# Asia–Pacific Abstracts

## Papers from Journals Published in Australia, India, China, and Japan in 1992

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The periodicals investigated are 1) *Journal of Electrical and Electronics Engineering* (*JEEE*), Australia, 2) *Australian Telecommunication Research* (*ATR*), Australia, 3) *Journal of the Institution of Electronics and Telecommunication Engineers* (*JIETE*), India, 4) *Acta Electronica Sinica* (*AES*), China, 5) *Journal of China Institute of Communications* (*JCIC*), China, 6) *Journal of Infrared and Millimeter Waves* (*JIMW*), China, 7) *Journal of Applied Sciences* (*JAS*), China, 8) *Journal of Electronics* (*JE*), China, 9) *Journal of Chinese Institute of Engineering* (*JCIE*), Taiwan, 10) *Transactions of the Institute of Electronics, Information and Communication Engineers* (*Trans. IEICE*), Japan, 11) *IEICE Transactions on Communications* (*IEICE Trans. Commun.*), Japan, and *IEICE Transactions on Electronics* (*IEICE Trans. Electron.*), Japan.

As for the Japanese papers in the *Trans. IEICE* that carry volume numbers J75-B-II, J75-C-I, and J75-C-II, short English summaries are found in the *IEICE Trans. Commun.*, vol. E75-B, and *IEICE Trans. Electron.*, vol. E75-C, issued the same month. Papers carrying volume numbers E75-B and E75-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.

The 1991 and 1992 issues of the *JIETE* are not available in Japan at the deadline of the Asia–Pacific Abstracts and will be reported next time.

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 and Techniques (only the titles and their authors)

### 1) Solid-State Microwave Devices and MMIC's

**(1) Cryogenic L-Band Low-Noise Amplifier for the Radioastron Space Radio Telescope**, by V. Waris (Research and Development Group, MITEC Ltd. Australia, 19-23 Hasp Street, Seventeen Mile Rocks Qld 4073, Australia): *JEEE*, vol. 12, pp. 313–317, Sept. 1992.

A cryogenic low-noise amplifier designed and developed for the L-band receiver on-board the Radioastron satellite is described. The two-stage amplifier uses FHR02FH HEMT's and achieves a noise temperature of 9 K with a gain of greater than 25 dB across a 40 MHz operating bandwidth at 1664 MHz at a physical temperature of 80 K.

**(2) Fabrication of GaAs MESFET and Circuit on Si Substrate Utilizing Ti/TiW/Au as Gate Metallization**, by M.-X. Li, Q.-Y. Tong, and Q.-D. Zhuang (Southeast University, Nanjing, P.R.C.): *AES*, vol. 20, pp. 37–40, Feb. 1992.

A Ti/TiW/Au gate metallization technique is developed, which can be used for the compatible co-integration of GaAs IC and Si IC. By utilizing Ti/TiW/Au gate metallization, good MESFET's and IC's performances of GaAs grown on Si substrate are obtained by molecular beam epitaxy.

**(3) Ku-Band Pulse Gunn Oscillator**, by J.-D. Xie, J.-A. Jing, and C.-L. Xu (Yaguang Electronic Engineering Factory, Chengdu, P.R.C.): *AES*, vol. 20, pp. 74–79, Feb. 1992.

Structure and design principles of a pulse Gunn diode and a pulse modulator are described. Performances of the pulse Gunn oscillator are as follows: the maximum pulse power of 5.7 W, highest efficiency of 5%, pulse duration ratio of 1% over the frequency range of 13–15 GHz.

**(4) A Fast Electromagnetic Simulation Technique for MMIC's**, by J.-F. Dai,* G.-X. Zhang,** and Y.-S. Wu* (*Tianjin University, Tianjin, P.R.C.; **Huazhong Normal University, Wuhan, P.R.C.): *AES*, vol. 20, pp. 17–24, Feb. 1992.

A principle of the electromagnetic simulation is outlined, a direct-picking method is presented for determining the circuit characteristics, and two kinds of matrix-order-reduced approach are studied. The fast electromagnetic simulation technique for MMIC's reduces computing time by about one order of magnitude.

**(5) Frequency-Domain Full Nonlinear Analysis Method for Microwave Mixers**, by L. Han, Y.-Y. Wang, and S.-F. Li (Southeast University, Nanjing, P.R.C.): *AES*, vol. 20, pp. 80–83, Mar. 1992.

A new frequency-domain mixer diode model and an adaptable spectral balance algorithm are proposed, and the full nonlinear analysis is performed in the frequency-domain for a microwave mixer driven by multi-tone signals. Some frequency-conversion performances of the mixer are investigated in detail.

**(6) A Segment-Rebuilding Method for Active Networks and Its Applications**, by J.-F. Dai, T.-H. Wang, and Y.-S.

Wu (Tianjin University, Tianjin, P.R.C.): *AES*, vol. 20, pp. 1–7, Aug. 1992.

A segment-rebuilding method for active networks is presented. By dividing the active network into a lumped element subnetwork and device subnetworks, and by means of the indefinite scattering matrixes of subnetworks and the connections and terminating of floating ports, the scattering matrix of the active network is founded for analysis and design of the network.

**(7) The Role of Backgating in GaAs MESFET Orientation Effect**, by Q.-A. Huang and Q.-Y. Tong (Microelectronics Center, Southeast University, Nanjing, P.R.C.): *AES*, vol. 20, pp. 29–34, Aug. 1992.

Based on the piezoelectric model, the effect of piezoelectric charge on the depletion layer at channel/substrate interface of GaAs MESFET is investigated. It has been suggested that threshold voltage shifts of GaAs MESFET for positive piezoelectric charges are greater than those for negative ones.

**(8) MM-Wave Double Varactors Tuned Oscillator**, by D.-J. Wang and D.-F. Li (University of Science and Technology of China, Hefei, Anhui, P.R.C.): *JIMW*, vol. 11, pp. 453–457, Dec. 1992.

The analysis and design of a new-type MM-wave VCO, reflection-type cavity stabilized, double varactors tuned Gunn oscillator are presented. The performances of the VCO are as follows: phase noise: −60 dBc/Hz ($f_m = 1$ kHz), −95 dBc/Hz ($f_m = 50$ kHz); rough tuning: 10–20 MHz/(0–15)V; fine tuning: ±(1–3) MHz/(0–15)V. The new type VCO has been successfully applied in a MM-wave Doppler pulse radar.

**(9) Two-Dimensional Numerical Analysis of the Narrow-Gate Effect**, by B. Yang and C.-R. Ji (Shanghai University of Science and Technology, Shanghai, P.R.C.): *JAS*, vol. 10, pp. 71–77, Jan. 1992.

The two-dimensional numerical analysis, obtained by Chung and Sah, is improved by adopting the mobility model. It is found that the slope of the conductance-gate voltage curve changes from increase to decrease with increasing gate voltage and that the narrow-gate shift of the threshold voltage is larger than that obtained from constant mobility approximation.

**(10) The Large-Signal Design for FET Fundamental and Harmonic Oscillators**, by J.-F. Mino and M. Liao (Southeast University, Nanjing, P.R.C.): *JE*, vol. 14, pp. 41–49, Jan. 1992.

A large-signal model for GaAs FET is derived based on its small-signal S parameter and dc characteristics. The harmonic balance algorithm is applied to analyze and optimize the FET fundamental and harmonic osillators, and the values of steady current are obtained. A simplified CAD approach is used to obtain the parameters of matching network when the output power is maximum. A fundamental oscillator and a harmonic oscillator of Q-band are fabricated.

**(11) A Novel Ku-Band Low Noise Amplifier with HEMT and GaAs MMIC**, by Y.-S. Dai (Nanjing Electronic Devices Institute, Nanjing, P.R.C.): *JE*, vol. 14, pp. 629–632, Nov. 1992.

A novel Ku-band low noise amplifier with high electron mobility transistor (HEMT) and GaAs monolithic microwave integrated circuit (MMIC) is demonstrated. Its noise figure is less than 1.9 dB with an associated gain over 27 dB and an input-output VSWR less than 1.4 in the frequency range of 11.7–12.2 GHz.

**(12) The Parameter Analysis of i-GaAlAs/i-GaAs HIGFET's by Using Finite-Element Method**, by C. Gu, D.-N. Wang, and W.-Y. Wang (Shanghai Institute of Metallurgy, Academia Sinica, Shanghai, P.R.C.): *JE*, vol. 14, pp. 548–554, Sept. 1992.

Two dimensional numerical simulation and analysis for the static state characteristics of i-GaAlAs/i-GaAs HIGFET's by using the finite-element method are presented. The electron concentration and potential distribution inside the HIGFET's are computed. The results of its output characteristics are in good agreement with experimental data.

**(13) Desired Mode Excitation by Power Additive Signal Injection in a Multiple-Device Cavity Combiner**, by S. Tanaka,* S. Nogi,** and K. Fukui** (*Faculty of Engineering, Fukuyama University, Fukuyama, 729-02 Japan; **Faculty of Engineering, Okayama University, Okayama, 700 Japan): *Trans. IEICE*, vol. J75-C-I, pp. 659–668, Oct. 1992.

A method for suppressing undesired modes in a multiple-device cylindrical cavity combiner is described. A mode analysis is carried out to derive the condition of undesired mode suppression and that of sustaining the desired mode oscillation.

**(14) High-Power Microwave Transmit-Receive Switch with Series and Shunt GaAs FET's**, by M. Matsunaga* and K. Nakahara** (*Electro-Optics and Microwave Systems Laboratory, Mitsubishi Electric Corporation, Kamakura, 247 Japan; **Optics and Microwave Device Development Laboratory, Mitsubishi Electric Corporation, Itami, 664 Japan): *IEICE Trans. Electron.*, vol. E75-C, pp. 252–258, Feb. 1992.

A new monolithic transmit-receive GaAs FET switch is developed, named the FET series-shunt connected TR switch and capable of switching high rf transmitting power. Both insertion loss and isolation limitations of this type of TR switch are analyzed using the switching cutoff frequency of the control FET.

**(15) A Self-Consistent Linear Theory of Gyrotrons**, by K. Hayashi and T. Sugawara (Research and Development Center, Toshiba Corporation, Kawasaki, 210 Japan): *IEICE Trans. Electron.*, vol. E75-C, pp. 610–616, May 1992.

A new set of self-consistent linear equations is presented for the analysis of the startup characteristics of gyrotron oscillators with an open cavity consisting of weakly irregular waveguides. Numerical results on frequency detuning and oscillation starting current for a whispering-gallery-mode gyrotron are described.

### 2) Transmission Lines and Passive Microwave Devices

**(1) Angular-Direction Period EECRM**, by P.-X. Huang, S.-F. Yu, and S.-G. Liu (University of Electronic Science and Technology of China, Chengdu, P.R.C.): *AES*, vol. 20, pp. 21–26, Mar. 1992.

A new structure EECRM is presented. The electrostatic field and the R.F. field are discussed in detail. A new electron bunching mechanism is found. It is shown that the efficiency of the energy transform in this system is higher than that in the coaxial EECRM.

**(2) A Design of 8mm Fin-Line Circulator**, R.-M. Xu and L.-J. Xue (University of Electronic Science and Technology of China, Chengdu, P.R.C.): *AES*, vol. 20, pp. 43–47, June 1992.

A method to design a Y-junction unilateral fin-line circulator is presented. The experimental results in Ka-band show that the transmission loss is less than 1.5 dB, the isolation is larger than 20 dB, and VSWR is less than 1.3 over a bandwidth of 7%.

**(3) A New Method for Tapered Transmission Line Design**, by Y. Wang and C.-Y. Sheng (Southeast University, Nanjing, P.R.C.): *AES*, vol. 20, pp. 87–89, Mar. 1992.

An inherent relation between the window function (WF) of digital signal processing and the tapered transmission line (TTL) in microwave engineering is revealed. Some high quality WF's are used for TTL design. The design formulas are derived.

**(4) The Characteristic Impedance of Rectangular-Coaxial-Cone Transmission Line**, by K.-M. Huang* and W.-G. Lin** (*Sichuan University, Chengdu, P.R.C.; **University of Electronic Science and Technology of China, Chengdu, P.R.C.): *AES*, vol. 20, pp. 81–84, June 1992.

A rectangular cone is mapped into a cylinder via conformal transformation in three dimensions. The maximum and the minimum values of characteristic impedance of a rectangular-coaxial-cone transmission line are obtained. The average of the two extreme values is in agreement with the characteristic impedance of the transmission line.

**(5) Convolution-Characteristic Method for Analysis of the Time Response of Multiconductor Transmission Lines**, by J.-F. Mao and Z.-F. Li (Shanghai Jiao-Tong University, Shanghai, P.R.C.): *AES*, vol. 20, pp. 47–54, Sept. 1992.

A convolution-characteristics method is introduced for the analysis of the time response of multiconductor transmission lines. Nonuniform transmission lines with frequency-dependent losses and arbitrary terminals can be analyzed by this method.

**(6) Analysis of Dispersion Characteristics of Groove Guides with Mode-Matching Method**, by S.-J. Xu and L.-J Yin (University of Science and Technology of China, Hefei, P.R.C): *JCIC*, vol. 13, pp. 81–86, July 1992.

The mode-matching method is used to analyze the dispersion characteristics of single and asymmetrical double groove guides, and the unified formula of $n$th-order approximation dispersion equation is presented. A general program for calculating the dispersion characteristics of various kinds of groove guides has been completed.

**(7) The Optimal Synthesis of Even Order Filter with Symmetrical Load**, by C.-H. Liang, R.-Q. Li, and T.-J. Cui (Xidian University, Xi'an, P.R.C): *JCIC*, vol. 13, pp. 116–120, July 1992.

This paper presents a type of optimal integer polynomial with zero-constraint which is fit into the solution of the optimal synthesis of even order filter with symmetrical load. The gain of the filter keeps equiripple property within passband and maximum slope outside the band.

**(8) Analysis and Design of Broadband Groove Guide Directional Couplers**, by S.-J. Xu and L.-J. Yin (University of Science and Technology of China, Hefei, P.R.C): *JIMW*, vol. 11 pp. 430–434, Dec. 1992.

The problems of analysis and design of the broadband groove guide directional couplers are investigated by the microwave network method. The calculations show that the relative bandwidths of the couplers given in this paper are all larger than 24%, which is five times as many as the bandwidth of the conventionally designed groove guide couplers; whereas the lengths of the present couplers are much shorter than those designed in the references.

**(9) W-Band Six-Port Reflectometer: Its Design, Calibration and Accuracy**, by Z.-H. Feng, J.-Z. She, K. Gong, J.-Z. Wang, and B.-C. Xu (Tsinghua University, Beijing, P.R.C): *JIMW*, vol. 11, pp. 459–466, Dec. 1992.

This paper describes a W-band six-port reflectometer, including its design, calibration, and error analysis. The waveguide junction is designed optimally by the use of the concept of generalized resonant cavity. The diode detectors are used as powermeters which are matched well. For measuring two-port network parameters, a least-squares method is proposed, which has merits of easiness, quickness, and high accuracy.

**(10) Study on Mode Coupling Coefficients in Curved Corrugated Circular Waveguides**, by H.-F. Li* and M. Thumm** (*University of Electronic Science and Technology of China, Chengdu, P.R.C.; **Institute Für Technische Physik, Kernforschungszentrum, Karlsruhe, Postfach, Karlsrube, Germany): *JIMW*, vol. 11, pp. 486–491, Dec. 1992.

Mode coupling due to curvature in circumferentially corrugated circular waveguides is analyzed. Starting from Maxwell's equations in the annular orthogonal curvilinear coordinate-system, the integral formulas for coupling coefficients are derived and the explicit expressions of coupling coefficients between positive or opposite modes are given.

**(11) Variational Solution of Resonant Cavity Filling Anisotropic Plasma**, by K. Liu, W.-X. Zhang, and J.-M. Ying (Southeast University, Nanjing, P.R.C): *JAS*, vol. 10, pp. 113–120, Apr. 1992.

A universal variational equation for solving electromagnetic boundary problems is deduced. It has the advantage that the trial functions are not restricted by the boundary condition, which is especially useful in solving problems of anisotropic medium of irregular geometry. The resonant characteristics of plasma filled cavities are analyzed by using the Rayleigh-Ritz method.

**(12) "L" Calibration for Dual-Six-Port Network Analyzer and Analysis of System Measuring Error**, by D.-Y. Shen,* C.-L. Ruan,** and W.-G. Lin** (*Yunnan University, Kunmin, P.R.C.; **University of Electronic Science and Technology of China, Chengdu, P.R.C): *JE*, vol. 14, pp. 379–384, July 1992.

A new method for calibrating the dual-six-port network analyzer is proposed. Using this method, only a section of transmission line is needed, and its length is not necessary to be known accurately. The measuring errors introduced by non-ideal isolators are discussed, and the degree of isolation needed for the system working in the quasi-ideal condition is given.

**(13) Full-Wave Analysis of 2-D Boundary Value Problems with Curved Boundaries by Method of Lines**, by C.-M. Qiu, S.-Z. Lin, and W.-G. Lin (University of Electronic Science and Technology of China, Chengdu, P.R.C.): *JE*, vol. 14, pp. 643–647, Nov. 1992.

The 2-D EM boundary value problems with curved boundaries are treated by the method of lines for the first time. The present method has the following advantages: generality, high accuracy, and small computations.

**(14) A New Type of Wide-Band Radar Absorbing Coating**, by L. Feng and C.-X. Lu (University of Electronic Science and Technology of China, Chengdu, P.R.C.): *JE*, vol. 14, pp. 616–623, Nov. 1992.

A new type of absorbing coating formed by inserting a frequency selective surface in an ordinary coating is introduced. The absorbing properties of the new structure are given.

**(15) Statistical Regression Methods for S-Parameter Measurements of Reciprocal Multi-Port Networks**, by C.-H. Liang and X.-W. Shi (Xidian University, Xi'an, P.R.C.): *JE*, vol. 14, pp. 611–617, Nov. 1992.

Two kinds of statistical regression methods named progressively regression theory and generalized Kajfez method are presented for S-parameter measurements without changing ports of reciprocal multi-port networks. Measurement data of an H-plane Tee is given.

**(16) Analysis of Lunar Waveguides and Vained Circular Waveguides**, by L.-Y. Zhang and W.-B. Wang (Xi'an Jiaotong University, Xi'an, P.R.C.): *JE*, vol. 14, pp. 509–516, Sept. 1992.

The lunar waveguides and vained circular waveguides are analyzed by the mode matching method. The fields in the waveguides are expressed by cylindrical harmonic expansions in which Bessel functions with half orders are involved. Characteristic equations for cutoff wave numbers for both TE and TM modes are obtained.

**(17) Millimeter-Wave Junction Circuits Using Nonradiative Dielectric Waveguide**, by F. Kuroki and T. Yoneyama (Reseach Institute of Electrical Communication, Tohoku University, Sendai, 980 Japan): *Trans. IEICE*, vol. J75-C-I, pp. 35–41, Jan. 1992.

Based on the NRD-guide, 3-port and 5-port circuits are fabricated, and their performances are tested at 50 GHz. Reasonable output power levels of −3 dB and −6 dB, in average, are obtained for respective circuits, and radiation loss, which is a major trouble for ordinary dielectric waveguides, is completely eliminated.

**(18) Tree-Dimensional Full Wave Analysis with Nonlinearity and Line Characteristics of Device by Electromagnetic Field Analysis on Time Domain**, by H. Kimura and N. Yoshida (Faculty of Engineering, Hokkaido University, Sapporo, 060 Japan): *Trans. IEICE*, vol. J75-C-I, pp. 42–51, Jan. 1992.

A Unified three-dimensional full wave analysis method is proposed for the analysis of nonlinear circuits. The nonlinearity and line characteristics are incorporated in the finite-difference time-domain method and in the spatial network method.

**(19) Equivalent Characteristic Impedance Formula of Waveguide and Its Applications**, by F. Ishihara* and S. Iiguchi** (*Faculty of Engineering, Tamagawa University, Machida, 194 Japan; **Department of Electronics, Chiba Institute of Technology, Narashino, 275 Japan): *Trans. IEICE*, vol. J75-C-I, pp. 52–60, Jan. 1992.

A formula of the equivalent characteristic impedance of the waveguide is derived, and the validity and usefulness of the formula are verified by several experiments. Furthermore, the formula is applied to the analysis and design of staircase-like transformers and curved tapered waveguides.

**(20) A Planar Circuit of Active Gyrator** (Letters), by M. Takashima and T. Inoue (Faculty of Technology, Tokyo University of Agriculture and Technology, Koganei, 184 Japan): *Trans. IEICE*, vol. J75-C-I, pp. 61–64, Jan. 1992.

A design chart for an active gyrator with wide-band phase response, which consists of two microstrip lines for phase shift and two amplifiers in loop, is obtained.

**(21) Finite Element Analysis of Electromagnetic Fields by Using Three-Dimensional Hexagonal Edge Elements**, by T. Yamabuchi,* S. Fujii,* T. Murai,* S. Hirose,* T. Futagami,* and Y. Kagawa** (*Faculty of Engineering, Toyama University, Toyama, 930 Japan; **Faculty of Engineering, Okayama University, Okayama, 700 Japan): *Trans. IEICE*, vol. J75-C-I, pp. 65–73, Feb. 1992.

A finite element formulation for three-dimensional electromagnetic fields using the hexahedral edge element based on vector shape functions is proposed. It is found that this element requires Lagrange multipliers as the additional variables to suppress the spurious modes.

**(22) Formulae for Estimating the Wide Band Reflection Characteristics of Inductive Window with Thickness in Rectangular Waveguide**, by F. Ishihara,* T. Shibazaki,* T. Suga,* and S. Iiguchi** (*Faculty of Engineering, Tamagawa University, Machida, 194 Japan; **Department of Electronics, Chiba Institute of Technology, Narashino, 275 Japan): *Trans. IEICE*, vol. J75-C-I, pp. 92–100, Feb. 1992.

Reflection characteristics of symmetrical and asymmetrical finitely thick inductive windows in rectangular waveguides are calculated. By considering the window to be continuous rather than discontinuous, the analysis technique presented here makes good use of the method of telegraphist's equations in a waveguide.

**(23) A Finite Element Analysis of Infinite Periodic Waveguides** (Letters), by A. Maruta and M. Matsuhara

(Faculty of Engineering, Osaka University, Suita, 565 Japan): *Trans. IEICE*, vol. J75-C-I, pp. 101–103, Feb. 1992.

A novel approach based on the finite element method is proposed for the analysis of infinite periodic waveguides. The complex propagation constant for the infinite periodic waveguide can be calculated at the given frequency.

**(24) The Equivalent Transmission Line Equation for Tapered Waveguides with Finite Wall Surface Resistance** (Letters), by F. Ishihara and T. Suga (Faculty of Engineering, Tamagawa University, Machida, 194 Japan): *Trans. IEICE*, vol. J75-C-I, pp. 113–116, Feb. 1992.

A transmission line for an equivalent tapered waveguide with finite wall surface resistance is defined. The given equation can be solved by the same method for both within and without cutoff regions.

**(25) Resonant Frequency Analysis of a Dielectric Ring Resonator for a New Method of Moisture Content Measurements**, by S. Okamura and M. Sone (Faculty of Engineering, Shizuoka University, Hamamatsu, 432 Japan): *Trans. IEICE*, vol. J75-C-I, pp. 164–170, Mar. 1992.

An analysis of the resonant frequency of a dielectric ring resonator is described to discuss a new method of moisture content measurements for samples having small or nonuniform size. The possibility of mesuring moisture contents only from the resonant frequency measurements is shown theoretically, and is proved by the experiments using cardboard samples.

**(26) Effect of Conductor Losses in New-Structure Filters for Suppressing Microwave Leakage**, by K. Iwabuchi,* T. Kubota,* Y. Sugaya,* T. Kashiwa,** and I. Fukai** (*Hitachi Hometec, Ltd., Kashiwa, 277 Japan; **Faculty of Engineering, Hokkaido University, Sapporo, 060 Japan): *Trans. IEICE*, vol. J75-C-I, pp. 179–187, Apr. 1992.

Attenuation characteristics of a broadband-stop waveguide filter for suppressing microwave leakage from a microwave heating apparatus are calculated. Theoretical expressions with conductor losses are derived from the equivalent circuits correponding to newly developed waveguide filters with multitude slit plates and rectangular-wave-shaped belts suitable for mass production.

**(27) Electro-Acoustic Surface Wave Convolver of Thin-Piezoelectric Materials/Semi-Conductor Structure**, by K. Yamanouchi and F. Kadosawa (Research Institute of Electrical Communication, Tohoku University, Sendai, 980 Japan): *Trans. IEICE*, vol. J75-C-I, pp. 468–477, June 1992.

Propagation characteristics and nonlinear phenomena of surface acoustic waves in the piezoelectric thin film/semiconductor structure are studied. The calculation results of ZnO/GaAs substrate show that the electro-coupling coefficients of 0.02, small attenuation of 0.02 dB/$\lambda$, and maximum convolution figure of merit (M-value) of $7\times10^{-1}$ V·m/W at 100 MHz are obtained for carrier density of $10^{12}$/cm$^3$ and mobility of 8000 cm$^2$/(V·s). The experimental results show the maximum M-value of $2.6\times10^{-2}$ at 200 MHz.

**(28) Optimum Structure Design of Stepped Impedance Dielectric Coaxial Resonator by Means of TM Mode Analysis**, by M. Toki,* H. Arai,* and M. Makimoto** (*Faculty of Engineering, Yokohama National University, Yokohama, 240 Japan; **Tokyo Information and Communications Research Laboratory, Matsushita Electric Industrial Co., Ltd., Kawasaki, 214 Japan): *Trans. IEICE*, vol. J75-C-I, pp. 503–511, July 1992.

A miniaturized dielectric coaxial stepped impedance resonator (SIR) is studied by means of the finite element TM-mode analysis which presents an optimum structure design of SIR. An optimum location of the SIR step is 40% of the axial length from the open end to minimize the resonant electrical length.

**(29) Analysis of the Optically Controlled Microwave Strip Circuits Utilizing the Frequency-Dependent Finite-Difference Time-Domain Method** (Letters), by M. Hira, T. Kitamura, Y. Mizomoto, and S. Kurazono (Faculty of Engineering, Osaka University, Suita, 565 Japan): *Trans. IEICE*, vol. J75-C-I, pp. 600–602, Sept. 1992.

Optically controlled microwave circuits are analyzed utilizing the frequency-dependent finite-difference time-domain method. The propagation constants of optically controlled coplanar lines are calculated and are in good agreement with the spectral domain results.

**(30) A Broadband Tunable Oscillator Using Two Magnetostatic Wave Resonators**, by H. Asao, H. Ohashi, and O. Ishida (Electro-Optics & Microwave Systems Laboratory, Mitsubishi Electric Corporation, Kamakura, 247 Japan): *Trans. IEICE*, vol. J75-C-I, pp. 652–658, Oct. 1992.

Design techniques and experimental results of a broadband tunable oscillator using two magnetostatic wave resonators are presented. The resonant frequency of a rectangular magnetostatic wave resonator is given as a function of resonator dimensions. The tunable bandwidth of an experimental oscillator, using two resonators with the designed resonant frequency difference, extends over 2 octaves up to 20 GHz, and the output power is more than +12 dBm.

**(31) Resonance Characteristics of Whispering Gallery Modes on a Dielectric Disk**, by Y. Tomabechi* and K. Matsumura** (*Faculty of Education, Utsunomiya University, Utsunomiya, 321 Japan; **Faculty of Engineering, Utsunomiya University, Utsunomiya, 321 Japan): *Trans. IEICE*, vol. J75-C-I, pp. 687–693, Nov. 1992.

Resonance characteristics of the whispering gallery modes in a large dielectric disk are presented. Theoretical results show a good agreement with X-band experimental results. Resonance frequencies, radiation loss, dielectric loss, and Q values of the whispering gallery modes are obtained.

**(32) Hairpin-Shaped Stripline Split-Ring Resonators and Their Applications**, by H. Yabuki, H. Endo, M. Sagawa, and M. Makimoto (Matsushita Electric Industrial Co., Ltd., Kawasaki, 214 Japan): *Trans. IEICE*, vol. J75-C-I, pp. 711–720, Nov. 1992.

The fundamental resonating properties of hairpin-shaped stripline split-ring resonators are investigated, and some useful applications, such as filters and oscillators, are proposed. Experimental results show that these resonators have a suitable structure for MIC's and MMIC's above the L band.

**(33) Finite Element Analysis of Excitation and Propagation Problems of Magnetostatic Forward Volume Wave**, by M. Hano, M. Kondo, and I. Awai (Faculty of Engineering, Yamaguchi University, Ube, 755 Japan): *Trans. IEICE*, vol. J75-C-I, pp. 721–729, Nov. 1992.

A finite-element formulation is described and some numerical results are presented for excitation and propagation problems of magnetostatic forward volume waves. The reflection coefficient changes periodically with the width of the conductor, and its periodicity agrees with the wavelength of magnetostatic waves.

**(34) An Improved Design Method of Two-Path Cutoff-Waveguide Cavity-Resonator Filters** (Letters), by T. Nakai, M. Tsuji, and H. Shigesawa (Faculty of Engineering, Doshisya University, Kyoto, 602 Japan): *Trans. IEICE*, vol. J75-C-I, pp. 752–754, Dec. 1992.

An improved design method for suppressing spurious resonances of two-path cutoff-waveguide cavity-resonance filters is proposed. Experiments for a test filter prove the effectiveness of the method presented here.

**(35) Exact Simulation of Picosecond Electrical Pulse Generation Using Nonlinear Microwave Transmission Lines** (Letters), by Y. Qian and E. Yamashita (Faculty of Electro-Communications, University of Electro-Communications, Chofu, 182 Japan): *IEICE Trans. Electron.*, vol. E75-C, pp. 113–116, Jan. 1992.

The wave propagation in a diode-equipped microstrip line is investigated. The theoretical prediction of solitons is confirmed by computer simulations using the harmonic balance method.

**(36) Accurate Analysis of Various Planar Transmission Lines with Finite Metallization Thickness Using Eigen-Function Weighted Boundary Integral Equation Method**, by L. Zhu and E. Yamashita (Faculty of Electro-Communications, University of Electro-Communications, Chofu, 182 Japan): *IEICE Trans. Electron.*, vol. E75-C, pp. 259–266. Feb. 1992.

The eigen-function weighted boundary integral equation method is applied to analyze the dispersion characteristics of various planar transmission lines with finite metallization thickness, such as microstrip lines, conductor-backed coplanar waveguides, and micro coplanar striplines for the first time. The difficulty in treating strip thickness can be overcome by considering the 90° edge on the strip as a 90° circular arc whose radius tends to zero.

**(37) Waveguide $\pi$-Junction with an Inductive Post** (Letters), by J. Hirokawa, M. Ando, and N. Goto (Faculty of Engineering, Tokyo Institute of Technology, Tokyo, 152 Japan): *IEICE Trans. Electron.*, vol. E75-C, pp. 348–351, Mar. 1992.

A waveguide $\pi$-junction with an inductive post for the element of a multiple-way power divider in a single-layered slotted waveguide array is proposed. This $\pi$-junction splits part of the power into two branch waveguides through one coupling window, and can excite densely arrayed waveguides at equal phase and amplitude.

**(38) Telegraphist's Equations of an E-Plane Taper of a Rectangular Waveguide** (Letters), by M. Kodama (Faculty of Engineering, University of the Ryukyus, Okinawa, 903-01 Japan): *IEICE Trans. Electron.*, vol. E75-C, pp. 957–959, Aug. 1992.

New telegraphist's equations which can give exact fields in E-plane tapers of rectangular waveguides are proposed.

### 3) Microwave Antennas

**(1) Desing of the Ku-Band Antennas for the Galaxy HS601C Satellites**, by T. S. Bird and C. Sroka (CSIRO Division of Radiophysics, PO Box 76, Epping NSW 2121, Australia): *JEEE*, vol. 12, pp. 267–273, Sept. 1992.

Outcomes of a study undertaken by CSIRO on the six possible shaped beams for the Galaxy HS601C satellites are described. These satellites will provide C- and Ku-band communications to the continental USA and neighboring islands. Of especial concern in the study is the effect on performance of mutual coupling between the multi-mode horns in the feed arrays for the reflectors that generate the shaped beams.

**(2) A High Frequency Radio Location System**, by G. L. Goodwin,* Z. R. Jeffrey,** and D. J. Hichens* (*University of South Australia, Australia; **Andrew Australia, Australia): *JEEE*, vol. 12, pp. 284–289, Sept. 1992.

A lightweight, compact, low-cost, low-power (10 W), high-frequency (3–16 MHz) radio transmitter and easily-erectable wide-band (loop) antenna are developed as a locator beacon for aircraft in distress, with application also to ships, road transports, and individuals such as bush-walkers. Skyloc, a sophisticated single-station-location receiving system, marketed commercially, receives the transmitted signals via the ionosphere, identifies the transmitting beacon and computes its location; the system has been tested successfully at ranges up to 2000 km.

**(3) The Power Gain of a Vertical Monopole Antenna for Ground Wave Propagation**, by R. M. Thomas and G. R. Haack (Surveillance Research Laboratory, Defence Science and Technology Organization, GPO Box 1650, Salisbury SA 5108, Australia): *JEEE*, vol. 12, pp. 290–299, Sept. 1992.

The gain of a broadband vertical monopole antenna employed in HF ground wave measurements is investigated. It is recommended that the use of this antenna in applications requiring a knowledge of absolute gain be restricted to frequencies between 8 and 26 MHz, due to the uncertainties which apply outside this band. Within this band, both the impedance and the directive gain are commendably tolerant of variations in ground properties.

**(4) Formulation of a Single Controlled Null in an Omnidirectional Pattern Using a Circular Array**, by X. Yang and M. H. Er (Center for Siganl Processing, School of Electrical and Electronic Engineering, Nanyang Technological University, Nanyang Avenue, Singapore 2263): *JEEE*, vol. 12, pp. 318–322, Sept. 1992.

A new method is presented for the formation of a single null in an otherwise omnidirectional pattern using a circular array which gives a great deal of controllability over the characteristics of the null. The optimal weight vector of the array processor is obtained by minimizing the mean square deviation between the response and the desired unity response over the entire 360° coverage, subject to certain constraints.

**(5) The Impact of Ground Irregularities on the Performance of an HF Antenna Array**, by C. J. Coleman (DSTO, Surveillance Research Laboratory, Salisbury, South Australia 5108, Australia): *JEEE*, vol. 12, pp. 387–393, Dec. 1992.

The degradation of a high frequency (HF) antenna array in the presence of ground irregularities is investigated. Irregularities such as surface roughness and vegetation are considered. In the presence of a modest ground screen, it is found that the irregularities need to be very large in order to cause an effect that is above the level of the sidelobes.

**(6) On Topology Optimization for Antenna Structures**, by B.-Y. Duan and G.-H. Xu (Xidian University, Xi'an, P.R.C.): *AES*, vol. 20, pp. 27–34, Mar. 1992.

An efficient method of topology optimization for antenna structures is presented. The optimal topological form is obtained to satisfy the demand of the electronic performance. The present method not only can deal with the behavior constraints such as displacement and stress constraints during the optimal design, but also avoids the main difficulty of predetermined displacement field.

**(7) Admittance Measurement of Inclined Slot Antenna in the Narrow Wall of a Rectangular Waveguide**, by L.-Y. Shen, X.-M. Qing, and Y.-C. Feng (Microwave Measurement Center of University of Electronic Science and Technology of China, Chengdu, P.R.C.): *AES*, vol. 20, pp. 35–39, Mar. 1992.

A new normalized S parameter method of measuring admittance of inclined slot antenna in the narrow wall of a rectangular waveguide is presented. Because attenuation and phase shift of measured waveguide section are deleted, the conductance and susceptance of a slot can be obtained accurately.

**(8) A New Numerical Synthesis Technique for Low Sidelobe Curved Arrays**, by Y.-C. Jiao and H.-S. Wu (Xidian University, Xi'an, P.R.C.): *AES*, vol. 20, pp. 7–14, June 1992.

A new numerical synthesis technique for low sidelobe curve arrays is presented. The synthesis of curved arrays is transformed into a problem of nonlinear optimization, and is solved by modified multiplier method to find a set of array coefficients that yield the best possible pattern directivity with specified sidelobes.

**(9) The Equivalent Shunt Admittance of Inclined Slot in the Narrow Wall of a Rectangular Waveguide**, by D.-F. Yi,* L. Ren,* and W.-B. Wang** (*Southwest Jiaotong University, Chengdu, P.R.C.; **Xi'an Jiaotong University, Xi'an, P.R.C.): *AES*, vol. 20, pp. 89–92, Sept. 1992.

A formula for evaluating the equivalent shunt admittance of an inclined slot in the narrow wall of a rectangular waveguide is presented. By uisng the infinite image array technique and the duality of electricity and magnetism, the difficulty involving the divergency of the series which is related to the dyadic Green's function in the guide has been avoided.

**(10) Improved Perturbation Analysis of Millimeter-Wave Omni-Directional Periodic Dielectric Rod Antenna**, by S.-J. Xu and Z.-W. Ma (University of Science and Technology of China, Hefei, P.R.C.): *AES*, vol. 20, pp. 89–92, June 1992.

The characteristics of the omni-directional periodic circular dielectric rod leaky-wave antenna are analyzed by the improved perturbation method. The electromagnetic fields are described in terms of a radial transmission-line network. The analysis yields expression for the leaked constant in a closed form and the design procedure of the antenna is tremendously simplified.

**(11) The Hybrid Phase Center of a Reflector Antenna Feed Source**, by Y.-H. Qi* and H.-S. Wu** (*Southeast University, Nanjing, P.R.C.; **Xi'an University, Xi'an, P.R.C.): *AES*, vol. 20, pp. 22–26, Sept. 1992.

The expression of a hybrid phase center of an axially symmetric reflector antenna feed source is rigorously derived from field relevance theory. It is proved that expressions for both linearly and circularly polarized feed sources are completely the same. Thus it provides a theoretical basis for design and adjustment of reflector antenna, particularly the modified Cassegrain antenna.

**(12) The Calculation of Radiation Characteristics of Microstrip Antennas of the Finite Truncated Cone-Cylinder**, by Q.-Z. Liu,* Y. Zhang,** and H.-N. Wang** (*Xidian University, Xi'an, P.R.C.; **Beijing Special Mechanic-Electric Research Institute, Beijing, P.R.C.): *AES*, vol. 20, pp. 93–95, Sept. 1992.

The formulas are developed to calculate 3-D radiation field and gain of microstrip antennas on finite truncated cone-cylinder by applying the UTD. Examples are given on the calculation of 3-D radiation patterns and gain of the finite truncated cone. The results of calculations agree well with the experimental ones.

**(13) An Efficient Numerical Analysis of Horn Antennas**, by B. Song and J.-M. Fu (Xi'an Jiaotong University, P.R.C.): *JE*, vol. 14, pp. 154–162, Mar. 1992.

The boundary-element method is used for the investigation of horn antennas. The input standing-wave property, aperture field, near field, and far field of horn antennas are studied thoroughly. The results obtained are in good agreement with data available in the literature.

**(14) On the Phase Center of Electromagnetic Horns**, by Y.-H. Qi and S.-F. Li (Southeast University, Nanjing, P.R.C.): *JE*, vol. 14, pp. 404–408, May 1992.

The characteristics of the phase centers of electromagnetic horns holding nearly symmetric pattern are presented analytically. It is proved that the phase center on the $\phi = 45°$ plane coincides with the average phase center, and if a single plane phase center is used to define the horn phase center approximately, the $\phi = 45°$ phase center will be the best choice.

**(15) Characteristics of the Cavity-Backed Narrow Slot Antenna in a Lossy Medium**, by X.-B. Wu,* W.-Y. Pan,* and W.-G. Lin** (*China Research Institute of Radiowave Propagation, Xinxiang, P.R.C.; **University of Electronics Science and Technology of China, Chengdu, P.R.C.): *JE*, vol. 14, pp. 225–232, May 1992.

The characteristics of the cavity-backed slot antenna in a lossy medium is investigated by using the moment method and dyadic Green's functions. The Poisson summation formula is used to convert the double series of elements into a more rapidly converging series, and the integration middle value theorem and elliptic integral are used to simplify the double integral of the elements.

**(16) Improved Perturbation Analysis of Dielectric Grating Antennas with Arbitrary Groove Profiles**, by S.-J. Xu and X.-Z. Wu (University of Science and Technology of China, Hefei, P.R.C.): *JE*, vol. 14, pp. 315–319, May 1992.

The improved perturbation method is used for analyzing the radiation characteristics of the millimeterwave dielectric grating antennas with various groove profiles. A comparison between the results given and those obtained by the rigorous calculations shows that the present analysis yields as highly accurate results as the rigorous method but the calculation procedure is tremendously simplified.

**(17) The Limitation of Mutual Impedance Precision to the Sidelobe Level of Array Antenna**, by L.-R. Zhang and Y.-H. Zhang (Electronic Engineering Research Institute, Xidian University, Xi'an, P.R.C.): *JE*, vol. 14, pp. 233–239, May 1992.

This paper deals with the requirements on the precision of mutual impedance for compensation in ultra-low sidelobe array antenna. The relationship between mutual impedance errors and the amplitude and phase errors of channels is derived, by which the relationship between mutual impedance error and the sidelobe level is given.

**(18) Study on Radiation Characteristics of Multi-Layer Microstrip Antennas**, by Y.-Z. Yin, C.-B. Ma, Q.-Z. Liu, and D.-M. Gong (Xidian University, Xi'an, P.R.C.): *JE*, vol. 14, pp. 546–549, Sept. 1992.

On the basis of spectral domain immittance approach and wave-matrix technique, an efficient numerical method for analyzing multi-layer microstrip antennas is presented. The formulas are simple and easy to be programmed. Numerical results are in good agreement with experimental results.

**(19) Superdirective Cascaded Dipole Array**, by T. Nakamura, S. Miyagawa, and S. Yokokawa (Faculty of Engineering, Gifu University, Gifu, 501-11 Japan): *Trans. IEICE*, vol. J75-B-II, pp. 62–68, Jan. 1992.

An endfire array of parallel dipole elements is analyzed for the high gain and small antenna. All elements are cascaded with zigzag transmission lines as simple feeding. The realization of the superdirective antenna by this configuration and its design principle are investigated.

**(20) Effects of Lower Sidelobe Level of a Large Deployable Mesh Reflector Antenna to Lower Effective Mass of Communications Equipment**, by S. Sato, A. Iso, T. Orikasa, T. Sugimoto, and Y. Dooi (Space Communications Research Corporation, Tokyo, 101 Japan): *Trans. IEICE*, vol. J75-B-II, pp. 69–77, Jan. 1992.

For the cluster-fed offset parabolic mesh reflector antenna, effects of the lower sidelobe level on the lower effective mass of communications equipment are analyzed. The antenna characteristics are shown in the case of the minimum communications equipment mass.

**(21) Analysis of Coil-Loaded Wire Antenna**, by M. Taguchi, K. Yamashita, K. Tanaka, and T. Tanaka (Faculty of Engineering, Nagasaki University, Nagasaki, 852 Japan): *Trans. IEICE*, vol. J75-B-II, pp. 95–102, Jan. 1992.

A numerical method with Pocklington's integral equation is presented for the analysis of a coil-loaded wire antenna. In the formulation, the surface electric and magnetic currents on the coil are determined by using the equivalence principle. The good agreement between the numerical and the measured current distributions and input impedances is obtained for the different numbers of turns, radius, pitch, and location of the coil.

**(22) Electrical Performances of Squint Reflector Antenna at Beam Steering by Sub-Reflector Drive** (Letters), by T. Itanami (NTT Radio Communications System Laboratories, Yokosuka, 238-03 Japan): *Trans. IEICE*, vol. J75-B-II, pp. 124–126, Jan. 1992.

Electrical performances of squint reflector antennas used for the ETS-VI satellite are investigated, especially for the beam steering by the sub-reflector drive.

**(23) Frequency Reuse and Mesh Reflector Mass of Multi-Beam Antenna Having Different Elliptical Beams on Transmitting and Recieving for Mobile Communication Satellites** (Letters) by S. Sato, A. Iso, T. Orikasa, and T. Sugimoto (Space Communications Research Corporation, Tokyo, 101 Japan): *Trans. IEICE*, vol. J75-B-II, pp. 150–152, Feb. 1992.

A large deployable mesh reflector multi-beam antenna having different elliptical beams on transmitting and receiving is considered to increase frequency reuse. By comparing with the case of circular multi-beam antenna, it is shown that the increase of frequency reuse number, the small earth terminal, and the decrease of the mass of mesh reflector are possible.

**(24) Analysis of Parallel Plate Mode in Slot-Coupled Microstrip Antenna**, by, H. Iwasaki, H. Shoki, and K. Kawabata (Research and Development Center, Toshiba Corporation, Kawasaki, 210 Japan): *Trans. IEICE*, vol. J75-B-II, pp. 171–178, Mar. 1992.

The electric field distribution and leakage power of the parallel plate mode are analyzed by the spatial network method. To suppress the parallel plate mode, a two-element array antenna is fabricated and tested. Analytical and experimental results are described.

**(25) Planar Array Antenna Loaded by Dielectrics** (Letters), by T. Tsugawa,* Y. Sugio,** and T. Makimoto** (*Faculty of Engineering, Osaka Institute of Technology, Osaka, 535 Japan; **Faculty of Engineering, Setsunan University, Neyagawa, 572 Japan): *Trans. IEICE*, vol. J75-B-II, pp. 208–210, Mar. 1992.

A planar receiving array antenna, which is composed of 64-microstrip patches loaded by cylindrical dielectrics with low permittivity, is fabricated. This antenna has the aperture area of 364×324 mm$^2$, the maximum gain of 31 dBi, and the 1 dBi-down frequency bandwidth of 660 MHz.

**(26) Analysis of Interference from Passive Intermodulation Products on Mesh Antenna Reflectors** (Letters), by T. Orikasa, S. Sato, A. Iso, and T. Sugimoto (Space Communications Research Corporation, Tokyo, 101 Japan): *Trans. IEICE*, vol. J75-B-II, pp. 248–251, Apr. 1992.

The interference from passive intermodulation products on mesh antenna reflectors is analyzed by using an antenna array model composed of small elements. The analytical results show that the interference power level of a mesh reflector is very small.

**(27) Investigation of Radiation Characteristics of Large Deployable Antennas Using a Model Antenna**, by E. Hanayama and T. Takano (Institute of Space and Astronautical Science, Sagamihara, 229 Japan): *Trans. IEICE*, vol. J75-B-II, pp. 285–292, May 1992.

In order to study the radiation characteristics of large deployable antennas that could be used in space, a model antenna with a polyhedron reflector is fabricated, and its characteristics are measured. The reflector consists of many triangular facets attached onto a paraboloid. As the aperture periphery is a hexagon, the remaining part of the circular aperture is corved with radiowave absorbers.

**(28) Transient Response of Resistively Loaded Dipole Antennas for Pulse Rader**, by M. Kominami,* T. Takagi,* S. Sawa,* and T. Kikuta** (*Faculty of Engineering, University of Osaka Prefecture, Sakai, 591 Japan; **R&D Center, Osaka Gas Co., Ltd., Osaka, 554 Japan): *Trans. IEICE*, vol. J75-B-II, pp. 293–299, May 1992.

A moment method solution is presented for the problem of transient coupling between two resistively loaded dipoles and a thin-wire target. The impulse response is calculated, and the effects of resistive loading and dipoletarget spacing are considered. Results are also given for near field patterns at the first resonant frequency.

**(29) A Radio Line Slot Antenna without a Slow Wave Structure**, by K. Ichikawa, J. Takada, M. Ando, and N. Goto (Faculty of Engineering, Tokyo Institute of Technology, Tokyo, 152 Japan): *Trans. IEICE*, vol. J75-B-II, pp. 363–369, June 1992.

A new design of a radial line slot antenna without a slow wave structure by utilizing the slow wave effect of slot coupling is proposed. The numerical analysis points out the fact that the grating lobes are suppressed when the height of the guide is small. The model antenna is fabricated and the efficiency of 61% is measured.

**(30) Characteristics of Space Diversity Branch Using Parallel Dipole Antennas in Mobile Radio Communications**, by T. Taga (NTT Radio Communication Systems Laboratories, Yokosuka, 238-03 Japan): *Trans. IEICE*, vol. J75-B-II, pp. 370–378, June 1992.

Characteristics of a space diversity branch constructed by two parallel half-wavelength dipole antennas are analyzed theoretically. When applying this diversity branch to postdetection selection diversity, the excellent mean effective gain of the antennas is obtained for the antenna spacing ranging from 0.3 to 0.4 wavelength.

**(31) Analysis of 3-m Site Attenuation Considering Effects of Finite Ground Plane: In Case of Vertical Polarization** (Letters), H. Sudo,* K. Gyoda,* H. Kawakami,* G. Sato,* R. Wakabayashi,** and K. Shimada** (*Faculty of Science and Technology, Sophia University, Tokyo, 102 Japan; **Tokyo Metropolitan College of Aeronautical Engineering, Tokyo, 116 Japan): *Trans. IEICE*, vol. J75-B-II, pp. 399–402, June 1992.

The wiregrid method and the hybrid method are used for calculating 3-m site attenuation in the case of vertical polarized waves.

**(32) Contoured-Beam Antenna Using Smoothly Shaped Dual-Reflectors for Broadcasting Satellites**, by K. Shogen and H. Nishida (NHK Science and Technical Research Laboratories, Tokyo, 157 Japan): *Trans. IEICE*, vol. J75-B-II, pp. 447–455, July 1992.

A downlink antenna whose aperture diameter of the main reflector is 2.3 m in a 12-GHz frequency band is designed. The radiation pattern of the antenna covers almost the whole of the four major islands in Japan and Okinawa at over 40 dBi of antenna gain, and other remote islands in Japan at over 28 dBi. The radiation patterns of a fabricated half-scale model antenna are measured in a 22-GHz frequency band.

**(33) Phase Controlling for Improving the Gain or Providing the Low Cross Polarization Level in Circularly Polarized Phased Array Antennas**, by I. Chiba, M. Ohtsuka, S. Mastumoto, and T. Takagi (Mitsubishi Electric Corporation, Kamakura, 247 Japan): *Trans. IEICE*, vol. J75-B-II, pp. 456–463, July 1992.

A phase controlling method for improving the gain or providing the low cross polarization level in circularly polarized phased array antennas is described. In this method, at some frequency points, the active element patterns of left-handed and right-handed circularly polarized polarizations are obtained. Using these element datas and the non-linear programming method, required exciting phase distributions are determined.

**(34) Conditions for a Rotationally Symmetric Aperture Mapping in Dual Reflector Antennas: A New Category of Reflector Systems Allowing a Double-Offset Configuration**, by S. Nomoto and Y. Mizuguchi (Research and Development Laboratories, Kokusai Denshin Denwa Co., Ltd., Kamifukuoka, 356 Japan): *Trans. IEICE*, vol. J75-B-II, pp. 464–471, July 1992.

Conditions are derived that are useful for designing dual reflector antennas with a rotationally symmetric aperture mapping in geometrical optics sense. As a result, a new category of dual reflector systems with higher degrees of freedom is discovered, which ensures a rotationally symmetric aperture mapping even in the case of a double-offset configuration without any symmetry.

**(35) Optimum Design of Yagi-Uda Antenna for Millimeter-Wave Imaging**, by K. Uehara, H. Nishimura, T. Yonekura, K. Natsume, and K. Mizuno (Research Institute of

Electrical Communication, Tohoku University, Sendai, 980 Japan): *Trans. IEICE*, vol. J75-B-II, pp. 472–479, July 1992.

Yagi-Uda antenna imaging arrays for operation at millimeter-wave frequencies are developed. The arrays consist of lens-coupled printed Yagi-Uda antennas integrated with beam-lead Schottky diodes. The radiation patterns and input impedance of the antenna are calculated and measured to attain the optimum efficiency of the imaging system.

**(36) A Consideration on Linearly Dual-Polarized Planar Antenna** (Letters), by A. Matsui and M. Haneishi (Faculty of Engineering, Saitama University, Urawa, 338 Japan): *Trans. IEICE*, vol. J75-B-II, pp. 490–492, July 1992.

A linearly dual-polarized planar antenna made of a slot-coupled rectangular microstrip antenna is studied, and its radiation properties are investigated.

**(37) Conformal Array Antenna for Mobile Satellite Communications**, by W. Chujo, Y. Konishi, Y. Ohtaki, and M. Fujise (ATR Optical and Radio Communications Research Laboratories, Kyoto-fu, 619-02 Japan): *Trans. IEICE*, vol. J75-B-II, pp. 547–555, Aug. 1992.

Radiation characteristics of conformal array antennas suitable for mobile satellite communications are examined by computer simulations, and mechanical and electrical performances of conformal arrays fabricated by the vacuum forming technique and the round faced compression method are presented.

**(38) Adaptive Array Antenna Based on Estimation of Arrival Angles Using DFT on Spatial Domain**, by C. Yim, R. Kohno, and H. Imai (Faculty of Engineering, Yokohama National University, Yokohama, 240 Japan): *Trans. IEICE*, vol. J75-B-II, pp. 556–565, Aug. 1992.

A new algorithm is proposed for constructing adaptive array antennas. In this algorithm arrival angles and signal-to-noise ratio (SNR) for desired and undesired signal waves can be estimated by using discrete Fourier transform of signals which are spatially sampled by array of antenna elements. Optimum weights can be derived by substituting the arrival angles and the SNR to the well-known Wiener solution.

**(39) Study of Shape Control for On-Board Modular Mesh Antenna**, by M. Shimizu and H. Tanaka (NTT Radio Communication Systems Laboratories, Yokosuka, 238-03 Japan): *Trans. IEICE*, vol. J75-B-II, pp. 566–572, Aug. 1992.

This paper describes thermal deformation analysis and static shape control simulation for a modular mesh antenna composed of mesh, cable network, and supporting structure. A new control method of displacing cable positions attached to the supporting structure is proposed. The proposed control method reduces the amount of surface distortion by 50% and restores main lobe gain almost to the order of underformed surface error.

**(40) Analysis of Slotted Tube Resonator for MRI** (Letters), by Q. Chen,* K. Sawaya,* S. Adachi,* H. Ochi,** and E. Yamamoto** (*Faculty of Engineering, Tohoku University, Sendai, 980 Japan; **Central Research Laboratory, Hitachi, Ltd., Kokubunji, 185 Japan): *Trans. IEICE*, vol. J75-B-II, pp. 602–605, Aug. 1992.

The characteristics of the slotted tube resonator for the magnetic resonance imaging (MRI) are analyzed by replacing the antenna into a model composed of conducting wires and by using the moment method of Richmond. Lumped condensers are included in this wire model to incorporate the capacitance between the guard ring and the wing.

**(41) A Diversity Performance Analysis of Paralleled Two Dipole Antennas Mounted on a Small Metal Body**, by K. Tsunekawa and K. Kagoshima (NTT Radio Communication Systems Laboratories, Yokosuka, 238-03 Japan): *Trans. IEICE*, vol. J75-B-II, pp. 629–637, Sept. 1992.

Numerical analysis results are presented for the diversity performance when two paralleled half-wave dipole antennas are mounted on a small metal body. By using a moment method with wire-grid model, it is found that 0.1 wavelength antenna separation yields low correlation coefficients of 0.23 and high efficiency accounting a mismatch loss of $-2.7$ dB.

**(42) A Desing of Chebyshev Microstrip Dipole Arrays Reduced Mutual Coupling** (Letters), by K. Kamogawa, M. Kominami, and S. Sawa (Faculty of Engineering, University of Osaka Prefecture, Sakai, 593 Japan): *Trans. IEICE*, vol. J75-B-II, pp. 655–657, Sept. 1992.

A design technique for reducing the mutual coupling of microstrip linear arrays is presented. Exciting voltages are determined based on the coefficients related to Chebyshev polynomials.

**(43) An Analysis of Dielectric Coated Wire Antennas** (Letters), by T. Nakamura, T. Nagatsu, and S. Yokoyama (Faculty of Engineering, Gifu University, Gifu, 501-11 Japan): *Trans. IEICE*, vol. J75-B-II, pp. 664–667, Sept. 1992.

A nonuniform distributed-constant transmission line model is used for the analysis of dielectric coated wire antennas. The effect of the dielectric coating is explained by series capacitance in the shunt admittance of the equivalent circuit.

**(44) On Circularly Polarized Energy Flux Densities**, by S. Tokumaru and R. Tanaka (Faculty of Science and Technology, Keio University, Yokohama, 223 Japan): *Trans. IEICE*, vol. J75-B-II, pp. 682–690, Oct. 1992.

The radiation mechanism in circularly polarized antennas is investigated. Circularly polarized energy flux density vectors are succinctly deduced for understanding circularly polarized wave energy radiation. As the most fundamental example, stream lines of circularly polarized flux densities are drawn in the case of cross dipoles. Directivity and exitation efficiency are also newly defined for the circularly polarized antennas.

**(45) Measurement of Angle of Arrival by Small Circular Array Antenna for Aircraft**, by M. Shirakawa, Y. Fukuda, and S. Ozeki (Electronic Navigation Research Institute, Ministry of Transport, Mitaka, 181 Japan): *Trans. IEICE*, vol. J75-B-II, pp. 691–698, Oct. 1992.

The use of a small radius circular array with the Buttler matrix is discussed for the airborne collision avoidance system. When the radius of the array decreases, the mutual coupling increases. However, the relative phase relation among the elements is not changed by adjusting the output phase independently.

**(46) Characteristics of Offset Parabolic Antenna with Snow Accretion on Its Reflector** (Letters), by T. Nakamura,* T. Sato,* and M. Shimba** (*Faculty of Engineering, Niigata University, Niigata, 950-21 Japan; **Faculty of Engineering, Tokyo Denki University, Tokyo, 101 Japan): *Trans. IEICE*, vol. J75-B-II, pp. 702–704, Oct. 1992.

The characteristics of an offset parabolic antenna with snow accretion on its reflector are investigated by measuring antenna patterns of a dielectric-coated offset parabolic antenna.

**(47) The Relation between the Antenna Effective Gain in Multipath Propagation Environments and the Length of Metal Housing for a Small Radio Unit** (Letters), by K. Tsunekawa,* K. Kagoshima,** and A. Ando** (*NTT Mobile Communications Network Inc., Yokosuka, 238 Japan; **NTT Radio Communication Systems Laboratories, Yokosuka, 238 Japan): *Trans. IEICE*, vol. J75-B-II, pp. 705–707, Oct. 1992.

Relations between the effective gain in multipath propagation environments and the length of metal housing for the monopole or inverted F antennas are studied.

**(48) A Feeding Technique for Broad-Banding and Dual-Banding Microstrip Antenna**, by K. Sakaguchi* and N. Hasebe** (*College of Industrial Technology, Nihon University, Narashino, 275 Japan; **College of Science and Technology, Nihon University, Funabashi, 274 Japan): *Trans. IEICE*, vol. J75-B-II, pp. 935–943, Dec. 1992.

A feeding technique for broad-banding and dual-banding microstrip antennas using a transformer consisting of three distributed elements is presented. For broad-band use the antenna yields a bandwidth of 3.4% with VSWR $\leq 2$. For dual-band use the separation of dual-frequency with respect to the original resonant frequency can be controlled in the region of 2–5%.

**(49) Corner Reflector Antenna with the Same Beam Width in Two Frequency Bands**, by T. Suzuki and K. Kagoshima (NTT Radio Communication Systems Laboratories, Yokosuka, 238-03 Japan): *Trans. IEICE*, vol. J75-B-II, pp. 950–956. Dec. 1992.

An antenna with the same sector beam width is designed for 900-MHz and 1.5-GHz bands. The antenna is realized by placing a rod-type parasitic element close to the driven element which parallels a corner reflector with a corner angle of 140°. The absolute beam width is determined by the corner length.

**(50) Analysis of Microstrip Antennas on a Curved Surface Using the Conformal Grids FD-TD Method**, by T. Oonishi,* T. Kashiwa,** and I. Fukai** (*Toyo Communication Equipment Co., Ltd., Kanagawa-ken, 253-01 Japan; **Faculty of Engineering, Hokkaido University, Sapporo, 060 Japan): *Trans. IEICE*, vol. J75-B-II, pp. 957–963, Dec. 1992.

Microstrip antennas on a curved surface are analyzed using the conformal grids finite-difference time-domain method. The impedance characteristics and radiation directivity are calculated and compared with experimental results.

**(51) An Experimental Study of Antennas for a Small Radio Unit Attached on an Animal** (Letters), by K. Tsunekawa* and N. Kanmuri** (*NTT Mobile Communications Network Inc., Yokosuka, 238 Japan; **Department of Electrical and Electronics Engineering, Shizuoka Institute of Science & Engineering, Fukuroi, 437 Japan): *Trans. IEICE*, vol. J75-B-II, pp. 993–995, Dec. 1992.

The experimental study of antennas near animals or birds is described. It is found that the 0.04-wavelength helical antenna vertical to the contact plane has 3-dB higher radiation efficiency than the 0.25-wavelength monopole antenna parallel to that plane.

**(52) Diversity Antenna by Flat M-Shaped Antenna and Notch Antenna** (Letters), by H. Arai, H. Sumiyoshi, and H. Namiki (Faculty of Engineering, Yokohama National University, Yokohama, 240 Japan): *Trans. IEICE*, vol. J75-B-II, pp. 996–998, Dec. 1992.

A flat diversity antenna system consisting of a flat M-shaped antenna and a notch antenna is proposed. The correlation coefficient between two antennas, calculated by complex patterns of the antenna, is less than 0.1, which is small enough for the diversity antenna.

**(53) Polarization Characteristics of One Side-Shorted Microstrip Antenna** (Letters), by S. Kuroda (Telecommunication and Information Systems Research Laboratory, Sony Corporation, Tokyo, 141 Japan): *Trans. IEICE*, vol. J75-B-II, pp. 999–1000, Dec. 1992.

Polarization characteristics of a one side-shorted microstrip antenna are described based on the calculated and measured results.

**(54) Comparison of PO and PTD Analyses of Offset Reflector Antenna Patterns**, by M. Andò, R. Okada, and T. Kitaoka (Faculty of Engineering, Tokyo Institute of Technology, Tokyo, 152 Japan): *IEICE Trans. Commun.*, vol. E75-B, pp. 76–81, Feb. 1992.

A comparative study of the physical optics (PO) and the physical theory of diffraction (PTD) is presented to demonstrate the limitations of PO. PO envelope errors in co-polar patterns are expressed as functions of antenna parameters. Serious PO errors in cross polarization prediction are pointed out for antennas with cross-polar suppressing feeds polarized in the plane of asymmetry.

**(55) An Adaptive Antenna System for High-Speed Digital Mobile Communications**, by Y. Ogawa, Y. Nagashima, and K. Itoh (Faculty of Engineering, Hokkaido University, Sapporo, 060 Japan): *IEICE Trans. Commun.*, vol. E75-B, pp. 413–421, May 1992.

A least-mean-square (LMS) adaptive array for frequency-selective fading reduction is described. A method to generate a reference signal, which is needed to adjust each weight in the LMS adaptive array, and a new diversity technique using the LMS adaptive array are presented. The adaptive antennas suppress the multipath components which carry desired information.

**(56) A Continuous Measurement of G/T for Satellite Broadcasting Receiving Systems**, by Y. Purwanto, Y. Ogawa, M. Ohmiya, and K. Itoh (Faculty of Engineering, Hokkaido University, Sapporo, 060 Japan): *IEICE Trans. Commun.*, vol. E75-B, pp. 767–774, Aug. 1992.

A continuous measurement method of G(antenna gain)/T(equivalent noise temperature at the output port) for the satellite broadcasting receiving systems is presented. Experimental results of the noise measurement in the satellite broadcasting band show that the noise level varies gradually with respect to frequencies.

**(57) Modified Transmission Line Type Antennas for Mobile Communication**, by T. Tsukiji and Y. Kumon (Faculty of Engineering, Fukuoka University, Fukuoka, 814-01 Japan): *IEICE Trans. Commun.*, vol. E75-B, pp. 775–780, Aug. 1992.

In order to provide a low profile wire antenna for mobile communication, a new type of the transmission line antenna is developed. A certain type of the modified transmission line antenna reveals that the input impedance and the gain can be determined independently by appropriately choosing the antenna configuration.

**(58) A Single-Layer Multiple-Way Power Divider for a Planar Slotted Waveguide Array**, by J. Hirokawa, M. Ando, and N. Goto (Faculty of Engineering, Tokyo Institute of Technology, Tokyo, 152 Japan): *IEICE Trans. Commun.*, vol. E75-B, pp. 781–787, Aug. 1992.

A simple feed system for a planar slotted waveguide array is designed. A waveguide $\pi$-junction with negligible reflection is cascaded to compose a multiple-way power divider. The frequency characteristics of the power divided to each port and the reflection at the feed point are discussed, and high performances are predicted.

4) MICROWAVE/LIGHTWAVE PROPAGATION AND SCATTERING

**(1) Standards and Management of Electromagnetic Interference**, by W. A. Miller (Electrical and Lighting, Standards Australia, 80 Arthur Street, North Sydney, NSW 2060, Australia): *JEEE*, vol. 12, pp. 73–83, Mar. 1992.

The increasing need for measurement and control of electromagnetic interference is described, together with the way in which this is managed overseas. Attention is given to the standards-setting and regulatory arrangements in different countries, especially the European Single Market. The options facing Australian industry are discussed.

**(2) Evaluation of the Frequency-Dependent Ground Wave Loss Technique for Measuring Effective Ground Conductivity and Permittivity at HF**, by R. M. Thomas (High Frequency Radar Division, Defence Science and Technology Organisation, PO Box 1500, Salisbury, SA 5108, Australia): *JEEE*, vol. 12, pp. 274–283, Sept. 1992.

The frequency-dependent HF ground wave loss technique for measuring the effective conductivity and relative dielectric constant of the ground has been validated by carrying out loss measurements for a single path over fresh-water and for 12 paths over solid earth. Results are compared with data obtained from other techniques, such as 4-probe resistivity, 2-loop induction, and laboratory sample analysis techniques.

**(3) Predictability of Radiation in Vertial Directions at Frequencies up to 30 MHz**, by I. P. Macfarlane (Telecom Australia Research Laboratories, Australia): *ATR*, vol. 26, pp. 25–40, May 1992.

This paper shows the limitations of the predictability of radiation in vertical directions when based on measurements at the ground, and identifies some of the factors that must be taken into account when determining limits of radiated electromagnetic disturbances and methods of measurement which are meant to ensure the protection of aeronautical communication and radionavigation services operating below 30 MHz.

**(4) The Calculation for the Diffraction Field of a Steady-State Quasi-Optical Resonator**, by J.-X. Ge and S.-F. Li (Southeast University, Nanjing, P.R.C.): *AES*, vol. 20, pp. 40–46, Mar. 1992.

The diffraction field of a steady-state quasi-optical resonator has been calculated by combining complex source and ray theory with GTD. The far field patterns of diffraction field in E and H plane are given. The calculated results are verified by the experiment.

**(5) A New Method for the Analysis of Electromagnetic Wave Scattering by an Infinite Plane Metallic Grating**, by W. Hong and W.-X. Zhang (Southeast University, Nanjing, P.R.C.): *AES*, vol. 20, pp. 47–51, Mar. 1992.

A new method for the analysis of electromagnetic wave scattering by an infinite plane metallic grating is presented, which is based on the method of lines and Floquet's theorem. Numerical results are in good agreement with those obtained by spectral domain method and experimental data.

**(6) Neural Network Approach for Radar Multitarget Tracking**, by S.-B. Yu,* S.-R. Hu,** and M.-R. Liu* (*Naval Academy of Engineering, Wuhan, P.R.C.; **Changsha Institute of Technology, Changsha, P.R.C.): *AES*, vol. 20, pp. 45–49, Apr. 1992.

A neural network approach is proposed for radar multitarget tracking. The simulated results show that the method is very useful for improving the accuracy of tracking.

**(7) Microwave Coherent Scattering System for Studing Plasma Wave**, by J.-X. Cao and C.-X. Yu (University of Science and Technology of China, Hefei, P.R.C.): *AES*, vol. 20, pp. 90–93, Mar. 1992.

An angle-resolved microwave coherent scattering system is described. Dielectric beam splitter is employed in this system, which facilitates the scan of scattering angle. The dispersion relation of ion acoustic wave and the wavenumber resolution of the system are measured by the system. It is shown that the system is very suitable for studing long-wavelength electrostatic waves and instabilities in plasma.

**(8) A Study of the Backscattering of Electromagnetic Missiles**, by G.-Y. Wen, C.-L. Ruan, and W.-G. Lin (University of Electronic Science and Technology of China, Chengdu, P.R.C.): *AES*, vol. 20, pp. 28–35, June 1992.

This paper studies the backscattering of an electromagnetic missile with an energy decreasing as $r^{-\varepsilon}$ by a perfectly conducting elliptical cylinder and a perfectly conducting sphere. The analysis indicates that the rates of the energy decay for the backscattered fields far from the elliptical cylinder and the sphere proportional to $r^{-(1+\varepsilon)}$ and $r^{-2(2+\varepsilon)}$, respectively.

**(9) Radar Cross Section Analysis of Slot-Array Antennas**, by S.-H. Deng and Y.-Z. Ruan (University of Electronic Science and Technology of China, Chengdu, P.R.C.): *AES*, vol. 20, pp. 15–20, June 1992.

The backscattering from a planar slot-array antenna is studied by the moment method and the technique of singularity elimination of the field integral. The scattering field from the conducting plane is computed by physical optics. It is shown that the scattering field contribution from the conducting plane is much greater than that from the slots.

**(10) Finite Element Analysis of 2-Dimensional Scattering by Applying Global Numerical Boundary Condition**, by D.-S, Fan and J.-X. Jiang (University of Science and Technology of China, Hefei, P.R.C.): *AES*, vol. 20, pp. 67–71, June 1992.

A new concept of the global numerical boundary condition (GNBC) is presented. A finite element analysis of 2-dimensional scattering of complex scatterers is given to demonstrate the application of GNBC in numerical solutions of differential equations for the open-region electromagnetic field problems.

**(11) Electromagnetic Scattering in Multiregion Cylindrically Layered Media Electromagnetic Wave Logging Analysis**, by Z.-P. Nie,* W.-C. Chow,** and Q.-H. Liu*** (*University of Electronic Science and Technology of China, Chengdu, P.R.C.; **University of Illinois, U.S.A.; ***Schlumberger-Doll Research, U.S.A.): *AES*, vol. 20, pp. 12–20, Sept. 1992.

The analytic and the numerical mode methods for the full wave analysis of electromagnetic scattering in cylindrically layered media are discussed. The former is applicable to field analysis under any kind of excitation; and the latter can be used to solve the field in 2-D inhomogeneous media efficiently by using the concepts of reflection matrix and transmission matrix.

**(12) Complete Polarimetric Scattering from a Layer of Nonuniformly-Oriented and Nonspherical Scatterers**, by Y.-Q. Jin* and L. Tsang** (*Fudan University, Shanghai, P.R.C.; **Washington University, U.S.A.): *AES*, vol. 20, pp. 55–61, Sept. 1992.

A nondiagonal extinction matrix and the phase matrix in vector radiative transfer equation for a layer of nonuniformly-oriented and nonspherical scatterers are derived. By using the integral equation of radiative transfer and the Mueller matrix, complete polarimetric scatterings from a layer of nonspherical scatterers are numerically calculated. The copolarized and depolarized backscattering coefficients, the degree of polarization of scattered Stokes vector, the phase difference between vv and hh waves, and the functional relation to some parameters are quantitatively discussed.

**(13) Computing Electromagnetic Scattering from Three-Dimensional Dielectric Objects by Field Iteration Technique**, by S.-H Deng and Y.-Z. Ruan (University of Electronic Science and Technology of China, Chengdu, P.R.C.): *AES*, vol. 20, pp. 60–67, Sept. 1992.

The iteration technique is presented for solving three-dimensional vector integral equation. The field distribution in dielectric objects illuminated by a given wave is obtained, and the scattering field outside a dielectric object is determined.

**(14) Two New Methods for Solution of Eigenvalues and Eigenvectors of Real Symmetric Matrix**, by Q.-M. Cheng and S.-J. Zhang (Northern Jiaotong University, P.R.C.): *JCIC*, vol. 13, pp. 93–96, Sept. 1992.

Two new methods for the solution of eigenvalues and eigenvectors of real symmetric matrix are proposed. The stochastic approximation strategy is introduced in these methods.

**(15) Theoretical Calculation of Directional and Bidirectional Scattering Coefficients of a Vegetative Canopy**, by J.-Q. Zhang and X.-P. Fang (Xi'an University of Electronic Science and Technology, Xi'an, Shanxi, P.R.C.): *JIMW*, vol. 11, pp. 307–311, Aug. 1992.

According to the optical and structural characteristics of the components of a vegetative canopy, the directional and bidirectional scattering coefficients of the canopy are derived and discussed theoretically, with the azimuth angles of incoming and exciting light vector being considered. The results extend Coudriaan's calculations and include Suit's conclusions as a special case.

**(16) Infrared and Millimeter Wave Scattering of Two-Dimensional Conductor-Dielectric Periodic Structures**, by T.-L. Dong (Huazhong University of Science and Technology, Wuhan, Hubei, P.R.C.): *JIMW*, vol. 11, pp. 475–480, Dec. 1992.

An improved method suitable to analyze infrared and millimeter wave scattering of two-dimensional conductor-dielectric periodic structures is presented. The effects of all electromagnetic parameters and geometry sizes are taken into account, and the numerical results can be obtained without invoking any basis functions.

**(17) An Approach to Radar Target Recognition by Using Wide-Band Millimeter Wave Technology**, by S.-H. He and G.-R. Guo (Changsha Institute of Technology, Changsha, Hunan, P.R.C.): *JIMW*, vol. 11, pp. 435–440, Dec. 1992.

A method for feature extraction and target recognition by using wide-band millimeter wave technology is presented. It is shown that the radar targets can be described in terms of multiple scattering centers at the operating frequency of millimeter wave. With a modest bandwidth of the transmitted signals, features about special distribution, category, and polarization of scattering centers can be extracted from the recieved signals.

**(18) Complex Ray Field in Lossy Media**, Y.-Z. Ruan and H.-P. Du (University of Electronic Science and Technology of China, Chengdu, P.R.C.): *JAS*, vol. 10, pp. 106–112, Apr. 1992.

As an asymptotic solution of the wave equation at high frequency, the complex ray field in lossy media is discussed in detail. It is found that the Gaussian beam can also be effectively expressed by the complex ray field in lossy media, and the complex ray approaches developed in the lossless case can also be used in the lossy case. The radar cross-section (RCS) results are obtained by both theoretical and experimental methods for a conducting flat plate with one surface coated with radar absorbing materials.

**(19) Conditions of Perfect Absorption for Single-Layer Electromagnetic Wave Absorber under Oblique Incidence**, by C.-H. Liang, X.-Y. Zhao, X.-P. Hu, and D.-S. Yang (Xidian University, Xi'an, P.R.C.): *JAS*, vol. 10, pp. 283–287, Oct. 1992.

The conditions for perfect absorption under oblique incidence in a single-layer homogeneous absorber backed by a perfect conducting plate are studied. The cases corresponding to the perpendicular (TE) and the parallel polarization (TM) incidence waves are discussed.

**(20) Radar Cross-Section Computation of Arbitrarily Complicated Objects by Applying the Panel Method**, by J.-J. Zhou and Y.-Z. Shu (Nanjing Aeronautical Institute, Nanjing, P.R.C.): *JE*, vol. 14, pp. 71–75, Jan. 1992.

A new method, panel method, for radar cross-section (RCS) computations of arbitrarily complicated objects is put forward based on the work by D. Klement *et al.* (1988). The RCS of an aircraft model at various attitudes is computed, and the obtained results agree with the exprimental data.

**(21) Unrelated Illumination Method for Electromagnetic Inverse Scattering of Inhomogeneous Lossy Dielectric Bodies**, by W.-Y. Wang and S.-R. Zhang (Institute of Electronics, Academia Sinica, Beijing, P.R.C.): *JE*, vol. 14, pp. 240–246, May 1992.

A novel method is proposed for reconstructing the complex permittivities of inhomogeneous lossy dielectric bodies. The accurate reconstructed results show that the method has great potentialities in developing the electromagnetic inverse scattering and the microwave imaging.

**(22) Complex Ray Analysis of Scattering from Ram Coated Targets**, by Y.-Z. Ruan and H.-P. Du (University of Electronic Science and Technology of China, Chengdu, P.R.C.): *JE*, vol. 14, pp. 254–261. May 1992.

With the extension of complex ray theory (CRT) for lossless media, the complex ray analysis in lossy media is constructed and effectively used in the problems of scattering analysis of objects coated with radar absorbing materials (RAM). The radar cross-section (RCS) of conducting flat plate coated with RAM is analyzed, and the theoretical predictions agree very well with the experimental results.

**(23) Reconstruction of One-Dimensional Multiple-Layered Medium Using a Time-Domain Signal-Flowgraph Technique**, by T.-J. Cui and C.-H. Liang (Xidian University, Xi'an, P.R.C.): *JE*, vol. 14, pp. 371–378, July 1992.

A new method to reconstruct multiple-layered medium is proposed for the first time by using a time-domain signal-flow graph (TDSFG) technique. With the equivalent network of the medium, a concept of TDSFG is given and its rules are derived. The reflection principles in time domain are analyzed, and a reconstruction method is established.

**(24) Radar Cross-Section Analysis of Dipole-Array Antennas**, by S.-H. Deng and Y.-Z. Ruan (University of Electronic Science and Technology of China, Chengdu, P.R.C.): *JE*, vol. 14, pp. 496–501, Sept. 1992.

The back scattering from a planar or cylindrical array of loaded dipoles is studied. The current distribution on the dipoles and the radar cross-section (RCS) of the array considering the interaction among dipoles are obtained by the moment method. The loading array technique and the curved surface array technique would greatly reduce the RCS of an array.

**(25) Experimental Verification of a Radar Target Discrimination Technique Using Multiple-Frequency Amplitude Returns**, by M.-C. Lin* and Y.-W. Kiang** (*Chung Shan Institute of Science and Technology, Lungtang, Taiwan, China; **National Taiwan University, Taipei, Taiwan, China): *JCIE*, vol. 15, pp. 571–577, Sept. 1992.

An experimental study of radar target discrimination using multiple-frequency scattering amplitude without phase data is presented. The radar cross sections of a spheroid and a thin wire are measured at different aspect- and bistatic-angles to distinguish different spheroids and wires in the resonance frequency range. The results show that the discrimination algorithm works well and can be applied to both monostatic and bistatic radars.

**(26) Maneuvering Target Tracking in the Presence of Complicated Measurement Noises**, by J.-A. Guu and C.-H. Wei (National Chiao Tung University, Hsinchu, Taiwan, China): *JCIE*, vol. 15, pp. 559–570, Sept. 1992.

The problem of maneuvering target tracking in the presence of complicated measurement noise is considered. The measurement noise is modeled as the sum of a high-order autoregressive process and a white process. This noise can be decorrelated by including the noise-correlation variables in the target state.

**(27) Radio Propagation Characteristics in Navigation Experiment Using ETS-V**, by M. Migaki (Electronic Navigation Research Institute, Ministry of Transport, Tokyo, 181 Japan): *Trans. IEICE*, vol. J75-B-II, pp. 78–85, Jan. 1992.

This paper describes the result of radio propagation experiment that was carried out between an airplane or a ship and a ground earth station through the Engineering Test Satellite-V as a part of the navigation experiment program whose purpose is to develop techniques to utilize a satellite to air traffic control in oceanic area and navigation aid for ships.

**(28) Experimental MF Direction Finder**, by T. Fukami,* M. Mambo,** I. Nagano,** and H. Johda*** (*Ishikawa College of Technology, Ishikawa-ken, 929-03 Japan; **Faculty of Technology, Kanazawa University, Kanazawa, 920 Japan; ***PFU Corp., Ishikawa-ken, 929-11 Japan): *Trans. IEICE*, vol. J75-B-II, pp. 86–94, Jan. 1992.

In order to probe the MF wave reflection region, an MF direction finder having a reference signal 5.5 Hz apart from the MF carrier frequency is developed, on the basis of the measurement of a vertical electric and two horizontal magnetic field components.

**(29) Wave Absorber by Resistive Sheet and Concrete Mixed with Ferrite**, by Y. Hashimoto,* H. Kurihara,* Y. Hirai,* K. Ishino,* and Y. Shimizu** (*Radio Engineering Division, TDK Co., Ichikawa, 272 Japan; **Center for Research and Development of Educational Technology, Tokyo

Institute of Technology, Tokyo, 152 Japan): *Trans. IEICE*, vol. J75-B-II, pp. 103–111, Jan. 1992.

A new absorber composed of a resistive sheet and concrete mixed with ferrite is proposed for suppressing TV ghost images caused by wave reflection from high-rise buildings. An excellent thin absorber, based on the 1/4 wavelength absorber design, is obtained.

**(30) Electromagnetic Shielding of Switching Power Supply with High Permeability Sheet** (Letters), by K. Hatakeyama* and E. Sawada** (*NEC Corporation, Kawasaki, 216 Japan; **Faculty of Technology, Tokyo Metropolitan University, Hachioji, 192-03 Japan): *Trans. IEICE*, vol. J75-B-II, pp. 112–115, Jan. 1992.

A shielding method using high-permeability sheets is applied to the shielding of an enclosure of switching power supply. It is experimentally confirmed that magnetic field leakages are sufficiently suppressed using high-permeability sheets.

**(31) Rayleigh Scattering Coefficient of Elliptic Plasma Cylinder** (Letters), by T. Ando (Faculty of Engineering, Osaka Institute of Technology, Osaka, 535 Japan): *Trans. IEICE*, vol. J75-B-II, pp. 116–119, Jan. 1992.

Rayleigh scattering coefficient of an elliptic cold plasma cylinder is analyzed. It is shown that the dielectric constant, which induces plasma resonance, is determined by the ratio of the semimajor and semiminor of the cylinder.

**(32) Measurement and Estimate of Electric Field Strength in the Vicinity of the ARSR Station** (Letters), by K. Tokushige and Y. Yamanaka (Communications Research Laboratory, Ministry of Posts and Telecommunications, Koganei, 184 Japan): *Trans. IEICE*, vol. J75-B-II, pp. 145–149, Feb. 1992.

A measurement of the electric field strength generated by the air route surveillance radar (ARSR) station, which operates at 1345 MHz, 2 MW (peak power), is described. The maximum values measured are approximately 500 V/m (peak value) and 1 V/m (mean value).

**(33) A Study on Sheet Type Wave Absorber at 50 GHz Band** (Letters), by O. Mizokami* and O. Hashimoto** (*Second Research Center of Japan Defense Agency, Tokyo, 154 Japan; **Faculty of Science and Engineering, Aoyama Gakuin University, Tokyo, 157 Japan): *Trans. IEICE*, vol. J75-B-II, pp. 153–155, Feb. 1992.

A sheet type millimeter-wave absorber is designed on the base of the relative permittivity. The reflection loss at 50-GHz band for the absorber is about 20 dB.

**(34) Computer Experiments on Electromagnetic Disturbance Produced by Spacecraft in a Fast Plasma Flow**, by M. Okada, Y. Omura, and H. Matsumoto (Radio Atmospheric Science Center, Kyoto University, Uji, 611 Japan): *Trans. IEICE*, vol. J75-B-II, pp. 179–187, Mar. 1992.

Computer experiments on spacecraft-plasma interactions are performed using a two-dimensional electromagnetic particle code. A spacecraft is placed in the model with an internal boundary which absorbs plasma particles. Formation of shock and wake structures around the spacecraft and its parametric dependence are investigated.

**(35) Reduction of Speckle of One-Look Synthetic Aperture Radar Images** (Letters), by H. Hirosawa (Institute of Space and Astronautical Science, Sagamihara, 229 Japan): *Trans. IEICE*, vol. J75-B-II, pp. 197–200, Mar. 1992.

An algorithm to reduce speckle of synthetic aperture radar images is described. The algorithm aims to generate images that preserve fine spatial details of one-look images and the amplitude of speckle of which is equivalent to that of three or four look images.

**(36) A Formula for Cumulative Time Probability Distribution of Slant-Path Rain Attenuation** (Letters), by K. Irie (Faculty of Engineering, Okayama University of Science, Okayama, 700 Japan): *Trans. IEICE*, vol. J75-B-II, pp. 211–214, Mar. 1992.

Based on the CCIR latest slant-path attenuation data bank, an improved formula for the normalized attenuation cumulative time probability distribution is proposed.

**(37) Direction Finding Measurements of Magnetospheric VLF Chorus Emissions and Their Generation and Propagation Mechanism**, by K. Hattori* and M. Hayakawa** (*Solar-Terrestrial Environment Laboratory, Nagoya University, Toyokawa, 442 Japan; **Sugadaira Space Radio Observatory, University of Electro-Communications, Chofu, 182 Japan): *Trans. IEICE*, vol. J75-B-II, pp. 217–228, Apr. 1992.

Wave normal directions for rising tone chorus observed in the offequational regions are presented, and they are compared with the results of three-dimensional ray-tracing computations. The use of direction finding is found to be very important in the study of generation and propagation of magnetospheric emissions.

**(38) Characteristics of Arrival Directions of Low Latitude Whistlers Observed in Okinawa**, by Y. Nakamura (Communications Research Laboratory, Ministry of Posts and Telecommunications, Koganei, 184 Japan): *Trans. IEICE*, vol. J75-B-II, pp. 229–238, Apr. 1992.

Direction-finding observations of whistlers are conducted on the ground at Okinawa, Japan, from 1979 to 1984. Whistlers at Okinawa show the characteristics of ducted propagation, and all frequency components of a whistler come from the narrow region at the zenith.

**(39) An Experimental Determination of the Relationship between Bit Error Rate and Multipath** (Letters), by S. Sekizawa, H. Hanado, and E. Moriyama (Communications Research Laboratory, Ministry of Posts and Telecommunications, Koganei, 184 Japan): *Trans. IEICE*, vol. J75-B-II, pp. 244–247, Apr. 1992.

The bit error rate due to multipaths is investigated. It is found that for the delay time of delayed signal larger than a single bit period, the relative power of delayed signals should be considered.

**(40) Relation between the Spike-Type Scintillation of Satellite Signals in the L Band and the Ionospheric Sporadic E Layer**, by Y. Moriya,* H. Sakurada,** and N.

Wakai*** (*Faculty of Engineering, Tokai University, Hiratsuka, 259-12 Japan; **Miyakonojo National College of Technology, Miyakonojo. 885 Japan; ***Institute of Research and Development, Tokai University, Tokyo, 151 Japan): *Trans. IEICE*, vol. J75-B-II, pp. 300–308, May 1992.

The spike type scintillation is analyzed using the records obtained at Hiratsuka and Miyakonojo since 1981 by receiving the L band signals from two geostationary satellites, MARISAT and INTELSAT, over the Indian Ocean. It is shown that the occurrence of this scintillation is closely related to the sporadic E layer in the ionosphere from the examination of the seasonal, diurnal, and structural characteristics of the layer.

**(41) Propagation Characteristics of Very Low Latitude Whistlers by Ray Tracing**, by K. Ohta,* T. Tomomatsu,* O. Takahashi,* and M. Hayakawa** (*Faculty of Engineering, Chubu University, Kasugai, 487 Japan; **Faculty of Electro-Communications, University of Electro-Communications, Chofu, 182 Japan): *Trans. IEICE*, vol. J75-B-II, pp. 309–314, May 1992.

By using the ray tracing computations, propagation characteristics of very low latitude whistlers are investigated for a wide frequency range of 1–10 kHz.

**(42) A Theoretical Study on the Wave Absorber Coating Cylinder Using Permeability Loss** (Letters), by O. Hashimoto and K. Ogura (College of Science and Engineering, Aoyama Gakuin University, Tokyo, 157 Japan): *Trans. IEICE*, vol. J75-B-II, pp. 315–318, May 1992.

A method for designing wave absorbers using permeability loss for cylindrical objects with various diameters is described. The nonreflection curves and the reflection losses of cylinder-type wave absorbers are calculated by the mode expansion method.

**(43) Long-Distance Propagation in a Stratified Atmosphere with an Even Power N Profile**, by Y. Kawaguchi (School of Science and Technology, Meiji University, Kawasaki, 214 Japan): *Trans. IEICE*, vol. J75-B-II, pp. 379–388, June 1992.

The electromagnetic-wave propagation in the stratified atmosphere with negative gradient of the modified refractive index is considered by using the wave theory. The distribution of the modified refractive index for the middle layer in the atmosphere is approximated by an even power of the height. It is found from the present analysis that when the middle layer is thick, the distant field strength varies with the different power numbers in this layer.

**(44) Prediction of Mobile Radio Delay Spread Based on Frequency Correlations**, by S. Ichitsubo* and T. Fujii** (*NTT Radio Communication Systems Laboratories, Yokosuka, 238-03 Japan; **NTT Mobile Commuinication Sector, Yokosuka, 238-03 Japan): *Trans. IEICE*, vol. J75-B-II, pp. 389–398, June 1992.

In order to improve transmission quality of digital mobile communication systems, a new prediction method based on selecting maximum likelihood delay profile is proposed. The prediction errors of conventional and proposed methods are clarified through computer simulation and measurements. The result shows that the average prediction error of the proposed method is 40%, while the error of the conventional method is 50%.

**(45) The Measurement of Reflecting Characteristics of the Objects by Short Pulse Method in the Room** (Letters), by O. Hashimoto and Y. Matsumoto (College of Science and Engineering, Aoyama Gakuin University, Tokyo, 157 Japan): *Trans. IEICE*, vol. J75-B-II, pp. 407–411, June 1992.

A measurement method of reflection from objects by short pulse in the room is discussed. For $30 \times 30$ cm plate, the measurable range of about $-40$ to $-50$ dB in X to Ku band is obtained.

**(46) Characteristics of Long Distance VHF Propagation by the $E_S$ Layer**, by S. Kainuma,* K. Matsubashi,* A. Suzuki,* and T. Ishimine** (*Communications Research Laboratory, Ministry of Posts and Telecommunications, Koganei, 184 Japan; **Advanced Millimeter Wave Technologies Co., Ltd., Yokohama, 240 Japan): *Trans. IEICE*, vol. J75-B-II, pp. 573–579, Aug. 1992.

The problem of TV and FM broadcast interferences by VHF radio waves reflected by the ionospheric sporadic-E ($E_S$) layer is studied. Twenty-four radio wave (80-MHz band) paths from FM broadcasting stations all over Japan are selected, and the attenuation coefficient of each wave reflected by the $E_S$ layer is measured.

**(47) A Method of Image Reconstruction for Snow Search Radar Using an Estimated Permittivity of Snow**, by R. Mitsuhashi and Y. Aoki (Faculty of Engineering, Hokkaido University, Sapporo, 060 Japan): *Trans. IEICE*, vol. J75-B-II, pp. 580–587, Aug. 1992.

This paper discusses a method of automatic estimation of the permittivity of snow and image reconstruction for the snow search radar system (SSRS). The SSRS is a 3-D imaging radar system for searching objects under accumulated snow using the multi-frequency microwave holography.

**(48) A Theoretical and Experimental Study on the Wave Absorber for Metal Cylinders with Mirror Symmetrical Cross Section**, by O. Hashimoto,* T. Soh,** and T. Inoue* (*College of Science and Engineering, Aoyama Gakuin University, Tokyo, 157 Japan; **Aerospace Division, Yokohama Rubber Co., Ltd., Hiratsuka, 254 Japan): *Trans. IEICE*, vol. J75-B-II, pp. 588–595, Aug. 1992.

An analysis of reflection loss of a wave absorber for cylinders with mirror symmetrical cross section is shown based on the point matching method. The design chart and reflecting characteristics for ellipse and egg shapes are given.

**(49) Propagation Loss Prediction in Microcell with Low Base Site Antenna** (Letters), by S. Ichitsubo and T. Imai (NTT Radio Communication Systems Laboratories, Yokosuka, 238-03 Japan): *Trans. IEICE*, vol. J75-B-II, pp. 596–598, Aug. 1992.

At 800 MHz and 1.4 GHz the propagation loss prediction in a microcell is investigated. The regression formulas of propagation losses are derived by the multiple regression analysis based on measured data in Tokyo.

**(50) A Fundamental Study on the Absorption Characteristics of FRP Incorporated with Silicon Carbide Fiber at 50-GHz Band** (Letters), by O. Hashimoto and K. Sakai (College of Science and Engineering, Aoyama Gakuin University, Tokyo, 157 Japan): *Trans. IEICE*, vol. J75-B-II, pp. 599–601, Aug. 1992.

Absorption characteristics of the FRP-type wave absorber incorporated with silicon carbide fiber are shown at V-band frequencies. A flat plate type wave absorber of 1.55 mm thick is designed from the complex permittivity measured at X band.

**(51) A Formulation of Surface Impedance Boundary Conditions Using the Finite Difference Time Domain Method** (Letters), O. Chiba, T. Kashiwa, and I. Fukai (Faculty of Engineering, Hokkaido University, Sapporo, 060 Japan): *Trans. IEICE*, vol. J75-B-II, pp. 606–609, Aug. 1992.

A new formulation of surface impedance boundary conditions is carried out using the finite difference time domain method. In this formulation, the boundary conditions expressed by the equivalent circuit is considered in one-dimensional space.

**(52) A Propagation Model for Mobile Radio Propagation Loss in Urban Area at 800 MHz**, by S. Ichitsubo and M. Kimura (NTT Radio Communication Systems Laboratories, Yokosuka, 238-03 Japan): *Trans. IEICE*, vol. J75-B-II, pp. 638–646, Sept. 1992.

In order to clarify the structure of propagation loss in microcells for elevated base station antennas, a propagation model is presented. The model is based on the principal factors of propagation loss. Multiple regression analysis for measured 800-MHz propagation loss in Tokyo city confirms that the principal factors are distance, building height, and antenna height of the base station.

**(53) Measurement and Analysis of Electro-Magnetic Pulses due to Indirect ESD**, by M. Masugi,* K. Murakawa,* N. Kuwabara,* and F. Amemiya** (*NTT Telecommunication Networks Laboratories, Musashino, 180 Japan; **Technical Assistance & Support Center, NTT, Musashino, 180 Japan): *Trans. IEICE*, vol. J75-B-II, pp. 647–654, Sept. 1992.

Measurement and analytical results of electromagnetic pulse caused by indirect electrostatic discharges (ESD) are described. Analytical results show that indirect ESD energy does not always increase in proportion to voltage and that ESD pulses by low discharge voltages may cause strong electromagnetic interference.

**(54) Distribution of r.m.s. Delay Spread in Urban Area with Elevation Base Station Antenna** (Letters), by S. Ichitsubo, M. Kimura, and T. Tanaka (NTT Radio Communication Systems Laboratories, Yokosuka, 238-03 Japan): *Trans. IEICE*, vol. J75-B-II, pp. 661–663, Sept. 1992.

It is clarified by measurements in an urban area that the distribution of r.m.s. delay spread with an elevation base station antenna is approximated by a log-normal distribution.

**(55) The Shielding Effectiveness of Conductive Materials** (Letters), by T. Ikeda (Faculty of Engineering, Nagoya Institute of Technology, Nagoya, 466 Japan): *Trans. IEICE*, vol. J75-B-II, pp. 699–701, Oct. 1992.

This letter discusses the values of conductivity and thickness of conductive plastics to satisfy the required shielding effectiveness.

**(56) Study on Diffraction Control and Improvement of Interference Characteristics by Beam Shaping**, by S. Yonehara and T. Takano (Institute of Space and Astronautical Science, Sagamihara, 229 Japan): *Trans. IEICE*, vol. J75-B-II, pp. 944–949, Dec. 1992.

A novel method to control the diffraction effect by shaping the field distribution on the beam cross-section using spatial filters is proposed. The improvement of interference characteristics is verified experimentally, using two types of filters with radially Gaussian and trapezoidal profiles.

**(57) Spotsizes of the Beam Waves Propagating along a Two-Dimentional Inhomogeneous Medium**, by M. Hashimoto (Osaka Electro-Communication University, Neyagawa, 572 Japan): *Trans. IEICE*, vol. J75-C-I, pp. 1–7, Jan. 1992.

Closed form solutions for the Gaussian beam propagating along inhomogeneous media are obtained by means of complex ray optics. The media are assumed to be inhomogeneous along the transverse direction and homogeneous along the longitudinal direction. General solutions for the spot size of the beam wave winding along the longitudinal axis are given.

**(58) Scattering from Strip Gratings with Surface Resistance: In the Case of General Anisotropic Substrates**, by M. Asai, A. Ozaki, J. Yamakita, and S. Sawa (College of Engineering, University of Osaka Prefecture, Sakai, 591 Japan): *Trans. IEICE*, vol. J75-C-I, pp. 74–84, Feb. 1992.

A diffraction problem for plane electromagnetic waves propagating in a resistive strip grating with general anisotropic layered media is analyzed. The analysis is formulated by expanding the $4 \times 4$ matrix method and each field is expanded by space harmonics. Spectral domain unknown currents are determined by applying Galerkin's method to the resistive boundary condition.

**(59) Reconstruction Algorithm for Diffraction Tomography Based on Modified Newton-Kantorovich Method** (Letters), by T. Takenaka,* H. Harada,** M. Tanaka,*** and A. Onoue* (*Faculty of Engineering, Nagasaki University, Nagasaki, 852 Japan; **Division of Computer Center, Nippon Bunri University, Oita, 870-03 Japan; ***Faculty of Engineering, Oita University, Oita, 870-11 Japan): *Trans. IEICE*, vol. J75-C-I, pp. 109–112, Feb. 1992.

A reconstruction algorithm for diffraction tomography based on the modified Newton-Kantorovich method is presented. The algorithm can be applied to characterize an object in situations where the Born approximation breaks down.

**(60) Scattering of TE and TM Waves by a Finite Periodic Array of Perfectly Conducting Cylinders**, by N. Saga,* T. Tanaka,** and T. Takenaka** (*Fukuoka Junior College of Technology, Fukuoka, 811-02 Japan; **Faculty of Engineering, Nagasaki University, Nagasaki, 852 Japan): *Trans. IEICE*, vol. J75-C-I, pp. 119–125, Mar. 1992.

An effective technique is presented to analyze the scattering of TE and TM waves by a large but finite number of equally spaced parallel perfectly conducting cylinders. The integral equation for the current induced on the cylinders is discretized into a large system of linear equations by the boundary element method. The discretized equation is solved iteratively by the conjugate gradient method.

**(61) Scattering of Electromagnetic Plane Waves by a Chiral Slab**, by M. Tanaka and H. Sueyoshi (Faculty of Engineering, Oita University, Oita, 870-11 Japan): *Trans. IEICE*, vol. J75-C-I, pp. 126–133, Mar. 1992.

Scattering characteristics of a chiral slab are extensively explored. The reflected and transmitted fields are obtained by noting that the electric field inside the slab is expressed as a sum of the right- and left-circularly polarized waves. The cross- and co-polarized powers of the reflected wave and its Stokes parameter are computed for the horizontal and vertical polarizations of the incident wave.

**(62) The Geometrical Law of Total Reflection for Wave-Normal Rays on the Discontinuous Interfaces in Inhomogeneous Media**, by M. Hashimoto (Osaka Electro-Communication University, Neyagawa, 572 Japan): *Trans. IEICE*, vol. J75-C-I, pp. 173–178, Apr. 1992.

When the wave-normal ray associated with a spherical wave is incident upon an interface between two homogeneous media and undergoes a total reflection, the angle of reflection differs slightly from the angle of incidence. The position of the image source, which has so far been known to be located at the position geometrically symmetrical to the real source, also shifts. This paper shows that similar phenomena occur for the case when the media are inhomogeneous and thus the ray curves.

**(63) Boundary Element Analysis of Electromagnetic Field in Cylindrical Structures**, by M. Matstuhara, M. Kamura, amd A. Maruta (Faculty of Engineering, Osaka University, Suita, 565 Japan): *Trans. IEICE*, vol. J75-C-I, pp. 523–527, Aug. 1992.

A novel combined integral equation, which can be applied to the analysis of electromagnetic fields in cylindrical structures, is proposed. The integral equation does not have difficulties arising from non-physical solutions which has been troubled conventionally. It has some more merits that it does not contain the derivatives of unknown quantities and a coefficient matrix of the matrix equation obtained by applying the boundary element method is a square matrix.

**(64) Analysis of Lossy Dielectric Grating Using Pseudo-Periodic Green's Function**, by K. Minami, J. Yamakita, and S. Sawa (Faculty of Engineering, University of Osaka Prefecture, Sakai, 591 Japan): *Trans. IEICE*, vol. J75-C-I, pp. 528–535, Aug. 1992.

A boundary element method using pseudo-periodic Green's function is proposed to avoid a weak point of the differntial method for lossy dielectric gratings. This boundary element method is advantageous to substantial reduction of computation time for the TM-polarization analysis.

**(65) On the Magnitude of the Image Source of a Spherical and Nonspherical Wave Reflected upon an Interface** (Letters), by M. Hashimoto (Osaka Electro-Communication University, Neyagawa, 572 Japan): *Trans. IEICE*, vol. J75-C-I, pp. 561–563, Aug. 1992.

When a spherical and nonspherical wave is totally reflected, the source of the reflected wave (the image source) will be located near the point of the real source. This letter discusses the amplitude and phase of the image source from a viewpoint of geometrical optics.

**(66) A Formulation of Gyrotropic Properties of a Magnetized Ferrite Using the Finite-Difference Time-Domain Method**, by S. Tokuda, T. Kashiwa, and I. Fukai (Faculty of Engineering, Hokkaido University, Sapporo, 060 Japan): *Trans. IEICE*, vol. J75-C-I, pp. 572–578, Sept. 1992.

A time-domain formulation of ferrite characteristics is presented. The formulation is based on the FD-TD method, and the equation of motion of polarization is used.

**(67) A Design Method of Dielectric Multi-Layer Bandpass Filters**, by K. Miyauchi and I. Wakabayashi (Faculty of Engineering, Science University of Tokyo, Tokyo, 162 Japan): *Trans. IEICE*, vol. J75-C-I, pp. 587–596, Sept. 1992.

A new design method of a dielectric multi-layer bandpass filter is presented. Configurations of dielectric multi-layer resonators necessary for this purpose are proposed and analyzed.

**(68) Transmission and Reflection Characteristics of a Multilayered Chiral Slab** (Letters), by M. Tanaka and K. Sato (Faculty of Engineering, Oita University, Oita, 870-11 Japan): *Trans. IEICE*, vol. J75-C-I, pp. 677–680, Oct. 1992.

Polarization transformation characteristics of a multilayered chiral slab are presented. The cross- and co-polarized powers of the transmitted and reflected waves are computed to show depolarization properties of the slab.

**(69) Analysis of Active DBR Structure with Chirped Grating** (Letters), by Y. Nagashima,* T. Sato,** and N. Yamauchi* (*Faculty of Engineering, Nagoya Institute of Technology, Nagoya, 466 Japan; **Toho Gas Co., Ltd., Nagoya, 456 Japan): *Trans. IEICE*, vol. J75-C-I, pp. 730–732, Nov. 1992.

An analytical method of arbitrary chirped active DBR structures using the finite division model is described. Numerical results show that the chirping of active DBR makes their characteristics of reflectances or transmittances not only tunable but also narrower.

**(70) TM Scattering from a Dielectric-Loaded Semi-Circular Trough in a Conducting Plane** (Letters), by T. J. Park,* H. J. Eom*. W.-M. Boerner,** and Y. Yamaguchi*** (*Department of Electrical Engineering, Korea Advanced Institute of Science and Technology, Kusung-dong, Yusung-gu, Taejon, Korea; **Department of Electrical Engineering and Computer Science, University of Illinois at Chicago, Chicago, IL 60680, USA; ***Faculty of Engineering, Niigata University, Niigata, 950-21 Japan): *IEICE Trans. Commun.*, vol. E75-B, pp. 87–91, Feb. 1992.

The behavior of TM-wave scattering from a dielectric-loaded semicircular trough in a conducting half-space is investigated. The dielectric loading is made of a circular cylinder which lies in a semi-circular through in the perfectly conducting plane. It is found that the scattering patterns exhibit the resonant behavior due to both of the concave surface contour and the dielectric loading.

**(71) An Intercomparison between MSR and SI Retrieved Rain Rates** (Letters), by Y. Ohsaki* and M. Fujita** (*Kashima Space Research Center, Communications Research Laboratory, Ibaraki, 314 Japan; **Communications Research Laboratory, Ministry of Posts and Telecommunications, Koganei, 184 Japan): *IEICE Trans. Commun.*, vol. E75-B, pp. 422–426, May 1992.

Rain rates are estimated from brightness temperature measured with a microwave scanning radiometer (MSR) carried on board the Marine Observation Satellite 1 (MOS-1). Estimations are made using a rain rate retrieval algorithm based on a radiative-transfer model assuming rain spaced uniformly over the ocean.

**(72) Voyager Radio Science: Observations and Analysis of Neptune's Atmosphere**, by E. Mizuno,* N. Kawashima,** T. Takano,** and P. A. Rosen* (*Faculty of Engineering, Kanazawa University, Kanazawa, 920 Japan; **Institue of Space and Astronautical Science, Sagamihara, 229 Japan): *IEICE Trans. Commun.*, vol. E75-B, pp. 665–672, July 1992.

This paper describes that a method of extracting the signal frequency and amplitude from the Voyager Neptune radio science data presents the magnitude of all the possible errors affecting the frequency estimates, and gives some examples of the data and derived physical quantities.

**(73) Space-Radar Surveillance: Concepts and Architectures**, by G. Galati* and M. Abbati** (*Department of Electronic Engineering and Vito Volterra Center, Tor Vergata University of Roma, Roma, Italy; **Department of Electronic Engineering, Tor Vergata University of Roma, Roma, Italy): *IEICE Trans. Commun.*, vol. E75-B, pp. 755–766, Aug. 1992.

Surveillance capabilities and operational requirements for future space-based radar systems are considered. With special attention paid to air traffic control applications, an optimal system architecture is defined. The resulting large antenna dimensions call for novel solutions such as distributed arrays in space.

**(74) An Active Reflector for SAR Calibration Having a Frequency Shift Capability** (Letters), by M. Fujita (Communications Research Laboratory, Ministry of Posts and Telecommunications, Koganei, 184 Japan): *IEICE Trans. Commun.*, vol. E75-B, pp. 791–793, Aug. 1992.

This letter proposes an active reflector for calibrating a synthetic aperture radar (SAR), in which the frequency of a received SAR signal is shifted by a certain amount and then it is retransmitted to the SAR. The frequency shift causes a shift of the reflector SAR image in an azimuth direction relative to its background.

**(75) Optimization of Doppler Filters for Fluctuating Radar Targets**, by V. Aloisio,* A. Di Vito,** and G. Galati*** (*Tor Vergata University of Roma, Roma, Italy; **Alenia Company, Via Tiburtina Km. 12.400, Roma, Italy; ***Department of Electronic Engineering and Vito Volterra Center, Tor Vergata University of Roma, Via Della Ricerca Scientifica, Roma, Italy): *IEICE Trans. Commun.*, vol. E75-B, pp. 1090–1104, Oct. 1992.

The detection problem of fluctuating radar targets in the presence of interference (noise and clutter) is considered; the assumed model for both target and clutter is a zero-mean stationary Gaussian random process with assigned power spectral densities. The pertaining optimum linear processor, namely the optimized filtering, is derived, and its performance is evaluated in different operating conditions, including mismatching with the designed model.

**(76) Analysis of Topographic Effects on SIR-B Imagery: Correlation of Image Intensity with Local Incidence Angles**, by M. Satake,* M. Fujita,** and N. Fugono** (*Kashima Space Research Center, Communications Research Laboratory, Ministry of Posts and Telecommunications, Ibaraki-ken, 314 Japan; **Communications Research Laboratory, Ministry of Posts and Telecommunications, Koganei, 184 Japan): *IEICE Trans. Commun.*, vol. E75-B, pp. 1220–1226, Nov. 1992.

In relation to the quantitative analysis of topographic effects on SAR imagery, the dependence of SIR-B image intensity on local incidence angles of radar illumination for the land surface is investigated.

**(77) On the Expressions for the Norton's Surface Wave of a Vertical Dipole** (Letters), by A. Yokoyama (Kumamoto Institute of Technology, Kumamoto, 860 Japan): *IEICE Trans. Commun.*, vol. E75-B, pp. 1376–1378, Dec. 1992.

An ideal style of arguments of the error function complement contained in the expression for the Norton's surface wave of a vertical dipole over the plane earth is discussed.

**(78) Theory of Scalar Wave Scattering from a Conducting Target in Random Media**, by M. Tateiba and E. Tomita (Faculty of Engineering, Kyushu University, Fukuoka, 812 Japan): *IEICE Trans. Electron.*, vol. E75-C, pp. 101–106, Jan. 1992.

A method is presented for analyzing the scalar wave scattering from a conducting target of arbitrary shape in random media for both the Dirichlet and Neumann problems. The current generators on the target are introduced and expressed generally by the Yasuura method. When using the current generators, the scattering problem is reduced to the wave propagation problem in random media.

**(79) Transient Electromagnetic Fields on a Conducting Sphere Excited by a Pulsed Plane Wave**, by A. Itoh,* T. Hosono,** and Y. Hirao* (*Tokyo National College of Technology, Hachioji, 193 Japan; **College of Science and Technology, Nihon University, Tokyo, 101 Japan): *IEICE Trans. Electron.*, vol. E75-C, pp. 107–112, Jan. 1992.

Transient fields on a perfectly conducting sphere excited by a half sine pulse are studied, and the Poynting vectors, the energy densities, and the energy velocities of the creeping waves are examined. The amplitude of the creeping wave excited by a beat pulse is compared with that of the steady state high frequency approximation obtained by the Watson transformation.

**(80) Equivalent Edge Currents by the Modified Edge Representation: Physical Optics Components**, by T. Murasaki and M. Ando (Faculty of Engineering, Tokyo Institute of Technology, Tokyo, 152 Japan): *IEICE Trans. Electron.*, vol. E75-C, pp. 617–626, May 1992.

The modified edge representation is introduced to overcome the ambiguity of the method of equivalent edge currents. The modified edge is the fictitious one which is defined so as to satisfy the diffraction law for given directions of incidence and observation. The equivalent edge currents for physical optics components at general edge points are obtained by utilizing these fictitious edges and the classical Keller's diffraction coefficients.

**(81) Analysis of the Time Transient EM Field Response from a Dielectric Spherical Cavity**, by H. Shirai, E. Nakano, and M. Yano (Faculty of Science and Engineering, Chuo University, Tokyo, 112 Japan): *IEICE Trans. Electron.*, vol. E75-C, pp. 627–634, May 1992.

Transient responses by a dielectric sphere are analyzed for a dipole source located at the center. The formulation is constructed first in the frequency domain, then transformed into the time domain to obtain an impulsive response by two analytical methods, namely the singularity expansion method and the wavefront expansion method.

**(82) Polarization Discriminating Characteristics of a Double Strip Grating Loaded with a Dielectric Slab**, by A. Matsushima and T. Itakura (Department of Electrical Engineering and Computer Science, Kumamoto University, Kumamoto, 860 Japan): *IEICE Trans. Electron.*, vol. E75-C, pp. 1071–1079, Sept. 1992.

An accurate numerical solution is presented for the electromagnetic scattering from infinite strip gratings attached to both sides of a dielectric slab. This structure is a model of polarization discriminating devices. The period of the strips is common to both planes, but the widths and the axes may be different. The direction of propagation and the polarization of an incident plane wave are arbitrary.

**(83) Equivalent Edge Currents for Arbitrary Angle Wedges Using Paths of Most Rapid Phase Variation**, by K. Natsuhara, T. Murasaki, and M. Ando (Faculty of Engineering, Tokyo Institute of Technology, Tokyo, 152 Japan): *IEICE Trans. Electron.*, vol. E75-C, pp. 1080–1087, Sept. 1992.

General forms of equivalent edge currents with the directions of inner coordinate as parameters are formulated first, and then, the paths of most rapid phase variation are substituted into the general forms. The resultant expressions are valid for any incidence and observaion aspects and have no false singularities.

**(84) An Improvement of the Equivalent Source Method for the Analysis of Scattering of a Plane Wave by a Conducting Cylinder with Edges** (Letters), by M. Kodama and K. Taira (Faculty of Engineering, University of the Ryukyus, Okinawa-ken, 930-01 Japan): *IEICE Trans. Electron.*, vol. E75-C, pp. 1088–1092, Sept. 1992.

An improvement of the equivalent source method is proposed to give an accurate solution for the scattering of an electromagnetic plane wave by a conducting cylinder with edges.

**(85) An Efficient Reconstruction Algorithm for Diffraction Tomography**, by H. Harada,* T. Takenaka,** and M. Tanaka*** (*Division of NBU Media Center, Nippon Bunri University, Oita, 870-03 Japan; **Faculty of Engineering, Nagasaki University, Nagasaki, 852 Japan; ***Faculty of Engineering, Oita University, Oita, 870-11 Japan): *IEICE Trans. Electron.*, vol. E75-C, pp. 1387–1394, Nov. 1992.

An efficient reconstruction algorithm for diffraction tomography based on the modified Newton-Kantorovich method is presented and numerically studied. With the Fréchet derivative obtained for the Helmholtz equation, one can derive an iterative formula for getting an object function, which is a function of refractive index of a scatterer.

### 5) Microwave Medical/Biological Applications

**(1) The Relationship between the EM Energy Absorption of Human Body and the Incident Direction and Polarization of Plane Wave**, by C.-Q. Wang and X.-L. Zhu (Peking University, Beijing, P.R.C.): *JE*, vol. 14, pp. 388–395, July 1992.

The problem of EM energy absorption of human body irradiated by plane waves is discussed by the FD-TD method. The local SAR (Specific Absorption Rate), the hole-body-averaged SAR, and the layer-averaged SAR for the inhomogeneous block model of human body with different incident direction and different polarization of the incident waves are calculated. The results show that the appearance of maximum EM energy absorption is not always at the situation of the front incidence, and the local SAR is more important for the interaction of the EM fields with human body.

**(2) FD-TD Analysis of Power Loss Distribution in Human Body Model Heated by a Waveguide-Type Applicator**, by N. Araki* and N. Morita** (*Faculty of Engineering, Osaka University, Suita, 565 Japan; **Chiba Institute of Technology, Narashino, 275 Japan): *Trans. IEICE*, vol. J75-B-II, pp. 188–196, Mar. 1992.

Power loss distribution is analyzed using the finite-difference time-domain method for the problem of human body heated by a waveguide applicator. The waveguide applicator is filled with water, and the electromagnetic wave is assumed to be excited by electric current on a post. Two methods for representing the electric current are presented; one is a method giving the current as the electric field source, and the other is a method giving the current as the magnetic field source.

**(3) Temperature Distribution within a Human Body Model Produced by Irradiation from a Waveguide-Type Applicator** (Letters), by N. Araki* and N. Morita** (*Faculty of Engineering, Osaka University, Suita, 565 Japan; **Chiba Institute of Technology, Narashino, 275 Japan): *Trans. IEICE*, vol. J75-B-II, pp. 201–204, Mar. 1992.

Temperature distribution within a muscle region produced by heating with a waveguide-type applicator is numerically analyzed. Power loss distribution is first calculated using the finite-difference time-domain method, and then temperature distribution is calculated using the finite difference method together with the implicit alternating direction method.

**(4) Absorption Characteristics of Microwave Power for a Multilayered Cylindrical Human Model with the Nonuniform Thicknesses** (Letters), by K. Kanai, S. Kuwano, and K. Kokubun (College of Engineering, Nihon University, Koriyama, 963 Japan): *Trans. IEICE*, vol. J75-B-II, pp. 252–254, Apr. 1992.

A numerical analysis of microwave power absorption for a human model, which is represented by the eccentric multilayered cylinder, is described. It is shown that the oscillatory magnitude of the average SAR as a function of frequency is reduced by the non-uniform thickness of skin.

### 6) Lasers and Other Devices

**(1) Solid State Lasers for Planetary Exploration**, by B. Greene,* M. Taubman,* B. Luther-Davies,** J. Watts,*** and G. Gaither*** (*Electro-Optic Systems Pty Limited, ACN 008 587451, Australia; **Australian National University, Australia; ***McDonnell Douglas Electronic Systems Co., Australia): *JEEE*, vol. 12, pp. 67–72, Mar. 1992.

Design and performance data for two spaceborne laser transmitters are presented. The application for each is planetary exploration. Both lasers are based on high reliability diode pumped YAG technology. The lasers will provide data for planetary science such as geodesy, geophysics, atmospheric circulation, geology, and polar processes which will greatly expand mankind's understanding of the Earth and Mars.

**(2) Researches on Relaxation Frequency and Modulation Properties of InGaAsP PBC Laser Diode**, by L.-Y. Zhou and C.-H. Xu (Peking University, Beijing, P.R.C.): *AES*, vol. 20, pp. 1–5, Sept. 1992.

The relaxation frequency formula of the BC laser diode (LD) is theoretically derived and confirmed experimentally. The high speed LD module is built which has broadband modulation property up to 5.3 GHz. By using this LD module in 1 km optic fiber link the other properties are measured. It is suitable to transmit C-band signal from communication satellite into the subcarrier multiplex optical fiber communication system.

**(3) Transient Response of HgCdTe PC and Sprite Detectors**, by Y.-J. Li, L.-Y. Zhu, and J.-X. Fang (Shanghai Institute of Technical Physics, Chinese Academy of Sciences, Shanghai, P.R.C.): *JIMW*, vol. 11, pp. 271–276, Aug. 1992.

The transient decay response of HgCdTe PC and SPRITE detectors are calculated and observed. The results of theory and experiment are in good agreement. At high bias fields, the decay processes of PC and SPRITE detectors are with ramp and rectangular waveforms, respectively. According to the curve of decay process, the excess carrier ambipolar mobility can be determined.

**(4) Long Wavelength HgCdTe PC Infrared Detector with Large Area**, by Z.-M. Wang, J.-X. Fang, C.-C. Si, Y.-C. Hu, and J.-L. Ma (National Laboratory of Transducer Technology, Shanghai Institute of Technical Physics, Chinese Academy of Sciences, Shanghai, P.R.C.): *JIMW*, vol. 11, pp. 277–282, Aug. 1992.

A long-wavelength HgCdTe photoconductor infrared detector with large area is developed. The detector with an area of $2.1 \times 2.1$ mm$^2$ has detectivity of $1.86 \times 10^{10}$ cmHz$^{1/2}$W$^{-1}$ and responsivity of 386 VW$^{-1}$ with $\lambda_{co}$ (50%) $> 18$ $\mu$m. An additional novel detector with a special structure of low temperature collectors, which has detectivity of $7.3 \times 10^{10}$ cmHz$^{1/2}$W$^{-1}$ and $\lambda_{co}$ (50%) $> 16$ $\mu$m, is developed.

**(5) 64-Band Airborne Imaging Spectrometer**, by J.-Y. Wang and Y.-Q. Xue (Shanghai Institute of Technical Physics, Chinese Academy of Sciences, Shanghai, P.R.C.): *JIMW*, vol. 11, pp. 181–188, June 1992.

This paper discusses the concept and design of the 64-band airborne scanning imaging spectrometer. The main technical parameters and the primary experiment results are given.

**(6) Optical Design of the Airborne Image Spectrometer**, by C.-W. Yang and W.-G. Yu (Shanghai Institute of Technical Physics, Chinese Academy of Sciences, Shanghai, P.R.C.): *JIMW*, vol. 11, pp. 211–218, June 1992.

This paper describes the optical system of the module airborne image spectrometer (MAIS), including the essentials of optical design for primary optics, dispersion assembly, and converging lens. The restriction among the primary optical parameters is analyzed. Some practical problems such as diffraction grating, expansion of spectral convering range, and the collimator for spectral calibration are also discussed.

**(7) Thermo-Infrared Multispectral Scanner**, by M.-M. Shen and C.-W. Yang (Shanghai Institute of Technical Physics, Chinese Academy of Sciences, Shanghai, P.R.C.): *JIMW*, vol. 11, pp. 195–200, June 1992.

The thermo-infrared multispectral scanner as a new special topic remote sensing instrument for geology applications has been developed in China. It has 7 bands in the range of 8.2–12.2 $\mu$m. This paper describes its system design, the methods and results of performance measurements, and the situation in the first airborne test.

**(8) Spectral Radiometer Calibration of the Airborne Multispectral Scanner System**, by J.-F. Yie (Shanghai Institute of Technical Physics, Chinese Academy of Sciences, Shanghai, P.R.C.): *JIMW*, vol. 11, pp. 217–222, June 1992.

The principle and apparatus of the spectral radiometer calibration for airborne multispectral scanners are described. The experimental results and discussions are given.

**(9) HgCdTe PC Detectors for Airborne Remote Sensors**, by G.-S. Xu, L.-Y. Zhu, X.-F. Jin, and J. Tang (Shanghai Institute of Technical Physics, Chinese Academy of Science, Shanghai, P.R.C.): *JIMW*, vol. 11, pp. 257–260, June 1992.

The principle, special constructions, and performances of HgCdTe PC-type infrared detectors for airborne remote sensors are reported.

**(10) Bistability and Self-Pulsation Optically Pumped Submillimeter Lasers**, by L.-G. Luo,* J.-S. Chen,** J.-W. Su,*** and S.-R. Xiong*** (*Shandong University, Jinan, P.R.C.; **Ningbo University, Ningbo, P.R.C.; ***National Laboratory for Infrared Physics, Shanghai Institute of

Technical Physics, Chinese Academy of Sciences, Shanghai, P.R.C.): *JIMW*, vol. 11, pp. 47–52, Feb. 1992.

Dynamical behaviors of bistability and self-pulsation in optically pumped submillimeter lasers are studied. Bistability emerges in pumping light. It leads to non-existence of partial steady state of submillimeter output. It is easy to give pulsation output. The pulsation frequency increases with increasing pumping intensity.

**(11) 910 nm Fiber Laser and Superfluorescence of Nd-Doped Silica Fiber**, by Y.-H. Chen, R.-H. Cheng, and F.-X. Gan (Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences, Shanghai, P.R.C.): *JIMW*, vol. 11, pp. 375–378, Oct. 1992.

Pumped by 514.5 nm Ar ion laser, 910 nm laser, and superfluorescence operation of Nd-doped silica fiber are achieved by suppressing the emission at 1080 nm. The maximal output of 910 nm fiber laser is 1.4 mW, and slope efficiency is 2.5%. The maximal output of 910 nm superfluorescence is 0.4 mW. An experimental comparison is made between the outputs at 1080 nm and 910 nm superfluorescence.

**(12) Sub-MM Wave Quasi-Optical Variable Power Divider**, by R.-M. Qiu and B.-S. Qiu (Zhongshan University, Guangzhou, Guangdong, P.R.C.): *JIMW*, vol. 11, pp. 471–474, Dec. 1992.

One kind of quasi-optical variable power divider consisting of double prisms of TPX material is developed. By using a CW HCN laser with wavelength of 337 $\mu$m as the signal source, a variable range of relative power of 14 dB is obtained. As a variable attenuator, its insertion loss is 4.5 dB and the amount of variable attenuation is 13.5 dB.

**(13) Optical Isolator Using In-Substituted Single Crystal BCVIG for Longer Wavelengths**, by X.-M. Ma* and S.-P. Tao** (*Xidian University, Xi'an, P.R.C.; **Beijing University of P&T): *JCIE*, vol. 13, pp. 38–45, May 1992.

A new optical isolator is demonstrated using In-substituted single crystal BCVIG, a non-rare-earth iron garnet. The devices have an isolation of greater than 40 dB with an insertion loss of 1.0 dB and an isolation of greater than 43 dB with an insertion loss of 1.1 dB, for 1.3 $\mu$m and 1.523 $\mu$m wavelength, respectively, where Fresnel reflection losses of 0.8 dB for two polarizers are included.

**(14) Research on Directional Coupler 4×4 Optical Waveguide Switch Array**, by Q.-S. Shen, X.-C Gong, and W. Qiu (Shanghai Jiaotong University, Shanghai, P.R.C.): *JAS*, vol. 10, pp. 304–310, Oct. 1992.

A 4×4 optical waveguide switch array-5 interconnected directional couplers with alternating electrooptical modulation is designed and fabricated. The parameters of the devices are $-10$ dB fiber-device-fiber-insertion loss, $-20$ dB crosstalk, a 15 V-drive voltage, response time $< 1.4$ ns, and 1.3 $\mu$m operating wavelength.

**(15) Theory of Circular Free Electron Laser with an Inverse Relativistic Nonneutral Electron Ring**, by Y.-Z. Yin (Institute of Electronics, Academia Sinica, Beijing, P.R.C.): *JE*, vol. 14, pp. 385–389, July 1992.

Working properties of a circular free electron laser with an intense relativistic nonneutral electron ring are investigated within the framework of the Vlasov-Maxwell equations. The results show that the space charge of intense electron beam can enhance the radiation growth rate and frequency.

**(16) Airborne Multispectral Scanner**, by J.-X. Sun (Shanghai Institute of Technical Physics, Chinese Academy of Sciences, Shanghai, P.R.C.): *JIMW*, vol. 11, pp. 201–206, June 1992.

This paper describes the design and specifications of the airborne multispectral scanner.

**(17) Tunable Waveguide $CO_2$ Laser Making Use of Three Mirror Type Internal Modulation Method**, by T. Matsushima, N. Maeda, M. Nakao, T. Kobayashi, and T. Sueta (Faculty of Engineering Science, Osaka University, Toyonaka, 560 Japan): *Trans. IEICE*, vol. J75-C-I, pp. 8–16, Jan. 1992.

A novel frequency-tunable $CO_2$ laser system using an internal modulator is proposed. In the proposed scheme, a tunable filter is used as the output laser mirror. From the analysis of internal modulation, the relation between frequency-shifted output power and modulation index is obtained using the single-pass laser gain as a parameter.

**(18) Characteristics of an Open-Boundary Circular Cherenkov Laser Immersed in Infinite Magnetostatic Field**, by K. Horinouchi, I. Hirakawa, and T. Shiozawa (Faculty of Engineering, Osaka University, Suita, 565 Japan): *Trans. IEICE*, vol. J75-C-I, pp. 188–196, Apr. 1992.

This paper discusses the characteristics of an open-boundary circular Cherenkov laser consisting of a dielectric-coated circular conductor and a cylindrical relativistic electron beam immersed in an infinite magnetostatic field.

**(19) A Single Mode Selection Method of Pulsed Lasers by Injection Seeding**, by T. Taira, H. Ogishi, and T. Kobayashi (Faculty of Engineering, Fukui University, Fukui, 910 Japan): *Trans. IEICE*, vol. J75-C-I, pp. 415–421, June 1992.

Basic equations are derived on the injection seeding of pulsed lasers using semiclassical theory, and fundamental mode selection characteristics are analyzed. These results are compared with experimental data using the LD pumped $Nd{:}YVO_4$ micro-chip master laser and a Nd:YAG pulsed slave laser.

**(20) Analysis of Optoelectronic Integrated Functional Device with Positive Optical Feedback**, by Y. Osawa, N. Onodera, and S. Satoh (Ricoh Research Institute of General Electronics, Natori, 981-12 Japan): *Trans. IEICE*, vol. J75-C-I, pp. 430–436, June 1992.

This paper describes a simple and analytic model of an optoelectronic integrated functional device composed of a light-emitting device and a photodetector connected in series with positive optical feedback. In this analysis, a light-emitting device and a photodetector are treated as a current-to-light transducer and a photoconductive device, respectively.

**(21) Discrete Frequency Sweeping of a Semi-Conductor Laser by Temperature Change and Electrical Feedback**, by A. Yoshizawa and T. Iwasaki (Electrotechnical Laboratory, Tsukuba, 305 Japan): *Trans. IEICE*, vol. J75-C-I, pp. 437–443, June 1992.

A frequency sweeping technique for semiconductor lasers by means of temperature change and electrical feedback is presented. Using a Fabry-Perot resonator to produce the feedback signal which controls injection current against the frequency shift caused by temperature, the oscillation is temporarily held at a resonant frequency, and then, the frequency jumps to next Fabry-Perot resonance, while the temperature change is proportional to time.

**(22) Stabilization and Control of a Semiconductor Laser Frequency by Using the Faraday Effect**, by T. Ueno, H. Rikukawa, T. Nakazawa, T. Sato, and M. Shimba (Faculty of Engineering, Niigata University, Niigata, 950-21 Japan): *Trans. IEICE*, vol. J75-C-I, pp. 460–467, June 1992.

A method using the Faraday effect, which is one of the magneto-optical effects around an absorption line, is reported as a frequency stabilization without direct modulation. Both modulated and biased magnetic fields are applied to the Rb cell in order to obtain a control signal for stabilization.

**(23) High-Repetition-Rated TEA $CO_2$ Laser with Surface-Wire-Corona Preionizer**, by T. Komi, M. Sugii, and H. Hara (Technical Research and Development Institute, Japan Defense Agency, Tokyo, 154 Japan): *Trans. IEICE*, vol. J75-C-I, pp. 497–502, July 1992.

A surface-wire-corona preionizer using $SrTiO_3$ ferroelectric is developed and applied to a semi-sealed-off, high-repetition-rate TEA-$CO_2$ laser to achieve a high-frequency, long-gas-life operation.

**(24) Numerical Analysis of Spontaneous Emission and Stimulated Emission by a Relativistic Electron Beam Propagation Parallel to a Dielectric Grating**, by M. Okita,* T. Tanaka,* K. Tanaka,* and K. Yasumoto** (*Faculty of Engineering, Nagasaki University, Nagasaki, 852 Japan; **Faculty of Engineering, Kyushu University, Fukuoka, 812 Japan): *Trans. IEICE*, vol. J75-C-I, pp. 515–522, Aug. 1992.

This paper represents a numerical analysis of Smith-Purcell radiations by a relativistic sheet electron beam propagating parallel to a dielectric grating. A self-consistent analysis of radiation and instability is developed using a mode-matching method.

**(25) Oscillation Wavelength Shifts of GaAlAs Laser Diodes in a Magnetic Field**, by T. Sato, H. Kawashima, T. Nakamura, M. Ohkawa, T. Maruyama, and M. Shimba (Faculty of Engineering, Niigata University, Niigata, 950-21 Japan): *Trans. IEICE*, vol. J75-C-I, pp. 579–586, Sept. 1992.

Oscillation wavelength shifts of some kinds of GaAlAs laser diodes in a magnetic field at room temperature are reported. The wavelength shift depends on the inner structure of the semiconductor laser and the relation between the directions of the magnetic field and the semiconductor laser crystal layer.

**(26) Locking Characteristics of Intermodal Injection Locking for a Semiconductor Laser**, by Y. Iida, T. Miyajima, and M. Morita (Faculty of Engineering, Kansai University, Suita, 564 Japan): *Trans. IEICE*, vol. J75-C-I, pp. 605–612, Oct. 1992.

This paper describes a theoretical and experimental investigation of intermodal injection locking for a semiconductor laser. The theoretical analysis takes into account the dependence of refractive index and of the gain on the carrier density and the spectral dependence of the gain function. Detuning characteristics are shown in detail.

**(27) Femtosecond Erbium-Doped Fiber Laser with a Nonlinear Amplifying Loop Mirror Pumped by Laser Diodes and the Repetition Rate Control of Output Pulses**, by E. Yoshida, Y. Kimura, and M. Nakazawa (NTT Optical Transmission Line Laboratory, Ibaraki-ken, 319-11 Japan): *Trans. IEICE*, vol. J75-C-I, pp. 613–621, Oct. 1992.

Lasing characteristics of an erbium-doped fiber laser with a nonlinear amplifying loop mirror pumped by InGaAsP diodes are investigated in detail. A 290-fs pulse with a peak power of 16 W is obtained at 1.56 $\mu$m for a pump power of 20 mW, where the repetition rate of output pulses varies between 5 MHz and 2 GHz. In order to control the pulse repetition rate, a sub ring cavity is attached to the main cavity.

**(28) Fabrication of Stretched Gold Island Films with Large Optical Anisotropy**, by J. Katsu, K. Baba, and M. Miyagi (Faculty of Engineering, Tohoku University, Sendai, 980 Japan): *Trans. IEICE*, vol. J75-C-I, pp. 647–651, Oct. 1992.

Fabrication process of anisotropic stretched gold island films is investigated experimentally. It is shown that embedding of island films in a glass layer and stretching the film with a large tension in lower temperature are necessary to produce the large anisotropy.

**(29) Interconnect of Semiconductor Laser and Optical Fiber Array Using Planar Microlens and Si Guide Holes** (Letters), by H. Konishi,* and K. Iga** (*Tatsuta Electric Wire & Cable Co., Ltd., Higashi-Osaka, 578 Japan; **Precision and Intelligence Laboratory, Tokyo Institute of Technology, Yokohama, 227 Japan): *Trans. IEICE*, vol. J75-C-II, pp. 46–48, Jan. 1992.

Alignment-free coupling is achieved by the connection of guide hole array and planar microlens array. The coupling efficiency of as high as 52.3% between a laser diode and 4 pieces of multi-mode fibers is achieved.

**(30) Control of GaInAs/InP Layer Thickness for Surface Emitting Lasers by Chemical Beam Epitaxy**, by T. Uchida, T. Uchida, F. Koyama, and K. Iga (Precision and Intelligence Laboratory, Tokyo Institute of Technology, Yokohama, 227 Japan): *Trans. IEICE*, vol. J75-C-II, pp. 135–140, Mar. 1992.

The controllability of GaInAs/InP growth in chemical beam epitaxy is investigated. The maximum growth rate of 2.6 $\mu$m/h (InP) and 6.0 $\mu$m/h (GaInAs) is obtained without degradating surface morphology. With the growth rate being kept reasonable high, a good controllability of layer thickness is obtained by growing a 0.6 nm quantum well.

**(31) Chemical Beam Epitaxy (CBE) Growth of GaInAsP/InP and Application to Surface Emitting Lasers**, by T. Uchida, N. Yokouchi, T. Miyamoto, F. Koyama, and K. Iga (Precision and Intelligence Laboratory, Tokyo Institute of Technology, Yokohama, 227 Japan): *Trans. IEICE*, vol. J75-C-II, pp. 741–747, Dec. 1992.

Doping characteristics and material qualities of GaInAsP/InP grown by chemical beam epitaxy (CBE) are investigated to realize long wavelength surface emitting (SE) lasers. Lasing operation of SE laser grown by CBE is obtained for the first time. The minimum threshold current is 2.7 mA (450 A/cm$^2$) under 77-K CW operation.

**(32) Effect of Reflected Light on Mode Partition Characteristics of Fabry-Perot Laser Diodes**, by A. Takeda,* T. Kawai,* M. Mori,* T. Goto,* and A. Miyauchi** (*Faculty of Engineering, Nagoya University, Nagoya, 464-01 Japan; **Transmission Division, Fujitsu Ltd., Kawasaki, 211 Japan): *IEICE Trans. Commun.*, vol. E75-B, pp. 217–225, Mar. 1992.

The effect of externally reflected light on the mode partition characteristics of 1.3-$\mu$m Fabry-Perot laser diodes is studied experimentally and numerically. It is found that the mode partition noise is mainly caused by the interference between the light in the laser diode and the reflected light, and also by the fluctuations of the induced emmission and absorption.

**(33) 130 GHz Frequency Sweep over a 30 nm Tuning Range without Mode Hopping by an External-Cavity Semiconductor Laser** (Letters), by Y. Ichihashi,* Y. Nagaki,** T. Tsukamoto,** and Y. Tamura** (*NTT Laboratories, Yokosuka, 238-03 Japan; **Anritsu Corporation, Atsugi, 243 Japan): *IEICE Trans. Commun.*, vol. E75-B, pp. 521–523, June 1992.

A method for sweeping frequency ranges of over 130 GHz within a tuning range of 30 nm, without mode hopping, is realized. The optical frequency is swept with a fine translation-rotation grating drive which uses a new, simplified operation method and a thermally controlled semiconductor laser system.

**(34) Characteristics of Mode Partition Noise of DFB LD's Induced by Externally Reflected Light**, by T. Kawai,* A. Kurihara,* M. Mori,* T. Goto,* A. Miyauchi,** and T. Nakagami*** (*Faculty of Engineering, Nagoya University, Nagoya, 464-01 Japan; **Transmission Division, Fujitsu Ltd., Kawasaki, 211 Japan): *IEICE Trans. Commun.*, vol. E75-B, pp. 906–913, Sept. 1992.

The mode partition noise of 1.3-$\mu$m distributed feedback laser diodes (DFB LD's), which is induced by the externally reflected light, is studied experimentally and numerically. It is observed that the mode partition noise monotonically increases with the dc bias current, when the reflected light affects DFB LD's and the dc bias current is above the threshold current.

**(35) Semiconductor Optical Modulator by Using Electron Depleting Absorption Control**, by M. Yamada, K. Noda, Y. Kuwamura, H. Nakanishi, and K. Imai (Faculty of Technology, Kanazawa University, Kanazawa, 920 Japn): *IEICE Trans. Electron.*, vol. E75-C, pp. 1063–1070, Sept. 1992.

Operation of a newly proposed semiconductor optical modulator based on absorption control by electron depletion around a p-n junction is demonstrated, forming preliminary structures of waveguide-type as well as panel-type (or surface-illuminated type) devices. The optical absorption is occurred at the intrinsic energy levels in the band structure not at the extended state into the band-gap.

**(36) Thresholding Characteristics of an Optically Addressable GaAs-pin/Ferroelectric Liquid Crystal Spatial Light Modulator and Its Applications** (Letters), by M. Hashimoto,* Y. Fukuda,** S. Ishibashi,*** and K. Kitayama* (*NTT Transmission Systems Laboratories, Yokosuka, 238-03 Japan; **NTT Opto-Electronics Laboratories, Atsugi, 243-01 Japan; ***NTT Interdisciplinary Research Laboratories, Musashino, 180 Japan): *IEICE Trans. Electron.*, vol. E75-C, pp. 1395–1398, Nov. 1992.

A newly developed GaAs-pin/SLM, that is structured with a GaAs-pin diode photodetector and a ferroelectric liquid crystal as the light phase modulator, shows the accumulative thresholding characteristics against the optical energy of the write-in pulse train.

**(37) Theoretical Analysis of Single Mode GaInAsP/InP Positive-Index-Guided Laser Array**, by J. Dong, J. Shim, S. Araki, and K. Komori (Faculty of Engineering, Tokyo Institute of Technology, Tokyo, 152 Japan): *IEICE Trans. Electron.*, vol. E75-C, pp. 1529–1535, Dec. 1992.

A detailed numerical solution of the design criteria of in-phase lateral and single-longitudinal-mode operation GaInAsP/InP DFB laser arrays is presented. The analysis, including broad-area pumped and stripe-geometry pumped index-guided arrays, is carried out on the basis of the eigenvalue equation method.

**(38) Numerical Analysis of Stability Property of an Optically Injection-Locked Semiconductor Laser Taking Account of Gain Saturation**, by K. Iiyama, K. Hayashi, and Y. Ida (Faculty of Technology, Kanazawa University, Kanazawa, 920 Japn): *IEICE Trans. Electron.*, vol. E75-C, pp. 1536–1540, Dec. 1992.

Stability property of an optically injection-locked semiconductor laser taking account of gain saturation is discussed. Numerical analysis shows that stable locking region is broadened due to gain saturation. It is also found that stable locking region is also broadened with increasing injection current, since damping of relaxation oscillation becomes strong with increasing injection current.

**(39) Static Characteristics of GaInAsP/InP Graded-Index Separate-Confinement-Heterostructure Quantum Well Laser Diodes (GRIN-SCH QW LD's) Grown by Metalorganic Chemical Vapor Deposition (MOCVD)**, by, A. Kasukawa, N. Matsumoto, T. Namegawa, and Y. Imajo (Yokohama R&D Laboratories, Furukawa Electric Co., Ltd., Yokohama, 220 Japan): *IEICE Trans. Electron.*, vol. E75-C, pp. 1541–1554, Dec. 1992.

Static characteristics of GaInAs(P)/GaInAsP quantum well laser diodes (QW LD's), with graded-index separate-confinement-heterostructure (GRIN-SCH) grown by metalorganic chemical vapor deposition (MOCVD), are investigated experimentally in terms of threshold current density, internal waveguide loss, differential quantum efficiency, and light output power.

### 7) Optical Fibers/Waveguides

**(1) Optical Fibre Fundamental Mode Approximations for Devices Using Evanescent Fields**, by A. Ankiewicz and G.-D. Peng (Research School of Physical Sciences and Engineering, The Australian National University, Canberra, ACT 2601, Australia): *JEEE*, vol. 12, pp. 49–66, Mar. 1992.

Several field approximations used in the analysis of both circular and noncircular optical fibers are reviewed, and these approximations are applied to various problems where the far-from-core field is required to be accurate. Simple formulas for these fields are needed for the analysis of devices using these fibers, especially for various types of couplers. The modified Gaussian approximation is simple and also accurate for devices using cladding fields and low-V fibers.

**(2) Preparation of Fluoride Glass Fiber with Low Optical Loss**, by H.-F. Hu, G.-H. Yi, F.-Y. Lin, Y.-C. Yu, Y.-J. Xu, and A.-M. Ye (Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences, Shanghai, P.R.C.): *JIMW*, vol. 11. pp. 379–382, Oct. 1992.

This paper presents the preparation of fluoride glass fiber with low optical loss, including high-purity raw material and fiber preparation. Based on these studies, the FEP-cladding fluorozirconate glass fiber with a minimum loss of 75 dB/km at 2.4 $\mu$m is obtained.

**(3) Interaction between Magnetostatic Forward Volume Wave and Optical Wave Guided in Layered YIG Film**, by H.-H. He, J. Su, Z.-K. Feng, J. Ouyang, and C.-Z. Chen (Huazhong University of Science and Technology, Wuhan, P.R.C.): *JAS*, vol. 10, pp. 293–298, Oct. 1992.

The coupling optical mode amplitude equations are derived with a new perturbation method; the Bragg diffraction efficiencies and the scanning characteristics of magnetostatic-optical wave interactions are discussed; the noncollinear interaction between magnetostatic forward volume wave and the optical wave end-butt coupled into the YIG film is realized.

**(4) Asymptotic Theory for Four Layer Dielectric Optical Waveguides**, by Z.-H. Wang (Shanghai University of Science & Technology, Shanghai, P.R.C.): *JAS*, vol. 10, pp. 299–302, Oct. 1992.

This paper presents an essentially analytic method for solving four layer planar optical waveguides by using the asymptotic theory which expands the propagation constant into asymptotic series in terms of a small parameter.

**(5) Instabilities and Their Characterization in Mach-Zehnder Ti:LiNbO$_3$ Optical Modulators**, by H. Jumonji and T. Nozawa (NTT Opto-Electronics Laboratories, Atsugi, 243-01 Japan): *Trans. IEICE*, vol. J75-C-I, pp. 17–26, Jan. 1992.

Instability phenomena, composed of short- and long-term dc drift and thermal drift, are quantified in Ti-diffused LiNbO$_3$ optical modulators. More specifically, characteristic parameters pertaining to each phenomenon and their temperature dependence are measured under regulated optical output.

**(6) Three-Dimensional Nonstationary Calculation of Quasi-Phase-Matched Guided-Wave Second-Harmonic Generation Using Weighted-Index Method**, by K. Yanagawa, K. Hayata, and M. Koshiba (Faculty of Engineering, Hokkaido University, Sapporo, 060 Japan): *Trans. IEICE*, vol. J75-C-I, pp. 27–34, Jan. 1992.

A three-dimensional nonstationary analysis method for quasi-phase-matched (QPM) second-harmonic generation (SHG) in a nonlinear optical waveguide with periodically domain-inverted structure is proposed. The weighted-index method, which is an accurate approximate method for calculating guided modes in a realistic optical channel waveguide, is effectively utilized.

**(7) Propagation Beam Analysis by Alternating-Direction Implicit Finite-Difference Method**, by J. Yamauchi, T. Ando, and H. Nakano (College of Engineering, Hosei University, Koganei, 184 Japan): *Trans. IEICE*, vol. J75-C-I, pp. 148–154, Mar. 1992.

The alternating-direction implicit (ADI) method is applied to the analysis of optical beam propagation in a three-dimensional space. The eigenmode propagation of step-index fibers is analyzed and compared with that of a conventional fast Fourier-transform beam propagation method (FFT-BPM). The spreading of a Gaussian beam is successfully calculated using a transparent boundary condition.

**(8) Fabrication and Characteristics of Optical Fiber Couplers by Local Power Injection Technique with Injection Window** (Letters), by I. Sasaki, K. Komai, and T. Hatsuda (Faculty of Engineering, Hokkaido Institute of Technology, Sapporo, 006 Japan): *Trans. IEICE*, vol. J75-C-I, pp. 200–204, Apr. 1992.

Optical fiber couplers with low insertion loss based on local power injection technique are fabricated for high efficient coupling of local signals to a primary fiber.

**(9) New Design Consideration for Low-Loss Single-Mode Bent Slab Waveguides by Suppressing Optical Beam Undulation** (Letters), by M. Hotta,* M. Geshiro,* and S. Sawa** (*Faculty of Engineering, Ehime University, Matsuyama, 790 Japan; **College of Engineering, University of Osaka Prefecture, Sakai, 591 Japan): *Trans. IEICE*, vol. J75-C-I, pp. 205–207, Apr. 1992.

This letter presents a new design consideration for low-loss bends of single-mode slab waveguides by suppressing optical beam undulation along the waveguide.

**(10) Uniform Asymptotic Solutions of the Scalar Wave Equation for Guided Modes in Inhomogeneous Optical Fibers with Even Polynomial Profile Cores and Its Error Estimation**, by H. Ikuno,* S. Mori,* and A. Yata** (*Faculty of Engineering, Kumamoto University, Kumamoto, 860 Japan; **College of Medical Science, Kumamoto University, Kumamoto, 862 Japan): *Trans. IEICE*, vol. J75-C-I, pp. 397–405, June 1992.

A uniform asymptotic solution of the scalar wave equation for guided modes in optical fibers with even polynomial profile cores is derived. This is a refined WKB solution.

**(11) Uniform Asymptotic Analysis of the Vector Wave Equation for Guided Modes in Inhomogeneous Optical

**Fibers with Even Polynomial Profile Cores**, by H. Ikuno,* S. Mori,* and A. Yata** (*Faculty of Engineering, Kumamoto University, Kumamoto, 860 Japan; **College of Medical Science, Kumamoto University, Kumamoto, 862 Japan): *Trans. IEICE*, vol. J75-C-I, pp. 406–414, June 1992.

High-order vector corrections to scalar solutions of graded-index optical fibers with even-polynomial profile cores are obtained by using the perturbation method in which the scalar solution can be represented by the uniform asymptotic one. Results show that the first-order vector solution plays a dominant part of the vector solution and holds its accuracy in the single-mode region.

**(12) Modeling and Design of Ti:$LiNbO_3$ Optical Modulator Electrodes with a Buffer Layer**, by T. Kitoh and K. Kawano (NTT Opto-Electronics Laboratories, Ibaraki-ken, 319-11 Japan): *Trans. IEICE*, vol. J75-C-I, pp. 422–429, June 1992.

A design method for $LiNbO_3$ optical modulator electrodes is described. The analysis of the traveling-wave electrode is based on the conformal mapping technique, where the effects of the buffer layer are taken into consideration. The microwave effective index and characteristic impedances of symmetric coplanar-strip, asymmetric coplanar-strip, and coplanar waveguide traveling-wave electrodes are calculated, and it is shown that thick buffer layers can improve velocity mismatch between microwaves and optical waves.

**(13) Propagation of Nonlinear Surface Wave in Linear-Nonlinear Optical Waveguide Structure**, by S. Ohke,* T. Umeda,** and Y. Cho*** (*Faculty of Engineering, Setsunan University, Neyagawa, 572 Japan; **College of Biomedical Technology, Osaka University, Toyonaka, 560 Japan; ***College of Engineering, University of Osaka Prefecture, Sakai, 593 Japan): *Trans. IEICE*, vol. J75-C-I, pp. 444–451, June 1992.

This paper describes stable light propagation along linear-nonlinear interface structures including a positive nonlinear refractive index material. The multi-segment numerical calculation scheme is applied to cases that the nonlinear region consists of multi-layer structure, for which the analytical approach is not applicable. Behavior of stable surface modes existing in this structure is discussed.

**(14) Velocity Matched Guided-Wave Optical Modulator Using Inverted Slot Line**, by T. Yoneyama, K. Niinuma, and S. Kanno (Research Institute of Electrical Communication, Tohoku University, Sendai, 980 Japan): *Trans. IEICE*, vol. J75-C-I, pp. 452–459, June 1992.

A inverted slot line is used to build a high-efficiency Ti-diffused $LiNbO_3$ waveguide optical modulator. Velocity matching demonstrated experimentally by adjusting the spacing between the slotted surface and ground plane of the inverted slot line to 200 $\mu$m and 22 $\mu$m at 10 GHz and 50 GHz, respectively.

**(15) Er-Doped Fluoride Fiber Amplifiers Operating in the 1.55 $\mu$m Band** (Letters), by Y. Fukasaku, T. Sugawa, and Y. Miyajima (NTT Telcommunication Field Systems R&D Center, Ibaraki-ken, 319-11 Japan): *Trans. IEICE*, vol. J75-C-I, pp. 478–479, June 1992.

A 33-dB gain is observed at 1.55 $\mu$m in an Er-doped fluoride fiber by pumping a 1.48-$\mu$m laser diode. A wide gain bandwidth is observed compared with an Er-doped silica fiber.

**(16) Loss Reduction of Ion-Exchanged Glass Waveguide Y-Branch** (Letters), by K. Nakama and S. Kobayashi (Tsukuba Research Laboratory, Nippon Sheet Glass Co., Ltd., Tsukuba, 300-26 Japan): *Trans. IEICE*, vol. J75-C-I, pp. 480–482, June 1992.

A loss reduction method of ion-exchanged glass waveguide Y-branches is found by an ion-exchanged waveguide simulation including the beam propagation method. The excess loss of 1.56 dB and branching loss of 0.023 dB are obtained experimentally.

**(17) Finite Element Analysis of Open-Type Axially Symmetric Waveguides**, by F. Ohkubo, A. Maruta, and M. Matsuhara (Faculty of Engineering, Osaka University, Suita, 565 Japan): *Trans. IEICE*, vol. J75-C-I, pp. 485–488, July 1992.

A new method using the finite element method (FEM) to analyze open-type axially symmetric waveguides is proposed. It is formulated in the form of a functional for the propagation constant, so it is suitable for the waveguide analysis. A new mapping technique to apply the FEM to open-type axially symmetric waveguides is also introduced.

**(18) $LiNbO_3$ Waveguide SHG Devices Using Ferroelectric Domain-Inverted-Grating Induced by $SiO_2$ Cladding**, by M. Fujimura, T. Suhara, and H. Nishihara (Faculty of Engineering, Osaka University, Suita, 565 Japan): *Trans. IEICE*, vol. J75-C-I, pp. 489–496, July 1992.

It is found that by heating an $LiNbO_3$ crystal with $SiO_2$ cladding on the +Z face, ferroelectric-domain inversion is induced under the cladding. The inversion method offers high reproducibility and is suitable for fabrication of quasi-phase-matching waveguide SHG devices. A prototype device is fabricated and demonstrated using a CW-Nd: YAG laser. The SHG normalized conversion efficiency of about 45%/W is obtained.

**(19) Analysis of Ti-Diffused $LiNbO_3$ Optical Waveguide by Modified-Step Segment Method**, by K. Kitoh* and K. Kawano** (*NTT Optoelectronics Laboratories, Ibaraki-ken, 319-11 Japan; **NTT Optoelectronics Laboratories, Atsugi, 243-01 Japan): *Trans. IEICE*, vol. J75-C-I, pp. 549–554, Aug. 1992.

The modified step segment method (MSSM) is proposed for obtaining accurate propagation constants and coupling lengths of graded-index optical waveguides. Accuracy of computed effective index is discussed for exponential refractive index slab waveguides, for which exact solution can be obtained. It is clarified that the MSSM provides excellent convergency, where the error of the calculated effective index is less than $10^{-6}$.

**(20) Hybrid-Type Optical Bistability in Polymer Thin Film Waveguide Doped with Nonlinear Organic Dyes**, by S.

Muto, K. Miyagawa, T. Ozawa, and S. Sugiyama (Faculty of Engineering, Yamanashi University, Kofu, 400 Japan): *Trans. IEICE*, vol. J75-C-I, pp. 555–560, Aug. 1992.

The operations of hybrid-type optical bistability, which is based on the Kerr effect in the Mach-Zehnder-type polymer thin film waveguides doped with nonlinear organic dyes such as disperse orange 3, trans-$\beta$-carotene, and nitroaniline derivatives, are obtained theoretically and experimentally. Furthermore, using the optical modulation property in these devices without feedback, the Kerr constants in the dye-doped polymer matrices are estimated to be $10^{-14}$–$10^{-13}$ m/V$^2$ at the dopant concentration of a few percents.

**(21) Finite Element Analysis of Open Type Waveguides with Homogeneous Cladding by the Use of Multipole Expansion**, by T. Ise, A. Maruta, and M. Matsuhara (Faculty of Engineering, Osaka University, Suita, 565 Japan): *Trans. IEICE*, vol. J75-C-I, pp. 567–571, Sept. 1992.

Open type waveguides with homogeneous cladding can be analyzed by the finite element method (FEM) with the multipole exapansion method. In this paper, a new connection method is proposed, in which the fields described by the FEM and those by the multipole expansion are combined at the connection boundary between the finite inner region and the infinite outer region by using the Galerkin method.

**(22) Radiation Properties of Leaky Waves in Anisotropic Circular Waveguides** (Letters), by M. Geshiro, M. Hotta, and T. Kameshima (Faculty of Engineering, Ehime University, Matsuyama, 790 Japan): *Trans. IEICE*, vol. J75-C-I, pp. 597–599, Sept. 1992.

Studied are leaky waves in an anisotropic circular optical waveguide in which the optical axis is on the plane containing the propagation axis. The analysis is based on the coupled mode theory where the continuum of radiation modes is discretized from a numerical integration viewpoint.

**(23) Optical Mode Conversion by Magnetstatic Surface Wave in Multi-Layered Waveguides**, by K. Hasegawa and Y. Miyazaki (Faculty of Engineering, Toyohashi University of Technology, Toyohashi, 441 Japan): *Trans. IEICE*, vol. J75-C-I, pp. 622–629, Oct. 1992.

An analysis of the optical TE-TM mode conversion by magneto-optic effect induced by magnetostatic surface wave is shown. Furthermore, a multi-layer, in which only the optical foundamental mode propagates, is proposed. The efficiency of 100% is achieved over the interaction length of about 1.0 cm for the applied microwave power density of a few mW/mm.

**(24) The Film Waveguide Polarizer with SiN Clad**, by I. Kato,* K. Mori,* and K. Sato** (*School of Science and Engineering, Waseda University, Tokyo, 116 Japan; **Faculty of Engineering, Shonan Institute of Technology, Fujisawa, 251 Japan): *Trans. IEICE*, vol. J75-C-I, pp. 630–637, Oct. 1992.

A suitable complex index of refraction ($n_c = n_c' - jn_c''$) for a clad film of the thin film waveguide polarizer operating at the wavelength of 0.5145 $\mu$m is examined. SiN films ($n_c'' = 0.02$, 0.07, 0.12, 0.16, 0.23) are deposited on the three-dimensional waveguide as clad films. It is experimentally cleared that the suitable $n_c''$ is 0.16 and 0.07 for TE and TM mode pass waveguide polarizers, respectively.

**(25) Application of the Beam Propagation Method to the Analysis of Butt-Jointed Slab Waveguides** (Letters), by M. Hotta,* M. Geshiro,* and S. Sawa** (*Faculty of Engineering, Ehime University, Matsuyama, 790 Japan; **College of Engineering, University of Osaka Prefecture, Sakai, 591 Japan): *Trans. IEICE*, vol. J75-C-I, pp. 681–683, Oct. 1992.

This letter describes two simple methods for modifying the beam propagation method in characterizing waveguide butt-joints in which a significant amount of reflection is expected.

**(26) Analysis of Ferrite Slab Waveguides with Resistive Strip Gratings**, by A. Ozaki, M. Asai, J. Yamakita, and S. Sawa (Faculty of Engineering, University of Osaka Prefecture, Sakai, 591 Japan): *Trans. IEICE*, vol. J75-C-I, pp. 694–702, Nov. 1992.

An exact numerical method for analyzing ferrite slab waveguides with palanar metallic gratings is presented. The complex propagation factor of leaky guided waves are calculated by using the resistive boundary conditions and the Green's functions on spectral domain for anisotropic magnetic media.

**(27) Analysis of 1×3 Coupled-Waveguide Optical Power Dividers by the Implicit Finite-Difference Method**, by J. Yamauchi, T. Ando, and H. Nakano (College of Engineering, Hosei University, Koganei, 184 Japan): *Trans. IEICE*, vol. J75-C-I, pp. 703–710, Nov. 1992.

Numerical investigation is made to reveal the power transmission and loss characteristics of a 1×3 coupled-waveguide divider (CWD). After confirming the validity of the implicit finite-difference method, a 1×3 CWD with linearly changing spacing is analyzed, and the effect of tilt-angle error on the power transmission is studied.

**(28) Design Considerations for Optical Power Dividers of Ununiformly Distributed-Coupling Type** (Letters), by M. Hotta,* M. Geshiro,* T. Arashiba,* and S. Sawa** (*Faculty of Engineering, Ehime University, Matsuyama, 790 Japan; **College of Engineering, University of Osaka Prefecture, Sakai, 591 Japan): *Trans. IEICE*, vol. J75-C-I, pp. 755–757, Dec. 1992.

In order to reduce the size of an optical power divider of distributed-coupling type, ununiformly distributed coupling, which is caused by step-like axial displacement of waveguides, is introduced.

**(29) Optical Stimulated Amplification and Absorption in Erbium-Doped Fiber**, by G. Yin, X. Yang, and M. Zhang (Department of Electronic Engineering, Southeast University, Nanjing 210018, P.R.C.): *IEICE Trans. Electron.*, vol. E75-C, pp. 90–92, Jan. 1992.

Making use of semiclassical theory relationships among optical stimulated absorption, amplification, and amplifier's parameters in erbium-doped fibers are discussed, and the phenomena occurring in experiments are explained theoretically.

**(30) Splice Losses of LP Modes in Multimode Graded-Index Optical Fiber**, by N. Harada, M. Yoshikawa, and H.

Kayano (Faculty of Science, Yamaguchi University, Yamaguchi, 753 Japan): *IEICE Trans. Electron.*, vol. E75-C, pp. 333–338, Mar. 1992.

Splice losses of LP modes in multimode graded-index optical fibers are investigated. It is found that the splice loss of the particular mode and the excitation rate of the other modes by mode conversion are predicted from the fiber axis misalignment, fiber end face gap, and fiber end face inclination.

**(31) Numerical Analysis of Three Channel Waveguides Arranged Two-Dimensionally**, by H. Kubo,* K. Yasumoto,** and T. Miyamoto*** (*Faculty of Engineering, Yamaguchi University, Ube, 755 Japan; **Faculty of Engineering, Kyusyu University, Fukuoka, 812 Japan; ***Faculty of Engineering, Fukuoka University, Fukuoka, 814-01 Japan): *IEICE Trans. Electron.*, vol. E75-C, pp. 339–347, Mar. 1992.

Optical couplers which are composed of three channel waveguides arranged two-dimensionally are investigated numerically. The mode-matching method that matches the boundary conditions in the sense of least squares is applied to this problem, using the hybrid-modal representation. The arrangement of three waveguides can be optimized so as to satisfy the condition for maximum power-transfer efficiency.

**(32) Analysis of Lightwave Propagation in a Bent Waveguide by the Galerkin Method**, by A. Maruta and M. Matsuhara (Faculty of Engineering, Osaka University, Suita, 565 Japan): *IEICE Trans. Electron.*, vol. E75-C, pp. 736–740, June 1992.

A simple method is developed to analyze a bent waveguide. By means of this method based on the Galerkin method, the sampling spacing can be chosen arbitrarily, and it is possible to treat narrow beams. In addition, an absorber using a graded lossy material is introduced. Lightwaves propagating in the uniform bend of the slab waveguide and the nonlinear slab waveguide are demonstrated.

**(33) Coupling Characteristics between a Slab Waveguide and a Tapered Slab Waveguide with a Wedge-Shaped Nonlinear Cladding** (Letters), by K. Ono, T. Sasaki, H. Osawa, and Y. Okamoto (Faculty of Engineering, Ehime University, Mastuyama, 790 Japan): *IEICE Trans. Electron.*, vol. E75-C, pp. 953–959, Aug. 1992.

A novel coupling configuration consisting of a tapered slab waveguide with a wedge-shaped nonlinear cladding is proposed. Coupling characteristics for TE waves are analyzed by means of the beam propagation method.

**(34) Finite-Difference Beam-Propagation Method for Circularly Symmetric Fields** (Letters), by J. Yamauchi, M. Ikegaya, T. Ando, and H. Nakano (College of Engineering, Hosei University, Koganei, 184 Japan): *IEICE Trans. Electron.*, vol. E75-C, pp. 1093–1095, Sept. 1992.

An analysis of the propagation of circularly symmetric fields is made using the finite-difference beam-propagation method. After testing the accuracy of this method, the guided-mode transmission of connected fibers whose core radii are different is investigated.

### 8) SUPERCONDUCTIVE DEVICES

**(1) Theoretical Calculations on Surface Impedance of High $T_C$ Superconductors**, by A. Jabbar, S.-P. Zhou, and J.-S. Bao (Shanghai University of Science and Technology, Shanghai, P.R.C.): *JIMW*, vol. 11, pp. 123–128, Apr. 1992.

A theoretical model that gives a full physical understanding of the frequency- and temperature-dependent surface impedance of high $T_C$ oxide superconductors possessing quasi-two-dimensional (layered) structure is presented. Using this model the calculated results for temperature-dependent magnetic penetration depth from measured temperature-dependent surface resistance of YBCO materials at different frequencies are very well agreed with conventional superconductors.

**(2) Development of 1–3 $\mu$m PV HgCdTe Arrays**, by Q.-S. Chen, Y.-F. Chen, J.-X. Cao, and L.-M. Liu (Shanghai Institute of Technical Physics, Chinese Academy of Science, Shanghai, P.R.C.): *JIMW*, vol. 11, pp. 223–226, June 1992.

The development and performances of the 1–3 $\mu$m PV type HgCdTe arrays used in the airborne high-resolution infrared scanner system are reported.

**(3) Characteristics of Microwave Planar Transmission Lines Using Superconducting Oxide Films**, by T. Konaka,* M. Sato,* H. Asano,** S. Kubo,** and Y. Nagano** (*NTT Field System R&D Center, Ibaraki-ken, 319-11 Japan; **NTT Interdisciplinary Research Laboratories, Ibaraki-ken, 319-11 Japan): *Trans. IEICE*, vol. J75-C-II, pp. 121–129, Feb. 1992.

The attenuation constant, characteristic impedance, and occupying area of the transmission lines of stripline, microstrip, and coplanar are analyzed with TEM and quasi-TEM models. It becomes clear that the microstrip gives a low loss line and that the coplanar on a substrate with low permittivity enables high density line designing.

**(4) High-Temperature Superconducting Small Helical Antenna**, by K. Itoh,* O. Ishii,** Y. Koshimoto,* and K. Cho** (*NTT Interdisciplinary Research Laboratories, Ibaraki-ken, 319-11 Japan; **NTT Radio Communication Systems Laboratories, Yokosuka, 238-03 Japan): *IEICE Trans. Electron.*, vol. E75-C, pp. 246–251, Feb. 1992.

To realize a highly efficient small antenna, high-$T_C$ superconductors are adopted to fabricate both a self-resonating helical radiator and a quarter-wave matching circuit. The actual gain and bandwidth measured at 478 MHz using a 1/45-wavelength radiator are, respectively, $-1.5$ dBi and 0.35%, indicating that this type of antenna has a high radiation efficiency and a fairly wide bandwidth.

### 9) SPECIAL ISSUES RELATED TO MICROWAVE THEORY AND TECHNIQUES

(1) *JEEE*, vol. 12, no. 2, June 1992, is a special issue on Australia Telescope.

**(1.1) The Australia Telescope Overview**, by R. H. Frater,* J. W. Brooks,* and J. B. Whiteoak** (*Institute of Information Science and Engineering, CSIRO, PO Box 93, North Ryde NSW 2113, Australia; **Australia Telescope National Facility, CSIRO, PO Box 76, Epping NSW 2121, Australia): pp. 103–112.

**(1.2) The Australia Telescope System Description**, by G. J. Nelson (Australia Telescope National Facility, CSIRO, PO Box 94, Narrabri NSW 2390, Australia): pp. 113–120.

**(1.3) The Antennas**, by D. N. Cooper, G. L. James, B. F. Parsons, and D. E. Yabsley (Division of Radiophysics, CSIRO, PO Box 76, Epping NSW 2121, Australia): pp. 121–136.

**(1.4) The Feed System**, by G. L. James (Division of Radiophysics, CSIRO, PO Box 76, Epping NSW 2121, Australia): pp. 137–146.

**(1.5) The Receiver System**, by M. W. Sinclair,* G. R. Graves,* R. G. Gough,** and G. G. Moorey* (*Australia Telescope National Facility, CSIRO, PO Box 76, Epping NSW 2121, Australia; **Australia Telescope National Facility, CSIRO, PO Box 94, Narrabri NSW 2390, Australia): pp. 147–160.

**(1.6) The Local Oscillator System**, by A. C. Young,* M. G. McCulloch,** S. T. Ables,* M. J. Anderson,* and T. M. Percival*** (*Australia Telescope National Facility, CSIRO, PO Box 76, Epping NSW 2121, Australia; **Nobeyama Radio Observatory, Nagoya, 384-13 Japan; ***Division of Radiophysics, CSIRO, PO Box 76, Epping NSW 2121, Australia): pp. 161–172.

**(1.7) The Sampling and Data Synchronization Systems**, by W. E. Wilson and M. W. Willing (Australia Telescope National Facility, CSIRO, PO Box 76, Epping NSW 2121, Australia): pp. 173–176.

**(1.8) The Optical Fiber System**, by A. C. Young,* M. J. Anderson,* M. J. W. Hayes,** and R. C. Ticehurst*** (*Australia Telescope National Facility, CSIRO, PO Box 76, Epping NSW 2121, Australia; **Australia Telescope National Facility, CSIRO, PO Box 94, NSW 2390, Australia; *** OTC, 231 Elizabeth Street, Sydony NSW 2000, Australia): pp. 177–181.

**(1.9) The Delay System**, by W. E. Wilson* and C. N. Carter** (*Australia Telescope National Facility, CSIRO, PO Box 76, Epping NSW 2121, Australia; **Alcatel-TCC, 1 Moorebank Avenue, Liverpool NSW 2170, Australia): pp. 183–186.

**(1.10) The Correlator**, by W. E. Wilson,* E. R. Davis,* D. G. Loone,** and D. R. Brown*** (*Australia Telescope National Facility, CSIRO, PO Box 76, Epping NSW 2121, Australia; **Australia Telescope National Facility, CSIRO, PO Box 94, Narrabri NSW 2390, Australia; ***Canon Australia, PO Box 313, North Ryde NSW 2113, Australia): pp. 187–198.

**(1.11) On-Line Computing for the Compact Array**, by M. J. Kesteven,* D. McConell,* and J. F. Deane** (*Australia Telescope National Facility, CSIRO, PO Box 94, Narrabri NSW 2390, Australia; **Australia Telescope National Facility, CSIRO, PO Box 76, Epping NSW 2121, Australia): pp. 199–204.

**(1.12) Data Reduction and Image Processing**, by R. P. Norris,* M. J. Kesteven,** and M. R. Calabretta* (*Australia Telescope National Facility, CSIRO, PO Box 76, Epping NSW 2121, Australia; **Australia Telescope National Facility, CSIRO, PO Box 94, Narrabri NSW 2390, Australia): pp. 205–210.

**(1.13) Monitoring and Protection Strategies for the Compact Array**, by P. J. Hall,* M. J. Kesteven,* R. J. Beresford,* R. H. Ferris,** and D. G. Loone* (*Australia Telescope National Facility, CSIRO, PO Box 94, Narrabri NSW 2390, Australia; **Australia Telescope National Facility, CSIRO, PO Box 76, Epping NSW 2121, Australia): pp. 211–218.

**(1.14) Operations Begin**, by G. J. Nelson* and J. B. Whiteoak** (*Australia Telescope National Facility, CSIRO, PO Box 94, Narrabri NSW 2390, Australia; **Australia Telescope National Facility, CSIRO, PO Box 76, Epping NSW 2121, Australia): pp. 219–224.

**(1.15) The First Radio Astronomy: Results and Future Developments**, by R. D. Ekers and J. B. Whiteoak (Australia Telescope National Facility, CSIRO, PO Box 76, Epping NSW 2121, Australia): pp. 225–232.

**(2)** *Trans. IEICE*, vol. J75-B-II, no. 11, Nov. 1992, is a special issue on Adaptive Signal Processing in the Spatial Domain and its Applications.

**(2.1) Overview of the Theory of Adaptive Antennas** (Invited), by K. Takano (Faculty of Engineering, Kyoto University, Kyoto, 606-01 Japan): pp. 713–720.

**(2.2) Developments and Prospects of Adaptive Antenna Theories** (Invited), by Y. Ogawa* and N. Kikuma** (*Faculty of Engineering, Hokkaido University, Sapporo, 060 Japan; **Faculty of Engineering, Nagoya Institute of Technology, Nagoya, 466 Japan): pp. 721–732.

**(2.3) Application of Adaptive Array Antennas to Radio Communications** (Invited), by M. Mizuno and T. Ohgane (Communications Research Laboratory, Ministry of Posts and Telecommunications, Koganei, 184 Japan): pp. 733–741.

**(2.4) Adaptive Microphone Arrays** (Invited), by Y. Kaneda (NTT Human Interface Laboratories, Musashino, 180 Japan): pp. 742–748.

**(2.5) Adaptive Signal Processing Antennas in Radar Systems** (Invited), by T. Muro-oka,* M. Ueno,* S. Mano,** and I. Chiba*** (*Research & Development Center, Toshiba Corporation, Kawasaki, 210 Japan; **Electro-Optics & Microwave Systems Laboratory, Mitsubishi Electric Corporation, Kawasaki, 247 Japan; ***ATR Optical and Radio Communications Research Laboratories, Kyoto-fu, 619-02 Japan): pp. 749–759.

**(2.6) A Dynamical System Model and Equivalent Steering Signal Concept in Adaptive Arrays**, by M. Ueno, K. Kawabata, and T. Moro-oka (Research & Development Center, Toshiba Corporation, Kawasaki, 210 Japan): pp. 760–769.

**(2.7) Systolic Array Structure of the Tamed Adaptive Antenna Utilizing Pseudo-Noise**, by N. Jinpo, N. Kikuma, and N. Inagaki (Faculty of Engineering, Nagoya Institute of Technology, Nagoya, 466 Japan): pp. 770–779.

**(2.8) Multipath Suppression Performance of an Adaptive Array Antenna with a Systolic Array Processor**, by M. Ohmiya, T. Kawabata, Y. Ogawa, and K. Itoh (Faculty of Engineering, Hokkaido University, Sapporo, 060 Japan): pp. 780–788.

**(2.9) Improvement of Suppression Performance of CMA Adaptive Array to Coherent Interference**, by M. Fujimoto (Toyota Central Research & Development Laboratories, Inc., Aichi-ken, 480-11 Japan): pp. 789–796.

**(2.10) BER Performance of CMA Adaptive Array for a High Speed GMSK Transmission: A Description of Measurements in Central Tokyo**, by T. Ohgane,* H. Sasaoka,* N. Matsuzawa,** and T. Shimura** (*Communications Research Laboratory, Ministry of Posts and Telecommunications, Koganei, 184 Japan; **Central Research Laboratory, Hitachi Ltd., Kokubunji, 185 Japan): pp. 797–805.

**(2.11) Multipath Suppression Using an Adaptive Array Based on an SMI Method in High-Speed Digital Land Mobile Communications**, by Y. Ogawa, T. Kawabata, and K. Itoh (Faculty of Engineering, Hokkaido University, Sapporo, 060 Japan): pp. 806–814.

**(2.12) Adaptive Array Antenna Combined with Tapped Delay Line Using Processing Gain for Direct-Sequence/Spread-Spectrum Mulitiple Access System**, by H. Wang, R. Kohno, and H. Imai (Faculty of Engineering, Yokohama National University, Yokohama, 240 Japan): pp. 815–825.

**(2.13) A Gram-Schmidt SLC Controlling the Number of Auxiliary Antennas to Preserve Desired Signals**, by Y. Harasawa and T. Kirimoto (Electro-Optics & Microwave Systems Laboratory, Mitsubishi Electric Corporation, Kamakura, 247 Japan): pp. 826–834.

**(2.14) Investigation on Adaptive Antennas Using a Kalman Filter**, by J. Wang and T. Takano (Institute of Space and Astronautical Science, Sagamihara, 229 Japan): pp. 835–842.

**(2.15) An Adaptive Antenna Using Lattice Filters**, by T. Kirimoto and Y. Harasawa (Electro-Optics & Microwave Systems Laboratory, Mitsubishi Electric Corporation, Kamakura, 247 Japan): pp. 843–853.

**(2.16) Prediction of the Number of Coherent Signals for Mobile Communication Systems Using Autoregressive Modeling**, by K. Minamisono and T. Shiokawa (Research and Development Laboratories, Kokusai Denshin Denwa Co., Ltd., Kamifukuoka, 356 Japan): pp. 854–861.

**(2.17) Active Control for Application to Noise Reduction Using Adaptive Signal Processing**, by K. Nagayasu and S. Suzuki (Research & Development Center, Toshiba Corporation, Kawasaki, 210 Japan): pp. 862–870.

**(3)** *Trans. IEICE*, vol. J75-C-I, no. 5, May 1992, is a special issue on Recent Advances in Multi-Dimensional Opto-electronics.

**(3.1) Photonic Public Network Prospects and Photonic Switching Technologies** (Invited), by J. Mizusawa and M. Akiyama (Faculty of Engineering, The University of Tokyo, Tokyo, 113 Japan): pp. 213–222.

**(3.2) Novel Optical Signal Processing Technologies and Multi-Dimensional Opto-Electronics** (Invited), by T. Matsumoto, K. Noguchi, and M. Koga (NTT Transmission Systems Laboratories, Yokosuka, 238-03 Japan): pp. 223–234.

**(3.3) Optical Interconnects and Optical Computing** (Invited), by S. Ishihara* and O. Wada** (*Electrotechnical Laboratory, Tsukuba, 305 Japan; **Fujitsu Laboratories, Ltd., Atsugi, 243-01 Japan): pp. 235–244.

**(3.4) Surface Emitting Semiconductor Lasers and Surface Operating Functional Devices** (Invited), by K. Iga (Precision and Intelligence Laboratory, Tokyo Institute of Technology, Yokohama, 227 Japan): pp. 245–256.

**(3.5) Three-Dimensional Memory LSI with Optical Interconnections** (Invited), by M. Koyanagi, H. Takata, H. Okano, and S. Yokoyama (Research Center for Integrated Systems, Hiroshima University, Higashi-Hiroshima, 724 Japan): pp. 257–268.

**(3.6) Optical Interconnection: A Review on Passive Optical Elements and Components** (Invited), by M. Takada (Faculty of Electro-Communications, University of Electro-Communications, Chohu, 182 Japan): pp. 269–277.

**(3.7) Process Technologies for 3-Dimensional Optoelectronic Integrated Circuits** (Invited), by Y. Katayama (Opto-electronics Technology Research Laboratory, Tsukuba, 300-26 Japan): pp. 278–284.

**(3.8) Ultra-High Dnsity Optical Memory by Photo-Chemical Hole Burning** (Invited), by M. Yoshimura (Central Research Laboratory, Mitsubishi Electric Corporation, Amagasaki, 661 Japan): pp. 285–295.

**(3.9) Integrated Correlators for Hybrid Optical Parallel Array Logic Systems: H-OPALS**, by D. Miyazaki, S. Kakizaki, J. Tanida, and Y. Ichioka (Faculty of Engineering, Osaka University, Suita, 565 Japan): pp. 296–304.

**(3.10) Optical Neuron Device Capable of Optical Parallel Operations and All-Optical Neuron Networks**, by A. Takimoto, K. Akiyama, and H. Ogawa (Central Research Laboratories, Matsushita Electric Industrial Co., Ltd., Moriguchi, 570 Japan): pp. 305–312.

**(3.11) An Optoelectronic Adaptive Device and Its Learning Performances**, by K. Kanamori, K. Tsuji, H. Yonezu, K. Pak, and Y. Takano (Faculty of Engineering, Toyohashi University of Technology, Toyohashi, 441 Japan): pp. 313–319.

**(3.12) A Photonic ATM Switch Using Vertical to Surface Transmission Electro-Photonic Devices (VSTEPs)**, by

M. Nishino,* K. Takagi,* S. Suzuki,* I. Ogura,** T. Numai,** K. Kasahara,** and K. Kaede* (*C&C Systems Research Laboratories, NEC Corporation, Kawasaki, 216 Japan; **Opto-Electronics Research Laboratories, NEC Corporation, Tsukuba, 305 Japan): pp. 320–329.

**(3.13) Vertical to Surface Transmission Electro-Photonic Device and Its Application for Optical Interconnection**, by Y. Yamanaka, T. Numai, K. Yoshihara, I. Ogura, H. Kosaka, K. Kurihara, M. Sugimoto, K. Kasahara, and K. Kubota (Opto-Electronics Laboratories, NEC Corporation, Kawasaki, 216 Japan): pp. 330–339.

**(3.14) Multi-Dimensional Optical Interconnections Using Far-Field-Pattern Scanning Laser Diodes**, by H. Itoh, S. Mukai, M. Watanabe, and H. Yajima (Electrotechnical Laboratory, Tsukuba, 305 Japan): pp. 340–348.

**(3.15) Operation Characteristics of Exciton Absorption Reflection Switch Arrays**, by C. Amano, S. Matsuo, and T. Kurokawa (NTT Opto-Electronics Laboratories, Atsugi, 243-01 Japan): pp. 349–355.

**(3.16) Light Coupling Characteristics of Planar Microlens**, by M. Oikawa, H. Imanishi, and T. Kishimoto (Tsukuba Research Laboratory, Nippon Sheet Glass Co., Ltd., Tsukuba, 305-25 Japan): pp. 356–364.

**(3.17) A New Optical Coupling between Waveguide and Photodiode Using Waveguide-Type-Layered Optical Coupler**, S. Koike, H. Takahara, and K. Katsura (NTT Interdisciplinary Laboratories, Musashino, 180 Japan): pp. 365–369.

**(3.18) High Speed LED/PD Arrays for Optical Parallel Interface**, by T. Uji,* J. Hayashi,** K. Fukushima,* I. Watanabe,*** T. Nagahori,*** and M. Itoh**** (*Kansai Electronics Research Laboratory, NEC Corporation, Otsu, 520 Japan; **R&D Planning and Technical Service Division, NEC Corporation, Kawasaki, 213 Japan; ***Opto-Electronics Research Laboratories, NEC Corporation, Kawasaki, 213 Japan; ****Functional Devices Research Laboratories, NEC Corporation, Kawasaki, 213 Japan): pp. 370–378.

**(3.19) Multi-Channel Optical Switch Using Polarization Control Device**, by T. Yamamoto, H. Itoh, and T. Nakagami (Fujitsu Laboratories Ltd., Kawasaki, 211 Japan): pp. 379–386.

**(3.20) Selective MOVPE Growth and Its Application to Semiconductor Photonic Integrated Circuits**, by T. Sasaki, M. Yamaguchi, T. Kato, Y. Sakata, H. Asano, M. Kitamura, and I. Mito (Opto-Electronics Research Laboratories, NEC Corporation, Tsukuba, 305 Japan): pp. 387–395.

(4) *IEICE Trans. Commun.*, vol. E75-B, no. 3, Mar. 1992, is a special issue on Measurements and Control of Electromagnetic Interference.

**(4.1) Anechoic Chambers for EMI Test** (Invited), by Y. Shimizu (Center for Research and Development of Education Technology, Tokyo Institute of Technology, Tokyo, 152 Japan): pp. 101–106.

**(4.2) Recent Progress in Fiber Optic Antennas for EMC Measurement** (Invited), by M. Tokuda and N. Kuwabara (NTT Telecommunication Networks Laboratories, Musashino, 180 Japan): pp. 107–114.

**(4.3) Mechanism of Electromagnetic Radiation from a Transmission Line** (Invited), by Y. Kami (Faculty of Electro-Communications, University of Electro-Communications, Chofu, 182 Japan): pp. 115–123.

**(4.4) The Determination of Radiated Emissions Limits for Integrated Circuits within Telecommunications Equipment** (Invited), by R. R. Goulette, R. J. Crawhall, and S. K. Xavier (Bell Northern Research, Ottawa, Canada): pp. 124–130.

**(4.5) New Approaches for Measurement of Static Electricity toward Preventing ESD** (Invited), by O. Fujiwara (Faculty of Engineering, Nagoya Institute of Technology, Nagoya, 466 Japan): pp. 131–140.

**(4.6) Method for Estimating Electromagnetic Interference due to Unbalance in Telecommunications Line**, by F. Amemiya, N. Kuwabara, and T. Ideguchi (NTT Telecommunication Networks Laboratories, Musashino, 180 Japan): pp. 141–147.

**(4.7) Stabilization of Power Line Impedance for Radiated EMI Level Measurement**, by A. Maeda (A. Maeda Associates, Inc., Yokohama, 222 Japan): pp. 148–156.

**(4.8) Analysis of Multiple Reflections by Transfer Functions of Transmission Line Networks with Branches and Its Application**, by I. Sakagami,* A. Kaji,* and T. Usami** (*Department of Electrical and Electronic Engineering, Muroran Institute of Technology, Muroran, 050 Japan; **Fujitsu Hokkaido System Engineering, Sapporo, 004 Japan): pp. 157–164.

**(4.9) Power-Sum Estimation of Electromagnetic Noise Radiated from High-Speed CMOS Printed Circuit Boards**, by O. Wada,* M. Kosaka,* H. Oka,* R. Koga,* and H. Sano** (*Faculty of Engineering, Okayama University, Okayama, 700 Japan; **Faculty of Engineering, Fukuyama University, Fukuyama, 729-02 Japan): pp. 165–173.

**(4.10) Magnetic Radiations from Harness Wires of Spacecraft**, by M. Tsutsui,* H. Kojima,* I. Nagano,** H. Sato,** T. Okada,*** H. Matsumoto,* T. Mukai,**** and M. Kawaguchi***** (*Radio Atmospheric Science Center, Kyoto University, Uji, 611 Japan; **Faculty of Technology, Kanazawa University, Kanazawa, 920 Japan; ***Faculty of Technology, Toyama University, Toyama, 939-03 Japan; ****Institute of Space and Astronautical Science, Sagamihara, 229 Japan; *****Space Development Division, NEC Corporation, Yokohama, 226 Japan): pp. 174–182.

**(4.11) Composite Noise Generator (CNG) with Random Pulse Stream (RPS) Generator for Immunity Test in Digital System**, by H. Suzuki, H. Shizuya, and T. Takagi (Faculty of Engineering, Tohoku University, Sendai, 980 Japan): pp. 183–187.

**(4.12) Distributed Signal Transmission System Using Discrete Fourier Transform for High Noise Immunity**, by

H. Kang, Y. Uh, and T. Takagi (Faculty of Engineering, Tohoku University, Sendai, 980 Japan): pp. 188–192.

**(5)** *IEICE Trans. Electron.*, vol. E75-C, no. 1, Jan. 1992, is a special issue on Fundamentals of Next Generation Opto-Technologies.

**(5.1) Optical Solitons for Signal Processing** (Invited), by S. R. Friberg (NTT Basic Research Laboratories, Musashino, 180 Japan): pp. 3–9.

**(5.2) Surface Emitting Lasers and Parallel Operating Devices: Fundamentals and Prospects** (Invited), by K. Iga (Precision and Intelligence Laboratory, Tokyo Institute of Technology, Yokohama, 227 Japan): pp. 10–17.

**(5.3) Low Dimensional Quantum Effects in Semiconductor Lasers** (Invited), by Y. Arakawa (Research Center for Advanced Science and Technology, The University of Tokyo, Tokyo, 153 Japan): pp. 18–25.

**(5.4) Optical Information Processing Systems** (Invited), by T. M. Cathey,* S. Ishihara,** S.-Y. Lee,*** and J. Chrostowski**** (*Optoelectronic Computing Systems Center, University of Colorado, Boulder, Colorado 80309-0525, USA; ** Electrotechnical Laboratory, Tsukuba, 305 Japan; *** Korea Advanced Institute of Science and Technology, Chongryangni, Seoul, Korea; ****Institute of Information Technology, National Research Council, Ottawa, K1A OR6, Canada): pp. 26–35.

**(5.5) Nonlinear Optical Properties of Organics in Comparison with Semiconductors and Dielectrics** (Invited), by T. Kobayashi (Faculty of Science, The University Tokyo, Tokyo, 113 Japan): pp. 36–43.

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