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# COMPLEXITY OF SEQUENTIAL AND PARALLEL NUMERICAL ALGORITHMS

Edited by J. F. TRAUB  
*Departments of Computer Science and Mathematics  
Carnegie-Mellon University  
Pittsburgh, Pennsylvania*

September 1973, 316 pp., \$11.50  
ISBN: 0-12-697550-7

This book contains a collection of papers that deal with numerical algorithms and programs for the new generation of super computers designed for large scientific problems. The papers were presented at a symposium held at Carnegie-Mellon University, May

16-18, 1973. The symposium was organized to provide a forum for the presentation and discussion of recent research results and surveys on topics such as sequential and parallel numerical algorithms, algebraic and analytical computational complexity, and the interdependence of machine organization and algorithms.

This book will be of value to computer scientists, numerical analysts, electrical engineers, and programmers, and to advanced students in these areas.

### CONTENTS:

- H. S. STONE, Problems of Parallel Computation
- D. J. KUCK, Multioperator Machine Computational Complexity
- J. F. TRAUB, Iterative Solution of Tridiagonal Systems on Parallel or Vector Computers
- R. S. BRENT, The Parallel Evaluation of Arithmetic Expressions in Logarithmic Time
- W. M. GENTLEMAN, On The Relevance of Various Cost Models of Complexity
- J. L. OWENS, The Influence of Machine Organization on Algorithms
- D. R. REDDY, Some Numerical Problems in Artificial Intelligence: Implications for Complexity and Machine Architecture

- A. BORODIN, On the Number of Arithmetics Required to Compute Certain Functions - Circa May 1973.
- S. WINOGRAD, Some Remarks on Fast Multiplication of Polynomials.
- J. R. BUNCH, Complexity of Sparse Elimination.
- G. BIRKHOFF and A. GEORGE, Elimination by Nested Dissection.
- S. C. EISENSTAT and M. H. SCHULTZ, The Complexity of Partial Differential Equation
- A. SCHÖNHAGE, Fast Schmidt Orthogonalization and Unitary Transformations of Large Matrices.
- List of Contributed Papers.
- List of Symposium Attendees.

# MATHEMATICAL PROGRAMMING

Edited by T. C. HU  
**STEPHEN M. ROBINSON**  
*University of Wisconsin*

1973, 306 pp., \$8.75  
ISBN: 0-12-358350-0

This book offers insight into several branches of mathematical programming which have advanced rapidly in recent years. It contains papers covering such areas as • integer programming • game theory • large-scale systems • nonlinear programming • dynamic programming • combinatorial equivalence. The papers - all written by authorities from government, industry, and various universities - were presented at the Advanced Seminar on Mathematical Programming held in Madison, Wisconsin, September 11-13, 1972, under the auspices of the Mathematics Research Center, University of Wisconsin, Madison.

### CONTENTS:

- GEORGE B. DANTZIG, R. W. COTTLE, B. C. EAVES, F. S. HILLIER, A. S. MANNE, G. H. GOLUB, D. J. WILDE, and R. B. WILSON, On the Need for a System Optimization Laboratory.
- ERIC V. DENARDO, A Markov Decision Problem.
- D. R. FULKERSON, On the Perfect Graph Theorem.
- R. S. GARFINKEL and G. L. NEMHAUSER, A Survey of Integer Programming Emphasizing Computation and Relations Among Models.
- RALPH E. GOMORY and ELLIS L. JOHNSON, The Group Problems and Subadditive Functions.
- ELLIS L. JOHNSON, Cyclic Groups, Cutting Planes, Shortest Paths.
- HARLAN P. CROWDER and ELLIS L. JOHNSON, Use of Cyclic Group Methods in Branch and Bound.
- C. B. GARCIA, C. E. LEMKE, and H. LUETHI, Simplicial Approximation of an Equilibrium Point for Non-Cooperative N-Person Games.
- L. S. SHAPLEY, On Balanced Games Without Side Payments.
- Index.

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# Numerical Solution of Systems of Nonlinear Algebraic Equations

Edited by **GEORGE D. BYRNE**

*Departments of Mathematics and  
Chemical and Petroleum Engineering  
University of Pittsburgh, Pittsburgh, Pennsylvania*

**CHARLES A. HALL**

*Department of Mathematics  
University of Pittsburgh  
Pittsburg, Pennsylvania*

With an Introduction by **WERNER C. RHEINBOLDT**

1973, 428 pp., \$14.50  
ISBN: 0-12-148950-7

This book presents articles on the origin of some nonlinear problems and on the generalization of linear algebraic techniques for the solution of nonlinear systems. It also surveys several important classes of nonlinear methods, treats their application to certain physical problems, and gives some new results. Topics covered include:

- The origin of some nonlinear algebraic systems of equations in continuum mechanics
- A review of iterative methods for large sparse linear algebraic systems of equations – with indications for their use in solving nonlinear systems
- Nonlinear systems in semi-infinite programming
- A review of quasi-Newton or modification methods – with comments about their utilization
- Specific techniques for solving systems of nonlinear algebraic equations

- The numerical solution of a nonlinear conductive heat transfer problem
- The contractor theory for solving equations

The papers in this book were presented at the NSF-CBMS Regional Conference on The Numerical Solution of Nonlinear Algebraic Systems with Applications to Problems in Physics, Engineering and Economics, Held at the University of Pittsburgh, July 10-14, 1972.

## CONTENTS:

WILLIAM F. AMES, Nonlinear Algebraic Equations in Continuum Mechanics  
GUNTER H. MEYER, The Numerical Solution of Quasilinear Elliptic Equations  
SVEN-ÅKE GUSTAFSON, Nonlinear Systems in Semi-Infinite Programming  
DAVID M. YOUNG, Jr., On the Solution of Large Systems of Linear Algebraic Equations with Sparse, Positive Definite Matrices  
JOHN E. DENNIS, Jr., Some Computational Techniques for the Nonlinear Least Squares Problem  
NORMAN M. STEEN and GEORGE D. BYRNE, The Problem of Minimizing Nonlinear Functionals I. Least Squares  
CHARLES G. BROYDEN, Quasi-Newton, or Modification Methods  
KENNETH M. BROWN, Computer Oriented Algorithms for Solving Systems of Simultaneous Nonlinear Algebraic Equations  
SAMUEL SCHECHTER, On the Choice of Relaxation Parameters for Nonlinear Problems  
MIECZYSLAW ALTMAN, The Contractor Theory of Solving Equations  
Subject Index.

# THEORY OF MACHINES AND COMPUTATIONS

Edited by **ZVI KOHAVI**

*Faculty of Electrical Engineering  
Technion—Israel Institute of Technology  
Haifa, Israel*

**AZARIA PAZ**

*Department of Computer Science  
Technion—Israel Institute of Technology  
Haifa, Israel*

1971, 430 pp., \$14.50  
ISBN: 0-12-417750-6

This book consists of the papers presented at the International Symposium on the Theory of Machines and Computations held at the Technion – Israel Institute of Technology, Haifa, Israel, August 1971. The papers, chosen by an international program committee, deal with a wide variety of subjects in the

areas of computability theory, formal language, automata theory, and switching theory, and constitute a collection of the most recent results obtained by leading researchers in the United States, Canada, Europe, Israel, and South America.

THEORY OF MACHINES AND COMPUTATIONS will be of value to computer scientists, applied mathematicians, logicians, and electrical engineers in industrial research centers and universities.

## SECTION AND SUBSECTION HEADINGS:

Computability Theory. Formal and Stochastic Languages: 1. Formal Languages. 2. Stochastic Automata and Languages. Finite Automata: 1. Algorithms and Bounds. 2. Linear Machines. 3. Algebraic Theory of Automata. Fault-Detection Experiments. Switching Theory: 1. Combinational Circuits. 2. Sequential Circuits.  
Author Index. Subject Index.

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