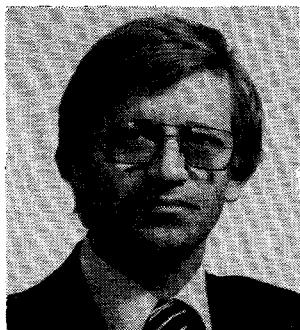


# Foreword

THE NEXT GENERATION of microwave digital systems will require much higher clock frequencies to increase computational speed. Both military and commercial electronics have applications for digital communications with multigigabit-per-second data rates, multi-phase-shift-keyed modulation/demodulation, time multiplexing, frequency division, counting, A/D converters, memories, and frequency and waveform synthesis. During the last several years, significant progress has been made in raising the operating speed of digital microcircuits above the 1-GHz/s level. Advances in silicon IC technology will generate some limited speed improvements, but GaAs IC technology offers a two- to six-times speed improvement for the immediate future and Josephson junction technology projects another two- to three-times speed improvement for the intermediate future.

This Special Issue contains representative papers of the state of the art in both high-speed GaAs IC's and Josephson junction logic with applications for microwave digital systems. The first few papers derive FET models used to compare the switching speeds of GaAs, Si, and InP devices and equivalent circuits for high-speed IC design, analysis, and optimization. Next, state-of-the-art GaAs FET IC results which have been obtained in different laboratories around the world are discussed. Finally, Josephson junction theory and technology are reviewed as related to high-speed logic in order to familiarize microwave engineers with this upcoming field.

PAUL T. GREILING  
*Guest Editor*



Paul T. Greiling (S'64-M'69) was born in Cleveland, OH. He received the B.S.E.E. degree in 1963, B.S. degree in mathematics in 1963, M.S.E.E. degree in 1964, and Ph.D. degree in 1970 from The University of Michigan, Ann Arbor.

He joined the Faculty of Electrical Engineering at Northeastern University, Boston, MA, in 1970. While at Northeastern he consulted for M.I.T. Lincoln Laboratory in the area of IMPATT diodes. In 1972, he joined the Faculty of Electrical Sciences and Engineering at the University of California, Los Angeles, where he did research on the theoretical analysis and experimental characterization of microwave solid-state devices. He consulted for local industry on millimeter-wave semiconductor devices. In 1976, he did research on GaAs FET's at Sandia Laboratory, Albuquerque, NM, as a Visiting Faculty. He joined the staff at Hughes Research Laboratory in 1976 where he has been responsible for the design, modeling and testing of GaAs FET integrated circuits. At present he is a Senior Staff Engineer working on both photolithographic and electron-beam fabricated, high speed GaAs logic circuits.

Dr. Greiling is a member of MTT-S ADCOM, Eta Kappa Nu, Tau Beta Pi, and Sigma Xi.