



The Institute of Electrical and Electronics Engineers

Incorporated

Microwave Theory and Technique Group 1967 Microwave Prize

to

Robert J. Wenzel

for a very significant contribution to the field of endeavor of the IEEE G-MTT in his paper entitled "Theoretical and Practical Applications of Capacitance Matrix Transformations to TEM Network Design" published in the IEEE TRANSACTIONS on Microwave Theory & Techniques, Volume MTT-14, No. 12 December 1966.

May 1968



John W. Calhoun
Chairman, G-MTT Awards Committee

Rudy Henning
Chairman, G-MTT

1968 International Microwave Symposium

THE ANNUAL IEEE International Microwave Symposium was held in Detroit, Michigan, on May 20-22, 1968. This important meeting of our professional group serves as the basis of stimulating and disseminating new techniques in the microwave field. This year's meeting was the first to be held in the Midwest and was hosted by the Southeastern Michigan chapter of the professional group; the registered attendance was 493.

The three-day program included several outstanding presentations. The ADCOM chairman, Rudy Henning, gave the welcoming address after having been introduced by J. E. Rowe, co-chairman of the Symposium Steering Committee. Featured at the luncheon on Monday was a very interesting review of his recent four-month visit to the U.S.S.R. by Prof. Rowe, chairman of the Department of

Electrical Engineering, The University of Michigan. Two special sessions were arranged for Monday evening on the subjects of computer-aided design of microwave networks, and solid-state control devices. On Tuesday evening at the banquet, the featured speaker was Dr. W. A. Geoffrey Voss of the University of Alberta and the International Microwave Power Institute, who spoke on the topic "Of Baking and Biology." In addition to these highlights, the three-day technical program consisted of 41 contributed papers and 4 invited papers.

LUNCHEON

Prof. Rowe at the luncheon reviewed for the more than 200 attendees his recent visit to the U.S.S.R. during which he lectured and toured within Soviet research activities in the



ADCOM Chairman R. Henning presents the 1967 Microwave Prize Award to R. J. Wenzel.

fields of electron and solid-state microwave devices and high-density plasmas. His visit was arranged by the U. S. National Academy of Sciences and the Soviet Academy of Sciences as part of a scientific exchange program. During his presentation, many colorful slides were shown of research institutes and universities in Moscow, Kiev, Leningrad, Novosibirsk, and Vilnius, Lithuania. He discussed in detail current Soviet educational programs and related them to similar U. S. activities, and discussed the scientific climate in the Soviet Union and the general welfare of the Soviet citizen.

PARALLEL EVENING SESSIONS

The Monday evening session on computer-aided design of microwave networks was organized by W. J. Getsinger of M.I.T. Lincoln Laboratory. The panel and guest speakers included R. Anderson, M. O'Hagen, H. Stinehelfer, and L. Young. Each member gave a 15-minute review of his recent activities in the application of computers to the design of microwave networks. The panel then heard questions and critique from the approximately 125 attendees. Following this, short 5-minute presentations of recent results using computer-aided design of microwave networks were given by J. W. Bandler, R. R. Gupta, K. Johnson, A. Kessler, J. Knapp, A. Smoll, C. P. Tresselt, and J. Verzino. An observation in regard to this session, made by J. W. Bandler and A. Wexler and appearing in the July, 1968, G-MTT *Newsletter*, perhaps bears repeating: "We encountered both a keen interest in computer-aided design and a lack of under-

standing of its basic philosophy. There is a danger that the informal session may have tended to encourage those who see the computer as a lazy man's tool, thus winning over the lazy and antagonizing the hard working."

The parallel Monday evening session on the topic of solid-state control devices was chaired by D. K. Adams and was equally well attended. The panelists and guest speakers at this session were E. Stern, N. J. Brown, R. V. Garver, S. P. Clark, J. E. Pippin, M. D. Sohigian, and R. G. Forest. The panel and guest speakers gave brief presentations on the design and application of high- and low-power microwave control devices using ferrite and semiconductor diode techniques. The panel then discussed fundamental limitations, performance, and cost for devices such as phase shifters, switches, circulators, duplexers, and limiters. A lively discussion, with several questions and comments from the floor, followed the panel discussion in regard to these topics. Several contributors from the audience gave short 5-minute capsule summaries of their recent work in the field of solid-state control devices. Both of the parallel evening sessions continued to approximately 11:30 PM.

BANQUET

On Tuesday evening, approximately 200 attendees turned out for the annual banquet which was chaired by Bill Bazzay as toastmaster. George Haddad introduced the foreign guests and dignitaries, who included:

Walter Baier, Technical University, Munich
 Ye. V. Bogdanov, U.S.S.R. Academy of Sciences
 James W. Crompton, Weapons Research Establishment, South Australia
 Brian Easter, University College of North Wales
 Tore T. Fjällbrant, L. M. Ericson, Sweden
 J. Magarshack, Radioteknique, France
 Tatsuo Miyakawa, Fujitsu Ltd., Kawasaki, Japan
 Olaf Schreiber, AEG-Telefunken, 79 Uln, Germany
 J. Snieder, National Defense Research Organization, The Hague, Netherlands
 Hans Georg Unger, Technische Universität, Braunschweig, Germany.

This year, for the first time, a recognition plaque was presented to the 1967 G-MTT National Lecturer, Art Oliner, by Rudy Henning, ADCOM Chairman. Rudy also announced that Leo Young holds the National Lecturer position this year, and he then made the presentation of the 1967 Microwave Prize award to R. J. Wenzel for his paper, "Theoretical and Practical Applications of Capacitance Matrix Transformations to TEM Network Design." Dr. W. A. Geoffrey Voss was then introduced as the featured speaker and gave a dynamic lecture emphasizing the importance, the future, and the problems associated with the field of microwave power applications.

TECHNICAL SESSIONS

The 45 technical papers were divided into six sessions during the three-day meeting.



The 1968 G-MTT Steering Committee.

Microwave Networks

The session on microwave networks was chaired by R. J. Wenzel. The paper by T. T. Fjällbrant analyzed types of microwave filters which incorporate reactive ladders with hybrids in a manner such as to realize nonminimum phase response. Two papers dealing with multi octave circuits and devices were presented: R. C. Van Wagoner discussed mixer circuits capable of operation throughout 20:1 bandwidths, and P. C. Goodman presented a stripline matched power divider having isolated output ports. A rigorous treatment of the isolated performance of multi aperture directional couplers was given by R. Levy. Three papers dealing with the calculation of the performance of strip transmission lines (W. Baier) and waveguides (M. A. K. Hamid; M. J. Beauvien and A. Wexler) completed the morning session.

Solid-State Microwave Power Generation

The chairman of this session was B. C. De Loach, Jr., who acted also as moderator for an impromptu panel discussion of microwave power generation techniques. Two papers were given on avalanche diode oscillators; the first discussing their power and efficiency by W. J. Evans and G. I. Haddad, and the second discussing noise reduction techniques and frequency stability by E. F. Scherer. Incorporation of IMPATT diodes into an integrated radiating circuit was presented by H. W. Cooper, C. Moskowitz, M. R. Natale, and T. Andrews. A paper by J. Magarshack discussed Gunn oscillators which are stable at several predetermined frequencies, and the potential use of these devices for frequency memory. A discussion of varactor diodes included their use as an ultra-high-speed switch at 50 GHz by S. Sugimoto and their use in multiplier chains which incorporate feedback stabilization in noise reduction circuitry by C. L. Cuccia and A. Savarin.

Microwave Integrated Circuits

F. A. Brand was chairman of this session which started with an invited paper by R. Webster, who discussed various integration techniques useful throughout the microwave fre-

quency range and gave several examples of state-of-the-art forms of microwave integrated circuits. S. B. Cohn gave an illuminating presentation of a novel slot-line transmission medium which may find useful application in microwave integrated circuits. Three papers were given covering the analysis and behavior of microstrip transmission lines; one by C. P. Hartwig, D. Masse, and R. A. Pucel, regarding frequency dependence; a second by T. G. Bryant and J. A. Weiss on coupled-pair impedance; and a third by K. C. Wolters, P. L. Clar, and C. W. Stiles on analysis and experimental evaluation of overlay structures. K. M. Johnson described an *X*-band integrated mixer having a reactively terminated image frequency, and M. D. Bonfeld, M. J. Bonomi, and E. G. Jaasma discussed a delay-line type of integrated FM discriminator which incorporates circulators. *X*-band integrated diode phase shifters were discussed in a paper by R. G. Stewart and M. N. Giuliano.

Solid-State Devices

Three papers on parametric amplifiers led off this session which was chaired by S. Okwit: an *S*-band integrated paramp with flat gain and linear phase was described by H. C. Okean and H. Weingart; L. E. Dickens described a *K_a*-band paramp using planar varactors; and the calculation of distortion effects was described by D. R. Chambers and D. K. Adams. R. J. Taylor and C. R. Westgate described the evaluation of point-contact tunnel diodes. Incorporation of a transistor into a microwave filter was discussed by D. K. Adams and R. Y. Ho. The bulk response of semiconductor switches and phase shifters was reviewed by K. E. Mortenson. J. F. White, A. Armstrong, and J. Borrego, and microwave phase modulation using frequency multipliers was discussed by A. Markovic, B. Schiek, and H. G. Unger. The last paper in this session, by J. G. Smith and J. Wolczok, described an *S*-band TW maser.

Ferrite Components

The first paper in the ferrites session, chaired by N. Lipetz, presented the propagation analysis of ferrite-loaded wave-

guide having a longitudinal magnetization, by D. C. Buck. Three papers on circulators included one in *E*-plane waveguide by M. Omori; one incorporating composite junctions for high-power stripline application by C. R. Buffler and J. Helszajn; and a third describing advances in microstrip circulators by V. E. Dunn and A. J. Domenico. R. A. Stern and J. P. Agrios described a 500-kW *X*-band ferrite latching switch. W. E. Hord, F. J. Rosenbaum, and C. R. Boyd presented a design theory for Reggia-Spencer reciprocal phase shifters, and a reciprocal latching ferrite phase shifter in waveguide was described by I. Bardash and J. J. Maune. Several magnetically tunable microstrip filter structures were described by R. R. Jones, J. Cunningham, and K. Bullock, in concluding this session.

Microwave Acoustics and Millimeter- and Optical-Wave Components

The chairman, Leo Young, started this session with two invited papers on the subject of microwave ultrasonics: D. L. White discussed the principles of guidance of ultrasonic waveguide systems as a surface wave phenomenon and showed the correlation between theory and experiment; in the second paper, W. A. Crofut gave an excellent review of the state of the art of microwave acoustic transducers and delay devices. A paper describing the performance of YIG-

pulsed compression networks was given by W. L. Bongianni, J. Burnsweig, and J. H. Polson. Two papers covering the design of millimeter-wave and quasi-optic filters were given by B. M. Schiffman and L. Young; and by G. L. Matthaei and D. A. Leedom. R. Shubert and J. Harris described waveguide modes and interactions observed in thin films in the visible spectrum. Dielectric waveguides useful at IR wavelengths were described by D. B. Anderson and C. B. Shaw, Jr.

The fourth invited paper, by M. E. Hines on the subject of network integration approaches for high-power microwave generation, was given in this session because of an earlier scheduling problem. Mr. Hines reviewed the power limitations of solid-state devices and presented a novel approach to combining the outputs of large numbers of diode devices in a unified network.

CONCLUSION

This year's attendance at the 1968 G-MTT International Symposium was large despite the general economic problem affecting research and developmental advances in our profession. However, it is felt that this year's symposium was a technical success and provided the professional and stimulating atmosphere which initiates, fosters, and promulgates new microwave ideas for the future.