

This technique has been successfully applied to the design and construction of a 12-channel multicoupler in which each narrow band channel is independently tunable from 225-400 MHz [1]. The 12 tunable bandpass filters are connected to the main transmission line at physically convenient intervals. The frequency selective phase shift network, connected below the last filter, is obtained from the parallel connection of 12 tunable cavity resonators,

each of which is associated with one of the bandpass filters. Residual effects of bandstop filters in the main transmission line are avoided, and the required phase shift is independently adjustable for each bandpass channel.

REFERENCES

[1] Australian patent 480994.

Contributors

Lynn R. Caldwell, photograph and biography not available at the time of publication.

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Carl H. Durney (S'60-M'64) was born in Blackfoot, ID, on April 22, 1931. He received the B.S. degree in electrical engineering from Utah State University, Logan, in 1958, and the M.S. and Ph.D. degrees in electrical engineering from the University of Utah, Salt Lake City, in 1961 and 1964, respectively.

From 1958 to 1959 he was employed as an Associate Research Engineer with the Boeing Airplane Company, Seattle, WA, where he studied the use of delay lines in control systems. He has been with the University of Utah since 1963, when he was appointed to be Assistant Research Professor in electrical engineering. From 1965 to 1966 he was employed at Bell Laboratories, Holmdel, NJ, while on leave from the University of Utah. During this time he worked in the area of microwave avalanche diode oscillators. Again, in 1971, he was engaged in study and research involving microwave biological effects at the University of Washington while on leave from the University of Utah. He is currently Professor of Electrical Engineering at the University of Utah, where he is engaged in teaching and research in electromagnetics, engineering pedagogy, and microwave biological effects.

Dr. Durney is a member of Sigma Tau, Phi Kappa Phi, Sigma Pi Sigma, Eta Kappa Nu, and the American Society for Engineering Education.

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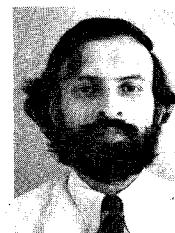


Om P. Gandhi (S'57-M'58- SM'65) was born in Multan, West Pakistan, on September 23, 1934. He received the B.Sc. (Honors) degree in physics from Delhi University, Delhi, India, in 1952, and the Diploma in electrical engineering from the Indian Institute of Science, Bangalore, India, in 1955. Continuing his graduate studies at the University of Michigan, Ann Arbor, he obtained the M.S.E. and Sc.D. degrees in electrical engineering in 1957 and 1960, respectively. Subsequently, he worked on semiconductor

plasmas at the Philco Scientific Laboratory, Blue Bell, PA. From 1962 to 1966 he worked at the Central Electronics Engineering Research Institute, Pilani, India, first as Assistant Director and then as Deputy Director in charge of the Microwave Devices Group. Since 1967 he has been with the University of Utah, Salt Lake City, where he is a Professor of Electrical Engineering and Research Professor of Bioengineering with research interests in microwave and optical interactions in solids and microwave biological effects.

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Anand Gopinath (S'64-M'65) received the B.E. degree from Madras University, Madras, India, the M.Tech. degree from the Indian Institute of Technology, Kharagpur, India, and the Ph.D. degree from Sheffield University, Sheffield, England.

He was a Graduate Apprentice with A.E.I. (Manchester) Ltd., Manchester, England, and then worked as an Engineer with Jessop & Company, Ltd., Calcutta. Since obtaining his Ph.D. in 1965, he was, at first, Research Assistant at Sheffield University, and then became Lecturer in Electronics at the University College of North Wales, Bangor, Gwynedd, U.K., in 1966. He spent most of 1971, while on leave of absence from the University College of North Wales, at McGill University, Montreal, Canada. He originally worked in the heavy-current area, but over the past 12 years his interests have been, and are currently, in microwaves and solid-state devices. He has contributed several papers on various aspects of microstrip lines and microwave integrated circuits, and is active in this area. He also directs a research group which operates a scanning electron microscope in the stroboscopic mode up to 9 GHz for dynamic device studies and this has enabled Gunn domains to be observed in X-band

devices. His current interests are in some of the theoretical problems of microstrip lines, in integrated optical guides, in various aspects of Gunn devices and GaAs FET devices, and in the limitations of very high speed bipolar logic.

Dr. Gopinath is a member of the Institution of Electrical Engineers, London, England, a graduate member of the Institution of Mechanical Engineers, London, England, and a member of Sigma Xi.



Chandra Gupta (S'76) was born in Ajmer, India, in 1954. He received the B.Sc. degree with honors in electronic engineering science from the University of Wales, U.K., in 1975. He is currently working towards the Ph.D. degree in electronic engineering at the University College of North Wales, Bangor, Gwynedd, U.K.

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Arthur W. Guy (S'54-M'57-SM'74-F'77) was born in Helena, MT, on December 10, 1928. He received the B.S. degree in electrical engineering in 1955 and the M.S. and Ph.D. degrees in 1957 and 1966, respectively, all from the University of Washington, Seattle.

From 1947 to 1950, and also from 1951 to 1952, he served in the U.S. Air Force as an Electronics Technician. Between 1957 and 1964 he was a Research Engineer in the Antenna Research Group, Boeing Co., Seattle, WA. While

there, his field included research on broad-band and microwave devices, surface wave antennas, propagation through anisotropic dielectrics, and antennas buried in lossy media. Between 1964 and 1966 he was employed by the Department of Electrical Engineering, University of Washington, Seattle, conducting research on VLF antennas buried in polar ice caps. At that time he also served as a consultant to the Department of Rehabilitation Medicine, doing work on problems associated with the effect of EM fields on living tissue. In 1966 he joined the medical school faculty and accepted his current position as Research Director in the Department of Rehabilitation Medicine. He is now also a Professor in that Department, and Adjunct Professor in the Department of Electrical Engineering, and a member of the Core Faculty, Center for Bioengineering, University of Washington, and is involved in teaching and research in the area of biological effects and medical applications of EM energy.

Dr. Guy holds memberships in Phi Beta Kappa, Tau Beta Pi, and Sigma Xi. He is also a member of the American Association for the Advancement of Science. He has positions on the IEEE Technical Committee on RF Radiation Sociotechnical Activity Committee on Man and Radiation (COMAR); the American National Standards Institute (ANSI) C95 Committee, where he holds the chairmanship of the C95 Subcommittee IV; the National Council on Radiation Protection; Armed Forces National Research Council Committee on Vision, Working Group 35; Commission A, Radio Measurement Methods and Standards, International Scientific Radio Union (URSI); and the Technical Electronic Product Radiation Standards Committee (TEPRSSC), FDA, of which he is publicity chairman. He serves as a consultant to Battelle Pacific Northwest Laboratories, specifically on a contract supported by the Energy Resources and Development Administration (ERDA); to the National Institute of Environmental Health Sciences on the U.S.S.R.-U.S. Health

Cooperative Program; and to the Bureau of Medical Devices and Diagnostic Products, Panel of Review of Physical Medicine (Physiatry) Devices (HFW/PHS/FDA). In addition, he is a member of the editorial boards of both the *Biophysical Journal* and the *Journal of Microwave Power*.

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Mark J. Hagmann (S'75) was born in Philadelphia, PA, on February 14, 1939. He received the B.S. degree in physics from Brigham Young University, Provo, UT, in 1960, and the M.Sc. Ed. degree from the University of Utah, Salt Lake City, in 1966.

He worked as a physics and mathematics teacher during 1961-1964. He did additional graduate studies in physics at Brigham Young University during 1965-1967. During 1968-1975 he worked in the research and development of explosives for IRECO Chemicals, West Jordan, UT. Since 1975 he has been a graduate student in the Department of Electrical Engineering at the University of Utah, where he is working towards the Ph.D. degree with emphasis on the interaction of electromagnetic radiation with biological systems.

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John L. Haine was born in Reading, England, on July 21, 1950. He received the B.Sc. degree with honors in electrical and electronic engineering from the University of Birmingham, England, in 1971.

From 1971 to 1974 he was with the British Post-Office Research Department, Dollis Hill, London, England, where he was concerned with distribution schemes for local telecommunications, and later with the design of Cable Television systems. Since 1974 he has been a Research Student at the University of Leeds, England, studying microwave filters and multiplexers.

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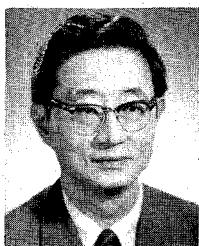
Wolfgang J. R. Hoefer (M'71), for a photograph and biography please see page 448 of the May 1977 issue of this TRANSACTIONS.

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Fumio Kato was born in Fukushima Prefecture, Japan, on November 13, 1950. He received the B.S. and M.S. degrees in electrical engineering from the National University of Yokohama, Yokohama, Japan, in 1973 and from the University of Tokyo, Tokyo, Japan, in 1975, respectively. At present he is studying toward the Ph.D. degree in the Graduate School of the University of Tokyo, specializing in distributed parameter networks.

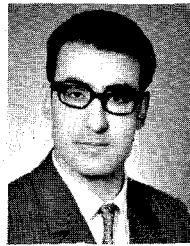
Mr. Kato is a member of the Institute of Electronics and Communication Engineers of Japan.



Walter H. Ku (S'56-M'62) received the B.S. degree (with Honors) from the Moore School of Electrical Engineering of the University of Pennsylvania, Philadelphia, in 1957, and the M.S. and Ph.D. degrees from the Polytechnic Institute of Brooklyn, Brooklyn, NY, in 1958 and 1962, respectively, all in electrical engineering.

From 1957 to 1960, he held a Research Fellowship at the Polytechnic Institute of Brooklyn. From 1960 to 1962, he was on the research staff of the Network Theory Group of the Microwave Research Institute (MRI), Polytechnic Institute of Brooklyn. During the summers of 1956 and 1958, he worked at IBM and the Vitro Electronics Corporation (now CEI Division of Watkins-Johnson Co.). From 1962 to 1969, he was with the Applied Research Laboratory (ARL) of the GT&E-Sylvania Electronic Systems, Waltham, MA, successively as an Engineering Specialist, Senior Engineering Specialist, and a Senior Scientist. From 1963 to 1969, he was also a Lecturer in the Graduate School of Northeastern University, Boston, MA, where he taught graduate courses in network synthesis and optimal estimation and control theory. He joined the faculty of the School of Electrical Engineering of Cornell University, Ithaca, NY, in 1969. In 1973-1974, he was on leave from Cornell and was a Visiting Associate Professor at the Department of Electrical Engineering and Computer Sciences of University of California, Berkeley. For the 1977 academic year, he is on sabbatic leave from Cornell University and is the Naval Electronic Systems Command (NAVELEX) Research Chair Professor of Electrical Engineering at the Naval Postgraduate School, Monterey, CA. He has served as Consultant to Sylvania Electronic Systems, Honeywell, TRW Systems, Air Force Rome Air Development Center (RADC), and PLAMIC. His current research interests are in the areas of microwave solid-state devices and circuits, digital and sampled-analog signal processing techniques, and digital secure communication systems.

Dr. Ku is a member of Eta Kappa Nu, Tau Beta Pi, Sigma Tau, Sigma Xi, AES, AAAS, and AAUP. He is an Associate Editor of the IEEE TRANSACTIONS ON CIRCUITS AND SYSTEMS and a member of the Editorial Board of the IEEE TRANSACTIONS ON MICROWAVE THEORY AND TECHNIQUES. He is also a cochairman of the Technical Committee on Acoustical, Microwave, and Optical Circuits (OMAC) of the IEEE Circuits and Systems Society.



M. E. Mokari-Bolhassan (S'67-M'70) was born in Azarshahr, Iran, on February 19, 1943. He received the B.S. degree in physics from the University of Tabriz, Iran, in 1964, the M.S. degree in electrical engineering from Michigan Technological University, Houghton, MI, in 1968, and the Ph.D. degree in electrical engineering from the University of Illinois, Urbana, IL, in 1970.

He has worked at Pahlavi University, Shiraz, Iran, since 1970, where he is currently a Professor. During 1974-1975 he spent a year of research appointment at the School of Electrical Engineering Cornell University, Ithaca, NY. His research interests are in distributed networks, broad-band matching, and computer-aided design.

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Takanori Okoshi (S'56-M'60) was born in Tokyo, Japan, on September 16, 1932. He received the B.S., M.S., and Ph.D. degrees from the University of Tokyo, Tokyo, Japan, in 1955, 1957, and 1960, respectively, all in electrical engineering. In 1960 he was appointed an Instructor and in 1961 became an Associate Professor in the Department of Electronic Engineering, University of Tokyo, where he worked primarily in the field of microwave circuits, microwave measurements, and microwave electron devices. From 1963

through 1964, on leave of absence from the University of Tokyo, he joined Bell Telephone Laboratories, Inc., Murray Hill, NJ, where he was engaged in research on electron guns. He returned to the University of Tokyo in 1964, and since then he has been working again in the microwave field, specializing in microwave planar (two-dimensional) circuits and collectors for beam-type tubes. In 1972 he joined the Technical University of Munich, Munich, Germany, on a temporary basis as a Guest Professor. In 1977 he was appointed a Professor in the Department of Electronic Engineering, University of Tokyo. At present his main fields of interest are the microwave planar circuits, optical waveguides, holographic memories, and three-dimensional imaging.

Dr. Okoshi is an Associate Editor of the IEEE TRANSACTIONS ON MICROWAVE THEORY AND TECHNIQUES.

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James C. Lin (S'67-M'71-SM'77) born December 29, 1942. He received the B.S. degree in electrical engineering in 1966 and the M.S. and Ph.D. degrees in 1968 and 1971, respectively, all from the University of Washington, Seattle.

He is currently an Associate Professor in the Department of Electrical and Computer Engineering, Wayne State University, Detroit, MI. His principal research interests are biological effects and medical applications of electromagnetics and ultrasonic radiation. Before joining Wayne State

University in September 1974, he was Assistant Professor of Rehabilitation Medicine and Assistant Director of the Bioelectromagnetics Research Laboratory, University of Washington School of Medicine, Seattle. He was also an investigator in the Center for Bioengineering at the University of Washington. Since 1973 he has been a scientific consultant to several private and governmental research laboratories.

Dr. Lin recently served as a member of Governor Milliken's Task Force to review Project Seafarer. He is on the IEEE Engineering in Biology and Medicine Regional Council and is a member of ANSI subcommittee C95.4 on Radiation Hazards with Respect to Personnel. He is also the recipient of the 1975 IEEE TRANSACTIONS ON ELECTROMAGNETIC COMPATIBILITY Best Paper Award.



Stig Rehnmark (S'71-M'76) was born in Hönefors, Sweden, on August 12, 1944. He received the M.Sc. and Ph.D. degrees in electrical engineering from Chalmers University of Technology, Göteborg, Sweden, in 1969 and 1976, respectively. From 1969-1975 he was a Research and Teaching Assistant at the Division of Network Theory, Chalmers University of Technology. His field of interest at that time was microwave couplers, phase shifters, and power dividers. In April 1975, he became the Research Engineer in the

same division and he was the project leader of the Chalmant antenna. Chalmant is the first two-dimensional (8 x 8 elements) phased array in

Sweden and is intended for maritime satellite communication in the *L* band. In 1976 he received a scholarship from the Sweden-America Foundation for studies in the United States. Since July 1976, he has been on a leave of absence from his position at Chalmers and is currently with Anaren Microwave, Inc., Syracuse, NY. At Anaren he has been working on the research, development, and production of couplers, baluns, power dividers, mixers, beam forming networks, and other microwave components in the frequency range 30 MHz-18 GHz.



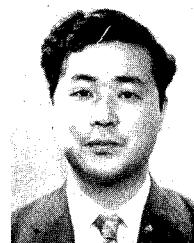
J. David Rhodes (M'67) was born in Doncaster, Yorkshire, England, on October 9, 1943. He received the B.Sc., Ph.D., and D.Sc. degrees in electrical engineering from the University of Leeds, Leeds, England, in 1964, 1966, and 1974, respectively.

From 1966 to 1967 he was a Research Fellow in the Department of Electrical and Electronic Engineering at the University of Leeds and then joined Microwave Development Laboratories, Inc., Natick, MA, as a Senior Research Engineer.

He currently holds a personal chair in the Department of Electrical and Electronic Engineering at the University of Leeds and is also a consultant in microwave engineering to Microwave Development Laboratories, Inc.

Dr. Rhodes was awarded the "Microwave Prize" by the professional group on Microwave Theory on Techniques in 1969, the IEEE Browder J. Thompson award in 1970, the J. J. Thompson award from the Institute of Electrical Engineers, London, in both 1971 and 1973, and the Guillemin-Cauer award by the Circuit and Systems Society in 1974.

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Masao Saito (S'59-M'63) was born in Japan in 1933. He received the B.S., M.S., and Ph.D. degrees in engineering from the University of Tokyo, Tokyo, Japan, in 1956, 1958, and 1962, respectively.

Working for some time as a member of the Faculty of Engineering at the University of Tokyo, he is now serving as a Professor of Medical Engineering on the Faculty of Medicine there. His principal interest is in circuit and systems theory, especially its application to biological and medical systems. In circuit theory, he is interested in distributed-parameter systems, variable and adaptive systems, and multivariable network theory.

Dr. Saito is a member of the board of the Japan Society of Medical Electronics and Biological Engineering, Vice-President of the International Federation for Medical and Biological Engineering, and Vice-President of the World Association of Medical Informatics.

Overseas Abstracts

PAPERS FROM JOURNALS PUBLISHED IN AUSTRALIA, INDIA, AND JAPAN

Compiled by Prof. T. Okoshi, Department of Electronic Engineering, University of Tokyo.

The periodicals investigated are: 1) Transactions of the Institute of Electronics and Communication Engineers of Japan (Trans. IECEJ), 2) Journal of the IECEJ, 3) Journal of the Institution of Engineers (J. IE (India)), 4) Proceedings of the Institution of Radio and Electronics Engineers—Monitor (Proc. IREE (Australia)), and 5) Australian Telecommunication Research (ATR).

As for the Japanese papers in the Trans. IECEJ, which carry volume numbers J59B or J59C, single-page English summaries (1/4 page for Correspondences) will be found in the "Transactions of IECEJ, Section E" issued in the same month, where "E" denotes English. Papers carrying volume number E59 are papers written originally in English and will be found in Section E. Both the Section J and Section E issues are published from the IECEJ, Kikai-Shinko-Kaikan, 3-5-8 Minato-ku, Tokyo 105, Japan.

This time the 1976 issues of the Journal of the Institution of Electronics and Telecommunication Engineers (J. IETE (India)) were not available in Tokyo.

Field Theory and Electromagnetic Compatibility

1

Unified Approach to the Derivation of Variational Expressions for Electromagnetic Fields, by K. Morishita and N. Kumagai (Faculty of Engineering, Osaka University, Suita-shi, 565 Japan): *Trans. IECEJ*, vol. J59-B, pp. 165-172, March 1976.

So far the variational expressions have been derived intuitively or upon a trial-and-error basis. This paper describes a unified method for deriving it upon the basis of the minimum action principle.

2

Detection of 2 GHz Microwave Power Passing through the Human Body (Correspondence), by I. Yamaura (Electrotechnical Laboratory, Tanashi-shi, 188 Japan): *Trans. IECEJ*, vol. J50-C, pp. 316-317, May 1976.

Attenuation in the human body is measured; the application of microwaves in medical diagnosis in the future is discussed.