG Electronics, Seoul, Korea; ***Dept. of Elec. Eng., Donga Univ., Pusan, Korea; **** Kumho Group, Seoul, Korea): *JKITE*, vol. 33-A, no. 6, pp. 1049–1057, June 1996.

A type of new GPS antenna system is proposed including RF stage in order to reduce a cable loss. The antenna system with TMPA (Truncated-corners Microstrip Patch Antenna) is designed and fabricated. As result of comparing between the typical system and the proposed system when cable length is 60 m, 63-, 55-, and 25-dB gain are obtained for RG-316/U, RG-58C/U, and RG-213/U, and better characteristics are achieved than the typical system.

(29) Analysis of Wide-Band Hoghorn Antenna, II: Radiation Pattern, by S. Y. Kim*, J. H. Lee**, and S. U. Kim* (*Div. of Electron. & Information Tech., KIST, Seoul, Korea; **Dept. of Electron. Eng., Seoul National Univ., Seoul, Korea): *JKITE*, vol. 33-A, no. 9, pp. 1759–1765, Sept. 1996.

The electric field on the hoghorn antenna aperture is constructed by summing four different ray components, which are radiated from the equivalent source on the terminal of the ridged waveguide. The radiation pattern of the hoghorn antenna is calculated from the electric field distribution on its aperture.

(30) Electromagnetic Scattering Characteristics of a Hyperbolic Reflector Antenna Accounting for the UTD Higher Order Diffraction, by J. H. Choi*, K. W. Lee**, and S. S. Lee* (*Dept. of Radio Science & Eng. Hanyang Univ., Seoul, Korea; **Dept. of Elec. Comm. Eng. Hanyang Univ., Seoul, Korea): *JKITE*, vol. 33-A, no. 5, pp. 813–821, May 1996.

The far-zone scattered field patterns of a hyperbolic reflector antenna are analyzed by using Uniform Geometrical Theory of Diffraction (UTD). The main objective of this paper is to obtain the higher order diffraction contributions which provide the continuity over the shadow boundaries of the first-order solution. The results of the present research are compared to those of the first order solution and the method of moments.

(31) Analysis of the Radiation Characteristics from a Slot Antenna in a Plane Conductor Covered with a Moving Isotropic Plasma Layer, by N. T. Kim (Dept. of Electronic Eng., Inje Univ., Kimhe, Korea): *JKITE*, vol. 33-A, no. 11, pp. 2190–2197, Nov. 1996.

The radiation characteristics of a slot antenna in a plane conductor covered with a moving isotropic plasma layer are analyzed. The radiation null which causes distortion in radiation pattern is explained by the zero of integrand in an asymptotic integral for radiation fields. Numerical results for a radiation null calculated from various plasma and velocity parameters agree with the results of two-dimensional problem.

(32) Analysis of a Dipole Antenna Attached on a Dielectric Slab Using a Spectral-Domain Green's Function and the Method of Moments, by Y. S. Oh (Dept. of Radio Science and Eng., Hongik Univ., Seoul, Korea): *JKICS*, vol. 21, no. 10, pp. 2703–2709, Oct. 1996.

This paper proposes an exact numerical method for analyzing a dipole antenna attached on a dielectric slab. A Green's function for an infinitesimal current filament on a dielectric slab is derived and a field integral equation is formulated using a boundary condition. The moment method is used to solve the field integral equation to obtain current distribution on the antenna. Using the computed current distributions, the input impedances, the resonance lengths, and the resonant resistances of the antennas for various values of the thickness and the dielectric constant of the slab are obtained.

(33) Design of Wideband Microstrip Antennas Using Parasitic Element, by T. W. Kim and J. K. Kim (Dept. of Elec. Eng., Joongang Univ., Seoul, Korea): *JKICS*, vol. 21, no. 5, pp. 1294–1303, May 1996.

The microstrip antenna with broad bandwidth is designed using parasitic element. Compared to the available wideband microstrip antennas, the designed antenna structure is very compact. A theoretical explanation of the rectangular patch antenna coupled with parasitic is analyzed by extending the theory of coupled microstrip lines.

(34) An Analysis of Characteristics for Corrugated Horn Antenna Using Surface Impedance Condition, by M. S. Uhm*, K. R. Park*, and A. Shishlov** (*Sec. of Payload System, ETRI, Taejon, Korea; **Dept. of Antenna, Radiophyzika Stock Company, Russia): *JKICS*, vol. 21, no. 6, pp. 1587–1695, June 1996.

We obtained the predicted and measured results for the reflection coefficient and radiation pattern of Ka-band (20 GHz) corrugated horn. We analyzed propagation constant of hybrid mode in the corrugated waveguide and then obtained the total reflection coefficient using the circuit theory of multistep transformer. A test model of corrugated horn antenna for Ka-band was designed and the results agree with the theoretical prediction.

(35) Analysis of Wide-Band Hoghorn Antenna, I; Double Ridged Rectangular Waveguide Feeder, by S. Y. Kim*, J. K. Park**, and S. U. Kim* (*Div. of Electron. & Infor-

mation Tech., KIST, Seoul, Korea; **Dept. of Electron. Eng., Seoul National Univ., Seoul, Korea): *JKITE*, vol. 33-A, no. 9, pp. 1752–1758, Sept. 1996.

The modal analysis is applied to a doubled ridged rectangular waveguide as a feeder of the hoghorn antenna operated in the frequency range 6–18 GHz. The propagation constant of the TE_{10} mode in the double-ridged waveguide is calculated by using the transverse resonance method. And the equivalent source at the terminal of the double-ridged waveguide is represented into a simple form.

(36) A Study On the Radiation Pattern Analysis of the Monopole Antenna Mounted on a Portable Phone, by O. H. Jeong*, Y. C. Moon**, S. W. Yun***, and I. S. Chang*** (*N-Hi Center, LG Electronics Inc., Seoul, Korea; **Satellite Comm. Tech. Group, ETRI, Taejon, Korea; ***Dept. of Elec. Eng. Sogang Univ., Seoul, Korea): *JKITE*, vol. 33-A, no. 12, pp. 2324–2332, Dec. 1996.

The radiation pattern of the monopole antenna mounted on the portable phone is analyzed. The analyzed model consists of a rectangular conductor box and a monopole antenna. Because of the conductor box, the portable phone acts as an unbalanced dipole antenna whose radiation patterns deviate from those of the conventional isolated monopole antenna. Using the moment method, its radiation patterns are analyzed and the numerical results are verified through the measurements.

(37) The Analysis of Radiation Characteristics of an Antenna on a Three-Dimensional Dome Using the UTD, by J. M. Chang*, J. H. Choi**, and S. S. Lee** (*Dept. of Elec. Comm. Eng., Hanyang Univ., Seoul, Korea; **Dept. of Radio Science and Eng., Hanyang Univ., Seoul, Korea): *JKITE*, vol. 33-A, no. 8, pp. 1541–1547, Aug. 1996.

Radiation patterns of a $\lambda/4$ monopole antenna mounted on a three-dimensional dome placed on the ground plane are analyzed using the UTD. The validity of the UTD solution using the Fock function is confirmed in the transition and shadow regions. The result obtained in this paper can be useful to analyze the radiation characteristics of an antenna mounted on a hill or artificial dome-shaped structure.

(38) Leaky Wave Antenna Analysis, Design, and Implementation, by J. P. Hong*, U. H. Cho**, J. I. Lee**, L. H. Yun**, J. H. Lee***, Y. K. Cho**, and H. J. Eom*** (*Dept. of Elec. Eng. Kyungpook Sanup Univ., Taegu, Korea; **Dept. of Elec. Eng. Kyungpook National Univ., Taegu, Korea; ***Dept. of Elec. Eng. KAIST, Taejon, Korea): *JKITE*, vol. 33-A, no. 11, pp. 2234–2241, Nov. 1996.

Periodically slotted, dielectrically filled parallel-plate waveguide as a leaky-wave antenna is designed and fabricated at the center frequency of 10.0 GHz. The antenna was fed by use of a hog-horn structure. The upper plate of parallel-plate waveguide with 48 periodic slots was made of copper plate. The experimental radiation pattern for the fabricated antenna was compared with the theoretical result for the finite periodic structure.

(39) A Design of the Microstrip Phased Array Antenna with the Slot-Coupled Structure for the Base Station of Mobile Communication, by J. P. Chang*, B. J. Jang**, Y. J. Yoon***, and H. K. Park*** (*LG Elec. Research Center, Seoul, Korea; **LG Elec. Company, Seoul, Korea; ***Dept. of Radio Science and Eng., Yonsei Univ., Seoul, Korea): *JKICS*, vol. 21, pp. 3205–3214, Dec. 1996.

The microstrip phased-array antennas with coupling-slots for the base station mobile communication is proposed and analyzed. The designed phased array antenna has eight slot-coupled microstrip patch array elements and the beam-scanning capability is obtained by using the 4-bit p-i-n diode phase shifters as switching devices. The overall results show that the slot-coupled phased-array antenna has great advantages of wideband, high gain, and reduced spurious radiation.

(40) Analysis of Inductance Loaded Small Type Open-Loop Travelling-Wave Antenna for Moisture Measurement Systems, by J. S. Jeong* and C. B. Joo** (*Dept. of Electronic and Communication, Changwon Junior College, Changwon, Korea; Dept. of Electronic Engineering, KyungNam Univ., Masan, Korea): *JKITE*, vol. 33-A, no. 7, pp. 1309–1318, July 1996.

We proposed an inductance loaded small-type open-loop travelling-wave antenna model for the suitable VHF/UHF frequency bands moisture measurement systems and analyzed its operating characteristics by Galerkin's solution method. This model showed the uniformly distributed power radiation characteristics above the loop axis and that it can effectively suppress the spurious radiations from its narrowband resonance characteristics.

(41) Microwave Measurement of $Ba_{0.7}Sr_{0.3}TiO_3$ Thin-Film Capacitors, by B. T. Jang*, S. Y. Cha*, S. H. Lee*, D. W. Kwak*, H. C. Lee*, B. G. Yu**, J. T. Baek**, and H. J. Yu** (*Dept. of Elec. Engineering, KAIST, Taejon, Korea; **Div. of Semiconductor Tech., ETRI, Taejon, Korea): *JKITE*, vol. 33-A, no. 2, pp. 266–273, Feb. 1996.

Thin-film $Ba_{0.7}Sr_{0.3}TiO_3$ (BST) capacitors were fabricated on SiO_2/Si substrates by RF magnetron sputtering method and characterized at microwave frequencies ranging from 40 MHz to 1 GHz. After de-embedding parasitic components in microwave measurement patterns, nearly frequency-invariant dielectric constant of about 120 was extracted in the measurement range of 40 MHz to 1 GHz.

(42) A Study of Characteristics of X-Band Microstrip Patch Antenna Affected by Permittivity and Electrical Thickness of the Substrate, by S. K. Park, J. H. Kim, and C. B. Park (Dept. of Elec. Eng., Chosun Univ., Kwangju, Korea): *JKITE*, vol. 33-A, no. 3, pp. 435–450, Mar. 1996.

Forty-five X-band rectangular microstrip patch antennas fed by microstrip line using $\lambda/4$ transformer were fabricated on teflon substrates with low · high permittivities and various thickness. Effects of permittivity and electrical thickness on antenna characteristics were studied with measured return loss $(1/S_{11})$ and resonant frequencies. Except for 12 and 13 GHz, we had very good measured return loss with greater than 20 dB, and in the range of 7–9 GHz resonant frequencies were within $\pm 2\%$ error, on $\epsilon_r = 5.0$, height $= 2.4$ mm substrate.

(43) Input Characteristics of Tri-Plate Aperture Array Antenna, by K. Tsukamoto* and H. Arai** (*Telecommunication Products Dept., Packaging Materials Division, Matsushita Electric Works, Ltd., 1048, Kadoma-shi, 571 Japan; **Di-

vision of Electrical and Computer Engineering, Faculty of Engineering, Yokohama National University, Yokohama-shi, 240 Japan): (vol. J79-B-II, no. 1, pp. 26–32): *Trans. IEICE*, vol. E79-B, p. 93, Jan. 1996.

The calculation method of the characteristic impedance of a tri-plate flat antenna is presented. By assuming an infinite array and using the periodic boundary condition, we solved the periodic equations of the electromagnetic field both inside and outside of tri-plate waveguide. Calculation and measurement agreed well and we confirm the effectiveness of this approach. The resonant condition of probe length and input return loss are also explained by this method.

(44) An Analysis of Multimode Conical Horn Antennas with Flare-Angle Changes by Using Generalized Telegraphist's Equation, by H. Deguchi, M. Takabayashi, N. Miyahara, S. Makino, O. Ishida, and T. Katagi (Mitsubishi Electric Corporation, Kamakura-shi, 247 Japan): (vol. J79-B-II, no. 1, pp. 33–41): *Trans. IEICE*, vol. E79-B, p. 93, Jan. 1996.

In this paper, an analysis method based on generalized telegraphist's equation is presented for the multimode horn antennas with flare-angle changes. In order to obtain rigorous solutions, many modes were taken into account. The validity was confirmed by comparing between calculated and measured results. Also, a design method using this analysis is presented.

(45) Design and Fabrication of 94-GHz Slot Array Antennas, by H. Kobayashi and Y. Yasuoka (Dept. of Electronic Engineering, National Defense Academy, Yokosuka-shi, 239 Japan): (vol. J79-B-II, no. 1, pp. 53–60): *Trans. IEICE*, vol. E79-B, p. 94, Jan. 1996.

In this paper the slot array antenna for 94-GHz millimeter-wave radiation with parasitic slots are fabricated on the fused quartz substrates, making use of the dimensions obtained from the model experiments in the microwave region, and the power gain are obtained experimentally. The fabricated antenna shows the antenna pattern expected from the theory and improves the power gain by 5–6 dB compared with the single slot antenna. These improvement of the gain agree well with that obtained from the model experiments in the microwave region.

(46) Application of a Near-Field Measurement to the Characteristics Verification of a Polyhedron Approximated Antenna, by E. Hanayama*, S. Someya**, and T. Takano** (*Dept. of Electronic Engineering, The Polytechnic University, Sagamihara-shi, 229 Japan; **The Institute of Space and Astronautical Science, Sagamihara-shi, 229 Japan): (vol. J79-B-II, no. 2, pp. 117–126): *Trans. IEICE*, vol. E79-B, p. 209, Feb. 1996.

This paper describes the near-field measurement methods and relevant problems, and measurement results for the polyhedron approximated antenna with 60-cm diameter at 25.25 GHz. The used near-field measurement system is a polar-plane scanning type and can measure field components expressed by polar-coordinate, simultaneously. The reduction of the measurement points is investigated from the viewpoint of the scanning region and sampling intervals. The scanning region should cover at least the aperture to obtain accurate far-field patterns near the main lobe. The measurement points should be more than 30 and 36, in the radial and circumferential directions, respectively.

(47) Application of Planar Multibeam Array Antennas to Diversity Reception, by S. Mano, M. Kimata, N. Inagaki, and N. Kikuma (Faculty of Engineering, Nagoya Institute of Technology, Nagoya-shi, 466 Japan): (vol. J79-B-II, no. 3, pp. 176–184): *Trans. IEICE*, vol. E79-B, p. 434, Mar. 1996.

The properties of three-element multibeam array antennas are studied with regards to Rayleigh distribution environment by a computer simulation and indoor propagation environment by a measurement using a manufactured test antenna. The simulated and the measured results agreed well with each other, and the usefulness of the proposed system has been verified. The diversity gain at 1% cumulative distribution is estimated by the simulation to be about 10, 13, and 14.5 dB for two-, three-, and four-branch combinations, respectively. An addition of one more branch to four allows the diversity gain increase of less than 1 dB.

(48) Study of Shape Control for Modular Mesh Antenna, by M. Shimizu (NTT Wireless Systems Laboratories, Yokosuka-shi, 238-03 Japan): (vol. J79-B-II, no. 3, pp. 185–191): *Trans. IEICE*, vol. E79-B, pp. 434–435, Mar. 1996.

This paper describes a surface shape control scheme that uses back projection from pattern to measure the antenna surface, and micro motors are installed into the cablenetwork of a modular mesh antenna. The node positions of the antenna are obtained by back projection of the far-field pattern measured at ground stations. The cable network is designed to have low sensitivity so that local node position changes do not lead to overall changes. The result of tests show that the surface accuracy needed to achieve the required RF performance can be obtained automatically.

(49) Fan-Beam Forming for a Linear Antenna with Exponential-Tapered Amplitude Distribution, by Y. Konishi, M. Ohtsuka, M. Matsunaga, and S. Urasaki (Mitsubishi Electric Corporation, Kamakura-shi, 247 Japan): (vol. J79-B-II, no. 3, pp. 192–199): *Trans. IEICE*, vol. E79-B, p. 435, Mar. 1996.

In this paper, authors investigate fan-beam forming method for a linear antenna with exponential-tapered amplitude distribution such as a traveling-wave linear antenna like a multifilar helical antenna or a traveling-wave-fed linear array antenna. First, the authors obtain some equations in order to achieve a desired fan-beam radiation pattern. Next, they investigate the relationships between coverage gain and antenna length L_T. Furthermore, the authors demonstrate a fan-beam forming experiment by using a bifilar helical antenna.

(50) Characteristics of Slot Coupling in Dielectric Loaded Radial Line Slot Antenna, by K. Ito, J. Takada, Y. Okano, and M. Maeda (Faculty of Engineering Chiba University, Chiba-shi, 263 Japan): (vol. J79-B-II, no. 4, pp. 264–267): *Trans. IEICE*, vol. E79-B, p. 618, Apr. 1996.

This paper proposes a small slot antenna installed in the band of a wrist watch-type pager. The radiation characteristics were measured and calculated for cylindrical and flat shapes, and the peak gain was as high as -14 dBd. The effect of the antenna size was also studied.

(51) A Circularly Polarized Broadband Rhombic Loop Antenna, by H. Morishita*, K. Hirasawa**, and T. Nagao* (*Dept. of Electrical and Engineering, National Defense Academy, Yokosuka-shi, 239 Japan; **Institute of Information Science and Electronics, University of Tsukuba, Tsukuba-shi, 305 Japan): *Trans. IEICE,* vol. E79-B, pp. 865–870, June 1996.

A broadband rhombic loop antenna is introduced to radiate a circularly polarized wave. This antenna has a single feed and is located above a ground plane. By adjusting a perimeter and a gap position of the loop, circular polarization is obtained. In addition, with the appropriate vertex angle of the rhombus, the bandwidth of about 20% for the axial ratio ($\leq$2 dB) is attained and the possibility of controlling the input impedance is found. Finally, it is observed that the sense of circular polarization can be changed easily from left-hand to right-hand, and vice versa by switching one gap position to the other on the rhombic loop.

(52) Synthesis of Microstrip or Coaxially FED Rectangular Patch Antennas, by D. Thouroude, M. Himdi, and J. P. Daniel (Laboratoire Antennes et Reseaux, URA 834 CNRS, Universite de Rennes I, 35042 Rennes Cedex, France): *Trans. IEICE,* vol. E79-B, pp. 871–874, June 1996.

A cavity model well suited for computed-aided design is developed to synthesize the dimensions of patches for a given resonant frequency, an input resistance, and a substrate. The antennas which have been investigated are rectangular patches fed with either a microstripline or a coaxial probe.

(53) Antenna Pattern Measurement of S-Band Active Phased Array on ETS-VI, by M. Tanaka, Y. Matsumoto, S. Yamamoto, K. Suzuki, and Y. Arimoto (Communications Research Laboratory, Ministry of Posts and Telecommunications, Koganei-shi, 184 Japan): (vol. J79-B-II, no. 7, pp. 381–388): *Trans. IEICE,* vol. E79-B, p. 984, July 1996.

Antenna pattern measurement of the on-board S-band active multibeam phased-array antenna making use of the spin of the Japanese Engineering Test Satellite-VI (ETS-VI) is presented. The ETS-VI failed to reach a geostationary orbit, and was then sent into an elliptical orbit. We conducted measurements in the spin mode before the ETS-VI started to establish three-axis attitude stabilization in this elliptical orbit.

(54) Detection-Estimation in Sensor Arrays without Eigendecompositions, by A. Klouche-Djedid* and R. Miura**† (*ATR Adaptive Communications Research Laboratories, Kyoto-fu, 619-02 Japan; **ATR Optical & Radio Communications Research Laboratories, Kyoto-fu, 619-02 Japan; †Presently, with Communications Research Laboratories, Ministry of Posts and Telecommunications): *Trans. IEICE,* vol. E79-B, pp. 1147–1155, Aug. 1996.

In this paper, a trade-off between accuracy and computational load is accomplished through a simplified algorithm which instead of eigendecompositions, uses the robust QR decomposition for which many efficient parallel (systolic, wavefront array) implementations exist. First, a simple detection scheme is presented and, through simulations, is shown to work very well for sufficient SNR, even when signals are coherent. Extensive simulations are performed assuming different scenarios of variations in SNR DOA's, leading to discussions on the possibilities and limitations of the proposed solution.

(55) Adaptive Noise Subspace Processing for Direction Finding in Sensor Arrays, by A. Klouche-Djedid (ATR Adaptive Communications Research Laboratories, Kyoto-fu, 619-02 Japan): *Trans. IEICE*, vol. E79-B, pp. 1165–1172, Aug. 1996.

Some adaptive methods are presented showing that an indirect noise-subspace estimation through a signal subspace estimation can be advantageous both in terms of convergence rate and computation complexity during each update. Some computer simulations examples showing performances are provided.

(56) Self-Beam Steering Array Antenna by Digital Beam-Forming for Mobile Satellite Communications, by R. Miura, I. Chiba, T. Tanaka, and Y. Karasawa (ATR Optical & Radio Communications Research Laboratories, Kyoto-fu, 619-02 Japan): (vol. J79-B-II, no. 8, pp. 448–458): *Trans. IEICE,* vol. E79-B, p. 1175, Aug. 1996.

This paper provides a self-beam steering algorithm for directive pattern control in mobile satellite communications systems made possible by digital beam-forming technique. This algorithm allows fast acquisition and stable tracking toward the direction of arrival by means of feedforward equal-gain or maximal-ratio combining of base-band signals detected in the branches of the antenna elements. This paper discusses the performance of this algorithm as evaluated by computational simulation with a QPSK band-pass signal in a mobile environment.

(57) A Double-Layer Dipole Array Polarizer for Planar Antenna, by H. Uchida, K. Sakurai, M. Ando, and N. Goto (Faculty of Engineering, Tokyo Institute of Technology, Tokyo, 152 Japan): (vol. J79-B-II, no. 8, pp. 459–468): *Trans. IEICE,* vol. E79-B, p. 1175, Aug. 1996.

A double-layer dipole array polarizer is designed for planar antenna application. Circular-to-linear polarization conversion with XPD more than 20 dB and the insertion loss less than 0.3 dB is realized in 12-GHz band. Total thickness of polarizer is reduced to about 1/10 wavelength, which is 20% of that for the conventional triple-layer polarizer. Minimum spacing to the planar array is predicted and confirmed experimentally.

(58) Beam Tilted Coupled Loop Antennas, by K. Nakada and H. Arai (Faculty of Engineering, Yokohama National University, Yokohama-shi, 240 Japan): (vol. J79-B-II, no. 8, pp. 469–475): *Trans. IEICE,* vol. E79-B, p. 1176, Aug. 1996.

This paper proposes beam-tilted loop antennas for the built in the roof, because the roof plane is on the slant in most cases. Two beam tilted loop antenna to receive vertical and horizontal polarization are analyzed by the moment method, and are also optimized for this application. The input characteristics and the radiation pattern are verified by the experiments.

(59) Characteristics of Dual-Polarized Flat Antenna, by K. Tsukamoto* and H. Arai** (*Telecommunication Products Dept., Packaging Materials Division, Matsushita Electric Works, Ltd., Kadoma-shi, 571 Japan; **Faculty of Engineering, Yokohama National University, Yokohama-shi, 240 Japan): (vol. J79-B-II, no. 8, pp. 476–485): *Trans. IEICE,* vol. E79-B, p. 1176, Aug. 1996.

Regarding the dual-polarized flat antenna, its Green's function are described as a periodic function and are presented

by considering the periodicity of array structure of multilayer antenna, which is consisted from two kinds of tri-plate antenna being disposed orthogonally. And the impedance characteristics of feeding probe, which is coupled to the radiation element electro-magnetically, is analyzed rigorously including the effect of printed circuit board suspending the probe. By comparison between measured data and calculated data, we verified this approach, and we analyzed the impedance matching condition and input return loss of this sort of flat antenna.

(60) Low Sidelobes for Radial Line Slot Antennas, by M. Takahashi, Y. Nakagawa, and M. Abe (Dept. of Electronic and Communication Engineering, Musashi Institute of Technology, Tokyo, 158 Japan): (vol. J79-B-II, no. 9, pp. 535–541): *Trans. IEICE,* vol. E79-B, p. 1407, Sept. 1996.

A radial line slot antenna (RLSA) is a slotted waveguide planar array proposed for DBS subscriber antennas. This paper presents a basic design and measured performances of the low sidelobes RLSA. The first sidelobes level of less than -25 dB and the antenna efficiency of 65% is realized.

(61) Beam-Switched Planar-Array Antenna for Mobile Communications, by N. Kuga and H. Arai (Faculty of Engineering, Yokohama National University, Yokohama-shi, 240 Japan): (vol. J79-B-II, no. 9, pp. 542–548): *Trans. IEICE,* vol. E79-B, p. 1408, Sept. 1996.

In this paper, we present a novel low-profile antenna element and a modified array concept. Improved antenna performances, including four beam switching, are confirmed experimentally. Antenna characteristics such as eigenvalue and quality factor are verified using the cavity resonator model with the two-dimensional finite-element method. It is also shown that radiation pattern of the array antenna can be predicted using the magnetic line current model neglecting mutual coupling.

(62) Moment Method Analysis of Antennas Composed of Conducting Wires and Plates, by H. Ochi*, E. Yamamoto*, Q. Chen**, and K. Sawaya** (*Central Research Laboratory, Hitachi Ltd., Kokubunji-shi, 185 Japan ; **Dept. of Electrical Communications, Faculty of Engineering, Tohoku University, Sendai-shi, 980 Japan): (vol. J79-B-II, no. 9, pp. 566–573): *Trans. IEICE,* vol. E79-B, p. 1409, Sept. 1996.

In applying the moment method to the antennas having conducting wire/surface junctions, the radial surface segment is necessary to expand the current on the junction. However, it is not able to analyze antennas whose dimension of the surface is smaller than 0.2λ, because the dimension of the radial surface segment has to be chosen to be greater than 0.2λ. In this paper, a method to overcome the above problem by introducing a joint patch segment is proposed. Numerical results for the input impedance of antennas are compared with measured data confirming the validity of the proposed method.

(63) An Analysis of Linear Antenna System as Multi-Port Nonlinear Circuit, by S. Ichikawa and Y. Nakamura (Division of Electrical Engineering, Graduate School of Engineering, Kyoto University, Kyoto-shi, 606-01 Japan): (vol. J79-B-II, no. 9, pp. 600–607): *Trans. IEICE,* vol. E79-B, p. 1410, Sept. 1996.

In this paper we present an analytical method to obtain steady-state response of nonlinearly loaded linear antenna system with respect to EMC and EMI problems. The problem has been incorporated with the analysis of susceptibility or immunity of electric devices in electromagnetic environment. Theoretical studies based on the Volterra model have been reported but the method is very complicated. We show efficient numerical method based on nonlinear steady state response method that gives equivalent result via Volterra model.

(64) Power Analysis on Triplate-Type Slot-Coupled Microstrip Antenna, by M. Yamamoto and K. Itoh (Faculty of Engineering, Hokkaido University, Sapporo-shi, 060 Japan): (vol. J79-B-II, no. 9, pp. 632–635): *Trans. IEICE,* vol. E79-B, p. 1411, Sept. 1996.

In this paper, we show the effect of the guided-wave modes on the power characteristics of the triplate-type slot-coupled microstrip antenna using spectral domain approach. Also we show the relation between the behavior of the radiant element and the power characteristics.

(65) A Circularly Polarized Omnidirectional Antenna, by K. Sakaguchi*, T. Hamaki**, and N. Hasebe*** (*College of Industrial Technology, Nihon University, Narashino-shi, 275 Japan; **Space Development Division NEC Corporation, Yokohama-shi, 226 Japan; ***College of Science and Technology, Nihon University, Funabashi-shi, 274 Japan): *Trans. IEICE,* vol. E79-B, p. 1704–1715, Nov. 1996.

To understand the radiation characteristics of the proposed antenna, an approximation theory using the induced electromotive force method is introduced. As an example, using a fixed spacing of a quarter wavelength between the vertical dipole and the parasitic elements, the possibility of generating circular polarization is examined. Then the computational results of the axial ratio and the input impedance are compared with the results of the numerical analysis using the moment method and the experimental result. From the experimental results, the proposed antenna has a gain of 2 dBi and 3-dB bandwidth with an axial ratio of about 8%.

(66) Reflector Design and Radiation Characteristics of a Small Aperture Multibeam Antenna, by A. Kondo and K. Kagoshima (NTT Wireless Systems Laboratories, 1-2356 Take, Yokosuka-shi, 238-03 Japan): (vol. J79-B-II, no. 11, pp. 901–908): *Trans. IEICE,* vol. E79-B, p. 1722, Nov. 1996.

This paper describes a new reflector-synthesis technique of a small aperture multifocal multibeam antenna. It was found that N-element-parabola reflectors which have different center-axes are tangential at the single point. A reflector-synthesis technique is established, in which a small aperture multibeam antenna is synthesized by adding weighted element-parabolas. It was clarified that this reflector-design is valid by designing and manufacturing a three-focal antennas and confirming the agreement between theoretical and experimental values.

(67) Design of a Dual Beam antenna Used for Base Station of Cellular Mobile Radios, by Y. Ebine and M. Ito (NTT Mobile Communications Network Inc. 1-2356 Take, Yokosuka-shi, 238-03 Japan): (vol. J79-B-II, no. 11, pp. 909–916): *Trans. IEICE,* vol. E79-B, p. 1722, Nov. 1996.

In this paper, we design a dual beam antenna (DBA) used for the base station of land mobile radios. The DBA of $60°$ beam width in the horizontal plane is composed of a main and sub reflectors with two radiators connected by a hybrid circuit.

The radiation patterns of the DBA are analyzed by moment methods using a wire grid model. It is clarified that the antenna parameters (width of the radiator, space to the radiator, space to the reflector and the radiator, and the parasitic element) are optimized as for the beam width and the side lobe level, respectively.

(68) A Study on Design of Cavity-Backed Slot Antennas Using the Finite-Difference Time-Domain Technique, by N. Ohno, K. Horiguti, M. Omiya, and K. Itoh (Faculty of Engineering, Hokkaido University, Sapporo-shi, 060 Japan): (vol. J79-B-II, no. 11, pp. 917–924): *Trans. IEICE*, vol. E79-B, p. 1723, Nov. 1996.

A cavity-backed slot antenna is thought to be one of the most suitable elements for microwave power transmission. A design technique is developed for the cavity-backed slot antenna with the finite-difference time-domain (FDTD) method. The technique is effective to characterize antenna performance such as the input impedance and the far-field pattern since it takes account the geometry of a feeder as well as the cavity. In the paper we give a way to overcome difficulties when we use the FDTD method to design the antenna. Moreover, we discuss how to determine parameters used in the FDTD analysis.

(69) Sinuous Array Antenna Feeds with Randomized Coupling Intervals to Disperse Multi-Reflection Phase, by M. Miyazaki*, Y. Isota**, N. Takeuchi**, and O. Ishida* (*Electro-optics and Microwave Systems Laboratory, Mitsubishi Electric Corporation, Kamakura-shi, 247 Japan ; **Communication Equipment works, Mitsubishi Electric Corporation, Amagasaki-shi, 661 Japan) (vol. J79-C-I, no. 6, pp. 189–195): *Trans. IEICE*, vol. E79-C, p. 875, June 1996.

A broadband sinuous array antenna feeds with randomized coupling intervals is developed. A method to disperse the multireflection between couplers, using the uniform random number, is presented. It is shown theoretically and experimentally that the best extent of interval shifts between couplers is a quarter-wavelength for the minimum S-band. And the VSWR less than 1.5 is obtained over the 25% frequency band.

(70) Consideration on Gain of Leaky-Wave Antennas, by E. Akashi and T. Yoneyama (Research Institute of Electrical Communication, Tohoku University, Sendai-shi, 980-77 Japan) (vol. J79-C-I, no. 6, pp. 196–198): *Trans. IEICE*, vol. E79-C, p. 875, June 1996.

Gain of leaky-wave antennas are investigated in terms of the leakage constant. As a result, leaky-wave antennas with uniform illumination can be superior in gain to those with exponential illumination provided that the leakage constant exceeds a certain critical value.

(71) Emission and Detection of Terahertz Electromagnetic Wave by Integrated Photoconductive Dipole Antennas, by N. Sekine, F. Sogawa, K. Hirakawa, and Y. Arakawa (Institute of Industrial Science, University of Tokyo, Roppongi 7-22-1, Tokyo, 106 Japan) (vol. J79-C-I, no. 11, pp. 446–447): *Trans. IEICE*, vol. E79-C, p. 1629, Nov. 1996.

We have grown a low-temperature GaAs on a semi-insulating GaAs substrate and integrated photoconductive dipole antennas on both sides of the wafer. The emission and detection properties of terahertz (THz) electromagnetic wave was characterized by the pump-probe method with femtosecond laser pulses. It is found that the detective sensitivity of the present integrated antenna structure is 2.5 times larger than that of the conventional separate antenna structure. The THz radiation spectra expected from the antenna geometry has been obtained with simple optics.

IV. Microwave/Lightwave Propagation and Scattering

(1) Radio Ground Wave Monitoring of lake Salinity, by R. M. Thomas (High Frequency Radar Division, Defence Science and Technology Organization, PO Box 1500, Salisbury SA 5108, Australia): *JEEE*, vol. 16, pp. 147–153, June 1996.

This paper reports an extended series of trial measurements of the salinity of Lake Alexandrina, at the mouth of the Murray River in South Australia, over an interval of almost two years, using the frequency-dependent ground wave loss technique. Each measurement provided a single "average" value of salinity over the propagation path. Excellent agreement was obtained with conventional laboratory measurements on water samples taken from an adjacent point of the lake at almost the same time.

(2) A New Mathematical Method for the Exact Evaluation of the Conditional Cochannel Interference Probability in Cellular Mobile Radio System, by G. K. Karagiannidis, C. J. Georgopoulos, and S. A. Kotsopoulos (University of Patras, Dept. of Electrical and Computer Engineering, Rion GR-261 10 Patras Greece): *JEEE*, vol. 16, pp. 185–192, June 1996.

In this paper, a new mathematical method is presented suitable for the exact evaluation of the outage probability of this type of interference under specific considerations concerning the existing mobile's propagation environment. Using this prototype method, a high level of probabilities accuracy is obtained, especially in the worst cases where the received signal is degraded due to the presence of radio-shadowing phenomena.

(3) A Review of EMI Problems in Switch-Mode Power Supply Design, by M. K. W. Wu and C. K. Tse, MIEAust (Dept. of Electronic Engineering, Hong Kong Polytechnic University, Hong Kong): *JEEE*, vol. 16, pp. 193–204, June 1996.

Switch-mode power supplies (SMPS's) have rapidly gained popularity in recent years because of their high efficiency and relatively small size and weight. Although SMPS's may not be operated at a very high frequency, the associated square pulses are full of high-frequency components that may cause electromagnetic interference (EMI) to other electronic products. Methods have been derived to reduce interference, such as snubbering, filtering, and spreading switching spectrum. This article gives a review on the various aspects of EMI problems related to the design of SMPS's and in particular discusses the sources and victims of interference and some controlling methods.

(4) A New propagation Model to Explain Trans-Horizon Communication, by A. K. Verma and K. K. Jha (Defense Electronics Applications Laboratory, Raipur Road, Dehradn 248 001, India): *JIETE*, vol. 42, pp. 41–46, Jan.–Feb. 1996.

The characteristic of troposphere play an important role for trans-horizon communication of radio signal. This paper proposes a propagation model to predict path loss, which is

the sum of free-space loss, diffraction loss, reflection loss, and thermal lens loss. The role of thermal lenses under the desert and equatorial climates for the normal and worst month conditions has been discussed. This model is useful during the design of VHF/UHF communication links for reliable operation in the different climatic conditions.

(5) Analytical Theory to Reflection of Electromagnetic Waves from Inverse Square Profile, by T.-J. Cui and C.-H. Liang (Xidian University, Xi'an, P.R.C.): *AES*, vol. 24, pp. 1–4, Mar. 1996.

The reflection of electromagnetic waves from inhomogeneous medium with a special profile is investigated. The function form of the spectral profile, an inverse square profile, is derived using a matrix analysis theory, and the reflection coefficient in closed form is given by simple elementary functions.

(6) Numerical Calculation of Diffraction Coefficient for Conducting Edge Coated by Absorbing Material, by D.-B. Ge and Z.-W. Zhu, (Xidian University, Xi'an P.R.C.): *AES*, vol. 24, pp. 27–31, Mar. 1996.

A numerical method for determining diffraction coefficient for edge of half-infinite metallic plate is described. The (FDTD) method is used to compute the scattered field of an object possessing several scattering centers. The numerical diffraction coefficient of the scattering center under investigation is then isolated by solving simultaneous equations established based on GTD consideration.

(7) Study of the Backscattering Polarization Characteristic of Finite Cone, by J.-X. Zhao, G.-X. Fu, and C.-L. Lin (University of Electronic Science and Technology of China, Chengdu, P.R.C.): *AES*, vol. 24, pp. 68–70, Mar. 1996.

Based on the uniform geometrical theory of diffraction, the equivalent current has been used to calculate the backscattering field for the finite cone, then the scattering matrix including information of polarization has been obtained. The optimized state of scattering polarization is counted out through energy-scattering matrix.

(8) Computation of Electromagnetic Scattering from Transversally Anisotropic Cylinders Using FD-MEI, by Z.-N. Chen, W. Hong, and W.-X. Zhang (Southeast University, Nanjing, P.R.C.): *AES*, vol. 24, pp. 1–4, Sept. 1996.

The difference equation with nine-point mesh of electromagnetic scattering from two-dimensional transversally anisotropic medium is derived. The measured equation of invariance and the difference equation are used to analyze electromagnetic scattering from transversally anisotropic medium cylinders with arbitrary section, inhomogeneous, lossy, and general electromagnetic parameters. Some results obtained for canonical anisotropic structures are given.

(9) Derivation of Numerical Diffraction Coefficient of the Wedge Characterized by Fractal Surfaces, by D.-B. Ge, Z.-W. Zhu, Q.-Z. Zhou, and Y.-L. Zhou (Xidian University, Xi'an, P.R.C.): *AES*, vol. 24, pp. 10–13, Sept. 1996.

The numerical method for derivation of diffraction coefficients of Wedge characterized by fractal surfaces is obtained. FDTD method is used to compute the scattered field of an object possessing several scattering centers. The numerical diffraction coefficient of the scattering center under investigation is then obtained by solving simultaneous equations established via GTD consideration. The examples show the feasibility of the present method.

(10) The Propagational Characteristics of Guided Waves in Inhomogeneous Bianisotropic Parallel-Plate Waveguides, by W.-Y. Yin, W. Wan, and W.-B. Wang (Xi'an Jiaotong University, Xi'an, P.R.C.): *AES*, vol. 24, pp. 29–33, June 1996.

By using the methods of eigenmode expansion and mode-matching, the field distribution and the dispersion equations of hybrid modes in an inhomogeneous biaisotropic parallel-plate waveguide are derived. The effects of the geometrical and constitutive parameters of bianisotropic media on the transmission coefficients of lower-order propagating mode are investigated.

(11) UTD Solution for Electromagnetic Scattering by a Circular Cylinder with Impedance Boundary, by J.-M. Xiao, X.-W. Wu, and C.-H. Ling (Xidian University, Xi'an, P.R.C.): *JCIC*, vol. 17, pp. 108–113, Jan. 1996.

The electromagnetic scattering mechanism of a two-dimensional impedance cylinder is investigated and the equivalent formats between a perfectly conducting cylinder, a dielectric coated cylinder and a impedance cylinder are given. A UTD solution is obtained for electromagnetic scattering by these circular cylinders, and several numerical examples are presented.

(12) The Optimum Design of the Relation between the Sensitivity and the Resolution of Synthetic Aperture Radiometers, by J. Lu, Z.-Y. Zhang, S.-J. Lin, and T.-X. Huang (HuaZhong University of Science and Technology, Wuhan, P.R.C.): *JCIC*, vol. 17, pp. 131–136, Mar. 1996.

This paper gives the expressions for the sensitivity a synthetic aperture microwave radiometer, and presents an optimum design method for the sensitivity and resolution. The relation between the sensitivity and the resolution is also analyzed and designed with an example. Some important conclusions are established.

(13) Scattering Analysis of Irregular Terrain by the Measured Equation of Invariance, by J. Chen and W. Hong (Southeast University, Nanjing, P.R.C.): *JCIC*, vol. 17, pp. 124–129, July 1996.

Scattering by the inhomogeneous irregular terrain is analyzed by the MEI method. The surface of the terrain is considered as the impedance surface around which the discretizations are made conformably. The truncation is much more close to the surface. Thus the memory requirement is saved dramatically to enable the PC to deal with terrain of electrically large dimension practically. The dimension involved is up to 180 wavelengths.

(14) Computation and Analysis of RCS and Creeping Wave Modes for a Lossy Material Coated Cylinder, by X.-L. Wang, Y.-C. Feng, L.-Y. Shen, and X.-M. Qing (University of Electronic Science and Technology of China, Chengdu, P.R.C.): *JAS*, vol. 14, pp. 295–299, Sept. 1996.

The RCS of a lossy material coated conducting cylinder has been computed and analyzed, and a numerical method for computing creeping wave propagation constants and amplitudes on the surface of the cylinder is presented. On the surface of a conducting cylinder, the defect of low precision for creeping

wave propagation constants obtained by Keller's formulas at low frequency is overcome by the method. Propagation constants and amplitudes of creeping wave current modes on the surface of a lossy material coated conducting cylinder, which are hardly obtained by GTD, have been resolved.

(15) Nonlinear Time-Domain Optimization of Two-Dimensional Lossless Dielectric Inhomogeneity Profile Reconstruction, by W.-H. Yu, Z.-Q. Peng (Beijing University of Technology, Beijing, P.R.C.), and L. Ren (Southeast Jiaotong University Chengdu, P.R.C.): *JAS*, vol. 14, pp. 141–148, Mar. 1996.

The Born iterative method is used to solve the nonlinear inverse scattering problem for two-dimensional dielectric inhomogeneity using time-domain data; three-order difference regularization is applied to improve the inversion process, and a general selecting regularization parameter is developed.

(16) The Calculation of the Scattering Field Produced by a Crescentlike Conductor Under HF Approximation and the Contour Projection, by M.-Y. Zhang and K.-Y. Feng (Institute of Electronics, Academia Sinica, Beijing, P.R.C.): *JE*, vol. 18, pp. 620–626, Nov. 1996.

The calculation of the scattered far-zone EM field produced by a crescentlike three-dimensional conductor under HF approximation is studied. The equivalent surface current distributions used in the calculation are obtained from the physical optics and Fock's theory. To take account of the contribution of the edge, a line distribution of charge along it is introduced. The calculated field data are applied to reconstruct the contour projections of the scatterer successfully.

(17) Application of B-Spline in Reconstruction of 2-D Conductor Cross-Section, by C.-Y. Yu, X.-L. Dong and W.-B. Wang (Xi'an Jiaotong University, Xi'an P.R.C.): *JE*, vol. 18, pp. 501–507, Sept. 1996.

B-spline is applied to the reconstruction of 2-D conductor cross section via backscattered field in near region illuminated by plane waves with different incident directions. The whole inverse problem may be viewed as a two-stage optimal procedure, and the optimal algorithm based on gradient, such as BFGS algorithm, is adopted as the gradient of the objective functions which may be derived by using Frechet differential. The position and the radius of optimal circular cylinder are obtained, then with the above results as its initial values the shape of 2-D cylinder can be reconstructed.

(18) Study on Passive Microwave Remote Sensing of Sea-Surface Oil Pollution, by Z.-D. Lei, L. Wang and S.-R. Zhang (Huazhong University of Science and Technology, Wuhan, P.R.C.): *JE*, vol. 18, pp. 496–500, Sept. 1996.

By using the model of ail-oil film-sea system, the influences of the oil thickness, operating frequency of the radiometer, and the incidence angle of the beam on the effective emissivity are calculated and analyzed. The optimal scheme for passive microwave remote sensing of sea-surface oil pollution is also proposed and used successfully for airborne microwave remote sensing experiments.

(19) A General Formula of Unrelated Illumination Method for the EM Inverse Scattering Problem, by W.-Y. Wang and S.-R. Zhang (Institute of Electronics, Academia Sinica, Beijing, P.R.C.): *JE*, vol. 18, pp. 413–421, July, 1996.

On the basis of the unrelated illumination method (UIM), the paper derived a general formula that is suitable for solving the electromagnetic inverse problem, for which the object to be reconstructed may be expanded in various set of orthogonal bases. The uniqueness of the solution has been proved.

(20) The Generalized Multipole Technique for Perfectly Conducting Cylinders with Sharp Edges, by C.-H. Cheng and K.-S. Chen (Zhejiang University, Hangzhou, P.R.C.): *JE*, vol. 18, pp. 322–326, May, 1996.

The principle of the generalized multipole technique (GMT) is studied, and the cause is discovered that the technique can be applied to perfectly conducting scatterers with sharp edges. Then a new method, combining GMT with finite difference technique, is proposed. Using the new method, the scattering from sharp edges can be analyzed effectively.

(21) Numerical Simulation of Time-Domain EM Scattering by Shallow Subsurface Objects, by G.-Y. Fang, Z.-Z. Zhang, and W.-B. Wang (China Research Institute of Radiowave Propagation, Xinjiang, P.R.C.): *JE*, vol. 18, pp. 276–283, May 1996.

The time-domain electromagnetic (EM) scattering by buried objects in dispersive media are deduced, and the absorbing boundary condition is given. The validity of FD-TD method in lossy media is verified through comparing the FD-TD's result and other one. The propagation of transient pulses in dispersive media is studied in detail. The scattering pulses and the wiggle traces for typical buried objects are given.

(22) Radar Cross-Section of Simply Face-Shaped Targets and Their Physical Similarity, by Z.-O. Shi and H.-W. Liu (University of Electronics Science and Technology of China, Chengdu, P.R.C.): *JE*, vol. 18, pp. 90–94, Jan. 1996.

A general representation for the radar cross section of simply face-shaped scattered with variance in these parameters is given. With this representation, the radar cross section of prototype of this scatterer can be evaluated by means of model-testings, even though the scaling relations between the prototype and the models are not satisfied.

(23) The Application of Nonorthogonal ED-TD Algorithm in 2-D TM Scattering Problems of Conducting Cylinders Coated With Absorbing Materials, by Y-S. Zhang, J. Fang, and W.-B. Wang (Xi'an Jiaotong University, Xi'an, P.R.C.): *JE*, vol. 18, pp. 44–49, Jan. 1996.

The foundational principle of the nonorthogonal FD-TD algorithm is introduced, and its stability condition and dispersion equation are derived. The numerical dispersion characteristics of this method are analyzed in detail. The scattering surface currents of perfectly conducting cylinder are calculated by using this method when the incident wave is sinusoidal plane wave in TM case. The TM scattering problem of polygon cylinder coated with absorbing material is studied and the monostatic RCS of the target is obtained. The electric scattering distribution pattern of square cylinder coated with absorbing material is also obtained by using nonorthogonal FD-TD.

(24) Solution of Transient Scattering using Unified Near-Zone to Far-Zone Field Transformation, by J.-F. Ma and B.-Q. Gao (Beijing Institute of Technology, Beijing, P.R.C.): *JM*, vol. 12, pp. 247–252, Dec. 1996.

A unified solution for both 2-D and 3-D scattering problems are presented by using Lapace Transformation and convolution technique, which makes 2-D problem a special case of 3-D problems. It provides convenience for programming to obtain time-domain scattered far-field. Compared with previous near-zone to far-zone transformation method, no additional computation effort is needed in this method.

(25) A Study on Electromagnetic Scattering from Two Adjacent Objects, by S.-Q. Li, J. Fang, and W.-B. Wang (Xi'an Jiaotong University, Xi'an, P.R.C.): *JM*, vol. 12, pp. 163–168, Sept. 1996.

The problem of electromagnetic scattering from two adjacent objects is considered. The integral expressions for scattered fields including the second-order scattering terms are given based on the reciprocity theorem. The closed-form solutions are derived for two adjacent cylinders and the forward scattering characteristics are calculated. The results of second-order solutions agree well with the numerical results based on the moment method.

(26) Transient Scattering by Nth-order Dispersive Media, by W.-J. Zhang, M.-Y, and C.-F. Xie (Shanghai University, Shanghai, P.R.C.): *JM*, vol. 12, pp. 9–14, Mar. 1996.

The FDTD method modified by z-transform for the study of transient scattering of the Nth-order dispersive media is proposed. The reflection coefficient of also good agreement has been seen the Nth-order dispersive media interface is calculated and with the known analytical results. The transient scattering fields of the Nth-order diapersive cylinder coated with conductor are calculated.

(27) Analysis of Electrically Large Conducting Cylinder Coated with Inhomogeneous Anisotropic Media, by J. Chen and W. Hong (Southeast University, Nanjing, P.R.C.): *JM*, vol. 12, pp. 1–8, Mar. 1996.

Finite difference equation for curved meshes filled with anisotropic inhomogeneous media is derived. The MEI equation is applied to the truncation boundary, which makes the truncation boundary very close to the scattering surface, thus reducing the memory requirements and saves CPU time compared with the MoM. The circumference of the cylinder calculated on the PC accesses 120 wavelengths, which is almost impossible to deal with by other methods.

(28) Analysis of Microstrip Line on Anisotropic Substrate in the Spectral Domain, by S. Y. Rhee*, Y. H. Lee**, S. G. Park***, and H. K. Park**** (*Dept of Elec. Comm., Yeosoo Susan Univ., Yeosoo, Korea; **Dept of Radio Sci. and Eng., Honam Univ., Kwangju, Korea; ***Dept. of Info. and Comm. Eng., Kongjoo Univ., Kongjoo, Korea; ****Dept. of Radio. Sci. and Eng., Yonsei Univ., Seoul, Korea): *JKICS*, vol. 2, no. 1, pp. 206–213, Jan. 1996.

The spectral-domain has been applied to an analysis of an open microstrip line on a dielectrically biaxial anisotropic substrate. Numerical results of propagation characteristics are validated for special dielectrically weak anisotropic cases (sapphire, Epsilon-10) and for dielectrically tight anisotropic case $(LiNbO_3)$.

(29) A Spectral Inverse Scattering Technique by Using the Moment Method with Series-Expanded Basis Function: Noise Effect, by H. C. Choi*, S. Y. Kim**, and J. W. Ra*** (*Dept. of Elec. Eng., Kyungpook Univ., Taegu, Korea; **KIST, Seoul, Korea; ***Dept. of Elec. Eng., KAIST, Taejon, Korea): *JKICS*, vol. 2, no. 1, pp. 214–223, Jan. 1996.

Noise effects on image profiles reconstructed by the spectral inverse scattering technique is studied based on moment method with series-expanded basis function. It is found that the Fourier series expansion of the field distribution and the averaging of the reconstructed profile in each enlarged cell provide an effective tool for the reduction of noise effects.

(30) A Study on the Electromagnetic Field Distributions in a W-TEM Cell Having Wire Array as an Inner Conductor, by M. H. Kim and J. G. Rhee (Dept. of Elec. Eng., Hanyang Univ., Seoul, Korea): *JKICS*, vol. 21, no. 6, pp. 1576–1586, June 1996.

We analyze a Wire-TEM cell (W-TEM cell) which has an inner wire array rather than a metallic septum, and their resultant integral equations are numerically analyzed by moment method. It is also shown that the EM field distortions resulting from loading by the conducting objects under test (loading effects) decrease considerably. This paper also deals with the investigations about relationship between the EM field distributions and the number of wire composing the inner conductor. Finally, the experimental analysis is performed on the practical model which is built on the basis of the design variables.

(31) An Angular Spectral Inverse Scattering Technique with Series-Expanded Field in Dielectric Object, by H. C. Kim*, H. Son**, and H. C. Choi** (*Dept. of Elec. Naval Academy, Jinhae, Korea; **Dept. of Elec. Eng. Kyungpook Univ., Taegu, Korea): *JKICS*, vol. 21, no. 5, pp. 1317–1324, May 1996.

The angular spectral inverse scattering using the pulse basis function for the large scatterer has the ill-posedness due to the input data of higher spectra. To reduce the number of higher spectra, enlarging the cell size and averaging over the cell with a suitable weighting function are found to play important roles for the reduction of ill-posedness of the angular spectral inverse scattering problems.

(32) Experimental Analysis of Radio Propagation Delay Characteristics in Urban Microcells, by S. W. Park*, W. Y. Kwak**, and J. W. Park*** (*Hansol Research Ins. of Tele., Korea; **Elec. Comm. Inst. of LG Elec., Korea; ***Dept. of Elec. Eng., Korea Univ., Seoul, Korea): *JKICS*, vol. 21, no. 9, pp. 2494–2504, Sept. 1996.

This paper describes the spread spectrum radio measurement system and the experimental analysis of 2-GHz radio wave propagation characteristics in urban microcells. The typical results obtained in Seoul are 300–600 ns of mean excess delay and about 75 ns of averaged RMS delay spread for LOS area, and 270–780 ns of mean excess delay and about 100 ns for N-LOS area. With the transmitting antenna tilted, observed in the experiments are increase in rms delay spread as expected, but increase of the received power at N-LOS areas in particular.

(33) Off-Bragg Blazing of Strip Grating over a Grounded Dielectric Slab, by J. N. Lee*, U. H. Cho*, L. H. Yun*, J. P. Hong**, J. T. Park***, Y. K. Cho*, and H. Son* (*Dept. of Elec. Eng., Kyungpook Univ., Taegu, Korea; **Dept. of Elec. Eng. Kyungpook Sanup Univ., Taegu, Korea;

***Changshin College, Masan, Korea): *JKITE*, vol. 33-A, no. 10, pp. 2032–2039, Oct. 1996.

A numerical method for scattering from a periodic strip grating over a grounded dielectric slab is considered for TE and TM polarization cases from the viewpoint of both reflection grating problem and leaky wave antenna problem. The relationship between complex propagation constant from the viewpoint of leaky wave antenna problem and off-Bragg and Bragg blazing phenomena from the viewpoint of reflection grating problem is investigated.

(34) Study of Electromagnetic Wave Propagation Characteristics on Indoor Single Floor, by W. H. Koh* and K. H. Baek** (*Dept. of Physics, Hanseo Univ., Seosan, Korea; **Dept. of Elec. Eng. Hanseo Univ., Seosan, Korea): *JKITE*, vol. 33-A, no. 9, pp. 1740–1751, Apr. 1996.

We present a two-dimensional propagation prediction model to analyze the characteristics of electromagnetic wave propagation. This model, based on a ray tracing technique, calculates the path loss by tracing rays propagating by multipath. The rays are considered to reflect and transmit specularly at wall boundaries and diffract at corners. This simulation results of office buildings show that this model is well applicable to the complex and various environments in buildings.

(35) A Simple Closed-Form Spatial Green's Function for the Electromagnetic Pulse Coupling Problem Through an Aperture into a Parallel-Plate Waveguide, by Y. S. Lee*, H. S. Kwon**, Y. K. Cho**, and H. Son** (*Dept. of Comm. Kumoh Univ. of Tech., Gumi, Korea; ** Dept. of Elec. Eng., Kyungpook Univ., Taegu, Korea): *JKITE*, vol. 33-A, no. 9, pp. 1773–1781, Aug. 1996.

Using an improved complex image method, simple closed-form expressions of Green's functions suitable for wide frequency range are derived for obtaining the vector and scalar potentials of a horizontal magnetic dipole in a parallel-plate waveguide filled with a homogeneous dielectric. The spatial Green's functions are used in moment method to analyze the electromagnetic pulse coupling problem through an aperture into a parallel-plate waveguide.

(36) An Electric Field Induced on the Same Plane by a Point Dipole Source within a Conductor-Backed Lossy Dielectric Slab above the Earth, by D. K. Park* and J. W. Ra** (*Dept. of Elec. Eng., Korea Maritime Univ., Pusan, Korea; **Dept. of Elec. Eng., KAIST, Teajon, Korea): *JKITE*, vol. 33-A, no. 12, pp. 2317–2323, Feb. 1996.

An electric field induced by a point dipole source within a conductor-backed lossy dielectric slab above the earth is calculated by a numerical method. The calculation is performed on the plane which is parallel to the conductor plane and containing the point dipole source. Computed S_{21} values of two parallel planar dipole antennas and two collinear planar diploe antennas are compared each other.

(37) A Study on the Transmission Efficiency of Electromagnetic Wave Propagation in Tunnels with Bend and Fold, by G. R. Kim*, K. K. Han**, T. Matsunaga**, K. Uchida**, and K. Yasumoto*** (*Dept. of Info. and Comm., Masan Jr. College, Masan, Korea; **Dept. of Info. and Computer Eng., Fukuoka Inst. Tech., Japan; ***Dept. of info. Eng., Kyushu Univ., Japan): *JKITE*, vol. 33-A, no. 12, pp. 2333–2340, Apr. 1996.

This paper is concerned with a finite-volume time-domain (FVTD) method for the analyzes of transmission efficiency of electromagnetic wave propagation in tunnels with bend and fold. The advantages of the present method are that the algorithm is very simple since the coordinate system is restricted only to the cartesian. The arbitrary shaped boundaries can easily be dealt with since the fields at every center point of the cells are assigned in an average fashion.

(38) Attenuation Pattern of the Electromagnetic Fields Scattered by Two Empty Circular Cylinders in a Dielectric Medium, by T. K. Lee*, S. Y. Kim**, and J. W. Ra*** (*Dept. of Avionics, Hankuk Aviation Univ., Goyang, Korea; ** Div., Electron. and inform. Thech., KIST, Seoul, Korea; ***Dept. of Elec. Eng., KAIST, Taejon, Korea): *JKITE*, vol. 33-A, no. 4, pp. 658–663, Apr. 1996.

The attenuation pattern of the E-polarized electromagnetic fields scattered by two empty circular cylinders in a dielectric medium is analyzed to calculate the effects of the inhomogenuity in the background medium. In the amplitude pattern of the electromagnetic field scattered by one cylinder, double dips occur at the locations corresponding to its top and bottom boundaries. The distortion of the original double dip pattern is calculated when other air cavity approaches or its size increases.

(39) An Analysis of Electromagnetic Wave Properties of the Leaky Coaxial Cable Using the Finite Difference Time Domain Algorithm (FDTD), by Y. I. Hong*, D. I. Shon*, T. W. Kim**, J. K. Kim**, and H. S. Nam*** (*Dept. of Elec. Comm., Pusan Jr. College, Pusan, Korea; **Dept. of Electronic Eng., Chungang Univ., Seoul, Korea; ***Intstitute for Defence Information Systems, Korea): *JKITE*, vol. 33-A, no. 5, pp 822–829, May 1996.

The purpose of this paper is to analyze the field distribution and the current distribution of leaky coaxial cable with the finite difference-time domain (FDTD) algorithm. To simulate the unbounded problem like a free space, the Mur's absorbing condition is also used. After modeling the leaky coaxial cable with the three dimensional grid structure, the transient response of the field distribution and the current distribution are depicted in the time domain.

(40) Beam Cone Analysis and Its Applications for the Beams Obliquely Input to Dielectric Boundaries, by B. Lee and S. W. Min (School of Electrical Engineering, Seoul National University, Seoul, Korea): *JKITE*, vol. 33-A, no. 5, pp. 870–876, May 1996.

It is shown that a simple vector analysis method can provide beam cone shapes for laser beams of nonparaxially input to dielectric boundaries. Acceptance cone shapes for angled-endface fibers are calculated by the method. Beam cone shapes inside InP substrate are also calculated by the method for the coupling of an optical fiber and an InP-based photodiode using a Si v-groove. The effectiveness and errors of the recently suggested matrix method for inclined boundaries are also studied.

(41) Calculation of Electromagnetic Field of a Compact Range Reflector, by K. I. Kwon and D. H. Hong (Agency for

Defense Development, Taejon, Korea): *JKITE*, vol. 33-A, no. 8, pp. 1523–1530, Oct. 1996.

We calculated the compact range field to manufacture a large reflector. We also tried to make relation between surface error and degradation of quiet zone (QZ).

QZ quality was measured for the reflector, and comparison with calculation showed reasonably good agreement. After all this work, we measured gain and pattern of a phased array antenna by compact range and NF (near field) measurement system. These two results showed very good agreement.

(42) Analysis for Transient Response of Electromagnetic Pulse Penetrated Through a Slot Aperture in Conducting Screen, by Y. S. Lee*, J. K. Kim**, C. T. Park***, Y. K. Cho**, and Y. Son** (*Dept. of Comm., Kumoh National Univ. of Tech., Kumi, Korea; **Dept. of Electronics, Kyungpook National Univ., Taegu, Korea; ***Changshin College, Masan, Korea): *JKITE*, vol. 33-A. no. 8, pp. 1531–1540, Oct. 1996.

An analysis method for obtaining transient response of electromagnetic pulse (EMP) penetration through a slot aperture in the planar conducting screen is considered. From the Fourier-inverse transform by the FFT algorithm of the transfer function, the transient response of the penetrated EMP is given.

(43) Scattering and Radiation of Electromagnetic Fields by a Periodic Strip Grating on a Grounded Dielectric Slab, by Y. K. Cho*, J. H. Ko**, L. H. Yun*, J. I. Lee*, and U. H. Cho* (*Dept. of Elec. Eng., Kyungpook National Univ., Taegu, Korea; **Dept. of Payload System Section, Satellite Comm. Tech., ETRI, Taejon, Korea): *JKITE*, vol. 33-A, no. 8, pp. 1548–1564, Aug. 1996.

Scattering and radiation problems of electromagnetic waves by periodic strips on a grounded dielectric slab in case of oblique incidence and arbitrary polarization are analyzed by the spectral domain method combined with the sampling theorem. It is found that the numerical results exhibit a good convergence even for a small truncation number.

(44) Prediction of Received Power and Delay Spread in Urban Cross-Roads for Microcell Design, by B. H. Jung*, C. Y. Kim*, and H. H. Kim** (*Dept. of Elec., Kyungpook National Univ., Taegu, Korea; **Dept. of Wireless Comm. Research Lab., Korea Telecom., Taejon, Korea): *JKITE*, vol. 33-A, no. 11, pp. 2224–2233, Nov. 1996.

In urban cross-roads with dense buildings, receiving power and delay spread were computed. We developed efficient codes by combining image method and algorithm for propagation paths. Receiving power and delay spread could be viewed in three-dimensional picture by virtue of computing electric fields in arbitrary receiving point.

(45) Diffraction Pattern of Cylindrical Cavity for Line Source Excitation in Lossy Medium, by J. S. Kang* and J. W. Ra** (*Dept. of Elec. and Computer Eng., Univ. of Illinois at Urbana-Champaign, Illinois, U.S.A.; **Dept. of Electrical Eng., KAIST, Taejon, Korea): vol. 33-A, no. 1, pp. 12–20, Jan. 1996.

Forward diffraction pattern of the total field by cylindrical cavity for line source excitation in lossy medium is analyzed when the wavelength is comparable with the radius of the cavity. It is shown that double nulls and dips of the total field exist, and their dependences on the source position and the medium loss are analyzed.

(46) E-polarized Diffraction Coefficients for a Perfectly Conducting Wedge Based on Dual Integral Equations, I: Exact Solution, S. Y. Kim (Div. of Electronics and Information Tech., KIST, Seoul, Korea): *JKITE*, vol. 33-A, no. 1, pp. 21–25, Jan. 1996.

Based on the formulation of dual integral equations, the diffraction coefficients for E-polarized diffraction by a perfectly conducting wedge are calculated exactly in the region outside the wedge. And the exact diffraction coefficients have to become zero in the artificial wedge region, of which material is substituted by the same material as that outside the wedge.

(47) E-polarized Diffraction Coefficients for a Perfectly Conducting Wedge Based on Dual Integral Equations, II: Correction to Physical Optics Solution, by S. Y. Kim (Div. of Electronics and Information Tech., KIST, Seoul, Korea): *JKITE*, vol. 33-A, no. 1, pp. 26–34, Jan. 1996.

A new method is suggested to analyze the E-polarized diffraction by a perfectly conducting wedge. Based on the formulation of dual integral equations, the physical optics diffraction coefficients are expressed by sum of two cotangent functions. An extended ray-tracing is performed for including those geometrical optics terms. The extended physical optics solution becomes exact if applying the edge condition to its diffraction coefficients.

(48) Analysis on E-Polarized Scattering by a Resistive Strip Grating Using Fourier-Galerkin Moment Method, S. I. Yang* and U. J. Yoon** (*Dept. of Elec. Eng., Soongsil Univ., Seoul, Korea; **Dept. of Elec. Comm., Kyungki Jr. College, Korea): *JKITE*, vol. 33-A, no. 1, pp 35–40, Jan. 1996.

The E-polarized scattering problems by a resistive strip grating with uniform resistivity are numerically analyzed by using the Fourier-Galerkin moment method. The numerical results of the geometrical optics reflection coefficient by the method proposed in this paper are in excellent agreement with those of the existing papers for the uniform resistivity.

(49) Electromagnetic Coupling through a Slit in a Parallel-Plate Waveguide Covered by a Dielectric Slab with an Embedded Conducting Cylinder, by J. I. Lee and Y. K. Cho (Dept. of Elec. Eng., Kyungpook National Univ., Taegu, Korea): *JKITE*, vol. 33-A, no. 1, pp. 41–50, Jan. 1996.

Electromagnetic coupling through a slit in the upper plate of a parallel-plate waveguide covered by a dielectric slab with a conducting cylinder embedded in it is investigated. The reflected and transmitted power in the guide, the coupled power through the slit, the radiation efficiency into the free space, the surface wave launching efficiency into the slab from the slit, and radiation patterns are computed.

(50) A New Absorbing Boundary Condition for the FDTD Simulation of Waveguides, M. J. Park and S. Nam (School of Electrical Eng., Seoul National Univ., Seoul, Korea): *JKICS*, vol. 21, no. 12, pp. 3227–3234, Dec. 1996.

This paper proposes a new absorbing boundary condition (ABC) for the FDTD simulation of waveguide problems. The ABC derived from the expression has a convolution form whose kernel (the discrete Green's function) has a simple, closed form formula. Also, it is applicable to the wide variety

of waveguide types with conducting boundaries and complex cross-sectional shapes.

(51) A Study on the Electromagnetic Wave Properties of the Leaky Coaxial Cable with the Finite Difference Time Domain (FDTD) Algorithm, by Y. I. Hong* and J. K. Kim** (*Dept. of Electronic Comm., Pusan Jr. College, Pusan, Korea; **Dept. of Electronic Eng., Chungang Univ., Seoul, Korea): *JKICS*, vol. 21, no. 11, pp. 2954–2955, Nov. 1996.

The electromagnetic field characteristics of leaky coaxial cable are analyzed by using the finite difference-time domain (FDTD) technique. To simulate the open boundary problem like a free space, the Mur's Absorbing Boundary Condition (Mur-ABC) is also used. After modeling the leaky coaxial cable with the three dimensional grid structure, the transient response of the field distribution and the current distribution, the field pattern, the coupling effect are depicted in the time domain.

(52) Dispersion Characteristics of the Finite-Difference Frequency-Domain (FDFD) Method with the Multi-Resolution Technique, by I. Hong*, D. Choi*, and H. Park** (*Dept. of Electronic Eng., Yonsei Univ., Seoul, Korea; **Dept. of Radio & Science, Yonsei Univ., Seoul, Korea): *JKICS*, vol. 21, no. 10, pp. 2724–2730, Oct. 1996.

The dispersive characteristics of the Finite-Difference Frequency-Domain method based on the Multi-Resolution Technique (MR-FDFD) are numerically analyzed. The superiority of the MR-FDFD method to the spatial discretization is shown.

(53) 2-Dimensional Scattering by a Periodic Strip Grating on a Grounded Dielectric Slab, by J. H. Ko**, W. S. Baek***, L. H. Yun*, J. I. Lee*, U. H. Cho*, C. H. Lee*, J. P. Hong****, Y. K. Cho*, and H. Son* (*Dept. of Elec. Eng., Kyungpook National Univ., Taegu, Korea; **Electronics and Telecom. Research Inst., Taejon, Korea; ***Dept. of Elec. Cont. Comm. Eng., Dongyang Univ., Korea; ****Dept. of Elec., Kyungpook Sanup Univ., Taegu, Korea): *JKICS*, vol. 21, no. 10, pp. 2710–2723, Oct. 1996.

A 2-dimensional scattering problem of electromagnetic waves by a periodic strip grating on a grounded dielectric slab is analyzed by the vector Floquet modal expansion method. The relationship between Bragg blazing phenomena and characteristic mode (current) on the strip is discussed.

(54) A Method of Extending the Number of Ray Paths to Predict the Characteristics of LOS Propagation in an Urban Microcell, by C. Y. Kim*, B. H. Jung*, J. Y. Park*, and J. D. Mok** (*Dept. of Elec., Kyungpook National Univ., Taegu, Korea; **Electronics and Telecomm. Research Inst., Taejon, Korea): *JKITE*, vol. 33-A, no. 2, pp. 167–174, Feb. 1996.

This paper presents the generalized method of the prediction of the LOS propagating characteristics in an urban microcell by using the ray tracing technique. Whereas the received power is calculated by the finite number of paths, the rms delay spread is computed by using the sufficient rays of convergence. Based on the method of extending the number of paths and the canyon model the received power and rms delay spread are computed.

(55) A Bayesian Regularization Approach to III-Posed Problems with Application to the Direction Finding of VLF/ELF Radio Waves, by M. Hirari and M. Hayakawa (Dept. of Electronic Engineering Faculty of Electro-Communications, The University of Electro-Communications, Chofu-shi, 182 Japan): *Trans. IEICE*, vol. E79-B, pp. 63–69, Jan. 1996.

In the light of simulation and application to real data, we propose a slight modification to the Bayesian information criterion to reconstruct the wave energy distribution at the ionospheric base from the observation of radio wave electromagnetic field on the ground. The achieved results in both the inversion problem and the wave direction finding are very promising and may support other works so far suggested the use of Bayesian methods in the inversion of ill-posed problems to benefit from the valuable information brought by the *a priori* knowledge.

(56) SAR Distributions in a Human Model Exposed to Electromagnetic Near Field by a Short Electric Dipole, by S. Watanabe and M. Taki (Faculty of Engineering, Tokyo Metropolitan University, Hachio-ji-shi, 192-03 Japan): *Trans. IEICE*, vol. E79-B, pp. 77–84, Jan. 1996.

The SAR distributions over a homogeneous human model exposed to a near field of a short electric dipole in the resonant frequency region were calculated with the spatial resolution of 1 cm^3 which approximated 1g tissue by using the FDTD method with the expansion technique. The maximum local SAR per gram tissue over the whole body model was also determined, showing that the ratios of the maximum local SAR to the whole-body averaged SAR for the near-field exposure were at most several times as large as the corresponding ratio for the far-field exposure, when the small source located farther than 20 cm from the surface of the human model.

(57) TM-Scattering from Notches in a Parallel-Plate Waveguide, by K. H. Park*, H. J. Eom*, and K. Uchida** (*Dept. of Electrical Engineering, Korea Advanced Institute of Science and Technology, 373-1, Kusong Dong, Yusung Gu, Taejon, Korea.; **Dept. of Communication and Computer Engineering, Fukuoka Institute of Technology, Fukuoka-shi, 811-02 Japan): *Trans. IEICE*, vol. E79-B, pp. 202–204, Feb. 1996.

The problem of TM-mode scattering from the finite number of rectangular notches in a parallel plate waveguide is considered. The Fourier-transform is employed to obtain simultaneous equations and the simultaneous equations are solved to obtain an analytic solution in rapidly convergent series. Numerical computations are performed to investigate the scattering behavior in terms of frequency and notch sizes. The presented theory is applicable to the analysis of scattering from the E-plane stubs in the rectangular waveguide.

(58) Characteristics of Indoor Radio Propagation in 2.5 GHz Band by Movement of Men in Rooms, by Y. Sakamoto, A. Tamura, and Y. Hata (Dept. of Electrical and Electronic Engineering, Muroran Institute of Technology, Muroran-shi, 050 Japan): (vol. J79-B-II, no. 2, pp. 110–116): *Trans. IEICE*, vol. E79-B, p. 209, Feb. 1996.

Recently, there has been indoor radio communication systems such as radio LAN systems and personal communication services systems. To characterize indoor radio propagation is very important for successful design of these systems. How-

ever, study of the characterization is not enough to implement these systems. The channel of the indoor environment is nonstationary in time, even when the transmitter and receiver are fixed. We show the results of the measurement of the temporal characteristic and discuss the statistics data.

(59) Estimation of Target Location from a 50 GHz-Band Back-Scattered Wave by the Fractal-Based Analysis, by T. Watanabe (College of Industrial Technology, Nihon University, Narashino-shi, 275 Japan): (vol. J79-B-II, no. 2, pp. 127–134): *Trans. IEICE,* vol. E79-B, p. 209, Feb. 1996.

Estimation of target location from a 50 GHz-band back-scattered wave can be carried out using fractal-based analysis. Some experiments show good detection even in a weak field back-scattered by a target such as a thin brass wire or a rectangular styrofoam post by examining the mappings of fractal dimension, linearity and standard deviation that represent the fractal features. As a result, it is confirmed that the fractal-based analysis is available for detecting targets even if received signal is blurred by a comparable amount of noise.

(60) TM-Wave Radiation from Finite Thick Slits in Parallel Plate, by J. H. Lee*, H. J. Eom*, Y. K. Cho**, and W. J. Chun*** (*Dept. of Electrical Engineering, Korea Advanced Institute of Science and Technology, 373-1, Kusong Dong Yusung Gu, Taejon, Korea; ** Dept. of Electrical Engineering, Kyungpook National University, Taegu 635, Korea; ***Communication Satellite Research Office Korea Telecom, Seoul, Korea): *Trans. IEICE,* vol. E79-B, pp. 875–878, June 1996.

The problem of TM-wave scattering and radiation from a finite number of thick slits in a parallel plate waveguide is solved. The Fourier transform and the mode matching are used to obtain simultaneous equations for the field inside the slits. The simultaneous equations are solved to obtain a series solution which is amenable to numerical computation. The numerical computations are performed to illustrate the behaviors of scattering, transmission, and reflection in terms of incident angle, slit size and operating frequency.

(61) Electromagnetic Wave Propagations in Two Dimensional Tunnels with Fundamental Junctions, by T. Matsunaga*, K. Uchida*, and Ki-Chai Kim** (*Faculty of Engineering, Fukuoka Institute of Technology, 3-30-1 Wajirohigashi Higashi-ku, Fukuoka-shi, 811-02 Japan; **College of Engineering, Yeungnam University, 214-1, Dae-Dong, Kyung San-shi, Kyung Pook, Korea): (vol. J79-B-II, no. 7, pp. 399–406): *Trans. IEICE,* vol. E79-B, pp. 984–985, July 1996.

Mobile stations are widely spreading in recent information societies. However, some difficulties occur when they are used in an underground building. Electro-magnetic wave decays more rapidly in a tunnel than in the free space. In this paper, we perform an experiment based on the microwave simulation and compare the experimental results with an approximate solution in order to investigate how electromagnetic waves propagate in rectangular cross-type and multi-cross-type tunnels. Present results give some important knowledge for mobile communications in the complicated underground buildings.

(62) Periodic Boundary Condition for Evaluation of External Mutual Couplings in a Slotted Waveguide Array, by K. Sakakibara, J. Hirokawa, M. Ando, and N. Goto (Dept. of Electrical and Electronic Engineering, Tokyo Institute of Technology, Tokyo, 152 Japan): *Trans. IEICE,* vol. E79-B, pp. 1156–1164, Aug. 1996.

In the design of a large slotted waveguide array, evaluation of mutual couplings between the slots is time consuming. This paper proposes an effective approximation analysis of the external mutual couplings using periodic boundary condition. Simple design procedure is verified for two-dimensional slot array.

(63) A Neural Network for the DOA of VLF/ELF Radio Waves, by M. Hirari and M. Hayakawa (Dept. of Electronic Engineering, The University of Electro-Communications, Chohu-shi, 182 Japan): *Trans. IEICE,* vol. E79-B, pp. 1598–1605, Oct. 1996.

In the present communication we propose the application of unsupervised Artificial Neural Networks (ANN) to solve general ill-posed problems and particularly we apply them to the estimation of the direction of arrival (DOA) of VLF/ELF radio waves. We use the wave distribution method which consists in the reconstruction of the energy distribution of magnetospheric VLF/ELF waves at the ionospheric base from observations of the wave's electromagnetic field on the ground. Then, we have proven the applicability and also we indicate the superiority of the ANN to the conventional methods to handle this kind of problems.

(64) FDTD Analysis of Electromagnetic Field in a TEM-Cell, by K. Harima* and E. Yamashita** (*Communications Research Laboratory, Ministry of Posts and Telecommunications, Koganei-shi, 184 Japan; **The University of Electro-Communications, Chohu-shi, 182 Japan): (vol. J79-B-II, no. 10, pp. 705–708): *Trans. IEICE,* vol. E79-B, p. 1613, Oct. 1996.

The Finite-Difference Time-Domain (FDTD) method is applied to the analysis of electromagnetic fields in a TEM-cell which is commonly used for radiated susceptibility testing of electromagnetic interference (EMI). The results of the FDTD analysis have given the distribution of electric field in the measurement area inside the TEM-cell and also indicate the reflection points in the cell by the time-domain response of a pulse input.

(65) A Finite Element Method for Scalar Helmholtz Equation with Field Singularities, by H. Igarashi and T. Honma (Division of Systems and Information Engineering, Faculty of Engineering Hokkaido University, Sapporo-shi, 060 Japan): *Trans. IEICE,* vol. E79-C, pp. 131–138, Jan. 1996.

This paper describes a finite element method to obtain an accurate solution of the scalar Helmholtz equation with field singularities. The finite element method formulated in terms of the regularized eigenfunction is expected to improve the accuracy and convergence of the numerical solutions. The finite element matrices for the present method can be easily evaluated since they do not involve any singular integrands. Moreover, the Dirichlet-type boundary conditions are explicitly imposed on the variables using a transform matrix while the Neumann-type boundary conditions are implicitly imposed in the functional.

(66) Near Fields Radiated from a Long Slot on a Circular Conducting Cylinder, by M. Kodama and K. Taira

(Faculty of Engineering, University of the Ryukyus, Okinawa-ken, 903-01 Japan): *Trans. IEICE*, vol. E79-C, pp. 249–251, Feb. 1996.

New series expressing the radiation fields from both axial and circumferential slots on a circular conducting cylinder are derived. These new series converge rapidly even for near fields. This letter includes useful figures showing characteristics of near fields calculated numerically using the new series.

(67) A Finite Element Beam Propagation Method for Strongly Guiding Optical Waveguides with Magnetooptic Materials, by Y. Tsuji, M. Koshiba, and T. Tanabe (Division of Electronics and information Engineering, Hokkaido University, Sapporo-shi, 060 Japan) (vol. J79-C-I, no. 2, pp. 39–44): *Trans. IEICE*, vol. E79-C, p. 252, Feb. 1996.

A unified finite element beam propagation method is described for both TE and TM waves propagating in strongly guiding and longitudinally varying optical waveguides with magnetooptic materials. In order to avoid nonphysical reflections from the computational window edges, the transparent boundary condition is introduced for both polarizations. The present algorithm is, to our knowledge, the first beam propagation method for modeling nonreciprocal magnetooptic components.

(68) Circularly Polarized Absolute Value Rays in Stratified Absorbing Media, by S. Tokumaru (Faculty of Science and Technology, Keio University, Yokohama-shi, 223 Japan) (vol. J79-C-I, no. 3, pp. 63–70): *Trans. IEICE*, vol. E79-C, p. 453, Mar. 1996.

Ray-tracting methods of newly proposed circularly polarized absolute value rays in nondispersive absorbing media are given in the case of stratified media traveled by two dimensional plane waves. Namely, numerical tracing of 1) Loci of real wave normals; 2) projected rays newly proposed concerning normalized Poynting fluxes; 3) circularly polarized absolute value rays; 4) stream lines of original Poynting fluxes; and 5) amplitudes of these rays and fluxes are shown theoretically. Furthermore, it is also shown that Fermat's principles are able to be satisfied for the wave normals and the projected rays under the newly defined anisotropic refractive indices, respectively.

(69) High Frequency Analysis of Radiation Field Excited by Incident Whispering-Gallery Mode over Concave-to-Convex Boundary, by K. Goto and T. Ishihara (National Defense Academy, Yokosuka-shi, 239 Japan) (vol. J79-C-I, no. 3, pp. 71–80): *Trans. IEICE*, vol. E79-C, p. 453, Mar. 1996.

We examine the asymptotic representations of radiation fields over concave-to-convex boundary excited by the lowest-order adiabatic whispering-gallery (WG) modes which are incident on an inflection point from concave side. Numerical comparisons with the reference solution reveal the validity of the asymptotic representations. Radiation phenomena are clarified from the numerical results and the geometrical picture obtained from the modal ray tracing.

(70) Bistable Polarization Switching in TM Wave Injected Semiconductor Lasers by Mode-Hopping, by S. Ohno, M. Ichii, M. Mamiya, T. Ohta, and T. Ichinose (Faculty of Engineering, Doshisha University, Kyoto-shi, 610 Japan) (vol. J79-C-I, no. 3, pp. 81–90): *Trans. IEICE*, vol. E79-C, p. 453, Mar. 1996.

In this paper, it is proposed and demonstrated that the bistable polarization switching could be realized in TM wave injected semiconductor lasers by utilizing the mode-hopping on the injection light wavelength. The semiconductor lasers are assumed as Fabry–Perot Laser amplifiers in this case. Therefore, the laser output changes according to the change in injection light wavelength, Furthermore, it is clarified that this switching has unprecedented unique properties.

(71) Streamlines of Energy Flux Densities in Electromagnetic Scattering of Perfectly Conducting Sphere, by S. Tokumaru (Faculty of Science and Technology, Keio University, Yokohama-shi, 223 Japan) (vol. J79-C-I, no. 3, pp. 91–92): *Trans. IEICE*, vol. E79-C, p. 453, Mar. 1996.

Streamlines of the electromagnetic energy flux densities are dependent of the polarization. In scattering of a perfectly conducting sphere streamlines of the Poynting flux and the circularly polarized energy fluxes are drawn in the case of right handed circularly polarized wave incidence. The calculated streamlines around the sphere are twisted by the existence of the sphere.

(72) An Analysis of Wave Propagation in Branching Slab Waveguides with 2-V Power Refractive Index, by Y. Kawaguchi, Y. Ichikawa, and E. Oka (School of Science and Technology, Meiji University, Kawasaki-shi, 214 Japan) (vol. J79-C-I, no. 3, pp. 93–97): *Trans. IEICE*, vol. E79-C, p. 454, Mar. 1996.

The propagation characteristics were theoretically analyzed in a branching slab waveguide with a 2-V power refractive index with respect to the thickness. Next, as a nonuniform waveguide model the each power is assumed to vary slowly with the distance. The effect of the nonuniform waveguide on the wave propagation was investigated by means of the FD-BPM.

(73) Boundary Integral Equations for Computer Aided Design of Near-Field Optics, by M. Tanaka* and K. Tanaka** (*Faculty of Administration and Informatics, Tohoku-Gakuen Hamamatsu University, Hamamatsu-shi, 431-21 Japan; **Faculty of Engineering, Gifu University, Gifu-shi, 501-11 Japan) (vol. J79-C-I, no. 4, pp. 101–108): *Trans. IEICE*, vol. E79-C, p. 597, Apr. 1996.

New forms of boundary integral equations for CAD of near-field optical circuits are presented. These integral equations can be solved numerically by boundary element method or moment method without using complicated mode-expansion techniques of open waveguide structures. As an example, they are applied to the design of optical manupilator for a small particle. Validity and correctness of the new method was demonstrated by showing numerical examples in detail.

(74) High-Frequency Diffraction by a Strip Located at the interface between Two Different Media, by S. Sapmaz*, K. Kobayashi*, A. Buyukaksoy**, and G. Uzgoren*** (*Faculty of Science and Engineering, Chuo University, Tokyo, 112 Japan; **Faculty of Electrical and Electronics Engineering, Technical University of Istanbul, 80626 Maslak, Istanbul, Turkey; ***Faculty of Engineering, Istanbul University, 34850

Avcllar, Istanbul, Turkey): *Trans. IEICE,* vol. E79-C, pp. 709–719, May 1996.

The E-polarized plane wave diffraction by a perfectly conducting strip located at the plane interface between two different media is analyzed by the Wiener-Hopf technique. It is shown that the high-frequency scattered far field comprises the geometrical optics field, the singly, doubly and triply diffracted fields and the lateral waves. Numerical examples of the radar cross section (RCS) and the lateral waves are presented, and the far field scattering characteristics are discussed in detail.

(75) Some Problems Concerning the EH-Formulation of Electromagnetism, by T. Hosono (College of Science and Technology, Nihon University, Tokyo, 101 Japan) (vol. J79-C-I, no. 5, pp. 129-137): *Trans. IEICE,* vol. E79-C, p. 720, May 1996.

This paper deals with these concepts critically on the basis of EB-formulation, and showed that these concepts do not correspond to the physical reality but are mathematical concepts to treat the electromagnetic phenomena simply. It also showed, with concrete examples, that the unlimited use of these concepts may lead to ghost or contradictory solutions. Thus, the position of the EH formulation in the electromagnetic theory and the limitation of its effectiveness and validity are dearified.

(76) Analysis of Diffracted Waves from Isotropic Chiral Gratings, by K. Matsumoto*, K. Rokushima*, and J. Yamakita** (*Faculty of Engineering, Osaka Sangyo University, Daito-shi, 574 Japan; **Faculty of Information Engineering, Okayama Prefectural University, Sojya-shi, 719-11 Japan) (vol. J79-C-I, no. 6, pp. 165–172): *Trans. IEICE*, vol. E79-C, p. 874, June 1996.

A method of analyzing the diffracted waves by isotropic chiral gratings is presented for the general three-dimensional case. The analysis approach is rigorously formulated in a unified matrix form by extending the space-harmonic expansion method for dielectric gratings The numerical examples indicate peculiar diffraction anomalies due to the chirality of the material and couplings between the circularly polarized waves at the Bragg condition.

(77) Unified Solutions of the Scattering Coefficients of E-Plane Junctions in Rectangular Waveguides, by A. Widarta, S. Kuwano, and K. Kokubun (College of Engineering, Nihon University, Koriyama-shi, 963 Japan) (vol. J79-C-I, no. 6, pp. 181–188): *Trans. IEICE*, vol. E79-C, p. 874, June 1996.

Unified solutions of the scattering coefficients of the E-plane right-angle bend, the T-junction and the cross junction in rectangular waveguides are presented. The solutions are obtained by the mode-matching method in which the electromagnetic fields in waveguides are matched with those in each junction section formed by a sectoral or a circular region. Since the T-junction and the cross junction can be divided into two and four of the right-angle bends, respectively, the solutions of all the junctions are expressed in same form based on the solution of the right-angle bend. By using the numerical results, the scattering properties of the dominant modes and higher order modes in the waveguide junctions are examined in detail.

(78) FVTD Analysis of Electromagnetic Wave Propagation in Two Dimensional Tunnels with Fundamental Junctions, by K. Uchida*, T. Matsunaga*, Ki-Chai KIM**, and Kyung-Koo HAN* (*Faculty of Engineering, Fukuoka Institute of Technology, 3-30-1 Wajirohigashi Higashi-ku, Fukuoka-shi, 811-02 Japan; **College of Engineering, Yeungnam University, 214-1 DaeDong, Kyung San-shi, Kyung Pook, Korea) (vol. J79-C-I, no. 7, pp. 210–216): *Trans. IEICE,* vol. E79-C, p. 1021, July 1996.

This paper is concerned with the finite volume time domain (FVTD) method for electromagnetic wave propagation in tunnels. This method is based on the volume integrations of the Maxwell's equations with respect to arbitrary shaped small volume. For the Cartesian coordinate system the FVTD formulation is almost the same as that of FDTD. We consider the electromagnetic wave propagation in the tunnels with bends and junctions where the tunnel structures are restricted to the two-dimensional case. Numerical results are compared with the experimental data based on the microwave simulation.

(79) Tracing of Poynting Flux in Stratified Absorbing Media-Geometrical Optics Fields, by S. Tokumaru (Faculty of Science and Technology, Keio University, Yokohama-shi, 223 Japan) (vol. J79-C-I, no. 7, pp. 217–224): *Trans. IEICE,* vol. E79-C, p. 1021, July 1996.

A tracing method of Poynting flux of geometrical optics field is proposed in stratified nondispersive absorbing media by using circularly polarized absolute-value rays. Projected stream lines of the poynting fluxes onto the wave normal plane satisfy Fermat's principle on an excitation condition of equiamplitude and equi-phase planes of the incident wave and furthermore, an isotropic reflection index dependent of polarization condition of the circularly polarized absolute-value rays traveling through the medium.

(80) An Analysis of Nonreciprocal Mode-Conversion Properties of Magnetooptic Channel Waveguides Using the Finite Element Method, by X.-P. Zhuang, M. Koshiba, and Y. Tsuji (Faculty of Engineering, Hokkaido University, Sapporo-shi, 060 Japan) (vol. J79-C-I, no. 7, pp. 234–239): *Trans. IEICE,* vol. E79-C, p. 1022, July 1996.

A finite element method is described for the analysis of nonreciprocal mode conversion properties of magnetooptic channel waveguides. The formulation is based on the scalar-wave approximation, and the spurious solutions which are included in the vector finite element method do not appear. A simple iterative method is proposed for solving the coupled nonlinear eigenvalue equations derived from the scalar finite element approach. Isolation characteristics of a magnetooptic rib waveguide are investigated.

(81) Vector Basis Functions in Mixed-Potential Integral Equation Method, by M. Matsuhara* and T. Angkaew** (*Faculty of Engineering, Okayama University of Science, Okayama-shi, 700 Japan; **Faculty of Engineering, Chulalongkorn University, Bangkok, Thailand) (vol. J79-C-I, no. 7, pp. 256–260): *Trans. IEICE,* vol. E79-C, p. 1022, July 1996.

The mixed-potential integral equation method (MPIE) is one of the most practical and promising computer aided design method of microwave and millimeter-wave integrated circuits. In this paper, a systematic making method of vector basis functions which are used in MPIE is presented. As an example, a patch antenna is analyzed by the use of the method. The

numerical result of the example demonstrates the validity and effectiveness of the vector basis functions proposed in this paper.

(82) Graphical Solution of the Dielectric Constant Measurement on the Standing Wave Method, by H. Yamanaka (Faculty of Engineering, Utsunomiya University, Utsunomiya-shi, 321 Japan) (vol. J79-C-I, no. 7, pp. 261–262): *Trans. IEICE*, vol. E79-C, p. 1023, July 1996.

The report describes the theoretical consideration of the graphical analysis for obtaining the complex dielectric constant of a sample by the standing wave method that the variable short plunger is used behind the sample. The study is performed at frequency 7 GHz.

(83) Equivalence of Physical Optics and Aperture Field Integration Method in the Full Pattern Analysis of Reflector Antennas, by M. Oodo and M. Ando (Faculty of Engineering, Tokyo Institute of Technology, Tokyo, 152 Japan): *Trans. IEICE*, vol. E79-C, pp. 1152–1159 Aug. 1996.

In this paper, uniform equivalent edge currents of PO and AFIM are compared analytically and their equivalence in high frequency is discussed. It is asymptotically verified that the patterns by AFIM are almost identical to PO fields in the full 360° angular region, provided that AFIM uses the equivalent surface currents consisting of two components, that is, the geometrical optics (GO) reflected fields from the reflector and the incident fields from the feed source, the latter of which are often neglected. Numerical comparison of PO and AFIM confirms all these results; the equivalence holds not only for large but also for a very small reflector of the order of one wavelength diameter.

(84) Generalized Representation of a Coupled Mode Equation Using a Normalized Coordinate System, by Y. Emori, T. Mizumoto, and Y. Naito (Dept. of Physical Electronics, Tokyo Institute of Technology, Tokyo, 152 Japan) (vol. J79-C-I, no. 9, pp. 355–362): *Trans. IEICE*, vol. E79-C, p. 1289, Sept. 1996.

The coupled mode theory in one of the way to describe propagation characteristics of lightwave in a coupled waveguide system composed of several waveguides. In the case of analysis based on the coupled mode theory, the result of coupled mode equation which is differential equation shows the propagation characteristics. Waveguide parameters and a wavelength are necessary to determine propagation constants and coupling coefficients which constitute a coupled-mode equation. In this paper, a coordinate system which contains a device size, refractive indices, and wavelength is proposed, and the coupled-mode equation in the system is shown.

(85) A Wide-Angle Beam Propagation Method Using a Finite Element Scheme, by Y. Tsuji, M. Koshiba, and T. Tanabe (Division of Electronics and information Engineering, Hokkaido University, Sapporo-shi, 060 Japan) (vol. J79-C-I, no. 10, pp. 381–388): *Trans. IEICE*, vol. E79-C, p. 1475, Oct. 1996.

A wide-angle finite element beam propagation method based on the Padé approximation is developed. Considerable improvement in accuracy over the paraxial approximation is achieved with virtually no additional computation. In the present algorithm, the quadratic element, transparent boundary condition, adaptive reference index, and adaptive grid are effectively utilized. Numerical examples are shown for a tilted waveguide, an S-shaped waveguide bend and a tilted optical directional coupler.

(86) FVTD Analysis of Metallic Grating, by T. Noda*, T. Kanetani**, and K. Uchida* (Faculty of Engineering at Fukuoka Institute of Technology, Fukuoka-shi, 811-02 Japan; **dot aster co., ltd. Fukuoka-shi, 814 Japan): *Trans. IEICE*, vol. E79-C, pp. 1772–1775, Dec. 1996.

This paper is concerned with a point-oriented finite volume time domain (FVTD) method in the Cartesian coordinate system for analyzing electromagnetic wave scattering by arbitrary shaped metallic gratings. The perfectly matched layer (PML) is used for the absorbing boundary conditions (ABC's) in the directions corresponding to transmitted and reflected wave regions. An FVTD version of the Floquet's theorem is described to impose the periodic condition in the direction where conducting rods are located periodically.

(87) Polarization Structure of Geometrical Optics Field in Absorbing Media, by S. Tokumaru (Faculty of Science and Technology, Keio University, Yokohama-shi, 223 Japan) (vol. J79-C-I, no. 12, pp. 453–460): *Trans. IEICE*, vol. E79-C, p. 1776, Dec. 1996.

An E-plane dose not coincide with a H-plane in the geometrical optics field in absorbing media. In this paper this kind of complex field is able to be represented geometrically by newly introduced polarization structure in the normalized geometrical optics field. The polarization structure is composed of an EH-planes frame and an E-plane elipse and an H-plane elipse. On this frame the E-plane elipse and the H-plane elipse are defined and are oriented along the E-plane vector and the H-plane vector, respectively.

V. Microwave Medical/Biological Applications

(1) A Study on the Interaction between Transient Electromagnetic Field and Biological Bodies, by B.-Y. Wang, J.-B. Yang, R.-M. Xu, Q.-G. Guo, and F.-Q. Li (Sichuan University, Chengdu, P.R.C.): *JM*, vol. 12, pp. 71–73, Mar. 1996.

The interaction between electromagnetic pulse (EMP) and cell bodies are studied. The preliminary conclusions are also presented.

(2) The Non-Heat Effect of Electromagnetic Waves on Chemical Reaction and its Application in the Mechanism Research of Athermal Biologic Effect of Electromagnetism, by K.-M. Huang, Y.-Q. Liu, J.-X. Tang, J. Zhao, and B.-Y. Wang (Sichuan University, Chengdu, P.R.C.): *JM*, vol. 12, pp. 126–132, June 1996.

The nonheat effect of electromagnetic wave on chemical reaction is demonstrated by an experiment. The result show that the electromagnetic wave can change the activation energy and pre- exponential factor of chemical reaction, so that can cause the variances of rate and equilibrium. The results may also be used to demonstrate the mechanism of a thermal biologic effect of electromagnetic.

(3) A Study on Killing Germs in Traditional Chinese Medicines by Means of Microwaves, by Z.-Y. Lu*, Z.-Q. Niu*, and J.-G. Ma** (*Xidian University, Xi'an, P.R.C.;

**Lanzhao University, Lanzhou, P.R.C.): *JM*, vol. 12, pp. 155–158, June 1996.

The method and results of killing germs in traditional chinese medicinal pills by microwaves with proper power and frequency are introduced. The results show that this method is efficient and spends less time. Especially, the germs, funguses, and mould spore germs which can not be killed under conventional high temperature 120 °C within more than 10 h, can be killed easily by microwaves in a few minutes. This method is simple and reliable, and remains the properties of medicines unchanged after treatment.

(4) Analysis of Modeling for the Mechanism of Millimeter Wave Acupuncture Effects-Hypothesis of Exited-Cell-Resonance-Diffuse-Chain (ECRDC), by S.-Y. Dong and X. Lan (Xidian University, Xi'an, P.R.C.): *JM*, vol. 12, pp. 191–196, Sept. 1996.

The medical effects caused by the faint millimeter-wave energy acted on acupuncture points are analyzed on the basis of the electromagnetics, physiology and Chinese acupuncture theory. The hypothesis of Exited-Cell-Resonance-Diffuse-Chain (ECRDC) is presented as the model for millimeter-wave acupuncture channel mechanism. This model can thus be used for millimeter-wave acupuncture medical applications.

(5) Application of Microwave in Immunohistochemistry, by H. Chen and T.-R. Ji (University of Electronic Science and Technology, Chengdu, P.R.C.): *JM*, vol. 12, pp. 228–233, Sept. 1996.

The development and application of microwave technique in immunohistochemistry are reviewed. The tissue fixation, antigen retrieval and immunostaining under microwave irradiation are introduced. The prospects of the advancement and application of microwave immunohistochemistry are also given.

(6) Analysis of Electro Encephalogram (EEG) for Estimating Maximum Permissible Exposure (MPE) of Rabbit for Microwave Exposure, by J. T. Park* and M. Y. Lee** (*Dept. of Elec. Eng., Yeungnam Jr. College, Taegu, Korea; **Dept. of Elec. Eng., Yeungnam Univ., Taegu, Korea): *JKICS*, vol. 21, no. 4, pp. 1038–1047, Apr. 1996.

Measured EEG from the nervous system of rabbit on a plane wave irradiated is used in quantitative analysis for the electrophysiogical effect of the biobody. The head of rabbit is modeled as three layers and the results of each SAR distribution are illustrated.

VI. Lasers and Other Devices

(1) Circuit Model for Multi-Longitudinal-mode Semiconductor Lasers, by W.-Y. Chen and S.-Y. Liu (Jilin University, Changchun, P.R.C.): *AES*, vol. 24, pp. 11–16, Feb. 1996.

A simple circuit model for multi-longitudinal-mode lasers is presented. This model is very suitable for the computer-aided analysis of OEIC. It can be introduced into the existing simulator and can be used to develop new simulator. By using this model, the DC, AC and transient characteristics of a TBH-LD are studied. The simulating results agree well with the reports. The dependence of threshold and mode spectra on the cavity length is also given.

(2) The Simple Calculation of the Wavelength of Gain-Peak in Compressively Strained Quantum Well Lasers, by Y.-H. Peng, W.-Y. Chen, T.-M. Zhao, and S.-Y. Liu (Jilin University, Changchun, P.R.C.): *AES*, vol. 24, pp. 18–21, May 1996.

By means of the effects of one dimension finite well, strain and band-filling, a simple and accurate method to calculate the wavelength of gain peak in compressively strained quantum-well lasers is provided. Two key factors which determine the gain peak is also discussed.

(3) The Sensitivity Analysis of Receiver with an Optical Preamplifier, by S.-Q. Min and D.-X. Huang (Huazhong University of Science and Technology, Wuhan, P.R.C.): *AES*, vol. 24, pp. 67–70, May 1996.

The noise characteristics of semiconductor laser amplifier are analyzed. The sensitivity formula of receiver with optical preamplifier is derived for the first time. The result show that the input coupling efficiency of optical preamplifier is the main factor that affects the sensitivity of this sort of receiver besides its inner gain, and the optimum judging level is higher than the original receiver's.

(4) High Reliability, High Power Light Emitting Diode at 1.3 μm, by Z.-Y. Wu, C.-Y. Hu, Z.-L. Liu, R.-P. Li, and T. Wu (Wuhan Telecom Devices Co., Wuhan, P.R.C.): *JCIC*, vol. 17, pp. 121–125, Mar. 1996.

1.3-μm wavelength ridge waveguide light emitting diodes (RWG LED's), which have separated absorbing area, are taken to carry out lifetest in different temperatures. Almost 248 500 device hours are tested. 1.2 * 10^6 h of lifetime (MTTF) can be got under the condition of 25 °C ambient temperature and 150-mA CW drive current; The degenerate activated energy is Ea = 0.48 eV; the light power of the RWG LED's is more than 30 μW, maximum can be more than 50 μW, which are got from coupled standard single-mode fiber under 25 °C and 100-mA DC drive current.

(5) The Impact of Stimulated Raman Scattering in "WDM+EDFA" System, by Q.-S. Xiang, A.-S. Xu, D.-M. Wu, and L.-Z. Xie (Peking University, Beijing, P.R.C.): *JCIC*, vol. 17, pp. 120–124, Nov. 1996.

This paper derives a general expression to calculated the power penalty of Stimulated Raman Scattering (SRS)in "WDM+EDFA" System, and analyzes some factors may influence the SRS. The conclusion is reached that the damage to the "WDM+EDFA" System caused by SRS depends greatly on the disposal of the EDFA's, and an easy way is proposed to minify the damage. Finally, the expressions are given to estimate the upper transmission distance and the number of EDFA's limited by SRS in "WDM+EDFA" System.

(6) Interaction Enhancement and Competition of Raman Processes in Optically Pumped NH3 Submillimeter Wave Laser, by X.-S. Zheng, X.-Z. Luo, C.-G. Lin, M. Liu, and Y.-K. Lin (Zhongshan University, Guangzhou, P.R.C.): *JIMW*, vol. 15, pp. 38–42, Feb. 1996.

When strong CO_2-9R (16) line pumped NH_3, two Raman processes interacted with each other and were enhanced. When CO_2-9R (30) line pumped NH_3, competition among the processes took place, and some were enhanced while others diminished.

(7) Module of Infrared Optical Fiber and 1–3 μm HgCdTe Infrared Detector, by S.-Q. Zhou*, Q. Wang*, C.-C. Shi**, R.-W. Xuan**, and J.-X. Fang** (*Shanghai University, Shanghai, P.R.C.; **Shanghai Institute of Technical Physics, Chinese Academy of Sciences, Shanghai, P.R.C.): *JIMW*, vol. 15, pp. 60–64, Feb. 1996.

The novel assembly constructed by infrared optical fiber and HgCdTe detector is reported. The device gives more free to the design and construction of optical systems and reduces the disturbance of stray light effectively and improve signal-to-noise ratio of the systems.

(8) Design of the Binary Optical Beam Splitter, by Q. Guo and R.-L. Wang (Shanghai Institute of Technical Physics, Chinese Academy of Sciences, Shanghai, P.R.C.): *JIMW*, vol. 15, pp. 72–76, Feb. 1996.

The basic design theories of several kinds of binary optical beam splitters were described. Comparisons among them in algorithm, diffraction efficiency and reconstruction error were made and some examples were given.

(9) Carrier Concentration Distribution and Performance of Overlap Photoconductive Detector, by X.-N. Hu and J.-X. Fang (Shanghai Institute of Technical Physics, Chinese Academy of Sciences, Shanghai, P.R.C.): *JIMW*, vol. 15, pp. 285–289, Aug. 1996.

Carrier concentration distribution of overlap and nonoverlap photoconductive detector was calculated and analyzed by solving the one-dimensional ambipolar transport equation. The results show that the overlap structure offers a region storing the minority carriers, which suppresses the sweepout and increases the average photo-induced carrier concentration, thus improving the responsivity.

(10) The Variation of the Central Wavelength of All Dielectric Hard Thin Narrow-Band Filters, by M.-L. Wang, Z.-X. Fang, and Y.-F. Li (Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences, Shanghai, P.R.C.): *JIMW*, vol. 15, pp. 209–212, June 1996.

The variation of the central wavelength of the all dielectric hard thin narrow-band filters was reported. The deposition and variation of the central wavelength of the 0.763-nm narrow-band filters for detecting oxygen spectrums were presented.

(11) Analysis of Green Light Chaos in Microchip Laser, by D. Xiang and Y. Li (Shanghai University, Shanghai, P.R.C.): *JIMW*, vol. 15, pp. 445–449, Dec. 1996.

The greenlight output chaos in Nd:YVO_4 microchip laser were studied. The relationship between chaos characters and structure parameters was obtained. The methods to eliminate the fluctuations of chaotic amplitude and frequency were presented.

(12) Study of Dielectric Cherenkov Master, by J.-Q. Wu, C.-D. Xiong, and S.-G. Liu (University of Electronic Science and Technology, Chengdu, P.R.C.): *JAS*, vol. 14, pp. 345–352, Sept. 1996.

Making use of the self-consistent linear field theory, the three-dimensional perturbation of electrons affected by the perturbed electromagnetic fields is generally discussed. The interaction of wave to the two conventional relativistic electron beam in the dielectric cherenkov master, i.e., annular electron beam and solid electron beam, are analyzed in detail. The dispersion equations and the wave growth rates corresponding to the two conventional relativistic electron beams are derived. The effects of the radii of the two electron beams on the wave growth rates are calculated, and the discussions are presented.

(13) Growth and Characterization Study on $AgGaSe_2$ Crystal for Nonlinear Infrared Applications, by S.-F. Zhu, B.-J. Zhao, J. Liu, Z.-H. Li, H.-G. Jiang, and W.-T. Li (Sichuan University, Chengdu, P.R.C.): *JAS*, vol. 14, pp. 432–440, Dec. 1996.

A perfect, crack-free single crystal of $AgGaSe_2$ of 20 mm in diameter and 55 mm in length is grown by a modified Bridgman–Stockbarger technique in the two-zone vertical furnace. A sample of size of 10 mm * 10 mm * 9 mm is cut along the (101) cleavage plane. It is found by the IR microscope that there are few inclusions and defects in the crystal. The transmission is 62% and the absorption coefficient is 0.05 cm^{-1} at 10.6 μm, respectively. The thermal etch pits and corrosion stripes are observed by the Scanning Electron Microscope.

(14) The Study of the Microwave Characteristics of the High Speed Semiconductor Laser Diode, by Z.-Y. Yu and W.-G. Lin (University of Electronic Science and Technology, Chengdu, P.R.C.): *JE*, vol. 18, pp. 391–396, July, 1996.

By considering the characteristics and microwave packing effects of the device, a microwave equivalent circuit of semiconductor quantum well laser and the numerical analogous methods for it are proposed. By developing a proper object function and selecting a correct calculation method, the element parameters of the circuit are successfully simulated under the measured microwave S_{11} parameters. By considering the results and the measured ones, it shows that presented equivalent circuit is correct.

(15) Study of Photocurrent Measurement and Optical Illumination Effects on Schottky Barriers, by H.-C. Tsai and C.-K. Liu (National Taiwan Institute of Technology, Taiwan, P.R.C.): *JCIE*, vol. 19, pp. 239–245, Mar. 1996.

Effects of chopped illumination on the electrical noise of Schottky diodes are studied theoretically and experimentally. It is shown that the noise spectra of a bare diode illuminated by a He-Ne laser show certain structures at specific frequencies. A theoretical model is presented for the observed noise spectra. A periodic pulse Voltage due to light illumination. This method can be used to find the equivalent photocurrent and quantum efficiency of Schottky diodes.

(16) Theoretical Study on Incoherent Triangular Holography without Bias and Conjugate Image, by S. G. Kim*, E. S. Kim**, H. Lee*, and B. G. Lee* (*School of Electrical Eng., Seoul National Univ., Seoul, Korea; **Dept. of Elec. Eng., Kwangwoon Univ., Seoul, Korea): *JKITE*, vol. 33-A, no. 10, pp. 2086–2093, Oct. 1996.

The theoretical analysis and the computer simulation of a new modified Cochran's triangular interferometer as an incoherent holography, which can eliminate bias and conjugate image problems of the conventional Cochran's triangular interferometer, are presented. We demonstrated the validity of the suggested method by comparing the modified Cochran's triangular interferometer with the conventional one.

(17) Low-Coherence Non-Scanning Michelson Interferometry Using Visible Broadband Light Source, by M. H. Song and B. G. Lee (School of Elec. Eng., Seoul National Univ., Seoul, Korea): *JKITE*, vol. 33-A, no. 10, pp. 2102–2109, Oct. 1996.

A new pathlength deviation detection technique which is composed of Michelson interferometer is described and verified experimentally. The technique uses a sub-threshold biased visible laser diode of 20-μm coherence length as a low-coherent light source.

(18) Grating Fabrication for DFB Laser Diode Using Holographic Interferometer System, by M. K. Kang* and H. S. Oh** (*Dept. of Electronic Comm., Chungbuk College, Chungju, Korea; **Dept. of Elec. Eng., Konkuk Univ., Seoul, Korea): *JKITE*, vol. 33-A, no. 6, pp. 1058–1063, June 1996.

Periodic gratings for $1.55-\mu$m Distributed FeedBack Laser Diode (DFB LD) have been fabricated by a holographic interference exposure system using an etalon stabilized Ar ion laser. We obtain a good development condition at developer concentration of 65%, and obtain etching rate of 1000 $\text{Å}/\text{min}$ at 20°C by the mixed solution HBr:HNO_3:H_2O (1:1:10 in volume ratio).

(19) A Study on the Single Frequency Operation Yield of DFB Lasers Using a Transfer Matrix Method, by J. D. Lee and S. B. Kim (Div. of Electrical & Electronics Eng., Ajou Univ., Seoul, Korea): *JKITE*, vol. 33-A, no. 6, pp. 1139–1146, June 1996.

We have studied single-frequency yield of 1.55-μm DFB lasers with uniform sinusoidal grating using an effective index transfer matrix method considering both threshold gain difference and spatial hole-burning effect. Optimum grating height and mirror reflectivities that maximize the single-frequency yield are found for a low-reflection (LR)/high-reflection (HR) mirror structure and a LR/as-cleaved mirror structure for an assumed basic waveguide structure.

(20) Design Rules of Three-Waveguide Optical Switches, by Y. J. Im and C. M. Kim (Dept. of Elec. Eng., Seoul City Univ., Seoul, Korea): *JKITE*, vol. 33-A, no. 6, pp. 1147–1155, June 1996.

Four types of three-waveguide optical switches are analyzed by means of the coupled mode theory. Assuming that three proximate waveguides of an optical switch are identical and equally spaced, we examine the switching behavior for both cases where an incident beam is launched into 1) the outer waveguide and 2) the center waveguide. For each beam-launching case, switching voltage is applied so that three waveguides' refractive indices be detuned 1) symmetric and 2) anti-symmetric.

(21) Holographic Recording Properties of Photopolymer Films, by J. S. Park*, D. H. Shin, J. S. Jang, and S. I. Jeong (Dept. of Telematics Eng., Pukyoung National Univ., Korea): *JKITE*, vol. 33-A, no. 9, pp. 1853–1861, Sept. 1996.

The hologram recording properties of DuPont HRF 710-20 transmission-type photopolymer films were investigated. The trend of diffraction efficiency increase in time was measured. Multiple images were recorded in the films and their recording properties were compared.

(22) Integrated Optical High-Voltage Sensor Based On a Polymeric Digital Optical Switch, by S. S. Lee*, S. W. Ahn*, S. Y. Shin*, and M. C. Oh** (*Dept. of Electrical Eng., KAIST, Taejon, Korea; **Electronics and Telecom. Research Inst., Taejon, Korea): *JKITE*, vol. 33-A, no. 9, pp. 1862–1870, Sept. 1996.

An integrated optical high-voltage sensor is realized by fabricating a Y-branch digital optical switch in an electro-optic polymer. The measurement of ac high voltage is accomplished by using the linear transfer characteristics of the switch at zero bias voltage.

(23) Parallel Optical Feature Extraction Using Rotationally Multiplexed Holograms, by J. S. Jang and D. H. Shin (Dept. of Telematics Eng., Pukyong National Univ., Korea): *JKITE*, vol. 33-A, no. 9, pp. 1871–1877, Sept. 1996.

We propose a novel peristrophic (rotational) multiplexing method in hologram recording for parallel optical feature extraction, and report basic experimental results on this. The extracted features can be utilized for shift-invariant, rotation-invariant, and size-invariant pattern recognition.

(24) A New Approach for Synthesizing Digital Hologram by Waveform Decomposition, by H. G. Yang* and E. S. Kim** (*Dept. of Radio Science and Eng., Kwangwoon Univ., Seoul, Korea; **Dept. of Electronic Eng., Kwangwoon Univ., Seoul, Korea): *JKITE*, vol. 33-A, no. 1, pp. 100–107, Jan. 1996.

This paper presents a new method for real-time synthesis of digital hologram for a two-dimensional object. It is shown that this method incorporates the spherical nature of a radiation pattern via decomposing it into the sum of plane waves. Some comparisons with existing methods are made and associated sampling constraints are derived.

(25) Optical Interconnection Using a Four Phase Grating, by M. S. Kim (Dept. of Electronics Eng., College of Eng., Kunsan National Univ., Kunsan, Korea): *JKITE*, vol. 33-A, no. 1, pp. 88–93, Jan. 1996.

Properties of a binary phase grating and a four phase grating are analyzed for optical interconnection. The four-phase grating is encoded for asymmetric optical interconnection with simulated annealing algorithm, and the encoded four-phase grating showed excellent performance for asymmetric optical interconnection.

(26) Design & Implementation of Pixilated Phase Gratings for Optical Image Generation, by D. J. Lee*, N. Kim*, K. Y. Lee**, and J. J. Eun*** (*Dept. of Computer & Comm. Eng., Chungbuk National Univ., Chungju, Korea; **Dept. of Electronic Eng., Sunchon Univ., Sunchon, Korea; ***Dept. of Electronic Eng., Changwon Univ., Changwon, Korea): *JKITE*, vol. 33-A, no. 5, pp. 860–869, May 1996.

We have compared and analyzed the characteristics of multilevel phase gratings, laying stress on efficiency and resulted pattern. Experimental results obtained from fabricated grating have been presented, and the real-time method using a liquid-crystal specific intensities have been designed and optical images have been generated by them.

(27) A New Optically Transparent Cell Generator for Optical TDM Network, by K. H. Kim, Y. H. Won, and K. U. Chu (Photonic Switching Section, Electronics and Telecom.

Research Institute, Taejon, Korea): *JKITE*, vol. 33-A, no. 8, pp. 1518–1522, Aug. 1996.

The proposed cell generator performs NRZ-to-RZ conversion and aggregates the RZ signals into a cell using the pair of semiconductor optical amplifiers (SOA's) and the cascaded optical fiber Mach-Zehnders (two stages). The high bandwidth nature of optical signal can be utilized without any degradation of the signal fidelity for the future telecommunication network.

(28) Fabrication of a Fe:$LiNbO_3$ Optical Switch Array Using the Photorefractive Effect, by K. H. Kang, B. D. Kim, T. H. Jung, T. H. Yoon, J. C. Kim, and G. J. Kim (Dept. of Electronics Eng., Pusan National Univ., Pusan, Korea): *JKITE*, vol. 33-A, no. 8, pp. 1643–1649, Aug. 1996.

We report the fabrication of a 5×5 Fe : $LiNbO_3$ optical switch array using the photorefractive effect. Since the diffraction efficiency and the decay time are larger for the $+$c axis direction, the diffusion of electrons is the main factor for the grating formation. The grating formation time is inversely proportional to the power, and the self-enhancement effect is larger at a high power.

(29) A Study on the Characteristics of a Widely Tunable Sampled Grating DBR Laser Diode Integrated with an External Modulator, by B. S. Kim*, Y. C. Chung* and S. H. Kim** (*Dept. of Elec. Comm. Eng., The Institute of New Technology, Kwangwoon, Seoul, Korea; **Div. of Electronics and Information, KIST, Seoul, Korea): *JKITE*, vol. 33-A, no. 8, pp. 1650–1661, Aug. 1996.

A SGDBR (sampled grating distributed bragg reflector) laser diode integrated with an external modulator is studied using the transfer matrix method and the scattering matrix. It is shown that a SGDBR laser diode without an external modulator has a wide tunability.

(30) Optimum Design of 1.55 μm RWG Laser Diode Using Equivalent Circuit Model, by Y. S. Han and S. B. Kim. (Dept. of Electron. Eng., College of Eng., Ajou Univ., Seoul, Korea): *JKITE*, vol. 33-A, no. 1, pp. 81–87, Jan. 1996.

It is shown that the optimum active thickness with minimum driving current at a specified optical output is always thinner than the thickness of lowest threshold current.

(31) Analysis of the Operating Characteristics of a Birefringent Optical Isolator, by S. Y. Cho, H. S. Kang, and K. S. Lee (Dept. of Elec. Eng., Sungkyunkwan Univ., Soowon, Korea): *JKICS*, vol. 21, no. 10, pp. 2731–2737, Dec. 1996.

The effect of the birefringence existing in the Faraday rotator on the isolation and transmission properties of the isolator was investigated. To maintain isolation of 50 dB, both the deviation of the transmission angle between input and output polarizers and the deviation of the Faraday rotation angle are permitted to $\pm 0.18^{\circ}$ for birefringenceless isolator and to $\pm 0.09^{\circ}$ for birefringent isolator.

(32) Analysis of Thermal Characteristic Variations in LD Arrays Packaged by Flip-Chip Solder-Bump Bonding Technique, by C. H. Seo*, J. M. Cheong*, and Y. K. Jhee** (*Dept. of Elec. Eng., KAIST, Taejon, Korea; **Dept. of Elec. Eng., Ewha Womans Univ., Seoul, Korea): *JKITE*, vol. 33-A, no. 3, pp. 510–521, Mar. 1996.

In the LD array module packaged by the flip-chip bonding technique without TEC (thermo-electric cooler), the important parameter is the absolute temperature of the active layer due to thermal crosstalk. In order to reduce thermal crosstalk we propose a heat-sink structure which can decrease the temperature at the active layer by 40%.

(33) Wideband Modulation Analysis of a Packaged Semiconductor Laser in Consideration of the Bonding Wire Effect, by S. K. Yun*, Y. S. Han**, S. B. Kim*, and H. Y. Lee* (*School of Electrical and Electronics Eng., Ajou Univ., Suwon, Korea; **Div. of Elec., Kukje Corp., Korea): *JKITE*, vol. 33-A, no. 2, pp. 300–306, Feb. 1996.

The inductances of bonding wires are calculated by the Method of Moments with incorporation of ohmic loss, and the wideband modulation characteristics are analyzed for different wire lengths and structures. We observed the modulation bandwidth for 1-mm-length bonding wire is 7 GHz wider than that for 2-mm-length bonding wire.

(34) Optical Implementation of Two-Stage Free-Space Interconnection Network Using Hologram Arrays, C. H. Ji, J. S. Park, J. S. Jang, and S. I. Jeong (Dept. of Telematics Eng., Pukyung Univ., Korea): *JKITE*, vol. 33-A, no. 7, pp. 1451–1458, July 1996.

In order to increase the diffraction efficiency of the hologram elements in photographic plates, a bleaching technique was used, which converts the amplitude hologram to the phase hologram. Using the bleached hologram arrays and an LCTV spatial light modulator, a photonic switching system was demonstrated.

(35) Effects of Structural Nonidealities on the Lasing Characteristics of $\lambda/4$ Phase-Shifted DFB Lasers, by J. S. Cho and S. B. Kim (Division of Elec. and Elec. Eng., Ajou Univ., Suwon, Korea): *JKITE*, vol. 33-A, no. 7, pp. 1443–1450, July 1996.

$\lambda/4$ phase-shifted DFB lasers with nonideal grating structure have been studied by using an effective-index transfer matrix method. Phase-shift error from the ideal shift of π causes a decease in the threshold gain difference and lasing wavelength shift should be less than $\pi/4$ when residual facet reflectivity is 0.7%. Also, positional error of the phase-shift should be less than 9% of the cavity length in order for the threshold gain difference to be decreased less than 10%.

(36) Operation of Optical Information Retrieval System Using Spatial Light Modulator, by M. Hatori*, K. Shioya*, K. Tsutida**, M. Mita***, M. Ohkawa*, and S. Sekine* (*Faculty of Engineering, Niigata University, Niigata-shi, 950-21 Japan; **Dept. of Electrical Engineering, Nagaoka College of Technology, Nagaoka-shi, 940 Japan; ***Dept. of Information Engineering, Niigata Polytechnic College, Shibata-shi, 957 Japan) (vol. J79-C-I, no. 1, pp. 10–18): *Trans. IEICE*, vol. E79-C, p. 139, Jan. 1996.

An information retrieval system based on the Fourier optics is described. The system can pick out required data from a huge amount of information in parallel processing using a spatial light modulator (SLM). In the system, a hologram is used as a storage medium to densely store digital information. We considered the feasibility of the system operation and designed an example that consists of optical elements presently available. The small-scale system in which nine pieces of

information with eighteen bits each could be accessed was built and tested successfully.

(37) Equalization of the Coupling Loss of LD Array Modules for Optical FDM System, by S. Kaneko, A. Adachi, and J. Yamashita (Mitsubishi Electric Corporation, Kamakura-shi, 247 Japan) (vol. J79-C-I, no. 2, pp. 45–52): *Trans. IEICE,* vol. E79-C, p. 252, Feb. 1996.

A method for equalizing the coupling loss of LD array modules has been proposed. In this method, second lens position is adjusted to equalize the distance between the image point and the fiber of each channel. This equalization can be achieved by utilizing the dependence of the outgoing angle from the second lens on the object height.

(38) Effect of Laser Phase-Induced Intensity Noise on Multiplexed Fiber-Optic Sensor System Using Optical Loop with Frequency Shifter, by Xiao-qun ZHOU, K. Iiyama, and K. Hayashi (Dept. of Electrical and Computer Engineering, Faculty of Engineering, Kanazawa University, Kanazawa-shi, 920 Japan): *Trans. IEICE,* vol. E79-C, pp. 437–443, Mar. 1996.

We have proposed a multiplexed fiber-optic sensor system using an optical loop with a frequency shifter. The measured output power spectrum of the system has shown that the multiplexed signals superimpose upon a noise pedestal which is like a series of hill peaks. In this paper, the output power spectrum is theoretically analyzed from the output intensity autocorrelation function. It displays that the noise pedestal originates from the laser phase-induced intensity noise.

(39) Properties of Phase Conjugate Reflectivity of Self-Pumped Four-Wave Mixing, by M. Dohata*, A. Okamoto*, K. Sato**, and K. Enbutsu* (*Faculty of Engineering, Hokkaido University, Sapporo-shi, 060 Japan; **Faculty of Engineering, Hokkai-Gakuen University, Sappro-shi, 064 Japan) (vol. J79-C-I, no. 4, pp. 109–116): *Trans. IEICE,* vol. E79-C, p. 597, Apr. 1996.

Phase conjugate reflectivity of self-pumped four-wave mixing (SPFWM) is analyzed. In SPFWM all of the interacting beams are contained within a single photorefractive crystal using a four-wave mixing configuration in which the same crystal produces self-pumped phase conjugation to generate the counter-propagating pump beam. Assuming the analysis model using an external Cat mirror for SPFWM, quantitative properties of the phase conjugate reflectivity versus coupling strength, incident beam ratio, and Cat mirror reflectivity are calculated.

(40) Single Axial Mode Operation of Resonantly Pumped Yb:YAG Microchip Lasers, by T. Taira*, W. M. Tulloch**, R. L. Byer**, and T. Kobayashi* (*Faculty of Engineering, Fukui University, 9-1 Bunkyo 3-chome, Fukui-shi, 910 Japan; **Gintzton Laboratory, Stanford University, Stanford, CA94305, USA) (vol. J79-C-I, no. 5, pp. 138–144): *Trans. IEICE,* vol. E79-C, p. 720, May 1996.

Trivalent ytterbium ion doped YAG is an attractive material for a high-power and high-stability laser, because it has a smaller quantum defect and a longer upper state life time than Nd: YAG. In the last few years, several reports have been devoted to the study of Yb: YAG lasers. However, a single axial mode Yb: YAG laser has never been reported. In this paper, we have demonstrated a resonantly pumped Yb: YAG microchip laser to overcome limited pump absorption. Single mode oscillation with output power of 30 mW at 13-mW threshold and 14.8% slope efficiency was observed in a 10 at.% doped 80-μm-thick Yb: YAG microchip laser pumped by a Ti: Al_2O_3 laser.

(41) Michelson-Interferometer Type CO_2 Laser for Specification to Lineshape Parameter Analysis, by Y. Kodama and H. Sato (Dept. of Electrical Engineering, National Defense Academy, Yokosuka-shi, 239 Japan): *Trans. IEICE,* vol. E79-C, pp. 853–862, June 1996.

The Michelson-interferometer (MI) optical resonator has been applied, together with physical interests, to a low-pressure and slow-flow-type CO_2 laser for specifying the system to a probe laser source. The fundamental characteristics on line-selection, oscillation power and Transverse mode are also investigated in comparison to the CO_2 laser obtained for various resonators such as an open-ended reflective-multiple interferometer (RMI), an open-sided MI, a Fox-Smith interferometer, and so on. Consequently, it is confirmed that the MI-type laser proposed can be one of the promising scheme, without losing oscillation power much and Transverse mode quality as a probe laser toward lineshape (or laser) parameter analysis.

(42) Characteristics in Neodymium-Doped Fiber Amplifiers at 1. 06 μm, by T. Miyazaki*†, Y. Karasawa*††, and M. Yoshida** (*ATR Optical and Radio Communications Research Laboratories, Kyoto-fu, 619-02 Japan; **Mitsubishi Cable Industries, Ltd., Hyogo-ken, 664 Japan; † Presently, with KDD R&D Laboratories; †† Presently, with ATR Adaptive Communications Research Laboratories): *Trans. IEICE,* vol. E79-C, pp. 863–869, June 1996.

We have investigated the gain and noise figure characteristics of a Nd-doped silica single-mode fiber amplifier (NDFA) at 1.06 μm. The pump wavelength tolerance at around 0.81 μm, the gain bandwidth and the sufficient value of the Nd concentration and length product for achieving maximum small signal gain are clarified. A noise figure of almost 3 dB and small signal gain of more than 30 dB are attained by 50-mW pump power. We also demonstrated high-power operation of the NDFA with four pump LD modules adopting a polarization-multiplexing technique. More than 100-mW signal output power is available for 1-mW signal input power at 200-mW launched pump power.

(43) Polarization Dependence of Pure Bending Loss in Slab Optical Waveguides, by J. Yamauchi, O. Saito, M. Sekiguchi, and H. Nakano (College of Engineering, Hosei University, Koganei-shi, 184 Japan): *Trans. IEICE,* vol. E79-C, pp. 870–873, June 1996.

The finite-difference beam-propagation method is applied to the analysis of a bent step-index slab optical waveguide. The results obtained in the rectangular coordinates with a modified index profile are compared with those in the cylindrical coordinates with a real index profile. It is found that the attenuation constant for TM_0 mode is larger than that for TE_0 mode. The polarization dependence of bending loss is negligible, provided the refractive index difference is less than 2%.

(44) Lasing Characteristics of a Mode-Locked EDF Laser Using an LD as an Optical Modulator, by J. Inoue and H. Kawaguchi (Faculty of Engineering, Yamagata University, Yonezawa-shi, 992 Japan) (vol. J79-C-I, no. 7, pp. 225–223): *Trans. IEICE,* vol. E79-C, p. 1021, July 1996.

We studied the mode-locking of an Er-doped fiber (EDF) laser of which an InGaAsP laser diode (LD) was inserted in the cavity. Using an LD as a saturable absorber, self-Q-switching and self-mode-locking was obtained. Active-mode-locking was obtained when the LD was operated as a modulator with optical gain. In proportion as the modulation frequency became higher, the pulse duration became short. When harmonic number is 390, 120-ps optical pulses were obtained. By short current pulse modulation, much shorter pulses (30 ps) were obtained. Stable mode-locking was also obtained when the polarization in EDF matched to the TE-mode of the LD.

(45) The Light-Chopper for Infrared Detection Utilizing Ferroelectric Crystal, by J. Kobayashi*, J. Kita*, and K. Yoshino** (*Central Research Laboratory, Shimadzu Corporation, Kyoto-shi, 604 Japan; **Faculty of Engineering, Osaka University, Suita-shi, 565 Japan) (vol. J79-C-I, no. 7, pp. 240–248): *Trans. IEICE,* vol. E79-C, p. 1022, July 1996.

The development of light chopper has been intended to apply to IR detection utilizing the TSM effect of FLC with domain switching. Optimum condition have provided high response and high performance of IR modulation by asymmetric rectangular voltage. In order to realize the origin of the corresponding phenomena, the reversal current has been monitored and structures of scattering objects have been observed through high speed camera. And the dependence of modulation intensity on applied voltage, incident angle or environmental temperature has been measured in 2–10-μm region. Also the specification of our IR-chopper fabricated is presented.

(46) TV Wave Receiving System Using Optical Modulator, by K. Hayeiwa*, H. Naka*, Y. Toba**, Y. Tokano**, and Y. Sato** (*Engineering Administration Dept., Japan Broadcasting Corporation, Tokyo, 150-01 Japan; **Tokin Corporation, Sendai-shi, 982 Japan) (vol. J79-C-I, no. 7, pp. 249–255): *Trans. IEICE,* vol. E79-C, p. 1022, July 1996.

This paper presents an RF signal transmission system for the TV relay station by using an optical modulator which can modulate its optical power by feeble RF signals from the receiving antenna. CN ratio of 50 dB is obtained in the electric field of 60 dB μV/m by developing high sensitive reflected-type optical modulator using the resonance circuit to amplify RF voltage signals. This system has an excellent DG of 1.1% and DP of 1.6°.

(47) Generation and Transmission of Optical Soliton Pulses, by M. Nakazawa, H. Kubota, and E. Yamada (NTT Access Network Systems Laboratories, Ibaraki-ken, 319-11 Japan) (vol. J79-C-I, no. 8, pp. 265–277): *Trans. IEICE,* vol. E79-C, p. 1180, Aug. 1996.

The first half of this paper describes methods of optical soliton pulse generation using mode-locked semiconductor lasers, mode-locked fiber lasers, gain-switched semiconductor lasers and electron absorption modulators and compares the relative merits of these generation methods. The latter half summarizes recent progress on soliton transmission including soliton control and WDM transmission.

(48) Effects of a Nonuniform Beam Velocity in a Cherenkov Laser, by T. Ueda and T. Shiozawa (Faculty of Engineering, Osaka University, Suita-shi, 565 Japan) (vol. J79-C-I, no. 8, pp. 278–286): *Trans. IEICE,* vol. E79-C, p. 1180, Aug. 1996.

Effects of a nonuniform beam velocity in a Cherenkov laser are investigated on the basis of the fluid model for the electron beam. Due to a nonuniform drift velocity of the electron beam, there appears a well-defined plane in the electron beam which separates it into two regions: one mainly contributes to the growth of the electromagnetic wave while the other does only slightly. Thus an optimum beam thickness for an efficient use of the electron beam in a Cherenkov laser is found, and it is approximately half of the reactive skin depth of the electron beam.

(49) Angular Dependence of Phase Conjugate Intensity in Forward Four-Wave Mixing with Gaussian Beam Pumping, by K. Hagiwara,* A. Okamoto*, H. Kaneko*, K. Koyanagi*, and K. Sato** (*Faculty of Engineering, Hokkaido University, Sapporo-shi, 060 Japan; **Faculty of Engineering, Hokkai-Gakuen University, Sapporo-shi, 064 Japan) (vol. J79-C-I, no. 8, pp. 295–302): *Trans. IEICE,* vol. E79-C, pp. 1180–1181, Aug. 1996.

In this paper, we analyze the angular dependence of phase conjugate beam intensity in forward four-wave mixing with Gaussian beam pumping. First, a phase conjugate diffracting field is derived assuming Gaussian beam pumping and sufficiently small conjugate beam intensity. Second, the intensity distribution of phase conjugate beam normalized by probe intensity is calculated in consideration of the beam angles and the nonlinear medium thickness. The angular dependence of the beam intensity in case of optically thin nonlinear medium is compared with one in the case of sufficiently thick nonlinear medium, and the difference between Gaussian beam pumping and plane wave pumping in forward four-wave mixing is shown.

(50) Fresnel-Type Variable Focus Electro-Optic Lens Using $LiNbO_3$ Crystal with Quadratic Curved Electrodes, by K. Koyanagi (Faculty of Engineering, Hokkaido University, Sapporo-shi, 060 Japan) (vol. J79-C-I, no. 8, pp. 339–342): *Trans. IEICE,* vol. E79-C, p. 1182, Aug. 1996.

Fresnel-type electro-optic lenses using a $LiNbO_3$ crystal with simple quadratic curved electrodes are proposed. The focal length of the concave or convex lens can be varied by applying electric fields perpendicular to the traveling direction of the incident light. The focal length for the ordinary ray is different from that for the extraordinary ray at the same applied electric fields.

(51) Lasing Characteristics of Optical Fiber Brillouin Ring Laser with Spatially Distributed Gain Coefficient, by Y. Tanaka and K. Hotate (RCAST, Research Center for Advanced Science and Technology, The University of Tokyo, Tokyo, 153 Japan): *Trans. IEICE,* vol. E79-C, pp. 1436–1441 Oct. 1996.

The thermal and/or the tensile strain distribution along the fiber make the Brillouin gain coefficient different in each point of the fiber. As a basic study of the Brillouin fiber optic gyro, its effect on lasing characteristics of a fiber Brillouin ring laser is formulated in the general form by using the statistical function and then calculation is done for typical values of the parameters. By suppressing the polarization-fluctuation-induced noise caused by the temperature, an example of the effect of the spatially distributed gain coefficient is experimentally demonstrated.

(52) Generation of Ultra-Flat Optical Ring Beam and Its Application to Laser Levels, by K. Iga*, Y. Kawaguchi**, and S. Katsura** (*Tokyo Institute of Technology, Yokohama-shi, 226 Japan; **Kawaguchi Optical Industry, Corp., Yokohama-shi, 227 Japan) (vol. J79-C-I, no. 10, pp. 396–397): *Trans. IEICE,* vol. E79-C, p. 1475, Oct. 1996.

In this paper, we propose a novel method to produce an ultra-flat optical beam by using a principle of zig-zag ray propagation in a stelp-index optical fiber. We present its basic principle, design, manufacturing of necessary components, and fabrication of a prototype laser-level system. This ring beam optical system may provide a wide range of applications in opto-electronics.

(53) Wavelength Trimming Technology for Distributed-Feedback Lasers, by T. K. Sudoh, Y. Nakano, and K. Tada (Faculty of Engineering, University of Tokyo, Tokyo, 113 Japan) (vol. J79-C-I, no. 10, pp. 400–401): *Trans. IEICE,* vol. E79-C, p. 1475, Oct. 1996.

In order to secure lasing-wavelength reproducibility in distributed-feedback lasers, we propose a novel concept of "wavelength trimming." This is a post-fabrication wavelength-error correction technology where no external tuning is necessary. We demonstrate 0.1 nm adjustment in a 1.55-μm DFB laser by making use of photo-induced refractive index change.

(54) New-Type Polarization Controller with Smectic A Liquid Crystals, by Y. Kometani*, M. Shibata*, H. Okada*, H. Onnagawa*, and Y. Kidoh** (*Faculty of Engineering, Toyama University, Toyama-shi, 930 Japan; ** Dept. of Electronic Engineering, Toyama National College of Technology, Toyama-shi, 939 Japan) (vol. J79-C-I, no. 10, pp. 402–405): *Trans. IEICE,* vol. E79-C, p. 1476, Oct. 1996.

Four-electrodes-type polarization controller with smectic A liquid crystal has been fabricated and polarization characteristics has been investigated. In this device structure, a direction of electric field can be changed freely and the two functions of the optical rotation and phase modulation are integrated.

(55) Time-Domain Sagnac Phase Reading in Open-Loop Fiber Optic Gyroscopes, by S. Oho*, H. Sonobe*, and H. Kajioka** (*Hitachi Research Laboratory, Hitachi, Ltd., Hitachi-shi, 319-12 Japan; **Hitachi Cable, Ltd., Hitachi-shi, 319-14 Japan): *Trans. IEICE,* vol. E79-C, pp. 1596–1601 Nov. 1996.

Time-domain characteristics of the signal of an open-loop fiber optic gyroscope were analyzed. The waveform moments of the gyroscope signal were dependent upon the rotation-induced Sagnac phase, just as the signal frequency spectra are. The peak positions of the time signal also varied with the supplied rotation, and the Sagnac phase could be read out, with optimum sensitivity, from the intervals between peaks. To demonstrate the time-domain measurement technique, the gyroscope signal was transferred to lower frequencies and the signal period was lengthened.

(56) Fabrication of High Quality Fiber Bragg Grating and Its Wavelength Tuning, by T. Komukai, T. Yamamoto, T. Imai, and M. Nakazawa (NTT Access Network Systems Laboratories, Ibaraki-ken, 319-11 Japan) (vol. J79-C-I, no. 11, pp. 413–419): *Trans. IEICE,* vol. E79-C, p. 1628, Nov. 1996.

3.10-eV Luminescence is generated by UV radiation and guided in a germanium-doped silica fiber. In this paper we propose a new UV scantype fiber Bragg grating fabrication technique by monitoring the power of the luminescence. We successfully fabricated chirp-free and high quality fiber Bragg gratings by using this approach. Also, applications for optical filters are discussed. Tunable and low-loss optical filters were realized.

(57) Proposal on a Temperature-Insensitive Wavelength Semiconductor Laser, by K. Oe and H. Asai (*NTT Opto-electronics Laboratories, Atsugi-shi, 243-01 Japan.): *Trans. IEICE,* vol. E79-C, pp. 1751–1759, Dec. 1996.

The paper discusses the possibility of building semiconductor lasers whose wavelength stays nearly constant with ambient temperature variation. Several factors affecting the lasing wavelength change with temperature variation in both distributed feedback lasers and Fabry–Perot lasers are addressed and the optimum design of bandgap temperature dependence for the active layer material is discussed. It is pointed out that the most important challenge we face in building temperature-insensitive wavelength lasers is the development of a temperature-insensitive bandgap material for the active layer.

(58) Experimental Evidence of Mode Competition Phenomena on the Feedback Induced Noise in Semiconductor Lasers, by M. Yamada, A. Kanamori, and S. Takayama† (Faculty of Engineering, Kanagawa University, 2-40-20, Kodatsuno, Kanazawa-shi, 920 Japan; †Presently, Tokyo Institute of Technology): *Trans. IEICE,* vol. E79-C, pp. 1766–1768, Dec. 1996.

Mechanism of the noise generation caused by the optical feedback in semiconductor laser was experimentally determined. Two types of the mode competition phenomena were confirmed to be the generating mechanisms. Applicability of the self-sustained pulsation to be a noise reduction method was also discussed.

(59) Water Vapor Density Measurement in Halogen Lamps Using Near-Infrared Semiconductor Laser Spectrometry I—Working Curve Measurement, by T. Suzuki (Sendai National College of Technology, Sendai-shi, 989-31 Japan): *Trans. IEICE,* vol. E79-C, pp. 1769–1771, Dec. 1996.

Preliminary experiments on nondestructive quantitative analysis of water vapor density in halogen lamps have been carried out. A working curve showing a relation between absorbance and water vapor density was successfully obtained by using frequency-stabilized InGaAsP/InP semiconductor laser spectrometric system.

(60) Fabrication of Optical Polarizer with Large Aperture Made of Diluted Metal-Implanted Anodized Alumina Film, by D. Tobise and M. Miyagi (Faculty of Engineering, Tohoku University, Sendai-shi, 980-77 Japan) (vol. J79-C-I, no. 12, pp. 468-472): *Trans. IEICE*, vol. E79-C, p. 1776, Dec. 1996.

A new method has been proposed for reducting insertion loss of optical polarizer made of metal-implanted anodized alumina film. The method is based on dilution of implanted metal in the film by use of selective bromination. Attenuation of the optical polarizer using this film has been theoretically estimated and optical polarizer with large aperture has been fabricated with an extinction ratio of $\geq$35 dB and an insertion loss of 0.57 dB at the wavelength of 1.55 μm.

(61) A Method for Reduction in Internal Reflection of Monolithically Integrated Optical Devices with Butt-Jointed Optical Waveguides, by T. Kurosaki, Y. Tohmori, O. Mitomi, K. Kasaya, Y. Sakai, H. Okamoto, M. Okamoto, Y. Suzaki, M. Wada, and N. Uchida (NTT Opto-electronics Laboratories, Atsugi-shi, 243-01 Japan) (vol. J79-C-I, no. 12, pp. 482–483): *Trans. IEICE*, vol. E79-C, p. 1777, Dec. 1996.

An effective method for reducing the internal reflection in monolithically integrated optical devices with butt-jointed optical waveguides is shown. Internal reflection of less than $-$47 dB and stable behavior in the spectrum characteristics are experimentally confirmed using a waveguide integrated laser diode with 45° tilted butt-joint structure.

VII. Optical Fibers/Waveguides

(1) Investigation of Si Based GaAs/GaAlAs Planar Optical Waveguide, by C.-Z. Zhao*, Z.-Y. Zhu*, Y.-J. Li*, E.-K. Liu**, G.-Z. Li**, and X.-D. Liu** (*Xidian University, Xi'an, P.R.C.; **Xi'an Jiaotong University, Xi'an, P.R.C.): *JIMW*, vol. 15, pp. 221–223, June 1996.

The structure characteristics of MOCVD GaAs/GaAlAs/GaAs/Si were analyzed. Some planar optical waveguides samples were fabricated with the structure of GaAs/GaAlAs/GaAs grown on Si substrates by MOCVD. The single-mode propagation losses of the planar optical waveguides were measured and they are less than 0.65 dB/cm at the wavelenth of 1.3 μm.

(2) Development of SiGe/Si Directional Couple, by Y. Gao*, G.-Z. Li*, E.-K. Liu*, C.-Z. Zhao*, X.-D. Liu*, X.-J. Zhang**, X.-K. Lu**, and X. Wang** (*Xi'an Jiaotong University, Xi'an, P.R.C.; **Fudan University, Shanghai, P.R.C.): *JIMW*, vol. 15, pp. 33–37, Feb. 1996.

Based on the analysis of structural parameters of SiGe/Si directional couple by using SiGe ridge waveguides single-mode conditions and the effective index methods, the SiGe/Si $(x = 0.05)$ directional couple was fabricated by MBE method and by using KOH anisotropic etching. The average coupling efficiency is 98.1% at $\lambda = 1.3$ μm. The average crosstalk is below $-$18.6 dB.

(3) An Interferometric Optical Fiber Electric Field Sensor with a Fiber-Optic Electrostrictive Transducer, by W. S. Kang*, H. S. Kang*, R. S. Jeong*, K. S. Lee*, and H. M. Jang** (*Dept. of Elec. Eng., Sungkyunkwan Univ., Suwon, Korea; **Dept. of Materials Sci. and Eng., Pohang Univ. of Sci. and Tech., Pohang, Korea): *JKITE*, vol. 33-A, no. 9, pp. 1847–1852, Sept. 1996.

The measured electrostriction coefficient of the electrostrictive transducer was 5.4 $\times 10^{-16}$ $(\mathrm{m/V})^2$ at 5.8 kHz. The electric field sensor showed a good linearity over the dynamic range 30 dB and a minimum detectable field of $\sim$0.22 $(\mathrm{V/m})/\sqrt{\mathrm{Hz}}$.

(4) Repeaterless Transmission of the MQW LD Directly Modulated 10 Gbit/s Optical Signal over 300 km of Dispersion-Shifted Fiber, by J. H. Han and M. S. Park (Optical Transmission Section, ETRI, Taejon, Korea): *JKITE*, vol. 33-A, no. 9, pp. 1878–1886, Sept. 1996.

An optical transmitter was designed and implemented using a commercially available MQW LD module. We applied 10-Gbit/s pseudo-random bit sequence $2^{23} - 1$ nonreturn-to-zero signal to the transmitter. The laser center wavelength of 1547 nm and side-mode-suppression-ratio of 38 dB were obtained.

(5) Analysis of Planar Optical Waveguides Using Incident Angle of Complex Number, by Y. J. Im and C. M. Kim (Dept. of Elec. Eng., Seoul City Univ., Seoul, Korea): *JKITE*, vol. 33-A, no. 5, pp. 877–882, May 1996.

We propose the concept of incident angle of complex number and analyze planar optical waveguides by applying the concept. It is shown that, when optical waveguides are analyzed by use of the transfer matrix method, the proposed concept enables us to find solutions faster and more accurately than Ghatak's method which introduces the leaky structure.

(6) A Study on Design Method of Waveguide Grating Router Composed of Star Couplers, by S. Moon and Y. Chung (Dept. of Electronic Comm. Eng. Institute of New Tech., Kwangwoon Univ., Seoul, Korea): *JKITE*, vol. 21, no. 9, pp. 2526–2527, Sept. 1996.

The efficient algorithm for design of waveguide grating router (WGR) composed of star couplers is proposed. It is well demonstrated that a star coupler design can be easily adjusted to the optimum state using the proposed design method, which analyzes relations between various parameters. The BPM (Beam Propagation Method) simulation results show that the channel spacing of the WGR agrees very well with the design, the excess loss is smaller than 2.5 dB, and the crosstalk is less than $-$21 dB.

(7) A Study on the Fabrication of Optical Waveguides Utilizing Strain-Optic Effect and Electrooptic Modulators in $LiNbO_3$, by S. B. Park and H. S. Jung (Dept. of Electronic and Computer Eng., Hongik Univ., Seoul, Korea): *JKITE*, vol. 33-A, no. 8, pp. 1662–1667, Aug. 1996.

Channel waveguides have been fabricated in X-cut $LiNbO_3$ having strain-optic effect by the strain resulting from depositing $\sim$3 μm SiO_2 film at 300 °C on it. The electrodes along channel waveguide were formed by depositing aluminum to produce the electrooptic amplitude modulators. A strain contour and strain value below the surface of $LiNbO_3$ were simulated by the finite-element method.

(8) A Study on the Fabrication of Y-branch for Optical Power Distribution and its Coupling Properties with Optical Fiber, by S. D. Kim*, S. B. Park**, J. H. Yun***, J. G. Lee***, and J. B. Kim*** (*Dept. of Electrics, Dong-A College, Pusan, Korea; **Dept. of Information & Comm.

Eng., Dongshin Univ., Naju, Korea; ***Dept. of Electronic Eng., Chosun Univ., Kwangju, Korea): *JKITE*, vol. 33-A, no. 12, 99, pp. 3277–3285, Dec. 1996.

We designed an optical power distribution device for application to an optical switching and an optical subscriber loop. Based on the measured index of fabricated thin film, rib-type waveguide was transformed to two-dimension by the effective index method. Numerical loss in branching area was calculated to be 0.1581 dB and equal to the total loss of the Y-branch.

(9) Compressing of Optical Pulse and Generation of Fundamental Soliton by Using Fibers Which Have Different Dispersion Values, by S. Y. Yoon*, K. C. Ahn**, Y. W. Song***, and B. H. Choi**** (*Samsung Elec. Institute of Info. & Comm., Seoul, Korea; **Dept. of Elec. Eng., Ansan Jr. College, Korea; ***Dept. of Elec. Eng., Daehun Jr. College, Korea; ****Dept. of Elec. Eng., Inha Univ., Inchun, Korea): *JKITE*, vol. 33-A, no. 11, pp. 3012–3023, Nov. 1996.

We analyze the compression of optical soliton which is obtained by proceeding the optical pulse in FSDD (Fiber with Slowly Decreasing Dispersion) using both NSE (Nonlinear Schrödinger Equation) and GNSE (General Nonlinear Schrödinger Equation) and compare the results. We replace the FSDD with a sequence of fibers having different dispersion values and compare the results with those obtained in FSDD.

(10) Capacitive Compensation and Consequent Bandwidth Expansion of 2.5 Gbps Optical Transmitter Module, by S. I. Kim, S. B. Kim, and H. Y. Lee (School of Elec. and Eng., Ajou Univ., Suwon, Korea): *JKITE*, vol. 33-A, no. 7. pp. 1414–1420, July 1996.

A capacitive compensation method for the 25 Ω transmitter module is proposed in order to expand the modulator bandwidth. The time-domain results show the rise time (140 ps) without the compensation is greatly improved to 63 ps with the compensation.

(11) Effects of the External Optical Feedback on the DFB-LD Modules for 2.5 Gbps Optical Communication System, by K. H. Park, J. K. Lee, J. H. Hahn, H. S. Cho, D. H. Jang, and C. S. Park (ETRI, Compound Semiconductor Research Dept., Taejon, Korea): *JKITE*, vol. 33-A, no. 7. pp. 1199–1212, July 1996.

It was suggested that polarization independent optical isolator or single polarization optical isolator with isolation ratio specification of more than 40 dB is required for 2.5-Gbps DFB-LD modules with complete suppression of external feedback effects.

(12) An Optical Fiber Dropping Method for Residential Premises Employing Optical Drop Wire Standed Cable, by K. Hogari, Y. Nakatsuji, and T. Morimitsu (NTT Access Network Systems Laboratories, Tokai-mura, Ibaraki-ken, 319-11 Japan): *Trans. IEICE*, vol. E79-B, pp. 205–208, Feb. 1996.

This letter describes an efficient and economical method for dropping optical fiber to residential premises in which several fiber ribbons in a distribution cable are assigned to one dropping point. The optical fiber cables for dropping, which contain mono-coated fibers, are then aerially installed between several poles from this point during initial construction. The tube stranding pitch of this cable is investigated theoretically and experimentally, and the cable is manufactured based on the results.

(13) Jitter-Stability in Paired Soliton Transmission System, by A. Sakai and Y. Fujii (Institute of Industrial Science, The University of Tokyo, Tokyo, 106 Japan) (vol. J79-C-I, no. 1, pp. 19–24): *Trans. IEICE*, vol. E79-C, p. 139, Jan. 1996.

The concept of the diversity transmission is applied to the fiber-optic transmission system. This system utilizes a pair of nonlinear fiber lines with couplers and fiber-optic amplifiers. This system can be resistant to the Gordon–Haus jitter of the soliton pulse caused by the ASE noise from amplifiers. The analysis shows that the jitter is stabilized if the fluctuations are within the optical pulsewidth. The phase perturbations in the fiber transmission is compensated. This system is promising for the transmission with high stability.

(14) Coupling Coefficients and Coupled Power Equations Describing the Crosstalk in an Image Fiber, by A. Komiyama (Osaka Electro-Communication University, Neyagawa-shi, 572 Japan): *Trans. IEICE*, vol. E79-C, pp. 243–248, Feb. 1996.

One of coupling coefficients appearing in the coupled power equations describing the crosstalk in an image fiber is derived based on the coupled mode theory. The coupling coefficient is described as the ratio of the power transfer ratio to the coupling length for two cores with slightly different radii characterizing the random cores. The theoretical results are in good agreement with measurement results except near cutoff.

(15) A Two-Waveguide Tapered velocity Coupler for a Variable Divider of Optical Power, by M. Geshiro*, T. Kitamura*, T. Yoshikawa**, and S. Sawa* (*College of Engineering, Osaka Prefecture University, Sakai-shi, 593 Japan; **Sharp Corporation, Tenri-shi, 632 Japan): *Trans. IEICE*, vol. E79-C, pp. 587–592, Apr. 1996.

A two-waveguide tapered velocity coupler is presented for a variable divider of optical beams. The coupler consists of one tapered slab waveguide in dimension and the other slab waveguide with a constant film thickness. Various numerical simulations through the finite difference beam propagation analysis show that a wide range of dividing ratios from -15 to 15 dB or more can be achieved with considerably small values of driving-voltage electrode-length product and that the dividing characteristics are stable over a wide range of frequencies.

(16) Characteristics of Five-Layered Waveguide with a Magneto-Plasma Layer Sandwiched between Two Dielectric Slabs, by T. Konishi*, I. Itoh*, and N. Okamoto** (*Kumano Technical College, Kumano-shi, 519-43 Japan; **Faculty of Science and Technology, Kinki University, Higashiosaka-shi, 577 Japan) (vol. J79-C-I, no. 4, pp. 117–122): *Trans. IEICE*, vol. E79-C, p. 597, Apr. 1996.

We have proposed a five-layered waveguide with a magnetoplasma layer sandwiched between two dielectric slabs. Through theoretical analysis we have given dispersion curves and field distributions of the waveguide. We have obtained some remarkable characteristics of the waveguide for applications to nonreciprocal sub-millimeter-wave devices.

(17) A Study on Splitting Ratio for Variable Optical Beam Splitter Utilizing a Tapered in Index Velocity Cou-

pler, by M. Hotta, M. Takasugi, and K. Ono (Faculty of Engineering, Ehime University, Matsuyama-shi, 790-77 Japan) (vol. J79-C-I, no. 4, pp. 123–125): *Trans. IEICE*, vol. E79-C, p. 597, Apr. 1996.

Improvement of splitting ratio for variable optical beam splitter utilizing a tapered in index velocity coupler on $LiNbO_3$ has been achieved in this paper. The numerical results obtained by finite difference method show that the splitting ratio can be drastically expanded by changing location of the electrodes.

(18) Measurement of Refractive Index Distribution of Optical Waveguides by the Propagation-Mode Near-Field Method Employing an Improved Inverse Analysis, by T. Yabu, S. Sawa, and M. Geshiro (Faculty of Engineering, Osaka Prefecture University, Sakai-shi, 593 Japan) (vol. J79-C-I, no. 6, pp. 173–180): *Trans. IEICE*, vol. E79-C, p. 874, June 1996.

Two practical measuring schemes for this method have been reported so far separately: One is based on the differentiation of field distribution and the other on the inverse analysis. In the present paper, we first discuss the core of the method of near field which tells how to determine the refractive index profile and then point out some problems in the two schemes developed earlier. Next, by revising the inverse analysis, we present a new scheme named "Inverse analysis using fewer parameters." Applying the new method, we estimate refractive index profiles of step-index optical fibers and diffused waveguides of buried type.

(19) Optical Quadratic Nonlinearity in Corona-Poled Glass Film Waveguides, by S. Horinouchi, H. Imai, H. Yamasaki, G. J. Zhang, K. Mito, H. Hirashima, and K. Sasaki (Faculty of Science and Technology, Keio University, 3-14-1 Hiyoshi, Kohoku-ku, Yokohama-shi, 223 Japan) (vol. J79-C-I, no. 8, pp. 287–294): *Trans. IEICE*, vol. E79-C, p. 1180, Aug. 1996.

Second-order nonlinearity via corona-poling at room temperature in a Corning 7059 glass film on a Pyrex glass substrate was studied. Blue phase-matched second harmonic generation was clearly observed in the waveguides. It was pointed out that there should be another mechanism responsible for the induced nonlinearity in addition to the previously reported models for poled bulk glasses. X-ray photo-electron spectroscopy measurement on a corona-poled Pyrex glass substrate gave the evidence that main mobile ions were sodium ions.

(20) Numerical Analysis of Nonlinear Optical Fiber Couplers with a Gaussian Mode Field Distribution, by M. Imai*, T. Adachi*, K. Takamatsu**and Y. Imsi*** (*Faculty of Engineering, Dept. Electrical and Electronic Eng., Muroran Institute of Technology, Muroran-shi, 050 Japan; **Hokkaido Electric Meters Industrial Co., Sapporo-shi, 060 Japan; ***Faculty of Computer Engineering, Dept. Computer Science and Electronics, Kyushu Institute of Technology, Iizuka-shi, 820 Japan) (vol. J79-C-I, no. 9, pp. 363–369): *Trans. IEICE*, vol. E79-C, p. 1289, Sept. 1996.

By assuming a Gaussian distribution for the mode field in nonlinear optical fiber couplers, coupling characteristics of incident power are evaluated numerically taking account of the overlap between the two mode fields. The coupling lengths for switching of incident power are evaluated as a function of waveguide separation and wavelength of light. From the dependence of nonlinear coupling on the wavelength, it is confirmed that a wavelength selective characteristic with a sharp band-pass filtering can be obtained in the nonlinear directional coupler.

(21) Fabrication of Low Loss Optical Fibers by Hybridized Process, by K. Yoshida, T. Satoh, N. Enomoto, T. Yagi, H. Hihara, and M. Oku (Yokohama R&D Laboratories, Furukawa Electric Co. Ltd., Yokohama-shi, 220 Japan) (vol. J79-C-I, no. 12, pp. 473–481): *Trans. IEICE*, vol. E79-C, p. 1776, Dec. 1996.

A hybridized process for fabrication of low-loss singlemode optical fibers has been studied. Single-mode optical fibers with losses of 0.336 dB/km at 1.3 μm and 0.205 dB/km at 1.55 μm were fabricated by the hybridized process consisting of direct overcladding a VAD-derived core rod with a porous body made from commercial silica powder by means of Cold Isostatic Pressing (CIP) technique, in which silica powder having an average particle diameter of 10 μm and a core rod having a core/cladding diameter ratio of 1/3 were used for starting materials. Further, polymer-clad-silica-core optical fibers with loss of 7.5 dB/km at 0.85 μm were also fabricated.

VIII. Superconductive Devices

(1) Superconductivity Applications to Electrical Power Engineering, by C. Chao, W. J. Bonwick, and M. F. Conlon (Dept. of Electrical and Computer Systems Engineering, Monash University, Clayton Victoria 3168, Australia): *JEEE*, vol. 16, pp. 123–132, June 1996.

The research and development of superconductivity for electrical power engineering applications started in the 1960s when useable low-temperature superconductors (cooled in liquid nitrogen at 77 K) in the mid 1980s triggered a renewal of interest in this area. To date, superconductivity applications cover not only conventional areas of electrical power engineering but have also led to new devices based on the special characteristics of a super conductor. This paper reviews the principles, benefits, history and future issues of the development of superconductivity applications to electrical power engineering.

(2) A General Small Signal Transmission Line Model of the Superconducting Field Effect Devices, by J.-F. Jiang, Q.-Y. Cai, Y.-S. Tang, and Z.-L. Zhou (Shanghai Jiaotong University, Shanghai, P.R.C.): *AES*, vol. 24, pp. 43–47, May 1996.

A general small signal transmission line model of the superconducting field effect devices is treated analytically. The analysis is based upon an active, distributed transmission line analogy to the kinetic admittance of a superconducting channel region of the superconducting field effect devices. Within the limitation of the gradual channel approximation, a general analysis is presented which is applicable to both superconducting MOSu and PN (or Schottky) junction field effect devices.

(3) Analysis of Propagation Characteristics of High-Tc Superconduction Interconnects for VLSI Packing, by J.-F. Kang, R.-Q. Han, and Y.-Y. Wang (Peking University, Beijing, P.R.C.): *AES*, vol. 24, pp. 105–107, Nov. 1996.

The propagation constant and rise time of High-T_c superconduction interconnects for VLSI Packing are calculated and simulated by using a generalized two-fluid model and transmisson line theory. Meanwhile, the temperature dependences of attenuation constant and phase velocity as well as the rise time based on the generalized two-fluid model are compared with those based on conventional two-fluid model. The results could be used in the VLSI system CAD.

(4) General Y Parameters and Small Signal Equivalent Circuit of the Superconducting Field Effect Devices, by J.-F. Jiang, Q.-Y. Cai, Z.-L. Zhou, and Y.-S. Tang (Shanghai Jiaotong University, Shanghai, P.R.C.): *AES*, vol. 24, pp. 6–9, Aug. 1996.

The general Y parameters and small signal equivalent circuit are established and the concept of frequency dependence resistance, capacitance and conductance are developed based on the general small signal transmission line model of the superconducting field effect devices. It provides the stronge base for the investigation of the high frequency characteristics and dynamics of superconducting field effect devices.

IX. Special Issues Related to Microwave Theory and Techniques

(1) IEICE TRANS. ELECTRON., vol. E79-C, no. 1, Jan. 1996, is a special issue on Optomicrowave Techniques and Their Applications.

(1.1) Gb/s-Range Semiconductor and Ti:$LiNbO_3$ Guided-Wave Optical Modulators, by K. Komatsu and R. Madabhushi (Opto-Electronics Research Laboratories, NEC Corporation, Tsukuba-shi, 305 Japan): pp. 3–13.

(1.2) Long-Wavelength Photodetectors for Ultrawide-Band Systems, by K. Kato (NTT Opto-electronics Laboratories, Atugi-shi, 243-01 Japan): pp. 14–20.

(1.3) Optical-Microwave Mixing Using Planar Transistors, by T. Berceli (Technical University of Budapest, 1111 Budapest, Goldmann Gyorgy-ter 3, Hungary): pp. 21–26.

(1.4) Push-Pull Type Ridged Ti:$LiNbO_3$ Optical Modulator, by K. Noguchi, O. Mitomi, and H. Miyazawa (NTT Opto-electronics Laboratories, Atugi-shi, 243-01 Japan): pp. 27–31.

(1.5) An Optical Bi-phase Modulator for Millimeter Wave Subcarrier Systems, by H. J. Thomas*†, N. Imai*, and E. Ogawa* (*ATR Optical and Radio Communications Research Laboratories, Kyoto-fu, 619-02 Japan; †GSM Research Group, GSM Products Division, Motorola Ltd., Euroway, Blagrove, Swindou, Wittshire, SN58YQ England): pp. 32–39.

(1.6) A 15-GHz Direct Optical Injection-Locked MMIC Oscillator Using Photosensitive HBTs, by H. Kamitsuna (NTT Wireless Systems Laboratories Yokosuka-shi, 238-03 Japan): pp. 40–45.

(1.7) BER Performance of Optically Controlled MESFET's as Photodetectors, by T. Shimizu, H. Ohtsuka, and K. Araki (Radio Systems Laboratory, NTT Wireless Systems Laboratories Yokosuka-shi, 238-03 Japan): pp. 46–51.

(1.8) Predistorter Implementation to SLD in Fiber-Optic Wireless Systems, by Y. Aburakawa and H. Ohtsuka (Radio Systems Laboratory, NTT Wireless Systems Laboratories Yokosuka-shi, 238-03 Japan): pp. 52–59.

(1.9) Optically Assisted Microwave Active Integrated Antennas, by S. T. Chew, D. T. K. Tong, M. C. Wu, and T. Itoh (Dept. of Electrical Engineering, University of California, Los Angeles, 405 Hilgard Avenue, Los Angeles, CA 90024 USA): pp. 60–67.

(1.10) Frequency Characteristics of a Beamforming Network of an Optically Controlled Array Antenna and Its Radiation Pattern Measurements, by K. Yamada, I. Chiba, and Y. Karasawa (ATR Optical and Radio Communications Research Laboratories, Kyoto-fu, 619-02 Japan): pp. 68–73.

(1.11) Photonic Integrated Beam Forming and Steering Network Using Switched True-Time-Delay Silica-Based Waveguide Circuits, by K. Horikawa*, I. Ogawa*, T. Kitoh**, and H. Ogawa* (*NTT Wireless Systems Laboratories Yokosuka-shi, 238-03 Japan; **NTT Opto-electronics Laboratories, Ibaraki-ken, 319-11 Japan): pp. 74–79.

(1.12) A Liquid-Crystal Control, Coherent Type Optoelectronic Phased Array Antenna Beam Forming Network Using Polarization Multiples Optical Heterodyning, by O. Kobayashi and H. Ogawa (NTT Wireless Systems Laboratories Yokosuka-shi, 238-03 Japan): pp. 80–86.

(1.13) Application of Optical Techniques to Microwave Signal Processing (MSP) ∼Optical-Microwave Signal Processing∼, by H. Ogawa (NTT Wireless Systems Laboratories Yokosuka-shi, 238-03 Japan): pp. 87–97.

(1.14) Trends of Fiber-Optic Microcellular Radio Communication Networks, by S. Komacenterions (Research Laboratories, Kyoto-fu, 619-02 Japan): pp. 98–104.

(1.15) Novel Optoelectronic Networks Using Cascaded Optical Intensity Modulation Links for Frequency Multiplexing and Mixing, by Y. Nakasuga, K. Horikawa, and H. Ogawa (NTT Wireless Systems Laboratories Yokosuka-shi, 238-03 Japan): pp. 105–110.

(1.16) Proposal of Fiber-Optic Radio Highway Networks Using CDMA Method, by S. Kajiya, K. Tsukamoto, and S. Komaki (Faculty of Engineering, Osaka University, Suita-shi, 565 Japan): pp. 111–117.

(1.17) A Short-Span Optical Feeder for Wireless Personal Communication Systems Using Multimode Fibers, by Y. Matsunaga and M. Shibutani (Opto-Electronics Research Laboratories, NEC Corporation, Kawasaki-shi, 216 Japan): pp. 118–123.

(2) IEICE TRANS. ELECTRON., vol. E79-C, no. 4, Apr. 1996, is a special issue on Ultra-High-Speed LSI's.

(2.1) High-Throughput Technologies for Video Signal Processor (VSP) LSIs, by T. Enomoto (Faculty of Science and Engineering, Chuo University, Tokyo, 112 Japan): pp. 459–471.

(2.2) Trends in High-Speed DRAM Architectures, by M. kumanoya*, T. Ogawa**, Y. Konishi*, K. Dosaka*, and K. Shimotori** (*Mitsubishi Electric Corporation ULSI Laboratory, Itami-shi, 664 Japan; **Mitsubishi Electric Corporation Semiconductor Group, Itami-shi, 664 Japan): pp. 472–481.

(2.3) Electro-Optic Testing Technology for High-Speed LSIs, by T. Nagatsuma (NTT LSI Laboratories, Atsugi-shi, 243-01 Japan): pp. 482–488.

(2.4) 1.4 GHz Natural Air-Cooling GaAs Standard Cell LSI's for 10 Gbit/s Optical Communication Systems, by Y. Ogawa*, K. Ikemura**, and S. Seki* (*Semiconductor Technology Laboratories, Oki Electric Industry Co., Ltd, Hachioji-shi, 193 Japan; **Transmission Systems Division, Oki Electric Industry Co., Ltd, Tokyo, 108 Japan): pp. 489–495.

(2.5) A Decision Circuit with Phase Detectors for 10-Gb/s Optical Communication Systems, by M. Shikata, A. Nishino, R. Shigemasa, T. Kimura, and T. Ushikubo (Research & Development Group, Oki Electric Industry, Co., Ltd., Hachioji-shi, 193 Japan): pp. 496–502.

(2.6) GaAs 10 Gb/s 64: 1 Multiplexer/Demultiplexer Chip Sets, by M. Shimada*, N. Higashisaka*, A. Ohta*, K. Hosogi*, K. Kubo**, N. Tanino*, T. Takagi, F. Hidani**, and O. Ishihara* (*Optoelectronic & Microwave Devices Laboratory, Mitsubishi Electric Corporation, Itami-shi, 664 Japan; **Information Technology R & D Center, Mitsubishi Electric Corporation, Itami-shi, 664 Japan): pp. 503–511.

(2.7) A 1.3 V Supply Voltage AlGaAs/InGaAs HJFET SCFL D-FF Operating at up to 10 Gbps, by M. Fujii*, T. Maeda*, Y. Ohno*, M. Tokushima*, M. Ishikawa*, M. Fukaishi*, and H. Hida *† (*Microelectronics Laboratories, NEC Corporation, Tsukuba-shi, 305 Japan; †ASIC Division, NEC Corporation, Kawasaki-shi, 211 Japan): pp. 512–517.

(2.8) Aluminum-Graded-Base PNp AlGaAs Heterojunction Transistor with 37 GHz Cut-Off Frequency, by A. Kameyama*, A. Massengale**, C. Dai**, and J. S. Harris** (*Toshiba ULSI Research Center, Toshiba Corporation, Kawasaki-shi, 210 Japan; **Dept. of Electrical Engineering, Stanford University CA, 94025, USA): pp. 518–523.

(2.9) A 2. 6-Gbps/pin SIMOX-CMOS Low-Voltage-Swing interface Circuit, by Y. Ohtomo, M. Nogawa, and M. Ino (NTT LSI Laboratories, Atsugi-shi, 243-01 Japan): pp. 524–529.

(2.10) A 2.6-ns 64-b Fast and Small CMOS Adder, by H. Morinaka, H. Makino, Y. Nakase, H. Suzuki, K. Mashiko, and T. Sumi (LSI Laboratory, Mitsubishi Electric Corporation, Itami-shi, 664 Japan): pp. 530–537.

(2.11) A Design of High-Speed 4-2 Compressor for Fast Multiplier, by H. Makino*, H. Suzuki*, H. Morinaka*, Y. Nakase*, H. Shinohara**, K. Mashiko*, T. Sumi*, and Y. Horiba* (*LSI Laboratory, Mitsubishi Electric Corporation, Itami-shi, 664 Japan; **Headquarters, Mitsubishi Electric Corporation, Tokyo, 100 Japan): pp. 538–548.

(2.12) A 40 GHz $f_{\mathbf{T}}$ SATURN Transistor Using 2-Step Epitaxial Base Technology, by H. Fujimaki, K. Yamano, and K. Suzuki (Electronic Device Group, OKI Electric Industry Co., Ltd., Hachioji-shi, 193 Japan): pp. 549–553.

(2.13) Shallow p-Type Layers in Si by Rapid Vapor-Phase Doping for High-Speed Bipolar and MOS Applications, by Y. Kiyota*, T. Nakamura*, S. Suzuki**, and T. Inada** (*Central Research Laboratory, Hitachi, Ltd., Kokubunji-shi, 185 Japan; **College of Engineering, Hosei University, Koganei-shi, 184 Japan): pp. 554–559.

(3) IEICE TRANS. ELECTRON., vol. E79-C, no. 5, May 1996, is a special issue on Microwave Devices for Mobile Communications.

(3.1) Developments in Mobile/Portable Telephones and key Devices for Miniaturization, by S. Urabe, and T. Nojima (NTT Mobile Communications Network Inc. (NTT DoCoMo), Tokyo, 105 Japan): pp. 600–605.

(3.2) An Improved Gate Current Model of GaAs FET's for Nonlinear Circuit Simulation, by S. Watanabe, and Y. Oda (Komukai Works, Toshiba Corporation, Kawasaki-shi, 210 Japan): pp. 606–610.

(3.3) Effect of Source Harmonic Tuning on Linearity of Power GaAs FET under Class AB Operation, by S. Watanabe, S. Takatsuka, K. Takagi, H. Kuroda, and Y. Oda (Komukai Works, Toshiba Corporation, Kawasaki-shi, 210 Japan): pp. 611–616.

(3.4) 3-V Operation Power HBT's for Digital Cellular Phones, by Chang-Woo KIM*, N. Hayama**, H. Takahashi**, Y. Miyoshi**, N. Goto**, and K. Honjo** (*Dept. of Radio Science and Engineering, Kyung-Hee University 4, Seocheon-ri, Kihung-eup, Yongin-gun, Kyungki-do, 449-701 Korea; **Microelectronics Research Laboratories, NEC Corporation, Tsukuba-shi, 305 Japan): pp. 617–622.

(3.5) A GaAs MuMIC Power Amplifier with a Harmonic Rejection Filter for Digital European Cordless Telecommunication System, by S. Makioka, N. Yoshikawa, and K. Kanazawa (Electronics Research Laboratory, Matsushita Electronics Corporation, Takatsuki-shi, 569 Japan): pp. 623–628.

(3.6) Design Study on RF Stage for Miniature PHS Terminal, by H. Tsurumi, T. Maeda, H. Tanimoto, Y. Suzuki, M. Saito, K. Yoshihara, K. Ishida, and N. Uchitomi (Research and Development Center, Toshiba Corporation, Kawasaki-shi, 210 Japan): pp. 629–635.

(3.7) L-Band SPDT Switch Using Si-MOSFET, by Y. Iyama*, N. Suematsu*, T. Shigematsu*, T. Moriwaki**, and T. Ikeda*** (*Information Technology R&D Center, Electro-Optics & Microwave System Laboratory, Mitsubishi Electric Corporation, Kamakura-shi, 247 Japan; **Kitaitami Works, Mitsubishi Electric Corporation, Itami-shi, 664 Japan; ***ULSI Laboratory, Mitsubishi Electric Corporation, Iatami-shi 664 Japan): pp. 636–643.

(3.8) 1.9 GHz Si Direct Conversion Receiver IC for QPSK Modulation Systems by C. Takahashi*, R. Fujimoto*, S. Arai**, T. Itakura*, T. Ueno*, H. Tsurumi*, H. Tanimoto*, S. Watanabe***, and K. Hirakawa*** (*Toshiba R&D Center, Kawasaki-shi, 210 Japan: **Toshiba Information & Communications Systems Lab., Hino-shi 191 Japan: ***Toshiba LSI Division I, Semiconductor Group, Kawasaki-shi, 210 Japan): pp. 644–649.

(3.9) A Multi Phase-States MMIC Phase Shifter, by K. Nakahara*, S. Chaki**, N. Andoh**, H. Matsuoka***, N. Tanino**, Y. Mitsui*, and M. Otsubo** (*Information Technology R&D Center, Mitsubishi Electric Corporation, Kamakura-shi, 247 Japan: **Electro-Optics & Microwave System Laboratory, Mitsubishi Electric Corporation, Iatami-shi 664 Japan: ***Kitaitami Works, Mitsubishi Electric Corporation, Itami-shi, 664 Japan): pp. 650–656.

(3.10) Noise Reduction Device Using Novel Automatic Wavelength-Offset Control for Highly Stable Optical-Microwave Transmission Systems, by T. Futakata, Y. Tarusawa, Y. Ito, and T. Nojima (*Dept. of Service

Development, NTT Mobile Communications Network Inc., Yokosuka-shi, 238-03 Japan: **Dept. of Research and Development, NTT Mobile Communications Network Inc., Yokosuka-shi, 238-03 Japan): pp. 657–663.

(3.11) 1. 5GHz SAW Miniature Antenna Duplexer Used in Personal Digital Cellular, by M. Hikita*, N. Shibagaki*, K. Asai*, K. Sakiyama**, and A. Sumioka*** (*Central Research Lab., Hitachi Ltd., Kokubunji-shi, 185 Japan: **Yokohama Works, Hitachi Ltd., Yokohama-shi 244 Japan: ***Hitachi Denshi, Ltd., Koganei-shi, 184 Japan): pp. 664–670.

(3.12) An Extended Configuration of a Stepped Impedance Comb-Line Filter, by T. Ishizaki*, T. Uwano*, and H. Miyake** (*Device Engineering Development Center, Matsushita Electric Industrial Co., Ltd., Kadoma-shi, 571 Japan: **Matsushita Nittoh Electric Co., Ltd., Kyoto-fu, 610-03 Japan): pp. 671–678.

(3.13) Planar Type Dielectric Resonator Filter at Millimeter-Wave Frequency, by Y. Ishikawa, T. Hiratsuka, S. Yamashita, and K. Iio (Research and Development Division, Murata Mfg. Co., Ltd., Nagaokakyo-shi, 617 Japan): pp. 679–684.

(3.14) A Beam Tilt Dipole Array Antenna for Indoor Mobile Applications, by K. Ogawa, and T. Uwano (Matsushita Electric Industrial Co., Ltd., Device Engineering Development Center, Osaka-shi, 571 Japan): pp. 685–692.

(3.15) High Performance Portable Telephone Antenna Employing a Flat-Type Open Sleeve, by K. Tsunekawa (NTT Mobile Communications Network Inc., Yokosuka-shi, 238-03 Japan): pp. 693–698.

(3.16) A Linear Array Antenna Using Bifilar Helical Elements for Mobile Satellite Communications, by M. Ohtsuka, Y. Konishi, M. Matsunaga, and T. Katagi (Mitsubishi Electric Corporation, Kamakura-shi, 247 Japan): pp. 699–704.

(3.17) GaAs MMIC for 2.4 GHz Wireless LAN Applications, by K. Kobayashi*, T. Maniwa*, and Y. Aoki** (*Fujitsu Laboratories Ltd., Kawasaki-shi, 211 Japan: **Fujitsu Limited, Kawasaki-shi, 211 Japan): pp. 705–708.

(4) IEICE TRANS. ELECTRON., vol. E79-B, no. 6, June 1996, is a special issue on Weather Radar Technology.

(4.1) Weather Radar Clutter and Its Suppression, by M. Sekine (Dept. of Applied Electronics, Tokyo Institute of Technology, Yokohama-shi, 226 Japan): pp. 736–743.

(4.2) Validation and Ground Truth for TRMM Precipitation Radar Using the MU Radar, by T. Sato, T. Teraoka†, and I. Kimura (Dept. of Electronics and Communication, Kyoto University, Kyoto-shi, 606-01 Japan): pp. 744–750.

(4.3) Accuracy of Radar-AMeDAS Precipitation, by Y. Makihara*, N. Uekiyo*, A. Tabata**, and Y. Abe** (*Meteorological Research Institute, Tsukuba-shi, 305 Japan; **Meteorological Agency, Tokyo, 100 Japan): pp. 751–762.

(4.4) A Preliminary Study of Non-Uniform Beam Filling Correction for Spaceborne Radar Rainfall Measurement, by T. Kozu, and T. Iguchi (Communication Research Laboratory, Koganei-shi, 184 Japan): pp. 763–769.

(4.5) CRL Airborne Multiparameter Precipitation Radar (CAMPR): System Description and Preliminary Results, by H. Kumagai*, K. Nakamura**, H. Hanado*, K. Okamoto***, N. Hosaka****, N. Miyano****, T. Kozu***, N. Takahashi*, T. Iguchi***, and H. Miyauchi**** (*Kashima Space Research Center, Communication Research Laboratory, Kashima-shi, 314 Japan; **Institute for Hydrospheric-Atmospheric Sciences, Nagoya University, Nagoya-shi, 464-01 Japan; ***Communication Research Laboratory, Koganei-shi, 184 Japan; ****Komukai Works, Toshiba Corporation, kawasaki-shi, 210 Japan): pp. 770–778.

(4.6) Studies of Winter Thundercloud Detection Using C-Band Weather Radar Data, by Y. Kanai*, K. Yasuda*, H. Oikawa**, M. Sugano***, and Y. Sato** (*Tokyo Electric Power Company, Tokyo, 100 Japan; ** Toshiba Corporation, Kawasaki-shi, 210 Japan; ***Toshiba Corporation, Hibiya Office Utility Power System engineering Dept., Tokyo, 100 Japan): pp. 779–785.

(4.7) Interference of Sea Surface Echo and Rain Echo Observed by a Real Aperture Airborne Imaging Radar, by K. Nakamura*, T. Kozu**, and S. Uratsuka** (*Institute for Hydrospheric-Atmospheric Sciences, Nagoya University, Nagoya-shi, 464-01 Japan; **Communication Research Laboratory, Ministry of Posts and Telecommunications, Koganei-shi, 184 Japan): pp. 786–792.

(4.8) Adaptive Determination of Maximum Diameter of Raindrops from Z_{DR}, by Y. Ohsaki* and K. Nakamura** (*Okinawa Radio Observatory, Communications Research Laboratory, Okinawa-ken, 901-24 Japan; **Institute for Hydrospheric-Atmospheric Sciences, Nagoya University, Nagoya-shi, 464-01 Japan): pp. 793–796.

(4.9) Radar Reflectivity and Rainfall Rate Relation from Weibull Raindrop-Size Distribution, by H. Jiang, M. Sano, and M. Sekine (Dept. of Applied Electronics, Tokyo Institute of Technology, Yokohama-shi, 226 Japan): pp. 797–800.

(4.10) Numerical Simulation of Low-Altitude Wind Shears for a Terminal Doppler Weather Radar System, by Y. Horibata* and H. Oikawa** (*Energy and Mechanical Research Laboratories, Research and Development Center, Toshiba Corporation, Kawasaki-shi, 210 Japan; **Electronic Application Engineering Dept., Komukai Works, Toshiba Corporation, Kawasaki-shi Japan): pp. 801–809.

(5) IEICE TRANS. ELECTRON., vol. E79-C, no. 8, Aug. 1996, is a special issue on Liquid-Crystal Displays.

(5.1) Fluorinated Liquid Crystalline Materials for AM-LCD Applications, by H. Saito*, E. Nakagawa*, T. Matsushita*, F. Takeshita*, Y. Kubo*, S. Matsui*, K. Miyazawa*, and Y. Goto** (*Specialty Chemicals Research Center, Chisso Petrochemical Corporation, Ichihara-shi, 290 Japan): pp. 1027–1034.

(5.2) Development of New Liquid Crystal Materials, by K. Tarumi, M. Bremer, and B. Schuler (Dept. of Liquid Crystal Research, Business Unit Liquid Crystals, Merck KGaA, Frankfurter Strasse 250, 64 271 Darmstadt, Germany): pp. 1035–1039.

(5.3) Alignment Control of Liquid Crystal Molecules using Photo-Dimerization Reaction of Poly (Vinyl Cinnamate), by Y. Iimura*, S. Kobayashi*, T. Hashimoto**, T. Sugiyama**, and K. Katoh** (*Faculty of Technology, Tokyo University of Agriculture and Technology, Koganei-shi, 184 Japan; **Stanley Electric Co., Ltd, Yokohama-shi, 225 Japan): pp. 1040–1046.

(5.4) Bistable Switching in PDLC Films with a Ferroelectric Alignment Layer, by M. Inomata, and M. Nakagawa (Dept. of Electrical Engineering, Faculty of Engineering, Nagaoka University of Technology, Nagaoka-shi, 940-21 Japan): pp. 1047–1057.

(5.5) Super Twisted Nematic (STN) Liquid Crystal Displays (LCD's) Using Spiral Polymer Aligned Nematic (SPAN), by H. Hasebe*, H. Takatsu*, K. Takeuchi*, Y. Iimura**, and S. Kobayashi** (*Dainippon Ink & Chemicals, Inc., Saitama-ken, 362 Japan; **Dept. of Electronic Engineering, Faculty of Technology, Tokyo University of Agriculture and Technology, Koganei-shi, 184 Japan): pp. 1058–1062.

(5.6) An Evaluation of Flicker on Space Modulated Frame Rate Control Multi-Gray Shading Methods for STN-LCDs, by I. Ohishi*, M. Maeda*, N. Takahashi**, A. Shiratani*, and T. Kuwata*** (*Faculty of Engineering, Tokyo Institute of Polytechnics, Atugi-shi, 243-02 Japan; **Meiko Electronics Co., Ltd., Ayase-shi, 252 Japan; ***Asahi Glass Co., Ltd. Yokohama-shi, 221 Japan): pp. 1063–1068.

(5.7) Wide Viewing-Angle Displays with In-Plane Switching Mode of Nematic LC's Addressed by TFTs, by M. Ohta*, K. Kondo**, and M. Oh-e*** (*Electron Tube & Devices Division, Hitachi, Ltd., Mobara-shi, 297 Japan; **Hitachi Research Laboratory, Hitachi, Ltd., Hitachi-shi, 319-12 Japan; ***Electron Tube & Devices Division, Hitachi, Ltd., Hitachi-shi, 319-12 Japan): pp. 1069–1075.

(5.8) Optically Compensated Bend Mode (OCB Mode) with Wide Viewing Angle and Fast Response, by T. Miyashita, and T. Uchida (Dept. of Electronic Engineering, Faculty of Engineering, Tohoku University, Sendai-shi, 980-77 Japan): pp. 1076–1082.

(5.9) 2-Transistor, 1. 5-Gate Redundancy Technology for Color TFT-LCDs, by T. Kawada*†, H. Nakajima*, S. Kohda*, and S. Sakai* (*NTT Interdisciplinary Research Laboratories, Musashino-shi, 180 Japan; †Presently, with Applied Komatsu Technology, Inc.): pp. 1083–1090.

(5.10) Characteristics of a-Si Thin-Film Transistors with an inorganic Black Matrix on the Top, by Y. Kato*, Y. Miyoshi*, M. Atsumi*, Y. Kaida*, S. L. Wright**, and L. F. Palmateer*† (*Display Technology, IBM Japan, Yamato-shi, 242 Japan; **IBM Thomas J. Watson Research Center, Yorktown Heights, NY 10598 USA; †Presently, with dpiX, A Xerox Company, 3406 Hillview Ave., Palo Alto, CA 94304-1345 USA): pp. 1091–1096.

(5.11) A 24 cm Diagonal TFT-LCD Fabricated Using a Simplified, Four-Photolithographic Mask Process, by K. Ono*, T. Suzuki*, H. Sakuta*, K. Onisawa*, M. Hiroshima*, T. Sasaki*, M. Tsumura**, and N. Konishi** (*Electron Tube & Devices Dev., Hitachi, Ltd., Mobara-shi, 297 Japan; **Hitachi Research Laboratory, Hitachi, Ltd., Hitachi-shi, 319-12 Japan): pp. 1097–1102.

(5.12) A 33-cm-Diagonal High-Resolution TFT-LCD with Fully Self-Aligned TFTs, by N. Hirano, N. Ikeda, S. Nishida, and S. Kaneko (Functional Devices Research Laboratories, NEC Corporation, Kawasaki-shi, 216 Japan): pp. 1103–1108.

(5.13) Low Power Multi-Media TFT-LCD Using Multi-Field Driving Method, by H. Okumura, G. Itoh, K. Suzuki, and K. Suzuki (Materials and Devices Research Laboratories, Toshiba Corp., Yokohama-shi, 235 Japan): pp. 1109–1111.

(6) IEICE TRANS. ELECTRON., vol. E79-C, no. 9, Sept. 1996, is a special issue on Toward Digital and Analog Applications of Superconductors.

(6.1) Superconducting Packet Switch, by M. Hosoya, Willy Hioe, S. Kominami, H. Nagaishi, and T. Nishino (*Hitachi, Ltd., Kokubunji-shi, 185 Japan): pp. 1186–1192.

(6.2) Josephson Memory Technology, by S. Tahara, S. Nagasawa, H. Numata, Y. Hashimoto, and S. Yorozu (Fundamental Research Laboratories, NEC Corporation, Tukuba-shi, 305 Japan): pp. 1193–1199.

(6.3) Binary Counter with New Interface Circuits in the Extended Phase-Mode Logic Family, by T. Onomi*, Y. Mizugaki**, T. Yamashita*, and K. Nakajima** (*Research Institute of Electrical Communication, Tohoku University, Sendai-shi, 980-77 Japan; **Laboratory for Electronic Intelligent Systems, Research Institute of Electrical Communication, Tohoku University, Sendai-shi, 980-77 Japan): pp. 1200–1205.

(6.4) Oscillation Modes in a Josephson Circuit and Its Application to Digital Systems, by A. Kanasugi, M. Morisue, H. Noguchi, M. Yamadaya, and H. Furukawa (Dept. of Electrical and Electronic Systems, Saitama University, Urawa-shi, 338 Japan): pp. 1206–1212.

(6.5) Modular Middle-Scale SQUID Magnetometer System for Neuromagnetic Research, by Y. Hirata and S. Kuriki (Research Institute for Electronic Science, Hokkaido University, Sapporo-shi, 060 Japan): pp. 1213–1218.

(6.6) Strato-Mesospheric Ozone Monitoring System Using an SIS Mixer, by H. Suzuki*, M. Suzuki**, and H. Ogawa*** (*Fujitsu Laboratories Ltd., Atsugi-shi, 243-01 Japan; **Fujitsu VLSI Ltd., Minokamo-shi, 505 Japan; ***Nagoya University, Nagoya-shi, 464-01 Japan): pp. 1219–1227.

(6.7) High-T_c Superconducting Planar Filter for Power Handling Capability, by A. Enokihara and K. Setsune (Central Research Lab., Matsushita Electric Industrial Co., Ltd., Kyoto-fu, 619-02 Japan): pp. 1228–1232.

(6.8) Flat and Lateral High-T_c Superconducting Junctions Applied to Millimeter-Wave Mixer, by K. Suzuki, S. Tokunaga, M. Ban, M. Ohtsuka, and Y. Enomoto (Superconductivity Research Laboratory, ISTEC, Tokyo, 105 Japan): pp. 1233–1236.

(6.9) Quasi-Optical SIS Mixers with Nb/AlO$_x$/Nb Tunnel Junctions in the 270-GHz Band, by Y. Uzawa*, A. Kawakami*, Zhen WANG*, and T. Noguchi** (*Kansai Advanced Research Center, Communications Research Laboratory, Kobe-shi, 651-24 Japan; **Nobeyama Radio Observatory, National Astronomical Observatory, Nagano-ken, 384-13 Japan): pp. 1237–1241.

(6.10) Josephson Array Oscillators Using Resonant Effects in Shunted Tunnel Junctions, by A. Kawakami and Zhen WANG (Kansai Advanced Research Center, Communications Research Laboratory, Kobe-shi, 651-24 Japan): pp. 1242–1246.

(6.11) Vortex Flow Transistors Based on $YBa_2Cu_3O_{7-\delta}$ Films, by A. Fujimaki*, M. Kusunoki*, M. Kito*, S. Yoshida*, H. Andoh**, and H. Hayakawa*

(*Dept. of Quantum Engineering, Faculty of Engineering, Nagoya University, Nagoya-shi, 464-01 Japan; **Toyota National College of Technology, Toyota-shi, 471 Japan): pp. 1247–1253.

(6.12) Weakly Coupled Grain Model for the Residual Surface Resistance of $YBa_2Cu_3O_x$ Thin Films, by K. Yoshida*, T. Onoue*, T. Kiss**, H. Shimakage*** and Zhen WANG*** (*Dept. of Electronic Device Engineering, Graduate School of Information Science and Electrical Engineering, Kyushu University, Fukuoka-shi. 812-81 Japan; **Dept. of Electrical and Electronic Systems Engineering, Graduate School of Information Science and Electrical Engineering, Kyushu University, Fukuoka-shi. 812-81 Japan; ***KARC Communications Research Laboratory, Kobe-shi, 651-24 Japan): pp. 1254–1259.

(6.13) Epitaxial Nature of New Insulating Material $BaSnO_3$ for $YBa_2Cu_3O_x$ Junctions, by Y. Tazoh, and S. Miyazawa (NTT System Electronics Laboratories, Atsugi-shi, 243-01 Japan): pp. 1260–1263.

(6.14) Morphological Study of $YBa_2Cu_3O_y$ Thin Films Grown by Excimer Laser Ablation Method, by S. Tomohisa, H. Nakatsuka, M. Tachiki, and T. Kobayashi (Faculty of Engineering Science, Osaka University, Toyonaka-shi, 560 Japan): pp. 1264–1268.

(6.15) Laser Deposition of $Y_1Ba_2Cu_3O_{7-\delta}$-$SrTiO_3$-$Y_1Ba_2Cu_3O_{7-\delta}$ Multilayers Utilizing the 4th Harmonics of Nd:YAG Pulse Laser, by T. Kiss, K. Enpuku, T. Matsumura, Y. Iriyama, T. Nakamura, and M. Takeo (Graduate School of Information Science and Electrical Engineering, Kyushu University, Fukuoka-shi. 812-81 Japan): pp. 1269–1273.

(7) IEICE TRANS. ELECTRON., vol. E79-C, no. 10, Oct. 1996, is a special issue on Electromagnetic Theory-Foundations and Applications.

(7.1) Recent Advances in Multiple Scattering Theories and Applications, by A. Ishimaru, and Y. Kuga (Dept. of Electrical Engineering, University of Washington, Seattle, Washington, 98 195-2500 USA): pp. 1295–1299.

(7.2) FDTD Analysis of Electromagnetic Interaction between Portable Telephone and Human Head, by M. Taki*, S. Watanabe*, and T. Nojima** (*Faculty of Engineering, Tokyo Metropolitan University, Hachioji-shi, 192-03 Japan; **NTT Mobile Communications Network Inc., Yokosuka-shi, 238-03 Japan): pp. 1300–1307.

(7.3) On Attractive Force of Evanescent Electromagnetic Field on Dielectric Slab, by Jingbo LI, and M. Agu (Dept. of Media and Telecommunications Engineering, Faculty of Engineering, Ibaraki University, Hitachi-shi, 316 Japan): pp. 1308–1311.

(7.4) Two Variational Principles in Geometrical Optics—Comparisons, by M. Hashimoto (Dept. of Applied Electronic Engineering, Osaka Electro-Communication University, Neyagawa-shi, 572 Japan): pp. 1312–1320.

(7.5) Method of Equivalent Currents for Calculation of Surface Diffraction by a Smooth Convex Objects, by M. Nishimoto and H. Ikuno (Dept. of Electrical Engineering and Computer Science, Kumamoto University, Kumamoto-shi, 860 Japan): pp. 1321–1326.

(7.6) Scattering of a Plane Wave from a Thin Film with Volume Disorder, by L. Gao and J. Nakayama (Faculty of Engineering and Design, Kyoto, Institute of Technology, Kyoto-shi, 606 Japan): pp. 1327–1333.

(7.7) Polarization Effects on the Effective Dielectric Constant of a Medium Containing Randomly Distributed Dielectric Cylinders, by Y. Nanbu* and M. Tateiba** (*Sasebo National College of Technology, Sasebo-shi, 857-11 Japan; **Faculty of Engineering, Kyushu University, Fukuoka-shi. 812-81 Japan): pp. 1334–1337.

(7.8) Source and Radiation Field Solution for Dielectric Scatterers—E Wave-, by S. Itoh and S. Tokumaru (Faculty of Science and Technology, Keio University, Yokohama-shi, 223 Japan): pp. 1338–1344.

(7.9) Reconstruction of Two Dimensional Rough Surface with Gaussian Beam Illumination, by K. Harada and A. Noguchi (Faculty of Science and Technology, Keio University, Yokohama-shi, 223 Japan): pp. 1345–1349.

(7.10) Physical Optics Analysis of Dipole-Wave Scattering from a Finite Strip Array on a Grounded Dielectric Slab, by Shuguang Chen, Y. Sato, M. Oodo, and M. Ando (Dept. of Electrical and Electronic Engineering, Tokyo Institute of Technology, Tokyo, 152 Japan): pp. 1350–1357.

(7.11) Numerical Analysis of 3-D Scattering Problems Using the Yasuura Method, by M. Kawano, H. Ikuno, and M. Nishimoto (Dept. of Electrical Engineering and Computer science, Kumamoto University, Kumamoto-shi, 860 Japan): pp. 1358–1363.

(7.12) Scattering of Electromagnetic Waves by an Axially Slotted Conducting Elliptic Cylinder in Homogeneous Medium, by T. Hinata, H. Hosono, and H. Ono (College of Science and Technology, Nihon University, Tokyo 101 Japan): pp. 1364–1370.

(7.13) Scattering from an Infinite Array of Slots with Polar-Type Anisotropic Media, by M. Asai*, J. Yamakita**, S. Sawa***, and J. Ishii* (*Faculty of Biology-Oriented Science and Technology, Kinki University, Wakayama-ken, 649-64 Japan; **Faculty of Computer Science and System Engineering, Okayama Prefectural University, Soja-shi, 719-11 Japan; ***Faculty of Engineering, University of Osaka Prefecture, Sakai-shi, 591 Japan): pp. 1371–1377.

(7.14) Scattering of Millimeter Waves by Metallic Strip Gratings on an Optically Plasma-Induced Semiconductor Slab, by K. Nishimura, and M. Tsutsumi (Faculty of Engineering and Design, Kyoto Institute of Technology, Kyoto-shi, 606 Japan): pp. 1378–1384.

(7.15) Analysis of a Millimeter-Wave Antenna Consisting of Layered Magnetic and Dielectric Slabs with Periodic Corrugation, by N. S. Chang and D. Yunus (Dept. of Communication Engineering, Osaka Electro-communication University, Neyagawa-shi, 572 Japan): pp. 1385–1390.

(7.16) Numerical Analysis of Capacitive Discontinuities of Finite Thickness in Rectangular Waveguides Using the Modified Residue-Calculus Method, by T. Shibazaki*, T. Kinoshita**, and T. Shibamoto** (Dept. of Electric Engineering, Tokyo Metropolitan College of Technology, Tokyo 140 Japan; **Faculty of Engineering, Tokyo Institute of Polytechnics, Atsugi-shi, 243-02 Japan): pp. 1391–1398.

(7.17) Design Considerations on a Guided-Wave Polarization Splitter Utilizing a Bifurcating Waveguide in a Uniaxial Anisotropic Substrate, by T. Kitamura, M. Geshiro, S. Sawa, and H. Yamanaka (College of Engineering, Osaka Prefecture University, Sakai-shi, 593 Japan): pp. 1399–1404.

(7.18) Optical Filter Utilizing the Directional Coupler Composed of the K^+-and Ag^+-ion Exchange Waveguides, by K. Kishioka and K. Yamamoto (Dept. of Applied Electronics, Osaka Electro-Communication University, Neyagawa-shi, 572 Japan): pp. 1405–1412.

(7.19) Analysis of Microstrip Line with a Trapezoidal Dielectric Ridge in Multilayered Media by Partial-Boundary Element Method, by Keren LI and K. Atsuki (Dept. of Electronic Engineering, The University of Electro-communications, Chofu-shi, 182 Japan): pp. 1413–1419.

(7.20) Coupling Efficiency of Grating Coupler for the Gaussian Light Beam Incidence, by M. Tomita (Faculty of Electro Communications, The University of Electro Communications, Chofu-shi, 182 Japan): pp. 1420–1429.

(7.21) Simulation Study on Magnetostatic Wave Solitons, by V. Priye, and M. Tsutsumi (Faculty of Engineering, Kyoto Institute of Technology, Kyoto-shi, 606 Japan): pp. 1430–1435.

(8) IEICE TRANS. ELECTRON., vol. E79-B, no. 11, Nov. 1996, is a special issue on Measurement Techniques for EMC.

(8.1) Research and Development on EMC/EMI Measurements and Technologies in Japan, by T. Takagi (Dept. of Information Science, Engineering College, Nihon University, Tokusada, Tamuramachi, Kohriyama-shi, 963-11 Japan): (vol. J79-B-II, no. 11, pp. 718–726).

(8.2) A Direction Finding of Conducted Interference Using the Coupled Transmission Lines, by K. Kawamata*, S. Minegishi**, A. Haga**, and R. Sato* (*Faculty of Engineering, Hachinohe Institute of Technology, Hachinohe-shi, 031 Japan; **Faculty of Engineering, Tohoku Gakuin University, Tagajo-shi, 985 Japan): (vol. J79-B-II, no. 11, pp. 727–733).

(8.3) Theoretical Analysis of the Sensitivity on Electric Field Sensor Using $LinbO_3$ Optical Modulator, by R. Kobayashi*, K. Tajima*, N. Kuwabara*, and M. Tokuda** (*NTT Multimedia Networks Laboratories, Musashino-shi, 180 Japan; **Kyushu Institute of Technology, Kitakyushu-shi, 804 Japan): (vol. J79-B-II, no. 11, pp. 734–743).

(8.4) Evaluation of Electric Field Sensor with Very Small Element Using Mach-Zehnder Interferometer, by K. Tajima*, N. Kuwabara*, R. Kobayashi*, and M. Tokuda** (*NTT Multimedia Networks Laboratories, Musashino-shi, 180 Japan; **Kyushu Institute of Technology, Kitakyushu-shi, 804 Japan): (vol. J79-B-II, no. 11, pp. 744–753).

(8.5) Evaluation of Complex Antenna Factor of Dipole Antenna by the Near-field 3-Antenna Method with the Method of Moment, by K. Fujii, S. Ishigami, and T. Iwasaki (Dept. of Electronic Engineering, University of Electro-Communications, Chofu-shi, 162 Japan): (vol. J79-B-II, no. 11, pp. 754–763).

(8.6) Site Attenuation Measurements Using Shortened Dipole Antennas, by A. Maeda*, A. Sugiura**, N. Kuwabara***, and S. Usuda**** (*A Maeda Associates, Inc., Yokohama-shi, 222 Japan; **Communications Research Laboratory, Koganei-shi, 184 Japan; ***NTT Telecommunication Networks Laboratories, Musashino-shi, 180 Japan; ****Voluntary Control Council for Interference by Information Technology Equipment, Tokyo, 105 Japan): (vol. J79-B-II, no. 11, pp. 764–770).

(8.7) Output Voltage of Transmission Line Coupled with Far-Field Radiation of Small Gap Discharge, by S. Ishigami and T. Iwasaki (Dept. of Electronic Engineering, University of Electro-Communications, Chofu-shi, 162 Japan): (vol. J79-B-II, no. 11, pp. 771–779).

(8.8) Noise Currents and Noise Voltages in AC Supply Lines due to a Fluorescent Lamp Switchin, by Y. Shimoshio*, M. Miyoshi**, and H. Koga* (*Dept. of Information and Communication, Kumamoto National College of Technology, Kumamoto-ken, 861-11 Japan; **Dept. of Electronics, Kumamoto National College of Technology, Kumamoto-ken, 861-11 Japan): (vol. J79-B-II, no. 11, pp. 780–788).

(8.9) Characteristics of the Discharge Current by the Human Charge Model ESD Simulator, by N. Murota (Industrial Research Institute, Aichi Prefectural Government, Nishishinwari Hitotugi-cho, Kariya-shi, 448 Japan): (vol. J79-B-II, no. 11, pp. 789–796).

(8.10) A Study of DC Operating Point Shift in Bipolar Transistor with Large RF Signals, by Y. Hattori, H. Hayashi, T. Kato, H. Tadano, and H. Nagase (Toyota Central R&D Labs., Inc., Aichi-ken, 480-11 Japan): (vol. J79-B-II, no. 11, pp. 797–804).

(8.11) Modeling of EMI Spectra Emitted from a Signal Line on a Digital PCB, by T. Miyashita*, O. Wada*, R. Koga*, and H. Sano** (*Faculty of Engineering, Okayama University, 3-1-1 Tsushima-Naka, Okayama-shi, 700 Japan; **Faculty of Engineering, Fukuyama University, Sanzou 1, Gakuencho, Fukuyama-shi, 729-02 Japan): (vol. J79-B-II, no. 11, pp. 805–811).

(8.12) Measurement of Magnetic Near Field on a Printed Circuit Board of Finite Size and a Simple Estimation Method of Far Fields, by T. Tobana and Y. Kami (Dept. of Electro-communications, University of Electro-Communications, 1-5-1 Chofugaoka, Chofu-shi, 182 Japan): (vol. J79-B-II, no. 11, pp. 812–818).

(8.13) Analysis of Crosstalk between Non-parallel Transmission Lines by Using a Circuit Concept, by W. Liu and Y. Kami (Dept. of communications and Systems Engineering, the University of Electro-Communications, Chofu-shi, 182 Japan): (vol. J79-B-II, no. 11, pp. 819–826).

(8.14) Measurement and Estimation of BER Degradation of PHS due to Electromagnetic Disturbance from Microwave Ovens, by Y. Yamanaka and T. Shinozuka (Communications Research Laboratory, M. P. T., Koganei-shi, 184 Japan): (vol. J79-B-II, no. 11, pp. 827–834).

(8.15) A Study on the Effect of Microwave Oven Interfereces to the Performance of Digital Radio Communication Systems, by S. Miyamoto*, Y. Yamanaka**, T. Shinozuka** and N. Morinaga* (*Faculty of Engineering, Osaka University, Suita-shi, 565 Japan; **Communications Research Laboratory, M. P. T., Koganei-shi, 184 Japan): (vol. J79-B-II, no. 11, pp. 835–844).

(8.16) Distribution Characteristics of Unwanted Emission around a Building, by Y. Maeda, Y. Komatsu, and M. Hattori (*NTT Multimedia Networks Laboratories, 3-9-11 Midori-cho, Musashino-shi, 180 Japan; **NTT Technical assistance and support center, 3-9-11 Midori-cho, Musashino-shi, 180 Japan): (vol. J79-B-II, no. 11, pp. 845–853).

(8.17) Shielding Evaluation of Shielding Gaskets for Millimeter Waves, by H. Togawa* and K. Hatakeyama** (*Tokin Corporation, Kawasaki-shi, 213 Japan; **NEC Corporation, Kawasaki-shi, 216 Japan): (vol. J79-B-II, no. 11, pp. 854–857).

(8.18) Phase and Amplitude Noise Measurement and Its Application, by K. Takagi (Kyushu Institute of Technology, Kitakyushu-shi, 804 Japan): (vol. J79-B-II, no. 11, pp. 858–860).

(8.19) N $\times$ M Arrayed Meteor Burst Communication Systems, by A. Fukuda and K. Mukumoto (Faculty of Engineering, Shizuoka University, Hamamatsu-shi, 432 Japan): (vol. J79-B-II, no. 11, pp. 861–869).

(8.20) Throughput Performance of a Slotted Nonpersistent CSMA with an Adaptive Array, by A. Sugihara, K. Enomoto, and I. Sasase (Dept. of Electrical Engineering, Keio University, Yokohama-shi, 223 Japan): (vol. J79-B-II, no. 11, pp. 870–880).

(8.21) In-orbit Performance Evaluation of Fixed and Mobile Communication Equipment on Kiku-6, by H. Sakamoto*, K. Ueno*, H. Tanaka**, K. Horikawa*, and H. Kohata** (*NTT Wireless Systems Laboratories, Yokosuka-shi, 238-03 Japan; **National Space Development Agency of Japan, Tokyo, 105 Japan): (vol. J79-B-II, no. 11, pp. 881–891).

(8.22) Analysis of Antennas Mounted on Portable Equipment near Human Body, by K. Sato*, K. Mishikawa*, N. Suzuki*, and A. Ogawa** (*Toyota Central R&D Labs., Inc., Aichi-ken, 480-11 Japan; **School of Engineering, Nagoya University, Nagoya-shi, 464-01 Japan): (vol. J79-B-II, no. 11, pp. 892–900).

(9) IEICE TRANS. ELECTRON., vol. E79-C, no. 11, Nov. 1996, is a special issue on Quantum Effect and Their Fabrication Technologies.

(9.1) Analog Computation Using Quantum Structures ∼A Promising Computation Architecture for Quantum Processors∼, by Y. Amemiya (Faculty of Engineering, Hokkaido University, Sapporo-shi, 060 Japan): pp. 1481–1486.

(9.2) Growth and Optical Properties of Self-Assembled Quantum Dots for Semiconductor Lasers with Confined Electrons and Photons, by Y. Arakawa, M. Nishioka, H. Nakayama, and M. Kitamura (Industrial Science, University of Tokyo, Tokyo, 153 Japan): pp. 1487–1494.

(9.3) Self-Organization Phenomenon in a Strained InGaAs System and Its Application for Quantum Disk Lasers, by J. Temmyo*, E. Kuramochi*, M. Sugo*, T. Nishiya*, Richard NOTZEL*†, and T. Tamamura* (*NTT Opto-electronics Laboratories, Atsugi-shi, 243-01 Japan; †Paul-Drude-Institut fur Feskorper-elektronik, Husvorgteiplatz, 5-7, D-10 117 Berlin, Germany): pp. 1495–1502.

(9.4) Si Single-Electron Transistors on SIMOX Substrates, by Y. Takahashi, A. Fujiwara, M. Nagase, H. Namatsu, K. Kurihara, K. Iwadate, and K. Murase (NTT LSI Laboratories, Atsugi-shi, 243-01 Japan): pp. 1503–1508.

(9.5) Room Temperature Operated Single Electron Transistor by STM Nano-Oxidation Process: Fabrication Process and Electrical Properties, by K. Matsumoto (Electrotechinical Laboratory MITI, Tsukuba-shi, 305 Japan): pp. 1509–1514.

(9.6) Device Technology for Monolithic Integration of InP-Based Resonant Tunneling Diodes and HEMTs, by K. J. Chen†, K. Maezawa*††, T. Waho*††, and M. Yamamoto*†† (*NTT LSI Laboratories, Atsugi-shi, 243-01 Japan; †Dept. of Electronic Engineering, City University of Hong Kong, Kowloon, Hong Kong; ††NTT System Electronics Laboratories, Atsugi-shi, 243-01 Japan): pp. 1515–1524.

(9.7) Current-Voltage Characteristics of Triple-Barrier Resonant Tunneling Diodes Including Coherent and Incoherent Tunneling Processes, by R. Takemura*, M. Suhara**, Y. Miyamoto*, K. Furuya*, and Y. Nakamura* (*Dept. of Electrical and Electronic Engineering, Faculty of Engineering, Tokyo Institute of Technology, Tokyo, 152 Japan; ** Research Center for Quantum Effect Electronics, Tokyo Institute of Technology, Tokyo, 152 Japan): pp. 1525–1529.

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