Foreword

THE "APPLICATIONS" THEME of this Issue is a reflection of the rapid progress in the surface-acoustic-wave (SAW) field since its beginnings in the late 1960's. Twelve years have elapsed since the first Special Issue on microwave acoustics including SAW's was published jointly by the Microwave Theory and Techniques Society and the Sonics and Ultrasonics Group. In November 1969, the SAW field was quite new, and a large fraction of the SAW papers published during 1969 were contained in that one Special Issue. Much of the Issue was devoted to speculations on the configuration and operation of future devices. By the time of the second joint Special Issue in April 1973, several types of SAW devices had been developed to the point of achieving very attractive levels of performance, and a few papers outlining the potential impact of these devices on systems applications were included in the Issue. Increasingly sophisticated and high-performance SAW devices were the major theme of the May 1976 Special Issue of the PROCEEDINGS OF THE IEEE. By the end of the 1970's, SAW devices found increased acceptance as practical, high-performance components for signal generation and processing in electronic systems. Accordingly, the goal of this Special Issue is to emphasize the fact that SAW devices "have arrived" by providing a number of specific examples of how the devices are being effectively and profitably used in many different systems. Engineers and systems designers will find interest in the variety of complex signal-processing functions that can be performed with SAW devices in compact and simple configurations.

The first two papers by Collins and Grant and by Gautier and Tournois are reviews of the role of SAW devices and other technologies in electronic warfare and in hybrid signal-processing systems employing both analog and digital components. These papers emphasize the advantage of employing the strengths of each technology and that the exploitation of the high-bandwidth signal-processing capabilities of SAW devices is keyed to advances in digital technology.

The development of an efficient means for radar signal generation and processing has been one of the continuing driving forces in the development of SAW technology. The use of SAW devices in radar systems is illustrated in the second group of papers. Implementation of sophisticated radar pulse compressors (Vale), of precision closely matched bandpass filters for phased-array radars (Haydl *et al.*), of a compact filter bank for FM–CW radars (Solie and Wohlers), and of SAW-resonator-stabilized oscillators for fine spectral control in radar signal generation (Tanski *et al.*) are described in these papers.

The third group of papers focuses on the application of SAW devices in communications. By far the most widely-used SAW devices are television IF filters. These are now produced by the millions. Two papers by Kodama *et al.* and by Matsu-ura *et al.* illustrate other filtering functions in TV broadcast and receiving equipment which are efficiently performed by SAW devices. Satellite communication systems utilize a number of signal generation and filtering components, many of which can be implemented with SAW devices, as described in the next two papers by Henaff and Brossard and by Jones *et al.* Advanced military communications systems employ spectral spreading for a variety of reasons including security and resistance to jamming. One spread-spectrum technique is to employ frequency hopping. A SAW-based synthesizer for generating frequency-hopped signals is described by Darby and Hannah. A major problem in the use of direct spectral spreading by means of phase-coded waveforms has been the need for wide-bandwidth programmable matched filters in the receivers. The solution of this problem through the use of SAW convolvers is the subject of the papers by Reible and by Goll and Malocha.

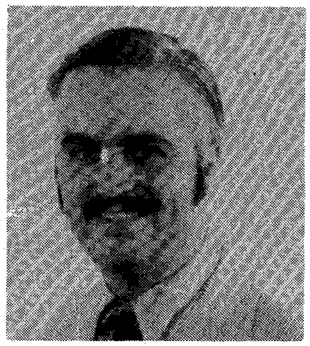
Maturity of a technology does not necessarily imply the end of research and development effort, as the final three papers attest. Expanding the repertoire and parameter range of signal-processing functions is a stimulus for a continuing high level of activity in the SAW field. A special type of correlator utilizing both optical and SAW devices (Casseday *et al.*), a unique type of programmable matched filter especially useful in adaptive processing (Bowers *et al.*), and a new type of memory (Manes) are examples of this continuing effort.

RICHARD C. WILLIAMSON
THOMAS W. BRISTOL
Guest Editors

Richard C. Williamson (M'72–SM'80) was born in Minoqua, WI, on September 10, 1939. He received the B.S. and Ph.D. degrees in physics from the Massachusetts Institute of Technology, Cambridge, in 1961 and 1966, respectively.

From 1966 to 1970, he was a Staff Physicist at the NASA Electronics Research Center in Cambridge, MA. While there he was involved in research programs concerning ultrasonics studies of critical phenomena and phase transitions in ordinary fluids and liquid crystals. During this period, he was also a Visiting Scientist at the M.I.T. Center for Materials Science and Engineering. In 1970, he joined the Staff of M.I.T. Lincoln Laboratory where he has been involved in the development of surface-acoustic-wave devices for signal processing in radar and communication, including reflective-array compressors and acoustoelectric convolvers. He became Associate Group Leader for the Surface Wave Technology Group in 1974. In January, 1980, he became Group Leader of the Applied Physics Group which investigates optical-signal-processing technology.

Dr. Williamson is a member of the American Physical Society and Sigma Xi. He has been a member of the Administrative Committee of the IEEE Sonics and Ultrasonics Group. He was General Chairman of the 1980 IEEE Ultrasonics Symposium in Boston. He is the 1980–1981 National Lecturer of the IEEE Sonics and Ultrasonics Group.



Thomas W. Bristol (M'68) was born on November 17, 1937, in Ilion, NY. He received the B. M. E. degree from General Motors Institute, Flint, MI, in 1960, the M. S. E. E. degree from the University of Michigan, Ann Arbor, in 1963, and the Ph.D. degree in electrical engineering from Syracuse University, Syracuse, NY, in 1968. His doctoral dissertation was in applied electromagnetic theory, under the guidance of Prof. Roger Harrington.

From 1963 to 1967 he was an Instructor at Syracuse University. In 1967 he joined the Technical Staff of the Autonetics Division of Rockwell International in Anaheim, CA. There he conducted research on remote sensing systems, array antennas, and electromagnetic penetration, and, in 1969, became involved in surface acoustic wave (SAW) device research. In 1971 he joined Hughes Aircraft Company in Fullerton, CA, where he was responsible for the SAW device research program, and in 1980 he was appointed Manager of the Microelectronics Technology Department. This area includes the manufacturing facility for SAW devices.

Dr. Bristol has authored several publications, symposia presentations, and lectures on SAW device design and applications. He is a member of Eta Kappa Nu, Tau Beta Pi, and Sigma Xi, and in 1975 was a recipient of the L. A. Hyland Award for patents and technical contributions to SAW research and technology. He was Technical Program Chariman for the 1977 Ultrasonics Symposium in Phoenix, NM, and has been a Member of the Administrative Committee of the IEEE Group on Sonics and Ultrasonics since 1978. He is currently President of GSU.