Authors

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Dr. Buturla is an advisory engineer in the Advanced Mathematics and Engineering Analysis department. He is currently engaged in developing algorithms for semiconductor device simulation, heat transfer, and electric- and magnetic-field modeling. He has been with IBM since 1967 and has worked on applications of the finite-element method to problems of heat transfer, viscoelasticity, plasticity, and linear elasticity. He received a B.S. in 1967 from the University of Connecticut and M.S. and Ph.D. degrees in mechanical engineering in 1970 and 1976, respectively, from the University of Vermont. From 1976 to 1979, he was a Clinical Assistant Professor in the Department of Orthopedics and an Adjunct Professor in the Department of Mechanical Engineering, both at the University of Vermont. In 1977, he was selected by the National Society of Professional Engineers as the Young Engineer of the Year for the State of Vermont. Dr. Buturla received an IBM Outstanding Innovation Award in 1979 for his work in semiconductor modeling. He is a member of the Association for Computing Machinery, the American Society of Mechanical Engineers, the American Society of Biomechanics, Sigma Xi, and the National Society of Professional Engineers, and is a registered professional engineer in the State of Vermont.

Enrico Clementi

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Dr. Clementi received the Ph.D. in theoretical chemistry in 1954 from the University of Pavia, Italy. After doing postdoctoral work on the electrical properties of organic polymers at the Polytechnical Institute of Milan, he held postdoctoral positions at Florida State University (1955–1957), the University of California at Berkeley (1957–1959), and the University of Chicago (1959–1960). He joined the IBM Research laboratory at San Jose, California in 1960 and served as group leader of the theoretical chemistry and physics group there from 1962–1966. In 1966, he was a visiting professorial lecturer at the University of Chicago, and in 1967, became manager of the Large-Scale Scientific Computations department at San Jose. Dr. Clementi was appointed an IBM Fellow in 1969. He resigned from IBM in 1975 after a year's leave of absence and became manager of a theoretical chemistry department at Montedison Corporation in Novara, Italy. He earned the title of professor in theoretical chemistry in 1976 and rejoined IBM at Poughkeepsie in 1979, serving as technical advisor for scientific computation. Dr. Clementi received an IBM Outstanding Contribution Award in 1968 for his advances in the area of large-scale scientific computing and is best known for his various works on computations involving atoms, molecules, and complex biological systems. He is a member of the Academia degli Agiati, the American Chemical and American Physical Societies, and the New York Academy of Science (lifetime member). He is also president of the International Society for Quantum Biology.

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Dr. Cottrell received his B.S., M.E., and Ph.D. degrees from Rensselaer Polytechnic Institute, Troy, New York, in 1968, 1970, and 1973, respectively. From 1970 to 1972, he was an Instructor at Rensselaer Polytechnic Institute. Since 1973, he has been employed at the IBM General Technology Division, Essex Junction, Vermont. His experience has included research and development in transient ionizing radiation effects in IMPATT diodes, hot-electron effects in MOSFETs, design limitations and characterization of MOSFET structures, and two-dimensional simulation of both bipolar and FET semiconductor devices. Dr. Cottrell is a member of Eta Kappa Nu, Tau Beta Pi, and Sigma Xi.

John A. Darringer

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Dr. Darringer received a Ph.D. from Carnegie-Mellon University in 1969; his doctoral dissertation dealt with the synthesis of hardware implementations from algorithmic specifications. From 1969 to 1972 he was a design automation consultant to the Large Computer Division of Philips in Holland. In 1972 he joined IBM at the Thomas J. Watson Research Center, where he worked on program specification and verification. More recently, he has begun a project to take a new look at the problem of hardware synthesis.

William J. Fitzgerald

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Dr. Fitzgerald is a research staff member in the Computer Sciences department at the IBM Thomas J. Watson Research Center, where his current areas of research are in algorithms and user's procedures for graphical input of volume models. He joined IBM in Poughkeepsie, New York, in 1951 and worked on the IBM 701 and SAGE systems. He managed a project which designed and fabricated superconducting circuits at the Federal Systems Division in Kingston, NY, 1958–1960. He was awarded an IBM Resident Graduate Fellowship to attend the University of California at Berkeley, where he received a Ph.D. in electrical engineering in 1965. Dr. Fitzgerald was involved in planning for graphics in the Data Systems Division in Kingston, New York, until 1968, when he joined the Research Division to manage an experimental input/output laboratory. There he worked on developing a raster display and a computer-aided drafting system and was assigned to the IBM Europe/Middle East/Africa Corporation in 1976–1977. Dr. Fitzgerald received a B.E. from Yale in 1949, an M.E. from Rensselaer Polytechnic Institute in 1952, and a Ph.D. from the University of California at Berkeley in 1965, all in electrical engineering. He is a member of the Institute of Electrical and Electronics Engineers and of the Computer Society.

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Mr. Gracer is a research staff member at the IBM Thomas J. Watson Research Center and is currently involved in the application of 3D modeling to mechanical design automation. He received a B.S. degree from City College of New York and joined IBM in 1956 as a programmer in the Service Bureau Corporation. He moved to the Research Division in 1966 and has worked in the areas of design automation and computer graphics.

Bertrand M. Grossman

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Mr. Grossman is a member of the Advanced Mathematics and Engineering Analysis department. His technical interests include numerical analysis, electromagnetics, and the physics of semiconductor devices. He is currently engaged in the mathematical modeling of the semiconductor transport equations by the finite-element method. Mr. Grossman received his B.S. and M.S. degrees in applied physics from Columbia University in 1974 and 1975, respectively. While he was a graduate student at Columbia, his research involved the mathematical modeling of magnetically confined plasmas used for thermonuclear fusion energy. Prior to joining IBM in 1978, he worked for Singer-Kearfott Co. in the area of inertial navigation systems. Mr. Grossman is a member of the American Physical Society.

Gary D. Hachtel

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Dr. Hachtel received a B.S. from the California Institute of Technology in 1959 and a Ph.D. from the University of California, Berkeley, in 1965, both in electrical engineering. He has taught at the University of California, Berkeley; New York University; the University of California, Los Angeles, where he was Regents Lecturer in 1974; and the University of Denver. Since 1965 he has been with IBM at the Thomas J. Watson Research Center and at the Office Products Division, Boulder, Colorado, and is now manager of modeling and systems design with the Mathematical Sciences department at Yorktown. His current interests are simplicial approximation, sparse matrices, VLSI design, and solar modeling. Dr. Hachtel was associate editor for the *International Journal for Numerical Methods in Engineering* and is now associate editor for the *IEEE Transactions on Circuits and Systems*. He received an IBM Outstanding Contribution Award for integrated circuit modeling in 1968 and an IBM Outstanding Invention Award in 1971 for the tableau approach to network design. In 1972, he was co-recipient of the best paper award from the Circuits and Systems Society and in 1978, the W. R. G. Baker Award for the best paper to appear in the 1978 IEEE *Proceedings* and *Transactions*. In 1979, Dr. Hachtel was elected a Fellow of the Institute of Electrical and Electronics Engineers.

Richard G. Hirko

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Dr. Hirko is a research staff member in the Advanced Storage Technology department at the IBM San Jose Research laboratory. He joined IBM at the Research Division, Yorktown Heights, New York in 1972. His current work involves device design for contiguous-disk magnetic-bubble memories. He received a B.S. in physics from the Rensselaer Polytechnic Institute in 1963 and M.S. and Ph.D. degrees in physics from Yale University in 1964 and 1969, respectively. He also received an M.S. degree in engineering economic systems in 1977 from Stanford University. He is a member of the American Physical Society.

Se June Hong

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Dr. Hong is a research staff member at the IBM Thomas J. Watson Research Center in Yorktown Heights, New York. He joined IBM in 1969 at the Poughkeepsie laboratory and, until 1978, worked in the areas of error correcting codes, testing, and various design automation algorithms for programmable logic arrays. He was a Visiting Associate Professor at the University of Illinois during the academic year 1974–1975 and Visiting Professor at the Korea Advanced Institute of Science and the Korea Institute of Science and Technology during the month of October, 1980. He is currently doing research in VLSI physical design automation. He obtained a B.Sc. in electronics engineering from Seoul National University in 1965 and his M.S. and Ph.D. degrees in electrical engineering from the University of Illinois in 1967 and 1969, respectively. He is a member of the Institute of Electrical and Electronics Engineers, the Association for Computing Machinery, Sigma Xi, Mathematical Association of America, and Korean Engineers and Scientists in America. Dr. Hong received an honorable mention award for Outstanding Young Electrical Engineer of 1974 from Eta Kappa Nu and has also received two Outstanding Innovation Awards from IBM.

H. L. (Ben) Hu

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Dr. Hu is currently manager of the magnetic bubble devices group, which is engaged in research and development of contiguous-disk devices at the IBM San Jose Research laboratory. He received a B.S. from the National Taiwan University in 1964, and an M.S. in 1967 and a Ph.D. in 1970 from the Massachusetts Institute of Technology, all in electrical engineering. In 1971, he spent one year in postdoctoral study at M.I.T., continuing research in infrared light scattering from microwave acoustic and magnetoelastic waves. He joined the IBM Thomas J. Watson Research Center, Yorktown Heights, New York, in 1972, working on material characterization and devices of submicron and amorphous bubbles. Since moving to San Jose in 1973, he has been working on high-density magnetic bubble devices.

William H. Joyner, Jr.

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Dr. Joyner received a B.S. in engineering science from the University of Virginia in 1968, and a Ph.D. in applied mathemat-

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Dr. Kaufman is a staff member in the organic solid state group of the Physical Sciences department at the Thomas J. Watson Research Center, where he joined IBM in 1973. His main interests have been in the design, synthesis, and properties of novel solids. Some of his recent work includes the synthesis of new conducting polymers and other novel polymer systems for use as conductors, resists, etc. He received a Ph.D. from Johns Hopkins University, Baltimore, Maryland, in 1973. Dr. Kaufman is a member of the American Chemical Society.

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Dr. Kozen is a research staff member in the Computer Sciences department at the IBM Thomas J. Watson Research Center. His research interests include complexity theory, theory of computation, and program logic and semantics. He received a B.A. in mathematics from Dartmouth College in 1974 and an M.S. and Ph.D. in computer science from Cornell University in 1977, and held a postdoctoral fellowship at the University of California, Berkeley, until joining IBM in September of 1978. He is a recent recipient of an IBM Outstanding Innovation Award for work in complexity theory. He is a member of the Association for Computing Machinery and the American Mathematical Society.

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Dr. Lee is an Assistant Professor in the Department of Electrical Engineering and Computer Science at Northwestern University. He received his B.S. degree in electrical engineering from the National Taiwan University, Taipei, in 1971; and his M.S. and Ph.D. degrees in computer science from the University of Illinois, Urbana, in 1976 and 1978. He was a summer visitor at the IBM Thomas J. Watson Research Center, Yorktown Heights, New York, in 1977 and 1979. His current research interests include design and analysis of algorithms, computational geometry, discrete mathematics of computation, and data base systems. Dr. Lee is a member of the Association for Computing Machinery and the Institute of Electrical and Electronics Engineers.

Marian H. Mack

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Miss Mack is an advisory programmer in the modeling and system design group, Mathematical Sciences department, at the IBM Thomas J. Watson Research Center. She worked as an x-ray crystallographer at Phillips Laboratories before joining IBM in 1967 as a system programmer in the Computer Assisted Instruction department at Yorktown. Since 1970 she has worked on the modeling of semiconductor devices and fluid flows. She received a Research Division Outstanding Contribution Award for her work on the implementation of IPS. Miss Mack received a B.S. in chemistry from Syracuse University and an M.S. in chemistry from the Polytechnic Institute of Brooklyn.

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Mr. Moore joined IBM at the Endicott, New York, laboratory in 1952, after receiving a B.S. in metallurgical engineering at the University of Cincinnati. In 1956 he became manager of a materials analysis laboratory at San Jose; he joined the Advanced Technology department in 1960 to work on the preparation and characterization of magnetic and other film materials. Since 1973 he has been participating in a joint effort with the IBM research laboratory at San Jose, doing research on magnetic bubble technology, and has been preparing garnet bubble materials for that effort since 1976.

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Dr. O'Brien received the B.S. (1953), M.S. (1954), and Ph.D. (1957) degrees in mathematics from the Massachusetts Institute of Technology. From 1958 to 1960, he worked for Sylvania Electric on communication and detection problems, and in 1960

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Mr. Saiki is a research staff member at the IBM San Jose Research laboratory. He joined IBM in 1973, and was involved in processing and process development in the fabrication of magnetic-bubble devices until the end of 1980. He is currently assigned to the development of advanced magnetic-recording heads. Prior to joining IBM he worked in the Research Division of Ampex Corporation in Redwood City, California, on the development of planar thin-film memories, magneto-optic laser record-and-read storage systems, disc plating, and semiconductor packaging. Mr. Saiki attended Wabash College, Crawfordsville, Indiana and Columbia University with majors in zoology and chemistry, respectively.

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Ms. Salsburg is an engineer in the Advanced Mathematics and Engineering Analysis department. She is currently engaged in developing a semiconducting process simulation system. Prior to joining IBM in 1978, Ms. Salsburg was a mathematician and programmer for the U.S. Bureau of the Census and the National Bureau of Standards. She received a B.S. in mathematics from St. Lawrence University, Canton, New York, in 1972, an M.S. in mathematics from the University of Rhode Island in 1973, and an MS. in applied mathematics from the University of Maryland in 1978. Ms. Salsburg is a member of the Association for Computing Machinery and the Society for Industrial and Applied Mathematics.

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Dr. Schwenker manages the magnetic bubble processing laboratory at the IBM Research laboratory in San Jose. Dr. Schwenker joined IBM in 1963 at Rochester, Minnesota after receiving a B.S. degree in physics from the University of Missouri at Rolla. He obtained M.S. and Ph.D. degrees in physics from the University of Illinois, Urbana, in 1964 and 1969, respectively. During the years 1968 to 1978, he worked in silicon process development at the IBM laboratory in East Fishkill, New York. Dr. Schwenker is a member of the American Physical Society, the Electrochemical Society, and Sigma Xi.

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Dr. Speelpenning is a development engineer working in the area of computer architecture. He joined Hewlett Packard in the architecture project in 1979. His current interests include nonconventional computer architectures, computer languages, and the mapping of languages onto architectures. In 1973 he held a summer assignment in the Mathematical Sciences department at IBM Research, Yorktown Heights, New York, working in numerical analysis, particularly the application of the finite-element method to semiconductor analysis. Dr. Speelpenning received the Engineering Degree from Delft University of Technology, Delft, the Netherlands, in applied mathematics in 1974 and a Ph.D. in computer sciences from the University of Illinois in 1980. He is a member of the Association for Computing Machinery.

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Miss Trevillyan joined IBM at Data Processing Services, San Francisco, in 1974. In 1977, she moved to the Thomas J. Watson Research Center, where she is currently working on the experimental compiler systems project in the Computer Sciences department. She received a B.A. in mathematics in 1968, and an M.A. in mathematics and an M.S. in computer sciences in 1970, all from the University of Michigan.

Robert N. Wolfe

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Mr. Wolfe received a B.S. in radio engineering from the Indiana Institute of Technology in 1955 and joined IBM at the Federal Systems Division in Kingston, NY, as an electrical engineer. He has had assignments in the Data Processing, Systems Development, Advanced Systems Development, and Research Divisions and in the World Trade Corporation of IBM. Since 1969 he has been a research staff member at the IBM Thomas J. Watson Research Center, Yorktown Heights, NY. During these assignments he received IBM Outstanding Contribution Awards in the fields of information retrieval, character and pattern recognition, and computer graphics. He is currently manager of a research project in Computer Graphics for 3D modeling applied to mechanical design automation. His professional society memberships include the Association for Computing Machinery, the National Computer Graphics Association, and the Society of Manufacturing Engineers.

Chak-Kuen Wong

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Dr. Wong joined IBM in 1969 as a member of the Computer Sciences department at the Thomas J. Watson Research Center. His current interests include VLSI design and algorithms, abstract and concrete computational complexity theory, optimization problems related to data allocation, magnetic bubble memory structures, theory of fuzzy sets, and satellite switching/time domain multiple access systems. Dr. Wong received a B.A. in mathematics from the University of Hong Kong in 1965 and M.A. and Ph.D. degrees in mathematics from Columbia University, New York, in 1966 and 1970, respectively. For the academic year 1972–73 he was a Visiting Associate Professor of Computer Science at Columbia University. He received an IBM Outstanding Invention Award in 1971 for a new family of sorting methods and two IBM Invention Achievement Awards.