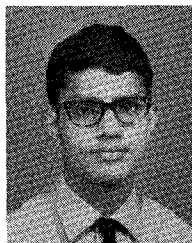




S. F. Paik (S'56-M'62) was born in Seoul, Korea, on November 12, 1935. He received the B.S. degree in electrical engineering from Northwestern University, Evanston, Ill., in 1958 and the M.S. and Ph.D. degrees from Stanford University, Stanford, Calif., in 1959 and 1961, respectively.

From 1959 to 1961 he was a Research Assistant at Stanford Electronics Laboratories. He was with Raytheon Research Division, Waltham, Mass., from 1961 to 1964, and during the academic years 1964-1966 he was on the faculty of the Department of Electrical Engineering at Northwestern University. After a brief association with NASA Electronics Research Center, Cambridge, Mass., in 1966, he joined Microwave Associates, Inc., Burlington, Mass., where he was engaged in R & D activities in high-power microwave tubes, gas-discharge devices, and solid-state microwave amplifiers. Since 1970 he has been with the Micro State Group of Raytheon Company, Waltham, Mass., where his main responsibility is in the development of avalanche diode amplifiers.

Dr. Paik is a member of Tau Beta Pi, Eta Kappa Nu, Pi Mu Epsilon, Phi Eta Sigma, and Sigma Xi.



Srinivasan Vijayaraghavan was born in Madras, India, on November 18, 1944. He received the B.Tech. degree in electrical engineering from the Indian Institute of Technology, Madras, in 1966 and the M.E. degree in electronics and communication engineering from the University of Roorkee, Roorkee, India, in 1968. At present he is working toward the Ph.D. degree in electronics and communication engineering.

In 1968 he joined the University of Roorkee as a Lecturer in Electronics and Communication Engineering. Since then he has been engaged in research work on shielded surface waveguides and his publications have appeared in journals of repute in India and abroad.

Foreign Abstracts

PAPERS FROM JOURNALS PUBLISHED IN JAPAN

Compiled by Prof. T. Okoshi, Department of Electrical Engineering, University of Tokyo. Prof. Okoshi points out that where articles in

Trans. IECEJ, in Japanese, are referenced, these may be available in English translation, with a few months' delay, in Electronics and Communications in Japan.

- 1
Millimeter-Wave Guided Transmission System, I—System, by K. Miyauchi and S. Matsuda (The Electrical Communication Laboratory, N.T.T., Musashino-shi); *J. IECEJ* (Invited Paper), vol. 53, pp. 1544-1547, Nov. 1970.
A review on recent advances.
- 2
Millimeter-Wave Guided Transmission System, II—Equipment, by S. Shimada (The Electrical Communication Laboratory, N.T.T., Musashino-shi) and R. Kuroda (Yokohama Works, Nippon Electric Co., Ltd., Yokohama-shi); *J. IECEJ* (Invited Paper), vol. 53, pp. 1548-1552, Nov. 1970.
A review on recent advances.
- 3
Millimeter-Wave Guided Transmission System, III—Waveguides, by N. Sushi (The Electrical Communication Laboratory, N.T.T., Musashino-shi), H. Kaiden (The Furukawa Electric Co., Ichihara-shi), N. Kurauchi (Sumitomo Electric Industries Ltd., Osaka-shi) and S. Tanaka (The Fujikura Cable Works Ltd., Tokyo); *J. IECEJ* (Invited Paper), pp. 1553-1556, Nov. 1970.
A review on recent advances.
- 4
Optical Communication System, by J. Hirano (The Electrical Communication Laboratory, N.T.T., Musashino-shi) and Y. Suematsu (Tokyo Institute of Technology, Tokyo); *J. IECEJ* (Invited Paper), pp. 1557-1563, Nov. 1970.
- A review on recent advances. Speculation on the future optical communication system is also described.
- 5
A Design Method for the Multi-Layer Absorber for Microwaves—The Case of Wide-Band Type, by M. Ono and M. Suzuki (Faculty of Engineering, Yamagata University, Yonezawa-shi, Japan 992); *Trans. IECEJ*, vol. 53-B, pp. 671-678, Nov. 1970.
A new method of synthesis is proposed. It features the use of the concept of the quarter-wave transformer extended to lossy lines. The computed frequency response is presented.
- 6
Millimeter-Wave Frequency-Multiplier Circuit Using a Semiconductor Diode, by S. Shinohara (Faculty of Engineering, Shizuoka University, Hamamatsu-shi, Japan 430) and S. Okamura (University of Tokyo, Japan 113); *Trans. IECEJ*, vol. 53-B, pp. 693-700, Nov. 1970.
A new type of frequency-multiplier circuit having no movable tuning element is proposed. A 70-GHz doubler has been designed and constructed. The observed output power, input, and output impedances agreed well with the theoretical prediction.
- 7
K-Band Tunnel Diode Mixer, by S. Kamoshita (The Electrical Communication Laboratory, N.T.T., Musashino-shi, Japan 190); *Trans. IECEJ* (Corresp.), vol. 53-B, pp. 712-713, Nov. 1970.
A conversion gain of 4 dB has been obtained in the 25.7-26.3-GHz range.
- 8
Beam Waves along Complex Dielectric Constant Lenslike Medium, by Y. Suematsu, T. Shimizu (Tokyo Institute of Technology, Tokyo, Japan 152), and T. Kitano (Central Research Laboratory, Nippon Electric Co., Ltd., Kawasaki-shi, Japan 211); *Trans. IECEJ*, vol. 53-B, pp. 727-734, Dec. 1970.

An analysis of the propagation properties of a light beam along a lens-like medium with distributions of both real and imaginary parts of the dielectric constant is presented.

9

Millimeter-Wave Up-Converter Using a Germanium Avalanche Diode, by S. Kita and N. Kanmuri (The Electrical Communication Laboratory, N.T.T., Musashino-shi, Japan 180); *Trans. IECEJ*, vol. 53-B, pp. 735-742, Dec. 1970.

The maximum output power of 5.6 dBm was obtained at 47 GHz with a signal power of 14 dBm at 4 GHz and local power of 10 dBm at 43 GHz. A conversion gain was observed at lower local power. The pulse performance was tested as an up-converter of a 400-Mbit/s PCM-PSK repeater.

10

An Analysis of Microwave Characteristics of Hot Electrons in n-type GaAs, by S. Kaneda and M. Abe (Faculty of Engineering Science, Osaka University, Toyonaka-shi, Japan 560); *Trans. IECEJ*, vol. 53-B, pp. 760-769, Dec. 1970.

An analysis of the microwave mobility of hot electrons in n-type GaAs is made to examine the microwave characteristics of bulk semiconductor devices such as Gunn-effect oscillators. The purpose is to take into account all possible scattering mechanisms. The negative mobility vanishes at around 100 GHz.

11

Strip Lines with Trough-Type Outer Conductor, by H. Ishikawa (Fujitsu Laboratories, Kobe-shi, Japan 652); *Trans. IECEJ* (Corresp.), vol. 53-B, pp. 790-791, Dec. 1970.

Comparison of computer analysis and experiment.

12

Matched Loads for Electromagnetic Waves Utilizing Ferromagnetic Materials (Sendust and Carbonyl Iron), by Y. Naito, S. Uekusa, and S. Sato (Tokyo Institute of Technology, Tokyo, Japan 152); *Trans. IECEJ*, vol. 54-B, pp. 16-21, Jan. 1971.

Ferrite matched load for VHF and UHF can be made much smaller than those using lossy dielectric materials. In this paper, the matching thickness, matching frequency, relative bandwidth of a matched load using "Sendust" (Fe, Si, Al) and carbonyl iron (Fe (CO)₂) is described.

13

Analogies Between the Waveguide Consisting of Lens-Like Media and the Circular TE₀₁ Waveguide, by N. Kumagai (Faculty of Engineering, Osaka University, Suita-shi, Japan 564) and S. Sawa (Faculty of Engineering, Ehime University, Matsuyama-shi, Japan 790); *Trans. IECEJ*, vol. 54-B, pp. 39-44, Jan. 1971.

The characteristics of a coherent optical beam waveguide consisting of lens-like media is considered with emphasis on the analogy to the circular TE₀₁ waveguide being used in low-loss millimeter wave transmission.

14

An Analysis of Microstrip Transmission Lines by the Integral Equation Approach, by M. Shimasaki and T. Kiyono (Faculty of Engineering, Kyoto University, Kyoto-shi, Japan 606); *Trans. IECEJ*, vol. 54-B, pp. 69-76, Feb. 1971.

A new method of analysis is proposed which requires shorter computer time. Various design charts are shown.

15

Capacitors in Microwave Integrated Circuits, by H. Kato (Central Research Laboratories, Nippon Electric Co. Ltd., Kawasaki-shi, Japan 211); *Trans. IECEJ*, vol. 54-B, pp. 95-102, Mar. 1971.

An expression for the complex impedance of a thin-film capacitor is derived. It includes the distributed resistive and inductive effect of the electrodes. The loss factors of Tantalum thin-film capacitor, SiO

thin-film capacitor, and ceramic chip capacitor were measured and compared with theory.

16

Measurements on High-Frequency Transmission Characteristics of Metalization Patterns in Monolithic ICs, by H. Hasegawa (Faculty of Engineering, University of Hokkaido, Sapporo-shi, Japan 063), M. Furukawa, and H. Yanai (Faculty of Engineering, University of Tokyo, Tokyo, Japan 113); *Trans. IECEJ*, vol. 54-B, pp. 108-115, Mar. 1971.

A microstrip model of a metalization pattern in a monolithic microwave IC was established and its characteristic impedance and propagation constant were measured over 30-4000 MHz as functions of substrate resistivity and strip width.

17

A Limit of Beam Capacity Caused by Irregularity of Focuser in Multiple Beam Waveguide, by H. Nagashima (Faculty of Engineering, Kogakuin University, Tokyo, Japan 160), Y. Suematsu, and N. Yonezawa (Faculty of Engineering, Tokyo Institute of Technology, Tokyo, Japan 152); *Trans. IECEJ*, vol. 54-B, pp. 116-122, Mar. 1971.

The crosstalk in a multiple-beam light-communication system limits the number of beams spatially resolvable at the detector. From a statistical analysis, it is concluded that the reduction of the beam capacity is mainly caused by surface irregularities of lenses.

18

Experiments on a Channel Dropping Filter with Linear Phase Using Two Ring Resonators, by I. Ootomo, S. Shimada, and K. Yamada (The Electrical Communication Laboratory, N.T.T., Musashino-shi, Tokyo, Japan 180); *Trans. IECEJ* (Corresp.), vol. 54-B, pp. 124-127, Mar. 1971.

Experimental verification of the design theory proposed previously (*Trans. IECEJ*, vol. 53-B, p. 495, Sept. 1970) was performed at 20 GHz. The results obtained show good agreement with the theory.

19

An Analysis of the Waveguide Y Junction with Ferrite, by N. Tsukamoto, M. Suzuki, and T. Matsumoto (Faculty of Engineering, Hokkaido University, Sapporo-shi, Japan 063); *Trans. IECEJ*, vol. 54-B, pp. 131-138, Apr. 1971.

The difficulty in the design theory of a Y-junction circulator is to solve a boundary value problem in a cylindrical space connected to three rectangular waveguides, that is, to join the two different types of field. This paper describes an exact solution of the problem using an integral equation. The eigenvalues of the admittance matrix are given.

20

An Improved Synthesis of the Multi-Layer Absorber, by M. Ono and M. Suzuki (Faculty of Engineering, Hokkaido University, Sapporo-shi, Japan 063); *Trans. IECEJ*, vol. 54-B, pp. 146-152, Apr. 1971.

An improved synthesis method of a multilayer lossy-dielectrics microwave absorber is described. The feature of this method is to start with a quarter-wave impedance transformer. Each transmission line element is then replaced by a lossy dielectric counterpart. Total thickness of the absorber was reduced to one-half of the conventional one.

21

Short-Slot Hybrid Junction Loaded with a Dielectric Slab, by K. Rokushima, H. Mori, and I. Taki (Faculty of Engineering, University of Osaka Prefecture, Sakai-shi, Japan 591); *Trans. IECEJ*, vol. 54-B, pp. 168-174, Apr. 1971.

The coupling between two waveguides through a slot with a dielectric slab in the partition wall is analyzed theoretically in order to compensate the reflection of the short-slot hybrid junction by the dis-

tributed capacitance of the dielectric slab, and to widen the operating frequency band. The results were confirmed by experiment. Such a junction is useful as a 3-dB coupler.

22

Analysis of the Optical Beam Consisting of Tapered Lens-Like Medium and Its Applications, by S. Sawa (Faculty of Engineering, Ehime University, Matsuyama-shi, Japan 790) and N. Kumagai (Faculty of Engineering, Osaka University, Suita-shi, Japan 564); *Trans. IECEJ*, vol. 54-B, pp. 190-197, Apr. 1971.

Transmission characteristics of an optical beam along a waveguide consisting of a tapered lens-like medium is analyzed, and its potential applications are described.

23

Electronically Variable Shorting Element for Coaxial Line Utilizing Variable Capacitance Diode and its Application, by F. Nagumo (Sony Corporation, Yokohama-shi, Japan 240) Y. Naito, and K. Suetake (Faculty of Engineering, Tokyo Institute of Technology, Tokyo, Japan 152); *Trans. IECEJ*, vol. 54-B, pp. 210-217, May 1971.

Experiment on an electronically variable shorting element (EVSE) for a coaxial line using a varactor is described. A movable length of 0.4λ has been obtained. The applications of the EVSE to a $\lambda/4$ matched load and an attenuator are described.

24

Stabilization of Solid-State Microwave Oscillator with a Reaction Cavity—Stabilization Factor and Power Loss, by S. Nagano (Central Research Laboratories, Nippon Electric Co. Ltd., Kawasaki-shi, Japan 211); *Trans. IECEJ* (Corresp.), vol. 54-B, pp. 286-288, May 1971.

By adding a reaction cavity to a Gunn oscillator, frequency-stability improvement of (1/100) was achieved with a 1-dB power reduction.

25

A Doppler Radar using a Gunn Diode as a Transmitter Oscillator as well as a Receiver Mixer, by S. Nagano and Y. Akaiwa (Central Research Laboratories, Nippon Electric Co., Ltd., Kawasaki-shi, Japan 211); *Trans. IECEJ* (Corresp.), vol. 54-B, pp. 288-290.

Comparison of theory and experiment. Locking of oscillation by the reflected wave plays a critical role in the performance of the mixer.

26

Vector Wave Solution of Light Beam Propagating Along Lens-Like Medium, by Y. Suematsu and K. Furuya (Faculty of Engineering, Tokyo Institute of Technology, Tokyo, Japan 152); *Trans. IECEJ*, vol. 54-B, pp. 325-333, June 1971.

A vector solution of Maxwell's equation in a three-dimensional lens-like medium having quadratic and fourth-order transverse variations of the dielectric constant, is obtained by using a perturbation method. The relation between the spot-size divergence and the pulse broadening is shown.

27

Reduction of Temperature Difference in the Shielding Pipe for Light Beam Transmission, by Y. Suematsu (Faculty of Engineering, Tokyo Institute of Technology, Tokyo, Japan 152), H. Nagashima, T. Egashira (Kogakuin University, Tokyo, Japan 160), and K. Hayashi (Yamagata Broadcast Station, Yamagata-shi, Japan 164); *Trans. IECEJ*, vol. 54-B, pp. 334-341, June 1971.

The temperature difference between the top and bottom of a light-transmitting pipe causes the deflection of a laser beam propagating through it. The reduction of the temperature difference in a multi-layer pipe (for example, consisting of aluminum and vesicatory-polystyrene) was investigated both experimentally and theoretically.

28

A Method of Transmission-Characteristics Estimation for a Millimeter-Wave Long-Distance Circular-Waveguide Line, by K. Kondoh (The Electrical Communication Laboratory, N.T.T., Musashino-shi, Japan 180); *Trans. IECEJ*, vol. 54-B, pp. 342-349, June 1971.

A new method for the estimation has been developed. The characteristics of a 1-km line are computed first from data of the guide-axis curvature, which are obtained from a 150-m long sample by an auto-regressive process. Then the characteristics for an arbitrary length can be estimated from the 1-km characteristics. The estimation error is less than 20 percent.

29

Millimeter-Wave Branching Filter System for 806-Mbit/s Transmission Experiments, by S. Shimada, I. Ohtomo, and N. Suzuki (The Electrical Communication Laboratory, N.T.T., Musashino-shi, Japan 180); *Trans. IECEJ*, vol. 54-B, pp. 396-403, July 1971.

A millimeter-wave 806 Mbit/s PCM transmission system consisting of a waveguide transmission line, a repeater, and a branching/combining filter was tested at ECL. This paper describes the frequency response, pulse transmission characteristics, error rate, and interchannel crosstalk in the branching/combining filter system consisting of three kinds of newly developed filters: semicircular waveguide type, figure-8 type, and ring-type filters.

30

Characteristic Impedance of Transmission Line in a Reverse-Phase Hybrid Ring, by N. Nagai, O. Morita, and M. Tamori (Research Institute of Applied Electricity, Hokkaido University, Sapporo-shi, Japan 060); *Trans. IECEJ* (Corresp.), vol. 54-B, pp. 437-438, July 1971.

The optimum impedance for realizing wide-band decoupling characteristics is known to be $\sqrt{2}Z_0$, where Z_0 denotes the externally connected impedance. It is shown that reducing the line impedance slightly below $\sqrt{2}Z_0$ leads to better characteristics.

31

Design of Diplexers Using TE₀₁₁-Mode Resonators for Millimeter-Wave Regenerative Repeaters, by M. Ando (Central Research Laboratories, Nippon Electric Co., Ltd., Kawasaki-shi, Japan 211); *Trans. IECEJ* (Corresp.), vol. 54-B, pp. 443-445, July 1971.

When the intermediate frequency in a repeater is relatively high (for example, 4 GHz), the diplexer design becomes difficult. This paper describes a practical design procedure of a specific diplexer using two TE₀₁₁-mode filters.

32

A Channel-Dropping Filter using Three Resonators, by I. Ohtomo, S. Shimada, and K. Yamada (The Electrical Communication Laboratory, N.T.T., Musashino-shi, Japan 180); *Trans. IECEJ* (Corresp.), vol. 54-B, pp. 445-446, July 1971.

Design data for a wide-frequency band obtained with an exact computer analysis are presented. Insertion-loss and delay-time characteristics are shown.

33

Computation of Single-Conductor and Two-Conductor Stripline Characteristics by Using Relaxation Method, by T. Hatsuda and T. Kimura (The Electrical Communication Laboratory, N.T.T., Musashino-shi, Japan 180); *Trans. IECEJ*, vol. 54-B, pp. 467-474, Aug. 1971.

The equipotential diagram, characteristic impedance, and velocity reduction factor of a single-conductor stripline supported by Teflon are shown. The characteristics of a stripline consisting of two symmetric or asymmetric strip conductors formed on both surfaces of a dielectric substrate, are also obtained. The results are compared with experiments.

34

Scattering by a Cylindrical Anisotropic Semiconductor Rod in a Waveguide, by T. Kobayashi and K. Fujisawa (Faculty of Engineering Science, Osaka University, Toyonaka-shi, Japan 560); *Trans. IECEJ*, vol. 54-B, pp. 506-513, Aug. 1971.

The scattering by a cylindrical semiconductor rod having an anisotropic complex permittivity, placed at the center of a rectangular waveguide perpendicularly with respect to the electric field of the TE_{10} mode, has been analyzed.

35

Waveguide-Type Millimeter-Wave Diode ECL-2173, by H. Niiyama, S. Ogawa, T. Yagasaki, T. Araki, Y. Ishii, and T. Imai (The Electrical Communication Laboratory, N.T.T., Musashino-shi, Japan 180); *Trans. IECEJ*, vol. 54-B, pp. 514-521, Aug. 1971.

A new-type cylindrical-waveguide diode-mount ECL-2173 developed for use in the millimeter-wave region is described. It has two openings to millimeter waveguides and a coaxial-type terminal with a low-pass filter having a cutoff frequency at a lower millimeter-wave frequency. The characteristics are as follows: 1) as a down-converter: $L_c = 5.6$ dB (77-MHz IF output, 6-dBm local power); 2) as an up-converter: $P_{out} = 5.4$ dBm (50-GHz output, 4-GHz IF input, 10-dBm local power); 3) as a quadrupler: $P_{out} = 17$ dBm (23-dBm input, 47-GHz output).

PAPERS FROM JOURNALS PUBLISHED IN THE SCANDINAVIAN COUNTRIES

Compiled by M. Michael Brady, Norconsult A. S., 1322 Høvik, Norway. Journals from Denmark, Finland, Norway, and Sweden were scanned. Articles in one of the four Scandinavian languages, English, or German as noted.

36

Backscattering from a Dielectric-Coated Metallic Cylinder for Various Angles of Incidence, by H. Wilhelmsson (Dept. of Theoretical Electrotechnics and Plasma Physics, Institute of Physics, Uppsala, Sweden) and H. Cerda (Catholic University, Santiago, Chile); *Ericsson Technics*, vol. 25, pp. 201-207, 4th Quarter 1969.

The backscattering of plane electromagnetic waves by dielectric-coated metal cylinders is discussed in detail and the results of computer computations are presented in the form of curves giving backscattering cross sections as functions of the angle of incidence and of the external radius of the dielectric coating. Both principal directions of polarization of the incident plane wave are considered. (In English.)

37

Microwave-Excited Chemical Processes, by M. M. Brady (Norconsult A. S., Box 9, 1322 Høvik, Norway) and T. Kvaal (Oslo Elementaertekniske Skole, Stenersgt. 15, Oslo 1, Norway); *Kjemi* (Oslo), vol. 30, pp. 16-20, May 28, 1970.

Inexpensive electric energy can economically be applied to efficient production of both inorganic and organic elements and com-

pounds with microwave-excited plasma reactions. The background of such reactions is presented and several examples of industrial processes are given. In particular, the production of atomic hydrogen is discussed, and it is claimed that this useful form of the element can be produced for N.Kr. 89.50 (about \$12.60) per kilogram. (18 references.) (In Norwegian.)

38

Economic Analysis of Finish Drying of Newsprint with Microwave Energy, by N. Andersson, P. Hedvall, and J. Svennebrink (Institute for Microwave Techniques, Fack S-100 44, Stockholm 70, Sweden); *Svensk Papperstidning* (Stockholm), vol. 73, pp. 397-403, Dec. 1970.

An economic model is deduced operating on the assumption that microwave energy is capable of leveling an uneven moisture profile in newsprint under production. This leveling makes it possible to increase production for the same amount of pulp or reduce the pulp required for a given production. It is assumed that several microwave applicators are positioned across the web and feedback controlled to eliminate moisture streaks at any transverse position. The conclusions drawn from the economic analyses are that the saving in pulp possible through the use of microwave leveling is more than adequate to compensate for the additional capital investment required for the microwave leveling. However, drying an entire web width is shown to be uneconomical when compared to conventional steam-heated cylinders. Thus microwave drying can be said to be a useful complement but not an alternative to a conventional drying system. (In Swedish.)

39

New Technology for Microwave Systems, by O. Gutteberg and K. Solbakken (Televerkets Forskningsinstitut, 2007 Kjeller, Norway); *Elektroteknisk Tidsskrift*, vol. 84, pp. 31-37, Mar. 4, 1971.

Stripline, integrated circuits, solid-state components, bulk-effect devices, and ferrite devices are discussed with a view to their incorporation as building blocks in telecommunications systems. The state of the art for each of these "newer" devices is reviewed, and telecommunications-oriented problems such as filtering are discussed. A compact telephone-pole-mounted microwave link repeater for frequencies over 10 GHz is used as an example of the overall system economics attained in using the devices discussed instead of the conventional link repeater construction techniques still prevalent today. (In Norwegian.)

40

New Materials for Electronics Uses, by K. Bløtekjaer (Faculty of Theoretical Electronics, Norwegian Institute of Technology, 7034 Trondheim, Norway); *Elektroteknisk Tidsskrift*, vol. 84, pp. 21-22, July 17, 1971.

Piezoelectric, electrooptic, and piezoelectric materials are reviewed and the mechanisms of electric fields, light, and acoustic waves in bulk materials are discussed. Examples are given of uses in the microwave region where optical and acoustical properties of materials are combined. (In Norwegian.)