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Dr. Birman is a member of the Computer Sciences Department at the Thomas J. Watson Research Center, where he is currently working on correctness of programs. He joined IBM in 1970 at the Research Center and has also worked on the design and development of time-sharing operating systems. His degrees are all in electrical engineering—a B.S. and an M.S. from the Technion-Israeli Institute of Technology, Haifa, in 1962 and 1967, and a Ph.D. from Princeton University in 1970. He is a member of the Association for Computing Machinery.

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Dr. Chu is a Professor of Engineering Science at Columbia University and since 1970 has been a consultant to the IBM System Development Division laboratory in Kingston, New York. His research interests are in fluid and plasma dynamics and in numerical analysis and computing. Before joining Columbia University in 1963 he held a position with the General Electric Company as a development engineer and also taught aerospace engineering at New York University's School of Engineering from 1959 to 1963. He was an associate editor of the *American Institute of Aeronautics and Astronautics Journal* and is currently an associate editor of *Physics of Fluids*. He was also editor of the reprint volume *Computational Fluid Dynamics* published by the American Institute of Aeronautics. His educational background includes B.S. and M.S. degrees in mechanical

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Mr. Godard is a graduate student at the Université Paris-Sud, France. He is temporarily working in the Advanced Technology Department at the Research Center in La Gaude, where he is fulfilling his thesis requirements toward a Ph.D. degree in the area of data transmission systems. Mr. Godard is currently involved in the theoretical aspects of signal processing applied to signal converters. He received the Mastership degree in physics from the University of Lyon, France, in 1971 and the Elaborate Study degree in electronics from the University of Paris in 1972.

Peter H. Haberland

System Development Division, Kingston, New York

Dr. Haberland is manager of display device technology, where he is responsible for the development of the gas discharge panel. He joined IBM in 1968 and in 1969 was appointed manager of the device physics group in advanced technology. He previously was employed by Westinghouse Research Laboratory from 1963 to 1964, where he worked on the development and test for CRT phosphors and was a consultant to Westinghouse until 1965. His educational background includes a Diplom Physicist from the Technische Universität, Berlin, 1963; an M.S. degree in physics from the Massachusetts Institute of Technology, 1966; and a Dr. Ing. degree from the Technische Universität, Berlin, 1968. He completed postdoctoral research in low temperature physics at Northeastern University, Boston, in 1968. His professional associations include the German Physical Society, the American Physical Society and the Society for Information Display.

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Dr. Karnaugh is a member of the Computer Sciences Department at the Thomas J. Watson Research Center. He joined IBM in 1966 at the Federal Systems Division, Gaithersburg, Maryland, where he studied large communication systems employing both satellite and cable transmission channels. He transferred to the Research Center in 1970 and has worked on digital signal processing, communication system configuration and digital switching systems. He previously was employed by

Bell Telephone Laboratories, Murray Hill, New Jersey, from 1952 to 1966 as a member of the technical staff, where he worked on logic design methods, magnetic logic circuits, switching systems, and digital transmission and switching techniques. His education includes a B.S. in physics from the City College of New York, 1948, and an M.S. and a Ph.D. in physics and theoretical physics from Yale University in 1950 and 1952. Dr. Karnaugh is a member of the Institute of Electrical and Electronics Engineers, Phi Beta Kappa, Sigma Xi and the International Council for Computer Communication.

Conrad Lanza

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Mr. Lanza is a member of the display technology group at the Thomas J. Watson Research Center and is currently working on computer analysis of gas display panel operation. Since becoming associated with IBM in 1959, his research has included studies of tunnel diodes, semiconductor injection lasers and Gunn effect devices. From 1953 to 1959 he was employed by Raytheon, Boston, where he worked on transistorized pulse position modulation communication systems and from 1947 to 1953 he was involved in the development of radio aids to airborne navigation while with Hazeltine Laboratories, Little Neck, Long Island. He received a B.S.E.E. degree from the Polytechnic Institute of Brooklyn in 1947 and an M.S.E.E. degree from Northeastern University, Boston, in 1956.

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Dr. Lay has been on a leave of absence from IBM since February 1973 and is currently a Professor of Electrical Engineering at Min-Chi Institute of Technology, Taipei Hsien, Taiwan, Republic of China. While at the Kingston laboratory, he was an advisory engineer and since 1968 had been involved in the development of the gas discharge display panel. He joined IBM in Kingston in 1967. He received a Ph.D. degree in the field of magnetic resonance from the University of Texas at Austin in 1966 and did postdoctoral research in the field of luminescence at the Massachusetts Institute of Technology. He is a member of Sigma Pi Sigma and of the American Physical Society.

Joseph A. Lukes

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Dr. Lukes is an advisory engineer with the advanced data systems evaluation group and is involved in performance evaluation of storage subsystems. He joined IBM in 1967 as a logic designer in the System Development Division in Menlo Park, California. He obtained a Ph.D. in electrical engineering from Stanford University in 1972. Dr. Lukes is a member of the Institute of Electrical and Electronics Engineers, the American Association for the Advancement of Science, Tau Beta Pi, Pi Mu Epsilon, Eta Kappa Nu, Phi Kappa Phi and Sigma Tau.

Hans R. Rottmann

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Dr. Rottmann is an advisory physicist in an advanced equipment development group. Before joining IBM he worked for the Owens-Illinois Glass Company, Toledo, where he developed automatic inspection systems, 1959 to 1963, and for the Carl Zeiss Company, Jena, Germany, as a research staff member, 1949 to 1953. He was also on the staff of the Heidelberg's Department of Nuclear Spectroscopy and was a lecturer of physics at the Instituto Tecnológico de Monterrey, Mexico, from 1958 to 1959. His education includes an M.S. and a Ph.D. in physics which he received from Jena University in 1949 and the University of Heidelberg in 1957, respectively. In March of 1973 he received an IBM Outstanding Contribution Award for the development of the automatic wafer flattener. Dr. Rottmann is a member of the Optical Society of America and the Research Society of America.

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Dr. Tang, who has been with IBM since 1959, is a senior engineer in a direct access storage device development group. He previously worked at the International Harvester Company, Chicago, Illinois, and was a part-time Assistant Professor at California State University, San Jose, from 1969 to 1971. He has also taught several classes in engineering education at the San Jose laboratory. His education includes a B.S. from Chiao-tung University, Chungking, China, 1942; an M.S. from Ohio State University, Columbus, 1950; and a Ph.D. in mechanical engineering from the Illinois Institute of Technology, Chicago, 1960. He is a member of the American Society of Mechanical Engineering, and is a registered professional engineer. In 1967 he received an IBM Outstanding Contribution Award for air bearing analysis.

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