



IEEE TRANSACTIONS ON

MICROWAVE THEORY AND TECHNIQUES

JULY 1985

VOLUME MTT-33

NUMBER 7

(ISSN 0018-9480)

A PUBLICATION OF THE IEEE MICROWAVE THEORY AND TECHNIQUES SOCIETY



PAPERS

A New Four-Port Automatic Network Analyzer: Part I—Description and Performance	<i>K. Brantervik and E. Kollberg</i>	563
A New Four-Port Automatic Network Analyzer: Part II—Theory	<i>K. Brantervik</i>	569
Finite-Element Analysis of Dielectric Waveguides with Curved Boundaries	<i>D. Welt and J. Webb</i>	576
Microwave Measurement of Dielectric Properties of Low-Loss Materials by the Dielectric Rod Resonator Method	<i>Y. Kobayashi and M. Katoh</i>	586
Stability of the Oscillation Mode in Multiple-Oscillator System	<i>S. Hamaya</i>	593
Circuit Analysis and Design of Radial Pretuned Modules Used for Millimeter-Wave Oscillators	<i>A. C. Derycke and G. Salmer</i>	600
A Continuously Tunable 65–115-GHz Gunn Oscillator	<i>J. E. Carlstrom, R. L. Plambeck, and D. D. Thornton</i>	610
Linearity Limits of the Varactor-Controlled Osc-Mod Circuits	<i>D. Kajfez and E. J. Hwan</i>	620
Circuit Design of the Loaded-Line Phase Shifter	<i>H. A. Atwater</i>	626

SHORT PAPERS

The Finite-Element Method for Finding Modes of Dielectric-Loaded Cavities	<i>J. P. Webb</i>	635
Large-Signal Microwave Performance Prediction of Dual-Gate GaAs MESFET Using an Efficient and Accurate Model	<i>A. Madjar and J. Dreifuss</i>	639
Analysis of Asymmetric Coupled Striplines	<i>T. Kitazawa and R. Mittra</i>	643
Focused Heating in Cylindrical Targets: Part I	<i>J. R. Wait</i>	647
Convergence of Local and Average Values in Three-Dimensional Moment-Method Solutions	<i>M. J. Hagmann and R. L. Levin</i>	649
E-Plane Integrated Parallel-Strip Screen Waveguide Filters	<i>F. Arndt, J. Beike, D. Grauerholz, C. Lingemann, and J. Bornemann</i>	654

PATENT ABSTRACTS	<i>J. J. Daly</i>	660
------------------------	-------------------	-----



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 \$24.00, plus the Society fee of \$8.00. For information on joining write to the IEEE at the address below.

ADMINISTRATIVE COMMITTEE

H. HOWE, JR., <i>President</i>		R. H. KNERR, <i>Vice President</i>		P. W. STAECKER, <i>Secretary-Treasurer</i>	
N. W. COX	H. HOWE, JR.	R. S. KAGIWADA	S. L. MARCH	M. V. SCHNEIDER	
V. G. GELNOVATCH	T. ITOH	R. H. KNERR	D. N. MCQUIDDY, JR.	B. E. SPIELMAN	
P. T. GREILING	F. IVANEK	H. J. KUNO	E. C. NIEHENKE	S. J. TEMPLE	
	G. JERINIC	R. LEVY	J. E. RAUE		

* *Ex officio (past presidents)*

A. C. BECK
S. B. COHN

Honorary Life Members

W. W. MUMFORD

A. A. OLINER
T. S. SAAD

Distinguished Lecturers

K. TOMIYASU
L. YOUNG

K. L. CARR
P. T. GREILING
S. WEINREB

S-MTT Chapter Chairmen

Albuquerque: C. W. JONES
Atlanta: J. D. NORGARD
Baltimore: J. A. FAULKNER, JR.
Benelux: A. GUISSARD
Buffalo: INACTIVE
Canaveral: E. P. VALKENBURG
Central Illinois: G. E. STILLMAN
Central New England/Boston: S. TEMPLE
Chicago: J. BLUBAUGH
Columbus: J. D. YOUNG
Connecticut: M. GILDEN
Dallas: J. HINTON
Denver-Boulder: G. R. OLHOEFT
Florida West Coast: J. C. CHU
Houston: S. A. LONG
Huntsville: M. D. FAHEY

India: B. BHAT
Israel: A. MADJAR
Kitchener-Waterloo: Y. L. CHOW
Los Angeles: D. W. BALL
Middle & South Italy: R. SORRENTINO
Milwaukee: A. KRAUSKA
Montreal: J. L. LEIZEROWICZ
New Jersey Coast: N. J. WILSON
New York/Long Island: R. KAMINSKY
North Jersey: R. V. SNYDER
Orange County: J. C. AUKLAND
Orlando: F. P. WILCOX
Ottawa: J. S. WIGHT
Philadelphia: A. AFRASHTEH
Phoenix: C. E. WEITZEL
Portland: M. H. MONNIER

Princeton: A. K. SHARMA
San Diego: D. T. GAVIN
San Fernando Valley: H. POMERANTZ
Santa Clara Valley/San Francisco: L. A. STARK
Schenectady: J. BORREGO
Seattle: D. G. DOW
Southeastern Michigan: D. K. REINHARD
St. Louis: D. GRANTEER
Sweden: E. L. KOLLBERG
Switzerland: F. E. GARDIOL
Syracuse: J. C. RAUTIO
Tokyo: E. YAMASHITA
Tucson: E. P. PIERCE
Twin Cities: C. R. SEASHORE
Utah/Salt Lake City: M. F. ISKANDER
Washington/Northern Virginia: M. ZISSERSON
West Germany: N. J. KEEN

IEEE TRANSACTIONS® ON MICROWAVE THEORY AND TECHNIQUES

Editor

T. ITOH

Associate Editors

J. J. DALY
(*Patent Abstracts*)

F. IVANEK

M. AKAIKE
(*Abstracts Editor—Asia*)

THE INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, INC.

Officers

CHARLES A. ELTON, *President*
BRUNO O. WEINSCHL, *President-Elect*
MERLIN G. SMITH, *Executive Vice President*
HENRY L. BACHMAN, *Treasurer*
WALTER E. PROEBSTER, *Secretary*

CYRIL J. TUNIS, *Vice President, Educational Activities*
RUSSEL C. DREW, *Vice President, Professional Activities*
JOSE B. CRUZ, JR., *Vice President, Publication Activities*
DENNIS BODSON, *Vice President, Regional Activities*
STEPHAN KAHNE, *Vice President, Technical Activities*

KIYO TOMIYASU, *Director, Division IV, Electromagnetics and Radiation*

Headquarters Staff

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

THOMAS W. BARTLETT, *Controller*
DONALD CHRISTIANSEN, *Editor, IEEE 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 TAMNEY, 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 © 1985 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 TRANSACTIONS ON MICROWAVE THEORY AND TECHNIQUES, 445 Hoes Lane, Piscataway, NJ 08854