



IEEE TRANSACTIONS ON

MICROWAVE THEORY AND TECHNIQUES

JANUARY 1984

VOLUME MTT-32

NUMBER 1

(ISSN 0018-9480)

A PUBLICATION OF THE IEEE MICROWAVE THEORY AND TECHNIQUES SOCIETY



PAPERS

An Alternative Procedure for Implementing the Desegmentation Method	<i>P. C. Sharma and K. C. Gupta</i>	1
Analysis of High-Speed GaAs Source-Coupled FET Logic Circuits	<i>M. Idda, T. Takada, and T. Sudo</i>	5
Scattering of Surface Waves on Transverse Discontinuities in Symmetrical Three-Layer Dielectric Waveguides	<i>K. Uchida and K. Aoki</i>	11
Finite-Element Analysis of Optical and Microwave Waveguide Problems	<i>B. M. A. Rahman and J. B. Davies</i>	20
Field Distribution of Two Conducting Posts in a Waveguide	<i>S. L. Lopuch and T. K. Ishii</i>	29
Design of Multisection Impedance-Matched Dielectric-Slab Filled Waveguide Phase Shifters	<i>F. Arndt, J. Bornemann, and R. Vahldieck</i>	34
Rectangular Bars Coupled Through a Finite-Thickness Slot	<i>J. H. Cloete</i>	39
Experimental Study of the W-Band Dielectric Guide Y-Branch Interferometer	<i>A. Axelrod and M. Kisliuk</i>	46
Properties of the Symmetrical Five-Port Circuit and Its Broad-Band Design	<i>D. I. Kim, K. Araki, and Y. Naito</i>	51
A 125-260-GHz Gyrotron	<i>G. F. Brand, N. G. Douglas, M. Gross, J. Y. L. Ma, L. C. Robinson, and C. Zhiyi</i>	58
An Analysis of a Hybrid-Mode in a Twisted Rectangular Waveguide	<i>H. Yabe and Y. Mushiaki</i>	65
2-20 GHz GaAs Traveling-Wave Amplifier	<i>Y. Ayasli, L. D. Reynolds, Jr., J. L. Vorhaus, and L. K. Hanes</i>	71
A Dual Six-Port Network Analyzer Using Diode Detectors	<i>J. R. Juroshek and C. A. Hoer</i>	78
Accurate Wide-Range Design Equations for the Frequency-Dependent Characteristics of Parallel Coupled Microstrip Lines	<i>M. Kirshning and R. H. Jansen</i>	83
Dispersion Characteristics of Twisted Rectangular Waveguides	<i>H. Yabe, K. Nishio, and Y. Mushiaki</i>	91
A Planar Quasi-Optical Subharmonically Pumped Mixer Characterized by Isotropic Conversion Loss	<i>K. D. Stephan and T. Itoh</i>	97
The Microstrip Open-Ring Resonator	<i>I. Wolff and V. K. Tripathi</i>	102

SHORT PAPERS

Characteristics of Some Asymmetrical Coupled Transmission Lines	<i>S. S. Bedair</i>	108
Plasma-Dielectric Sandwich Structure Used as a Tunable Bandpass Microwave Filter	<i>G.-C. Tai, C. H. Chen, and Y.-W. Kiang</i>	111
Dielectric Waveguide Corner and Power Divider with Metallic Reflector	<i>K. Ogusu</i>	113
Broadside-Coupled Slot-Line Field Components	<i>R. N. Simons</i>	116
Radar-Echo Location of Conducting Spheres in Waveguide	<i>P. I. Somlo</i>	120
Propagation on a Sheath Helix in a Coaxially Layered Lossy Dielectric Medium	<i>M. J. Hagmann</i>	122
Impedance Calculation of Three Narrow Resonant Strips on the Transverse Plane of a Rectangular Waveguide	<i>K. Chang</i>	126
Accurate Approximations for a Function Appearing in the Analysis of Microstrip	<i>E. F. Kuester</i>	131
W-Band Low-Insertion-Loss E-Plane Filter	<i>R. Vahldieck, J. Bornemann, F. Arndt, and D. Grauerholz</i>	133
S- and X-Band GaAs FET Mixers with Thin-Film Lumped Elements	<i>H. Ohnishi and S. Yamashita</i>	135

PATENT ABSTRACTS	<i>N. R. Dietrich</i>	139
------------------------	-----------------------	-----

IEEE COPYRIGHT FORM		143
---------------------------	--	-----



IEEE MICROWAVE THEORY AND TECHNIQUES SOCIETY

The Microwave Theory and Techniques Society is an organization, within the framework of the IEEE, of members with principal professional interest in the field of microwave theory and techniques. All members of the IEEE are eligible for membership in the Society and will receive this TRANSACTIONS upon payment of the annual Society membership fee of \$8.00. Affiliate membership is available upon payment of the annual affiliate fee of \$22.00, plus the Society fee of \$8.00. For information on joining write to the IEEE at the address below.

ADMINISTRATIVE COMMITTEE

H. G. OLTMAN, JR., *President*

H. HOWE, JR., *Vice President*

N. W. COX, *Secretary-Treasurer*

J. E. DEGENFORD, JR.
V. G. GELNOVATCH
P. T. GREILING
R. B. HICKS
H. HOWE, JR.

T. ITOH
F. IVANEK
G. JERINIC
R. H. KNERR
Y. KONISHI

H. J. KUNO
S. L. MARCH
D. N. MCQUIDDY, JR.
E. C. NIEHENKE
J. M. ROE

F. J. ROSENBAUM*
C. T. RUCKER*
R. A. SPARKS*
B. E. SPIELMAN

* *Ex officio (past presidents)*

Honorary Life Members

Distinguished Lecturers

A. C. BECK
S. B. COHN

D. D. KING
W. W. MUMFORD

A. A. OLINER
T. S. SAAD

K. TOMIYASU
L. YOUNG

J. A. GORDMAINE
S. ADAM

S-MTT Chapter Chairmen

Albuquerque: R. L. GARDNER
Atlanta: J. A. FULLER
Baltimore: PETER D. HRYCAK
Benelux: A. GUISSARD
Boston: CARL D. BERGLUND
Boulder/Denver: C. T. JOHNS
Buffalo: INACTIVE
Canaveral: G. G. RASSWEILER
Central Illinois: G. E. STILLMAN
Chicago: S. S. SAAD
Columbus: N. WANG
Connecticut: INACTIVE
Dallas: R. E. LEHMANN
Florida West Coast: M. MOCZYNSKI

Houston: S. LONG
Huntsville: INACTIVE
India: B. BHAT
Israel: A. MADJAR
Kitchener-Waterloo: Y. L. CHOW
Los Angeles: F. J. BERNUES
Milwaukee: C. J. KOTLARZ
Montreal: J. L. LEIZEROWICZ
New Jersey Coast: RUSSELL A. GILSON
New York/Long Island: J. HAUSNER
North Jersey: M. SCHNEIDER
Orange County: INACTIVE
Orlando: C. F. SCHUNEMANN
Ottawa: J. WIGHT

Philadelphia: C. C. ALLEN
Phoenix: LEX AKERS
Portland: INACTIVE
Princeton: WALTER SLUSARK
San Diego: J. H. ZICKGAF
Santa Clara Valley: P. T. HO
Schenectady: J. BORREGO
Seattle: C. K. CHOU
Southeastern Michigan: P. I. PRESSEL
St. Louis: CURTIS E. LARSON
Syracuse: B. K. MITCHELL
Tokyo: T. OKOSHI
Tucson: INACTIVE
Washington, DC: J. H. DOUGLAS

IEEE TRANSACTIONS® ON MICROWAVE THEORY AND TECHNIQUES

Editor

T. ITOH

Associate Editors

N. R. DIETRICH
(*Patent Abstracts*)

F. IVANEK

E. YAMASHITA
(*Abstracts Editor—Asia*)

Address all manuscripts to the Editor, T. Itoh, Dept. of Electrical Engineering, University of Texas at Austin, Austin, TX 78712. Submission of four copies of manuscripts, including figures, will expedite the review. *Publication Policy* All papers will be reviewed for their technical merit, and decisions to publish will be made independently of an author's ability or willingness to pay charges. Voluntary page charges of \$95 per printed page will be requested for papers of five pages or less. Page charges of \$100 per page are mandatory for each page in excess of five printed pages. Also, the MTT-S Administrative Committee has established a quota for the number of pages printed in each issue of this TRANSACTIONS whose costs are not defrayed by payment of page charges. Papers not covered by page charges may be delayed until space in an issue is available. The Editor can waive the quota requirement for exceptional papers or because of other extenuating circumstances.

THE INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, INC.

Officers

RICHARD J. GOWEN, *President*
DONALD D. KING, *President-Elect*
HENRY L. BACHMAN, *Executive Vice President*
CYRIL J. TUNIS, *Treasurer*
V. PRASAD KODALI, *Secretary*

J. BARRY OAKES, *Vice President, Educational Activities*
RUSSEL C. DREW, *Vice President, Professional Activities*
JOSE B. CRUZ, JR., *Vice President, Publication Activities*
MERRILL W. BUCKLEY, JR., *Vice President, Regional Activities*
STEPHAN KAHNE, *Vice President, Technical Activities*

EMERSON W. PUGH, *Division IV Director*

Headquarters Staff

ERIC HERZ, *Executive Director and General Manager*
ELWOOD K. GANNETT, *Deputy General Manager*

THOMAS W. BARTLETT, *Controller*
DONALD CHRISTIANSEN, *Editor of Spectrum*
IRVING ENGELSON, *Staff Director, Technical Activities*
LEO FANNING, *Staff Director, Professional Activities*
SAYA SHERR, *Staff Director, Standards*

DAVID L. STAIGER, *Staff Director, Publishing Services*
CHARLES F. STEWART, JR., *Staff Director, Administration Services*
DONALD L. SUPPERS, *Staff Director, Field Services*
THOMAS C. WHITE, *Staff Director, Public Information*
JOHN F. WILHELM, *Staff Director, Professional Activities*

Publications Department

Production Managers: ANN H. BURGMAYER, CAROLYN ELENOWITZ, GAIL S. FERENC
Associate Editor: WILLIAM J. HAGEN

IEEE TRANSACTIONS ON MICROWAVE THEORY AND TECHNIQUES is published monthly by The Institute of Electrical and Electronics Engineers, Inc. **Headquarters:** 345 East 47 Street, New York, NY 10017. Responsibility for the contents rests upon the authors and not upon the IEEE, the Society, or its members. **IEEE Service Center** (for orders, subscriptions, address changes, Region/Section/Student Services): 445 Hoes Lane, Piscataway, NJ 08854. **Telephones:** Headquarters 212-705 + extension: Information -7900, General Manager -7910, Controller -7748, Educational Services -7860, Publishing Services -7560, Standards -7960, Technical Services -7890. IEEE Service Center 201-981-0060. Professional Services: Washington Office 202-785-0017. NY **Telecopier:** 212-752-4929. **Telex:** 236-411 (International messages only). Individual copies: IEEE members \$6.00 (first copy only), nonmembers \$12.00 per copy. Annual subscription price: IEEE members, dues plus Society fee. Price for nonmembers on request. Available in microfiche and microfilm. **Copyright and Reprint Permission:** Abstracting is permitted with credit to the source. Libraries are permitted to photocopy beyond the limits of U.S. Copyright law for private use of patrons: (1) those post-1977 articles that carry a code at the bottom of the first page, provided the per-copy fee indicated in the code is paid through the Copyright Clearance Center, 29 Congress Street, Salem, MA 01970; (2) pre-1978 articles without fee. Instructors are permitted to photocopy isolated articles for noncommercial classroom use without fee. For other copying, reprint or republication permission, write to Director, Publishing Services at IEEE Headquarters. All rights reserved. Copyright © 1984 by The Institute of Electrical and Electronics Engineers, Inc. Printed in U.S.A. Second-class postage paid at New York, NY and at additional mailing offices. **Postmaster:** Send Address changes to IEEE, 445 Hoes Lane, Piscataway, NJ 08854.