



IEEE TRANSACTIONS ON MICROWAVE THEORY AND TECHNIQUES

NOVEMBER 1977

VOLUME MTT-25

NUMBER 11

A PUBLICATION OF THE IEEE MICROWAVE THEORY AND TECHNIQUES SOCIETY



ACCENT ON THEORY

PAPERS

- Fundamental Limits on Conversion Loss of Double Sideband Resistive Mixers *A. J. Kelly* 867
- Analysis of Frequency-Conversion Techniques in Measurements of Microwave Transistor Noise Temperatures *G. Caruso and M. Sannino* 870
- Numerical Analysis of the Rectangular Dielectric Waveguide and Its Modifications *K. Ogusu* 874
- Solutions of the Vector Wave Equation for Inhomogeneous Dielectric Cylinders—Scattering in Waveguide *G. Cicconi and C. Rosatelli* 885
- Some Effects of Field Perturbation upon Cavity-Resonance and Dispersion Measurements on MIC Dielectrics *P. H. Ladbrooke* 892
- Analysis of an Inhomogeneously Loaded Rectangular Waveguide with Dielectric and Metallic Losses *F. Gauthier, M. Besse, and Y. Garault* 904
- Dispersion in Shielded Planar Transmission Lines on Two-Layer Composite Substrate *P. K. Saha* 907
- Random Discrete Imperfections in Millimeter Waveguide Systems *G. Falciasecca and S. Rogai* 911
- Accurate Resonant Frequencies of Dielectric Resonators *P. Guillon and Y. Garault* 916
- Coupling Between Guided Surface Waves, Lateral Waves, and the Radiation Fields by Rough Surfaces—Full-Wave Solutions *E. Bahar* 923
- Traveling Waves in Coupled Yagi Structures *C. C. Lee and L. C. Shen* 931
- Coupling of Circuit Structures to Magnetostatic Modes of Ferromagnetic Resonators *N. J. Moll* 933
- Further Studies on the Microwave Auditory Effect *J. C. Lin* 938
- Theoretical Analysis of Acoustic Signal Generation in Materials Irradiated with Microwave Energy *D. E. Borth and C. A. Cain* 944
- Input Impedance of Coaxial Line to Circular Waveguide Feed *M. D. Deshpande and B. N. Das* 954

LETTERS

- Perturbation Theory Generalized to Arbitrary (p , l) Modes in a Fabry-Perot Resonator *C. W. Erickson* 958
- Correction to "Coupled Transmission Lines" *M. Kumar and B. N. Das* 958

COMPUTER PROGRAM DESCRIPTIONS

- Planar Network Analysis Programs—PNAP1 and PNAP2 *P. Silvester and A. Konrad* 959

-
- CONTRIBUTORS 960
-



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 \$20.00. For information on joining write to the IEEE at the address below.

ADMINISTRATIVE COMMITTEE

L. R. WHICKER, <i>President</i>	H. SOBOL, <i>Vice President</i>	B. E. SPIELMAN, <i>Secretary-Treasurer</i>
S. F. ADAM	J. E. DEGENFORD, JR.	H. G. OLTMAN, JR.
J. L. ALLEN	J. B. HORTON	D. PARKER
J. C. AUKLAND	F. H. HOWE	R. A. RIVERS*
K. J. BUTTON	E. L. KOMAREK	G. P. RODRIGUE*
H. W. COOPER*	H. J. KUNO	C. T. RUCKER

* *Ex officio (past presidents)*

Honorary Life Members

A. C. BECK	W. W. MUMFORD	K. TOMIYASU
D. D. KING	T. S. SAAD	F. STERZER
		J. M. OSEPCCHUCK

National Lecturer

S-MTT Chapter Chairmen

Albuquerque	C. E. BAUM	India	D. P. SETH	Phoenix	R. S. STRAWN
Atlanta	C. E. RYAN, JR.	Israel	Y. HIPSH	Portland	P. P. FASANG
Baltimore	B. D. GELLER	NY/Long Island	J. A. MEZAK	Princeton	R. L. CAMISA
Benelux	E. J. MAANDARES	Los Angeles Council	H. POMERANZ	St. Louis	L. MEDGYESI-MITSCHANG
Boston	(interim)	Milwaukee	R. C. GARNIER	San Diego	G. SCHAFFNER
Denver	C. T. JOHNK	Montreal	GAR LAM YIP	Santa Clara V./O-EB/SF	J. P. ROONEY
Central Illinois	G. E. STILLMAN	N. J. Coast	L. G. COHEN	Schenectady	J. R. ESHBACH
Chicago	G. A. BOWMAN	North Jersey	E. W. NIEMIEC	Seattle	G. L. MITCHELL
Columbus	WALTER D. BURNSIDE	Orange County	J. C. AUKLAND	S. E. Michigan	W. J. FLEMING
Dallas	T. B. CANNON	Orlando	D. N. BOWYER	Syracuse	D. L. BINSLEY
Florida West Coast	W. E. CLAUSEN	Ottawa		Tokyo, Japan	T. MAKIMOTO
Houston	S. A. LONG	Philadelphia	J. J. CAMPBELL	Washington, DC	G. KANTOR
Huntsville	M. D. FAHEY				

IEEE TRANSACTIONS® ON MICROWAVE THEORY AND TECHNIQUES

Editor

J. L. ALLEN	H. G. OLTMAN, JR.	J. E. DEGENFORD, JR.	B. PERLMAN	M. CAULTON	T. OKOSHI	H. E. SCHRANK
	(Applications)	(Business Editor)	(Computer Program Descriptions)	(Special Issues)	(Abstracts Editor—Asia)	(Institutional Listing)

Associate Editors

Address all manuscripts to the Editor, J. L. Allen, Electrical and Electronic Systems, University of South Florida, Tampa, FL 33620. Submission of three 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 \$70 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

ROBERT M. SAUNDERS, <i>President</i>	JOHN J. GUARRERA, <i>Vice President, Professional Activities</i>
CARLETON A. BAYLESS, <i>Executive Vice President</i>	DOUGLAS M. HINTON, <i>Vice President, Regional Activities</i>
ROBERT D. BRISKMAN, <i>Secretary-Treasurer</i>	IRENE C. PEDEN, <i>Vice President, Educational Activities</i>
FRANKLIN H. BLECHER, <i>Vice President, Technical Activities</i>	JEROME J. SURAN, <i>Vice President, Publication Activities</i>

RICHARD W. DAMON, *Division IV Director*

Headquarters Staff

THOMAS W. BARTLETT, <i>Controller</i>	RICHARD M. EMBERSON, <i>Executive Director and Acting General Manager</i>
DONALD CHRISTIANSEN, <i>Editor of Spectrum</i>	ELWOOD K. GANNETT, <i>Staff Director, Publishing Services</i>
(RICHARD M. EMBERSON), <i>Staff Director, Educational, Field, Standards, and Technical Services</i>	JOHN M. KINN, JR., <i>Staff Director, Professional Services</i>
	NEIL D. PUNDIT*, <i>Director, Technical Activities</i>
	CHARLES F. STEWART, JR., <i>Staff Director, Administration Services</i>

* Name legally changed from Narendra P. Dwivedi.

Publications Department

H. JAMES CARTER, <i>Manager, Publication Production</i>
<i>Supervisors, Publication Production:</i> ANN H. BURGMAYER, CAROLYNE ELENOWITZ, GAIL S. FERENC*
<i>Associate Editors:</i> LINDA GRADY-TROIA, PRIJONO HARDJOWIROGO, JOSEPH MORSICATO, KALLIE ZAPITI

* Responsible for this Transactions

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): 445 Hoes Lane, Piscataway, NJ 08854. **Telephones:** Headquarters 212-644 + extension: Information -7900, General Manager -7910, Controller -7748, Educational Services -7860, Publishing Services -7560, Region/Section Services -7750, Standards -7960, Technical Services -7890. IEEE Service Center 201-981-0060. Washington Office/Professional Services 202-785-0017. Individual copies: IEEE members \$5.00 (first copy only), nonmembers \$10.00 per copy. Annual subscription price: IEEE members, dues plus Society fee. Price for nonmembers on request. Available in microfiche and microfilm. Abstracting is permitted with mention of source. For republication permission write to Director, Publishing Services at IEEE Headquarters. All rights reserved. Copyright © 1977 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.