

# Recent computer-related math books from Addison-Wesley

**Numerical Analysis and Computation: Theory and Practice** by Edward K. Blum, University of Southern California. Consulting Editor: Richard S. Varga. Intended primarily for graduate-level courses, this book uses functional analysis methods and ideas to unify treatment of finite- and infinite-dimensional problems. The author treats numerical analysis as a link between discrete and continuous mathematics.

**A Survey of Numerical Mathematics, Volumes I and II** by David M. Young and Robert Todd Gregory, The University of Texas at Austin. Consulting Editor: Richard S. Varga. This two-volume work, intended for advanced undergraduate and graduate courses, covers the use of computer-oriented numerical algorithms for solving mathematical problems.

## ... recent math-related computer books

**Computer Applications of Numerical Methods** by Shan S. Kuo, University of New Hampshire. This text is designed to introduce students of engineering and the pure and applied sciences to the numerical methods used in solving problems on a high-speed digital computer. The book discusses man-machine communication, numerical methods suitable for computers, and modern topics in digital computation.

**Simplified FORTRAN Programming, with Companion Problems** and **Simplified BASIC Programming, with Companion Problems** by Lisa Rosenblatt, General Electric Co., and Judah Rosenblatt Case Western Reserve University. Designed to supplement finite mathematics, pre-calculus, and calculus courses as well as courses in introductory computer science, these two paperback texts teach computer programming in a framework of problem-solving. After briefly covering the fundamentals of the respective languages, the authors concentrate on the carefully graded problems, which start at a very elementary level.

Write to Mary Clare McEwing for your examination copies, giving course numbers, titles, enrollments, and present texts. Also ask for your 1973-74 Addison-Wesley catalog.

**Addison-Wesley**  
PUBLISHING COMPANY, INC.  
Reading, Massachusetts 01867



THE SIGN OF  
EXCELLENCE

# Mathematical Reviews

## SECTIONS

Those sections marked Class 1 are \$10; Class 2 are \$8; Class 3 are \$6. The first sectional subscription is \$12, no matter what the class. In the case of multiple subscriptions, the section with the lowest class number will be considered the first subscription.

- |  |   |
|--|---|
| 00 General (Class 2)                                       | 46 Functional analysis (Class 1)                                |
| 01 History and biography (Class 2)                         | 47 Operator theory (Class 1)                                    |
| 02 Logic and foundations (Class 1)                         | 49 Calculus of variations, optimal control (Class 2)            |
| 04 Set theory (Class 3)                                    | 50 Geometry (Class 2)   |
| 05 Combinatorial theory, graph theory (Class 1)            | 52 Convex sets and geometric inequalities (Class 3)             |
| 06 Order, lattices, ordered algebraic structures (Class 2) | 53 Differential geometry (Class 1)                              |
| 08 General mathematical systems (Class 3)                  | 54 General topology (Class 1)                                   |
| 10 Theory of numbers (Class 1)                             | 55 Algebraic topology (Class 2)                                 |
| 12 Fields and polynomials (Class 3)                        | 57 Topology and geometry of manifolds (Class 1)                 |
| 13 Commutative associative rings and algebras (Class 2)    | 60 Probability (Class 1)  |
| 14 Algebraic geometry (Class 2)                            | 62 Statistics (Class 1)   |
| 15 Linear and multilinear algebra, matrix theory (Class 2) | 65 Numerical methods (Class 1)                                  |
| 16 Associative rings and algebras (Class 1)                | 68 Computing machines (Class 3)                                 |
| 17 Non-associative rings and algebras (Class 3)            | 69 General applied mathematics (Class 3)                        |
| 18 Category theory, homological algebra (Class 2)          | 70 Mechanics of particles and systems (Class 3)                 |
| 20 Group theory and generalizations (Class 1)              | 73 Elasticity, plasticity (Class 3)                             |
| 22 Topological groups and Lie theory (Class 2)             | 76 Fluid mechanics, acoustics (Class 3)                         |
| 26 Functions of real variables (Class 2)                   | 78 Optics, electromagnetic theory (Class 3)                     |
| 28 Measure and integration (Class 2)                       | 80 Classical thermodynamics, heat transfer (Class 3)            |
| 30 Functions of a complex variable (Class 1)               | 81 Quantum mechanics (Class 1)                                  |
| 31 Potential theory (Class 3)                              | 82 Statistical physics, structure of matter (Class 3)           |
| 32 Several complex variables (Class 2)                     | 83 Relativity (Class 3)   |
| 33 Special functions (Class 2)                             | 85 Astronomy and astrophysics (Class 3)                         |
| 34 Ordinary differential equations (Class 1)               | 86 Geophysics (Class 3)   |
| 35 Partial differential equations (Class 1)                | 90 Economics, operations research, programming, games (Class 1) |
| 39 Finite differences and functional equations (Class 3)   | 92 Biology and behavioral sciences (Class 3)                    |
| 40 Sequences, series, summability (Class 2)                | 93 Systems, control (Class 1)                                   |
| 41 Approximations and expansions (Class 2)                 | 94 Information and communications, circuits, automata (Class 1) |
| 42 Fourier analysis (Class 1)                              |   |
| 44 Integral transforms, operational calculus (Class 3)     |   |
| 45 Integral equations (Class 2)                            |   |

-----

The sections that appear on the cover of MATHEMATICAL REVIEWS can now be ordered. In all, there are fifty-nine sections (tear sheets).

Please use this order form for fast service.

List sections wanted here \_\_\_\_\_

- |   |              |
|---|--------------|
| <input type="checkbox"/> Payment enclosed | Date _____   |
| <input type="checkbox"/> Please bill      |              |
| <input type="checkbox"/> Member           | Amount _____ |
| <input type="checkbox"/> Nonmember        |              |
| Order # _____                             |              |

Send bill to \_\_\_\_\_ Ship to \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**SALES AND SUBSCRIPTIONS**  
**American Mathematical Society**  
**P. O. Box 6248**  
**Providence, R. I. 02904**

## OPTIMAL CONTROL OF DIFFERENTIAL AND FUNCTIONAL EQUATIONS

by J. WARGA, Northeastern University

This book presents a mathematical theory of deterministic optimal control—with special emphasis on problems defined by differential and functional-integral equations and on problems involving functional restrictions or conflicting controls. The book investigates three types of optimal solutions: “original” (ordinary) solutions, “approximate” solutions (minimizing sequences), and

“relaxed” (weak solutions). It studies the existence of various types of solutions and their interrelationships, derives necessary conditions for original and relaxed minima, and indicates a procedure for constructing an optimal approximate solution out of an optimal relaxed solution. It devotes restrictions that characterize problems with conflicting and minimax controls.

1972, 544 pp., \$27.50

## COMPUTER-ORIENTED APPROACHES TO PATTERN RECOGNITION

by WILLIAM S. MEISEL, University of Southern California

A Volume in the MATHEMATICS IN SCIENCE AND ENGINEERING Series

This book discusses mathematical concepts and techniques of wide applicability to the solution of problems involving recognition of patterns in image, speech, or data. It emphasizes methods which can be used in the solution of practical problems but which are independent of specific applications, and is oriented toward the development of algorithms for the design of pattern recognition systems on a general-purpose digital com-

puter. Features include: basic concepts and some necessary mathematical material from statistical decision theory and optimization; linear discriminant function and extension; approximation to empirically estimated probability densities; potential function (Parzen estimator) methods; piecewise linear methods; cluster analysis (classification with unlabeled samples) and its relation to “unsupervised learning.” 1972, 264 pp., \$15.00

## METHODS OF INTERMEDIATE PROBLEMS FOR EIGENVALUES Theory and Ramifications

by ALEXANDER WEINSTEIN, Georgetown University, Washington, D.C.

and WILLIAM STENGER, Ambassador College, Pasadena, California

This book presents in detail two complementary methods for the computation of upper and lower bounds for eigenvalues, i.e., the Poincare-Rayleigh-Ritz Method and the Weinstein Method of Intermediate Problems and its variants. It begins with classical and modern variational principles and ends with a new discussion of perturbations of

finite rank. The monograph presents, on the one hand, several contributions to functional analysis, but it also includes—for the first time in book form—several new devices for high precision computation of lower bounds, such as those for vibrations of cantilever plates, for the Mathieu equation, and for energy levels in quantum mechanics.

1972, 246 pp., \$14.50

## INTRODUCTION TO GRAPH THEORY

by ROBIN J. WILSON, The Open University, Milton Keynes, England

The book contains introductory chapters on definitions, paths and circuits, and the properties of trees; the chapters following include such subjects as planarity and duality, problems relating to the four-colour conjecture, digraphs, transversal theory, and

network flows. An important feature is the inclusion, at the end of each of the 33 sections, of large numbers of exercises which will not only test the reader on the material in the text, but also introduce him to many results of lesser importance.

1972, 175 pp., Paper: \$7.50

## REGRESSION AND THE MOORE-PENROSE PSEUDOINVERSE

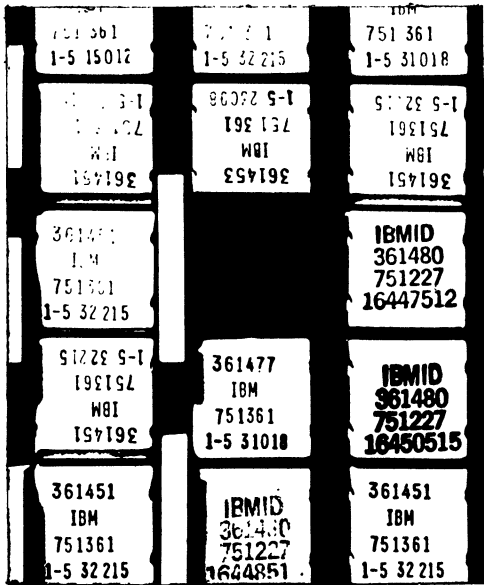
by ARTHUR ALBERT, Boston University

A Volume in the MATHEMATICS IN SCIENCE AND ENGINEERING Series

This book develops the theory of the Moore-Penrose pseudoinverse for rectangular matrices and applies it to such diverse fields as least squares theory, the theory of linear equations, linear regression, the analysis of variance, multiple regression, recursive estimation, and stepwise regression. The book contains much new material—some of which appears in print for the first time here. Features of particular interest: discusses the

application of pseudoinverses to the general linear model when residuals have a singular covariance (Gauss-Markov Theorem generalized); considers constraints (in least squares) as errorless observations; and includes a new treatment on nonnegative definite matrices that leads easily to a highly simplified exposition of multiple regression for normal random variables.

1972, 192 pp., \$12.50



# It's Not The Complex Circuitry That Makes The Computer Tick

It's the complex thinking behind it. And the Courant Institute Symposium Series presents an in-depth analysis of that thinking as well as other aspects of computer science.

**DEBUGGING TECHNIQUES IN LARGE SYSTEMS:** Offers a concise collection of papers dealing with efforts at controlling and eliminating bugs in computer programs. Papers discuss procedures capable of guaranteeing that programs are free of bugs. 1971 148 pp. cloth (013-197319-3) \$7.95

**FORMAL SEMANTICS OF PROGRAMMING LANGUAGES:** Covers a range of semantical problems and approaches in programming from methods of semantic specification to the activities of the IBM Vienna Laboratory and the formal definition of PL/I. 1972 250 pp. cloth (013-329060-3) \$9.95

**COMPUTER NETWORKS:** Deals with problems faced by computer network designers. Discusses IBM's Network/440, the MERIT Computer Network, the APRA, the OCTOPUS Network, and IMP. 1972 224 pp. cloth (013-166108-6) \$9.95

**ALGORITHM SPECIFICATIONS:** Focuses on attempts to specify algorithms so that they are acceptable to man

and machine. Describes SETL, ESPL, and BALM, as well as algorithms in terms of flowcharts. 1972 160 pp. cloth (013-022319-0) \$9.95

**DESIGN AND OPTIMIZATION OF COMPILERS:** Analyzes program transformations applied by programs called into play during the compiling process. 1972 141 pp. cloth (013-200204-3) \$9.95

**DATA BASE SYSTEMS:** Emphasizes the general problems confronting the designers of data base systems. Discusses data independence; proposes a retrieval language based on mathematical set theory; and suggests the use of certain specific forms of relation expressions. 1972 208 pp. cloth (013-196741-X) \$10.50

All books in the series edited by Randall Rustin of New York University.

For further information write: Robert Jordan, Dept. J-537, College Division, Prentice-Hall, Englewood Cliffs, N.J. 07632.

## PRENTICE-HALL

Quadratic Fields with Four Invariants Divisible by 3	DANIEL SHANKS & RICHARD SERAFIN	183
A Note on the Catalan-Dickson Conjecture . . . . .	H. J. J. TE RIELE	189
Numerical Results for Waring's Problem in $GF[q, x]$ . . .	WILLIAM A. WEBB	193
A Probabilistic Approach to a Differential-Difference Equation Arising in Analytic Number Theory . . . . .	JEAN-MARIE-FRANÇOIS CHAMAYOU	197
REVIEWS AND DESCRIPTIONS OF TABLES AND BOOKS . . . . .		205
BEIZER <b>12</b> , COCHRAN <b>7</b> , GASTINEL <b>4</b> , GEL'FOND <b>3</b> , MARTZ <b>8</b> , MORRIS <b>11</b> , NEWMAN <b>9</b> , REID, Editor <b>5</b> , ROBERTS & SHIPMAN <b>6</b> , SARD & WEIN- TRAUB <b>1</b> , SCHÖNHAGE <b>2</b> , YATES <b>10</b> .		
TABLE ERRATA . . . . .		219
ABRAMOWITZ & STEGUN <b>500</b> .		
MICROFICHE SUPPLEMENT		
A Catalogue of Combinatorial Geometries	JOHN E. BLACKBURN, HENRY H. CRAPO & DENIS A. HIGGS	
A Comparison of Algorithms for Rational $l_\infty$ Approximation		

---

The editorial committee would welcome readers' comments about this microfiche feature. Please send comments to Professor Eugene Isaacson, MATHEMATICS OF COMPUTATION, Courant Institute of Mathematical Sciences, New York University, 251 Mercer Street, New York, New York 10012.

# Mathematics of Computation

## TABLE OF CONTENTS

JANUARY 1973

Accurate Evaluation of Wiener Integrals . . . . .	ALEXANDRE JOEL CHORIN	1
A Finite Element Collocation Method for Quasilinear Parabolic Equations JIM DOUGLAS, JR. & TODD DUPONT		17
Mesh Refinement GERALD BROWNING, HEINZ-OTTO KREISS & JOSEPH OLIGER		29
A Note on the Stability of an Iterative Finite-Difference Method for Hyperbolic Systems . . . . .	MOSHE GOLDBERG	41
On the Instability of Leap-Frog and Crank-Nicolson Approximations of a Nonlinear Partial Differential Equation . . . . .	B. FORNBERG	45
Discrete Green's Functions . . . . .	G. T. MCALLISTER & E. F. SABOTKA	59
A Mollifier Useful for Approximations in Sobolev Spaces and Some Applications to Approximating Solutions of Differential Equations STEPHEN HILBERT		81
Local Extrapolation in the Solution of Ordinary Differential Equations L. F. SHAMPINE		91
Spline Approximation to the Solution of the Volterra Integral Equation of the Second Kind . . . . .	ARUN N. NETRAVALI	99
Improved Computation of Cubic Natural Splines with Equi-Spaced Knots MALCOLM A. MACLEOD		107
A Comparison of Algorithms for Rational $l_\infty$ Approximation C. M. LEE & F. D. K. ROBERTS		111
Chebyshev Approximations for the Psi Function W. J. CODY, ANTHONY J. STRECOK & HENRY C. THACHER, JR.		123
Derivatives of Whittaker Functions $W_{\kappa, 1/2}$ and $M_{\kappa, 1/2}$ with Respect to Order $\kappa$ . . . . .	BERNARD J. LAURENZI	129
Computing the Brouwer Degree in $R^2$ . . . . .	P. J. ERDELSKY	133
A Simple Approach to the Perron-Frobenius Theory for Positive Operators on General Partially-Ordered Finite-Dimensional Linear Spaces WERNER C. RHEINBOLDT & JAMES S. VANDERGRAFT		139
Algorithms for Triangular Decomposition of Block Hankel and Toeplitz Matrices with Application to Factoring Positive Matrix Polynomials J. RISSANEN		147
A Catalogue of Combinatorial Geometries JOHN E. BLACKBURN, HENRY H. CRAPO & DENIS A. HIGGS		155
On Integral Groups. III: Normalizers H. BROWN, J. NEUBÜSER & H. ZASSENHAUS		167