

Contributors



Larry R. Adkins was born in Sherman, Tex., on May 21, 1939. He received the B.S. degree in physics and mathematics from Abilene Christian College, Abilene, Tex., in 1961, and the M.A. and Ph.D. degrees in physics from the University of Texas, Austin, in 1964 and 1968, respectively.

While at the University of Texas, he was engaged in experimental and theoretical research studies in the field of spin lattice relaxation processes. He joined the Microwave Technology Group, Research and Engineering Division, of Autonetics, a Division of North American Rockwell Corporation, Anaheim, Calif., in 1968, where he is presently engaged in research in acoustic surface wave guidance phenomena. He has designed and built guidance structures and has performed experiments on the behavior of surface waves on these devices. Currently, he is extending the frequency range of these experiments and is designing useful signal processing devices to be operated at such frequencies. While at Autonetics, he has also studied lattice defects in thin film semiconductors using EPR techniques.

Dr. Adkins is a member of the American Physical Society, the American Association of Physics Teachers, Sigma Pi Sigma, and Alpha Chi.



Eric A. Ash (A'53—M'55—F'68) was born in Berlin, Germany, in 1928. He received the B.Sc. degree in electrical engineering in 1948, and the Ph.D. degree in 1952, both from the Imperial College of Science and Technology,

University of London, London, England. From 1952 to 1954 he was a Research Associate in the Electronics Research Laboratory at Stanford University, Stanford, Calif. In 1955 he joined the Standard Telecommunication Laboratories, Harlow, England, where he worked on vacuum and solid state electron devices. In 1963 he joined the staff of University College, London, where he is now Professor of Electrical Engineering. He is currently on leave of absence at IBM Corporation, Yorktown Heights, N. Y.

Dr. Ash is a member of the IEE (London) and a Fellow of the Institute of Physics.

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James M. Alsup (M'68) was born in Covina, Calif., on May 24, 1940. He received the B.S. degree in physics from Harvey Mudd College, Claremont, Calif., in 1962, and the M.S. degree in physics from Brigham Young University,

Provo, Utah, in 1964.

In 1964 he joined the Ocean Technology Department of the Pasadena Laboratory of the U. S. Naval Undersea Research and Development Center (formerly, USNOTS), Calif., where he has worked in the fields of signal processing, underwater acoustics, optics, and ultrasonics.

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Eric A. Ash (A'53—M'55—F'68) was born in Berlin, Germany, in 1928. He received the B.Sc. degree in electrical engineering in 1948, and the Ph.D. degree in 1952, both from the Imperial College of Science and Technology,



Henry L. Bertoni (M'67) was born in Chicago, Ill., on November 15, 1938. He received the B.S. degree in electrical engineering from Northwestern University, Evanston, Ill., in 1960, and the M.S. degree in electrical engineering, and the Ph.D. degree in electrophysics from the Polytechnic Institute of Brooklyn, Brooklyn, N. Y., in 1962 and 1967, respectively.

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From 1966 to 1967 he was an Instructor in the Electrophysics Department of the Polytechnic Institute of Brooklyn, where at present he is an Assistant Professor. His past research has dealt with the propagation and scattering of electromagnetic radiation in anisotropic media. Currently, his interests are in electromagnetic propagation and scattering in lossy media and in the excitation and guiding of elastic surface waves.

Dr. Bertoni is a member of Eta Kappa Nu, Tau Beta Pi, and Sigma Xi.

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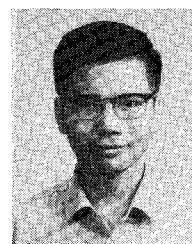


Paul H. Carr (SM'68) was born in Boston, Mass., on May 12, 1935. He received the B.S. degree in physics and the M.S. degree from the Massachusetts Institute of Technology, Cambridge, in 1957 and 1961, respectively, and the Ph.D. degree in physics from Brandeis University, Waltham, Mass., in 1966.

He was a Staff Associate at the M.I.T. Lincoln Laboratory from 1958 to 1961, during which time he studied the microwave phonon-spin interaction. From 1961 to 1962 he served as an Ordnance Corps Lieutenant at Redstone Arsenal, Ala., where he did vacuum metrology research at the Calibration Laboratory. Since 1962 he has been doing research in microwave acoustics at the Air Force Cambridge Research Laboratories, Bedford, Mass., where he is now Chief of the Microwave Acoustics Branch.

Dr. Carr is a member of the American Physical Society and the Research Society of America.

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Ruey Shi Chu (S'68—M'69) was born in Taipei, Taiwan, China, on March 15, 1940. He received the B.S. degree in electrical engineering from National Taiwan University, Taipei, in 1962, and the M.S. degree in electronic engineering from the Institute of Electronics, National Chiao-Tung University, Hsinchu, Taiwan, in 1964.

From 1964 to 1965 he was an instructor at the Institute of Electronics, National Chiao-Tung University. Since 1965 he has been at the Polytechnic Institute of Brooklyn, Brook-

lyn, N. Y., where he is presently a Senior Graduate Assistant in the Department of Electrophysics and is completing the requirements for a Ph.D. degree. He is engaged in research in the area of electromagnetic theory with particular applications to optic-acoustic interactions.

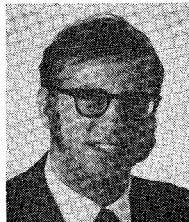
Mr. Chu is a member of Phi Tau Phi.



Jeffrey H. Collins was born in Luton, England, on April 22, 1930. He received the B.Sc. degree in physics and the M.Sc. degree in mathematics from the University of London, London, England, in 1951 and 1954, respectively.

From 1951 to 1956, his experience in the areas of high-power traveling wave tubes, ferrite parametric amplifiers, and the backward wave oscillator was obtained during employment at the Hirst Research Centre, Wembley, England, and at Ferranti Ltd., Edinburgh, Scotland, where he was a Senior Engineer. From 1957 to 1967, he was with the Electrical Engineering Department, University of Glasgow, Glasgow, Scotland, where he taught in the fields of networks and materials science and did research on microwave ferrites and microwave acoustics. During the scholastic years 1966-1968, he was a Research Engineer in the W. W. Hansen Laboratories of Physics, Stanford University, Stanford, Calif., where he was engaged in research on microwave acoustics, garnet delay lines, opto-acoustic interactions, and pulse compression applications. He joined Autonetics, a Division of North American Rockwell Corporation, in July, 1968, as Director of Physical Sciences. He is also Resident Director, Autonetics, at the North American Rockwell Science Center.

Mr. Collins is a member of the IEE (London) Professional Group Committee on Microwave Techniques and Quantum Electronics.



Ian N. Court was born in London, England, on August 26, 1936. He received the B.Sc. and Ph.D. degrees in physics from the University of Nottingham, England, in 1958 and 1962, respectively.

While at the University he was a part-time lecturer at the Nottingham and District Technical College. From December 1961 to September 1966, he was employed by the Electronics Laboratory of General Electric Company, Syracuse, N.Y., where he worked on the research and development of laser devices. In 1966 he joined Stanford Research

Institute, Menlo Park, Calif., where he has been engaged in research in the field of microwave acoustics.

Dr. Court is a member of the American Institute of Physics.

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Richard M. De La Rue was born in Reading, England, in 1945. He received the B.Sc. (Eng.) degree from the University of London, London, England, in 1966, and the M.A.Sc. degree from the University of Toronto, Ont., Canada, in 1968.

He is currently a doctoral student at University College, London.

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Wadim I. Dobrov was born in Masur, Russia, on July 14, 1926. He received the Ph.D. degree in physics from the University of California, Berkeley, in 1956.

Since 1956 he has been with the Lockheed Research Laboratory, Palo Alto, Calif., where he has concentrated primarily on the study of microwave interactions in solids. His work has also included research in the field of gaseous discharges, ferro-electrics, nonlinear optics, and microwave ultrasonics. In the ultrasonics field his activity includes magnetic ultrasonic resonance, transducer development, and microwave frequency delay lines.

Dr. Dobrov is a member of the American Physical Society, Sigma Xi, and the IEEE Group on Sonics and Ultrasonics.

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Henry M. Gerard was born in Brooklyn, N. Y., on November 7, 1942. He received the B.S. and M.S. degrees in physics in 1964 as a participant in the Unified Honors Program at the Polytechnic Institute of Brooklyn. Currently, he is working toward the Ph.D. degree in applied physics at Stanford University, Stanford, Calif.

Since 1964, he has been working at the Stanford Microwave Laboratory on the study of ultrasonics. Upon receiving the Ph.D. degree in 1969, he will join the Technical Staff at Hughes Aircraft Company, Fullerton, Calif.

Mr. Gerard is a member of Sigma Xi.



Harold V. Hance (S'39 - A'41 - M'46 - SM'57) was born in St. Louis, Mo., on January 9, 1918. He received the B.Sc. degree in electrical engineering from the California Institute of Technology, Pasadena, in 1939, and the D.Sc. degree from the Massachusetts Institute of Technology, Cambridge, in 1951.

He conducted research on radar display devices and on radar signal detection theory and techniques from 1941-1951 while at the U. S. Naval Research Laboratory, Washington, D. C., and the U. S. Naval Air Development Center, Johnsville, Pa. In 1951 he joined the Hughes Aircraft Company, Culver City, Calif., where he was engaged in theoretical performance and design analysis of advanced airborne radar systems. In 1961 he joined the Lockheed Palo Alto Research Laboratory, Palo Alto, Calif., where he has conducted research in the fields of acousto-optic interactions, acoustic modeling of microwave radar systems, and laser communications.

Dr. Hance is a member of the Research Society of America, the IEEE Group on Aerospace and Electronic Systems, and Sigma Xi.

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Fred S. Hickernell (M'64) was born in Phoenix, Ariz. on January 16, 1932. He received the B.A. degree from Arizona State College, Tempe, in 1953, and the M.S. and Ph.D. degrees in physics from Arizona State University, Tempe, in 1959 and 1966, respectively.

From 1953 to 1957 he served as a meteorologist with the United States Air Force. From 1958 to 1960 he was employed by Goodyear Aircraft, Litchfield Park, Ariz., and performed theoretical work on high resolution radar and data processing systems for aircraft. Since joining Motorola Inc., Phoenix, Ariz., in 1960, he has been engaged in the study of electromagnetic and acoustic effects in insulating and semiconducting solids for application to advanced solid state devices.

Dr. Hickernell is a member of the American Physical Society, the American Meteorological Society, and Sigma Xi.

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A. James Hughes was born in Litchfield, Neb., on December 7, 1935. He received the B.A. degree from the University of California at Riverside, in 1958, the M.S. degree from the University of California at Los Angeles, in 1961, and the Ph.D. degree from the Uni-



versity of California at Riverside, in 1965, all in physics.

As a Graduate Research Physicist at the University of California at Riverside, he was engaged in high pressure properties of water, lattice dynamics, and energy band theory. From 1964 to 1967 he worked at the Theoretical Physics Department, Applied Research Laboratory, Philco-Ford Corporation, where his interests were energy band theory, impurity bands in emission, absorption from semiconductors, and the development and application of solid-state scattering theory for localized defects in semiconductors. In 1967 he joined the Theoretical Physics Group, Research and Engineering Division, of Autonetics, a Division of North American Rockwell Corporation, Anaheim, Calif., where he is currently investigating acoustic surface wave propagation, localized defects in semiconductors, radiation damage, energy band theory, electronic and elastic properties of semiconductors and insulators, and the theory of guidance of surface waves and semiconductor phenomena related to various devices.

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R. F. Humphries (S'68) was born in London, England, in 1946. He received the B.Sc. (Eng.) degree in 1967, and the M.Sc. degree in 1968, from the University of London, London, England. At present he is a doctoral student at

University College, London.

Mr. Humphries is an associate member of the IEE (London).

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Kjell A. Ingebrigtsen was born in Tromsø, Norway, on October 8, 1937. He received the Electrical Engineering degree and the licentiate degree (lic. techn.) from the Norwegian Institute of Technology, Trondheim, Norway, in 1962 and 1968, respectively.

From 1961 to 1964 he was a Research Engineer at the Norwegian Defense Research Establishment working with varactor diodes on microwave frequencies. Since 1964 he has been working with acoustic surface waves at the Electronics Research Laboratory of the Norwegian Institute of Technology.



Ernst K. Kirchner (M'67) was born in San Francisco, Calif., on June 18, 1937. He received the B.S., M.S., and Ph.D. degrees in electrical engineering from Stanford University, Stanford, Calif., in 1959, 1960, and 1963, respectively.

In 1963 he was assigned to the U. S. Army Electronics Research and Development Activity, Ft. Huachuca, Ariz. (USAERDA), where he served as Research Officer for both the Meteorology and Electronics Departments. During the same period he taught advanced mathematics and physics courses at the University of Arizona, Tucson. In 1965 he joined the Solid-State Research Group of Microwave Electronics, a Teledyne Co., Palo Alto, Calif., where he has been primarily engaged in research on microwave acoustic, magnetoelectric, and elastooptic phenomena.

Dr. Kirchner is a member of Sigma Xi, Tau Beta Pi, and the American Physical Society.

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Kenneth M. Lakin was born in Grand Rapids, Mich., on January 14, 1941. He received B.S.E. degrees in electronics, physics, and mathematics, all in 1964, and the M.S.E. degree in electronics, in 1965, from the University of Michigan, Ann Arbor. In 1969 he received the Ph.D. degree in applied physics from Stanford University, Stanford, Calif. His dissertation was on acoustoelectric surface wave amplification.

From 1965 to 1966 he was an Assistant Research Engineer at the University of Michigan. Since September, 1966, he has worked as a Graduate Research Assistant in the microwave acoustics field at the Stanford Microwave Laboratory.

Dr. Lakin is a member of Sigma Xi.



Electrophysics Department. During the summer of 1964, he was a Walker-Ames Visiting Professor at the University of Washington, Seattle, and, during the 1965-1966 academic year, he was on sabbatical leave at the Ecole Normale Supérieure, Paris, France, under a Guggenheim Fellowship. He has been engaged in research on a wide variety of topics in the microwave field, including network representations of microwave structures, precision measurement methods, guided-wave theory with stress on surface waves and leaky waves, traveling-wave antennas, plasmas, and phased arrays. His latest interests include open periodic structures, nonlinear optics, and microwave acoustics.

Dr. Oliner is a past Chairman of both the G-MTT and the Committee on Antennas and Waveguides. He is a member of Commissions I and VI and a past Chairman of U. S. Commission I, all of the International Scientific Radio Union. He is also a former Chairman of a National Academy of Sciences Advisory Panel to the National Bureau of Standards. In 1964 he won the Institution Premium, the highest award of the Institution of Electrical Engineers (London), and in 1967 he received the IEEE Microwave Prize. He also served during 1967 as the G-MTT's first National Lecturer.

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Thomas M. Reeder (S'59-M'69) received the B.S.E.E. degree from the University of Illinois, Urbana, in 1960, and the M.S.E.E. and Ph.D. degrees from Stanford University, Stanford, Calif., in 1961 and 1965, respectively.

Between 1962 and 1965 he was a Research Assistant at the Stanford Microwave Laboratory where he did research on the amplitude and phase characteristics of high-power traveling-wave tubes. In 1965 he joined the Electron Devices Group of Standard Telecommunications Laboratory in Harlow, England, as a Research Engineer. There he was in charge of the Microwave Acoustics Program, setting up facilities for thin-film transducer fabrication and experimental analysis. After returning to the United States in 1967, he continued his studies in microwave acoustics at the Microwave Electronics Corporation in Palo Alto, Calif., where he was responsible for research and development of low-loss broad-band matching networks for thin-film transducers. In the fall of 1968, he rejoined the Stanford Microwave Laboratory as a Research Associate, and since that time has been engaged in research on acoustic surface-wave delay lines and amplifiers.



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Arthur A. Oliner (M'47-SM'52-F'61) was born in Shanghai, China, on March 5, 1921. He received the B.A. degree from Brooklyn College, Brooklyn, N. Y., and the Ph.D. degree from Cornell University, Ithaca, N. Y., both in physics, in 1941 and 1946, respectively.

While at Cornell he held a Graduate Teaching Assistantship in the Physics Department and also conducted research on a project of the Office of Scientific Research and Development. He joined the Microwave Research Institute, Polytechnic Institute of Brooklyn, in 1946, and was made Professor in 1957. Since 1966, he has been Head of the



Georg Rupprecht was born in Nürnberg, Germany on May 13, 1922. He received the Ph.D. degree from the University of Erlangen, Germany.

He came to the United States on a post-doctoral fellowship from the National

Academy of Sciences in 1955 and worked as a Research Associate on surface states in semiconductors for two years at the University of Illinois, Urbana. He joined the Research Division of Raytheon Company in 1958 where he worked on basic aspects of ferroelectricity. In 1962 he joined Tyco as Director of Research. He became interested in lattice dynamics and piezoelectric and acoustic phenomena. In 1967 he joined Bendix Research Laboratories, Southfield, Mich., as Principal Scientist, and is presently involved in space flight programs at the Denver, Colo., Facility.

Dr. Rupprecht is a member of the American Physical Society.

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Ronald V. Schmidt (S'68) was born in San Francisco, Calif., on March 31, 1944. He received the B.S. and M.S. degrees from the University of California, Berkeley, in 1966 and 1968, respectively. He is presently working towards the

Ph.D. degree at the same university. His present interests are in the areas of elastic waves and optical interactions with elastic waves.

Mr. Schmidt is a member of Phi Beta Kappa and Sigma Xi.

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Herbert J. Shaw (M'55) was born in Seattle, Wash., on June 2, 1918. He received the B.S. degree from the University of Washington, Seattle, in 1941, and the M.A. and Ph.D. degrees from Stanford University, Stanford, Calif., both in electrical engineering, in 1943 and 1948, respectively.

In 1941 he was a Test Engineer at General Electric Company, Schenectady, N. Y. Since 1942 he has been at Stanford University where he is presently a Senior Research Associate in the Microwave Laboratory and a Research Associate in the Physics Department. He has been primarily engaged in research on microwave tubes and microwave physics. He is cur-

rently involved in investigations of high frequency surface acoustic waves in solids.

Dr. Shaw is a member of Tau Beta Pi and Sigma Xi.

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Alan B. Smith (S'59-M'66) was born in Karuizawa, Japan, on July 28, 1932. He received the B.S. degree in electrical engineering from Swarthmore College, Swarthmore, Pa., in 1953, the M.E.E. degree from Rensselaer Polytechnic Institute, Troy, N. Y., in 1959, and the M.A. and Ph.D. degrees in applied physics from Harvard University, Cambridge, Mass., in 1961 and 1966, respectively.

From 1953 to 1959 he was an engineer at the Sprague Electric Company, North Adams, Mass., where he worked on electronic measuring equipment and on ceramic-based integrated circuits. From 1961 to 1965 he was a Research Assistant at Harvard University, doing research on magnetoelastic interactions in ferrites and garnets. Since 1965 he has been a member of the research staff of the Sperry Rand Research Center, Sudbury, Mass., where he has been working in the field of microwave acoustics.

Dr. Smith is a member of Sigma Xi, the American Association for the Advancement of Science, and the American Physical Society.

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W. Richard Smith was born in Salem, N. J., on July 2, 1942. He received the A.B. degree in physics from Princeton University, Princeton, N. J., in 1964, and the M.S. degree in applied physics from Stanford University, Stanford,

Calif., in 1966, where he is currently working toward the Ph.D. degree in applied physics.

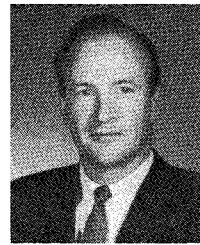
He is presently working as a Research Assistant in the Microwave Laboratory at Stanford University. His dissertation will be concerned with acoustic surface wave transducers and dispersive delay lines.

Mr. Smith is a member of Sigma Xi.

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William D. Squire was born in Tyler, Tex., on January 15, 1924. He received the B.S. degree in physics, the M.S. degree in mathematics, and the Ph.D. degree in electrical engineering (communication theory) from the California Institute of Technology, Pasadena, in 1950, 1960, and 1964, respectively.

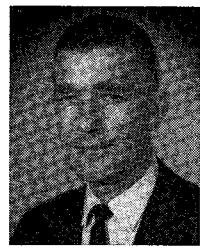
Since 1950 he has been with the Pasadena Laboratory of the U. S. Naval Undersea Re-



search and Development Center (formerly, USNOTS), where he now heads the Engineering Science Division of the Ocean Technology Department. His work has been in the fields of communication theory, statistical decision theory, the implementation of electronic devices, especially in an underwater acoustic environment, optical correlation, and the electronic simulation of human auditory localization.

Dr. Squire is a member of Sigma Xi and the American Association for the Advancement of Science.

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Ronald F. Steinberg (M'66) was born in Lapeer, Mich., on December 20, 1929. He received the B.S. degree in electrical engineering from Lawrence Institute of Technology, Southfield, Mich., in 1962, and the M.S. degree in electrical engineering from Wayne State University, Detroit, Mich., in 1968.

He joined Bendix Research Laboratories, Southfield, Mich., in 1955, and participated in the development of several solid-state devices including the germanium power transistor, drift transistor, and silicon varactor diode. Since 1963 he has been active in the thin-film device field. He was responsible for a thin-film field effect transistor development program and is presently Project Supervisor for development programs on thin-film microwave acoustic transducers and thin-film semiconductor photocathodes.

Mr. Steinberg is a member of the Thin Film Division of the American Vacuum Society.

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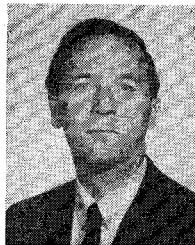


Ernest Stern (S'55-M'56-SM'68) received the B.S. degree from Columbia University, New York, N. Y., in 1953, and attended graduate school at Cornell University, Ithaca, N. Y., from 1953 to 1955.

From 1955 to 1958 he worked at the Sperry Gyroscope Company, and from 1958 to 1962 at the General Electric Company, where he was concerned with nonlinear ferrite phenomena and ferrite devices. From 1962 to 1964 he was Director of Research at Microwave Chemicals Labora-

tory. He joined M.I.T. Lincoln Laboratory, Lexington, Mass., in 1964 to work on remanent ferrite devices for phased arrays. He is presently leading the research at Lincoln Laboratory for the realization of microsound components and circuits. He is the author of many published papers dealing with various aspects of ferrite device design, and holds several patents.

Mr. Stern is a member of Sigma Pi Sigma, the Scientific Research Society of America, and the American Association for the Advancement of Science. He has been a member of the Program Committees for the 1968 NEREM Conference, the 1969 IEEE Convention, and the 1969 Microwave Theory and Techniques Conference. Currently he is a member of the Administrative Committee of the IEEE Group on Sonics and Ultrasonics and Co-Chairman of the 1970 Gordon Conference on Ultrasonics.

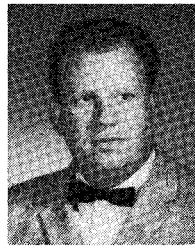


Andreas Tonning (SM '62) was born in Stryn, Norway, on July 23, 1922. He received the Electrical Engineering degree and the doctors degree (dr. techn.) from the Norwegian Institute of Technology, Trondheim, Norway, in 1948 and 1959,

respectively.

From 1948 to 1961 he was a Research Engineer at the Norwegian Defence Research Establishment. Since 1961 he has been a Professor in the Department of Electrical Engineering, Norwegian Institute of Technology. He has done work in the fields of electromagnetic theory, network theory, and solid state electronics.

Dr. Tonning is a member of the American Physical Society.



Harper John Whitehouse (S'59-M'61) was born in Monterey Park, Calif., on August 15, 1935. He received the B.S. degree in physics from Oregon State University, Corvallis, in 1958.

In 1957 he joined the Ocean Technology

Department of the Pasadena Laboratory of the U. S. Naval Undersea Research and Development Center (formerly, USNOTS), Calif., where he has been engaged in research and development in the fields of communication theory, signal processing, underwater acoustics, and ultrasonics.

Mr. Whitehouse is a member of the Acoustical Society of America.



Fred W. Voltmer (M'66-S'67) was born in San Francisco, Calif., on April 2, 1942. He received the B.S. and M.S. degrees in electrical engineering from the University of California, Berkeley, in 1964 and 1966, respectively. He

is currently completing work for the Ph.D. degree at the same university.

In 1966 he was employed by the Summer Development Program at Texas Instruments Inc., Dallas. His primary areas of interest are microwave acoustics and solid-state microwave devices.

Mr. Voltmer is a member of Tau Beta Pi and Eta Kappa Nu.



Donald K. Winslow (SM'57) was born in Hanford, Calif. on September 25, 1914. He received the A.B. and M.A. degrees in mathematics from the University of California, Berkeley, in 1936 and 1939, respectively, the M.S. degree in meteorology from the California Institute of Technology, Pasadena, in 1943, and the M.S. and Ph.D. degrees in physics from Stanford University, Stanford, Calif., in 1954 and 1957, respectively.

From 1938 to 1947, he taught in high schools and junior colleges in California, except when he was an Officer in the United States Navy from 1942 to 1946. From 1947 to 1951 he was an Assistant Professor of Physics at Fresno State College, Fresno, Calif. From 1951 to 1957 he was a graduate student in physics and Research Assistant in the Microwave Laboratory at Stanford University. Since 1957 he has been a Research Associate and Research Engineer at the Microwave Laboratory doing research on high-power traveling-wave tubes, microwave properties of ferrites, the interaction of acoustic waves with laser beams, and microwave acoustics.

Dr. Winslow is a member of Sigma Xi and the American Physical Society.



Richard A. Waldron was born in Portsmouth, England, on July 11, 1925. He received the B.A., M.A., and Sc.D. degrees from the University of Cambridge, Cambridge, England, in 1949, 1959, and 1968, respectively.

He joined the Research Staff of the Marconi Company Ltd. in 1951, where he was engaged in microwave theory from 1954 to 1967. The results of this work are given in numerous papers that have been recognized by awards: the Clerk Maxwell Premium and twice the Heinrich Hertz Premium from the IERE (London); a prize for technical writing from the Radio and Electronics Industry; runner-up in the 1960 Quinquennial International Competition of the Institut Montefiore. Other publications include papers on