



# IEEE TRANSACTIONS ON MICROWAVE THEORY AND TECHNIQUES

NOVEMBER 1983

VOLUME MTT-31

NUMBER 11

(ISSN 0018-9480)

A PUBLICATION OF THE IEEE MICROWAVE THEORY AND TECHNIQUES SOCIETY



---

## PAPERS

Submillimeter-Wave Receivers—A Status Report (Invited Paper) .....	<i>W. J. Wilson</i>	873
Fundamental and Harmonic Operation of Millimeter-Wave Gunn Diodes .....	<i>W. H. Haydl</i>	879
A Planar Electrooptic Beam Splitter with a Zig-Zag Electrode .....	<i>C. L. Lee, J. S. Horng, and C. H. Huang</i>	890
A New Stacked Two-Dimensional Spectral Iterative Technique (SIT) for Analyzing Microwave Power Deposition in Biological Media .....	<i>R. Kastner and R. Mittra</i>	898
Experimental Properties of Three-Cavity Tunnel Diode RF Oscillators .....	<i>L. E. Campisi and W. O. Hamilton</i>	905
Numerical Analysis of Shielded Coplanar Waveguides .....	<i>D. A. Rowe and B. Y. Lao</i>	911
Theory and Measurement of Back Bias Voltage in IMPATT Diodes .....	<i>L. H. Holway, Jr. and S. L. Chu</i>	917
Scattering of Guided Modes Caused by an Arbitrarily Shaped Broken End in Dielectric Slab Waveguide .....	<i>E. Nishimura, N. Morita, and N. Kumagai</i>	923
Complex Gyrator Circuits of Planar Circulators Using Higher Order Modes in a Disk Resonator .....	<i>J. Helszajn</i>	931

---

## SHORT PAPERS

Rectangular Waveguide with Two Double Ridges .....	<i>D. Dasgupta and P. K. Saha</i>	938
Mutual Impedance Computation Between Microstrip Antennas .....	<i>E. H. Newman, J. H. Richmond, and B. W. Kwan</i>	941
Analysis of the Hybrid Modes from Eccentrically Cladded Fiber .....	<i>A. Lyras, J. A. Roumeliotis, J. D. Kanellopoulos, and J. G. Fikioris</i>	945
An Accurate Determination of Dielectric Loss Effect in Monolithic Microwave Integrated Circuits Including Microstrip and Coupled Microstrip Lines .....	<i>D. Mirshekar-Syahkal</i>	950
Mathematical Representation of Microwave Oscillator Characteristics by Use of the Rieke Diagram .....	<i>K. Fukumoto, M. Nakajima, and J. Ikenoue</i>	954
Single-Mode Fiber Design for Minimum Dispersion .....	<i>P. S. M. Pires and D. A. Rogers</i>	959
Noise Due to Pulse-to-Pulse Incoherence in Injection-Locked Pulsed Microwave Oscillators .....	<i>D. Anderson, T. Lewin, and M. Lisak</i>	963

---

PATENT ABSTRACTS .....	<i>N. R. Dietrich</i>	965
------------------------	-----------------------	-----



## 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

C. T. RUCKER, *President*

S. F. ADAM\*  
J. E. DEGENFORD, JR.  
V. G. GELNOVATCH  
P. T. GREILING  
R. B. HICKS

\* *Ex officio (past presidents)*

A. C. BECK  
S. B. COHN

D. D. KING  
W. W. MUMFORD

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

H. HOWE, JR.  
T. ITOH  
F. IVANEK  
G. JERINIC  
R. H. KNERR

*Honorary Life Members*

A. A. OLINER  
T. S. SAAD

N. W. COX, *Secretary-Treasurer*

Y. KONISHI  
H. J. KUNO  
S. L. MARCH  
D. N. MCQUIDDY, JR.  
E. C. NIEHENKE

J. M. ROE  
F. J. ROSENBAUM\*  
R. A. SPARKS\*  
B. E. SPIELMAN

*Distinguished Lecturers*

K. TOMIYASU  
L. YOUNG

J. A. GIORDMAINE  
S. ADAM

### S-MTT Chapter Chairmen

Albuquerque: R. L. GARDNER  
Atlanta: J. A. FULLER  
Baltimore: PETER D. HRYCAK  
Benelux: A. GUSSARD  
Boston: CARL D. BERGLUND  
Boulder/Denver: C. T. JOHNK  
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. LEZEROWICZ  
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

N. R. DIETRICH  
(*Patent Abstracts*)

#### Associate Editors

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

JAMES B. OWENS, *President*  
RICHARD J. GOWEN, *President-Elect*  
CHARLES A. ELDON, *Executive Vice President*  
CYRIL J. TUNIS, *Treasurer*  
V. PRASAD KODALI, *Secretary*

J. BARRY OAKES, *Vice President, Educational Activities*  
EDWARD J. DOYLE, *Vice President, Professional Activities*  
G. P. RODRIGUE, *Vice President, Publication Activities*  
MERRILL W. BUCKLEY, JR., *Vice President, Regional Activities*  
JOSE B. CRUZ, JR., *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*  
SAVA 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. BURGMEYER, 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 © 1983 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.