

*Current and forthcoming titles in the Prentice-Hall*

## **AUTOMATIC COMPUTATION SERIES**

*Edited by Dr. George E. Forsythe, Professor of Mathematics and Computer Science at Stanford University and Executive Head of the Computer Science Dept.*

### **COMPUTATION: FINITE AND IN-FINITE MACHINES** by Marvin Minsky, Massachusetts Institute of Technology

An introduction to the theories of finite-state machines, programmed computers, Turing machines and formal languages (in the form of Post Systems). Topics range from basic principles to current research problems with extensive discussions of the meaning and motivation of the theory, its practical value and limitations. This book includes guidance for self-study and further reading and study. Solutions to problems are in the text. February 1967, approx. 320 pp., \$10.50

### **NUMERICAL SOLUTION OF INITIAL VALUE PROBLEMS** by F. Ceschino, Civil Engineer, Armament, France; J. Kuntzmann, Grenoble, France (Translated by D. Boyanovitch, Grumman Aircraft Engineering Co.)

Deals with the exposition of problems relative to numerical integration of initial value problems. Theory is based on approximate representation of the derivative and integral by discontinuous expressions. The principal tool used in the development of techniques presented here as Taylor's series. June 1966, approx. 352 pp., \$10.50

### **INTERVAL ANALYSIS** by Ramon E. Moore, University of Wisconsin

Presents a new set of techniques by which a computer can be programmed to provide solutions of guaranteed accuracy to a variety of types of mathematical problems. All the necessary analysis is carried out by the computer itself for each specific application of the resulting programs. For graduate level courses and as a reference book for professional computer programmer's, mathematicians, and numerical analysts. October 1966, approx. 192 pp., \$9.00

### **CHEBYSHEV METHODS IN NUMERICAL APPROXIMATION** by Martin Avery Snyder, Courant Institute of Mathematical Sciences, New York University

Designed for numerical analysts and mathematical programmers—to show how the Chebyshev polynomials can be used in approximation to obtain nearly optimal or minimax approximations. This is the first time it has been brought together as a unified point of view. September 1966, approx. 144 pp., \$7.50

(Prices shown are for student use.)

For approval copies, write: Box 903

**PRENTICE-HALL  
ENGLEWOOD CLIFFS,  
NEW JERSEY 07632**



# MATHEMATICS NEWS FROM POLAND

**Mieczyslaw Warmus**

## TABLES OF LAGRANGE COEFFICIENTS FOR CUBIC INTERPOLATIONS

(In English)

These tables permit interpolation of functions when used with the tables for arguments with  $k$  significant figures to find the values of the function with  $k + 5$  significant figures.

Published by  
Polish Scientific Publishers

In two volumes, each 501 pp. Cloth.  
\$25.00 both volumes

ORDER FROM:

### ARS POLONA

FOREIGN TRADE ENTERPRISE

7 Krakowskie Przedmiescie,  
WARSAW, Poland

Oxford  
University Press

## Numerical Solution of Partial Differential Equations

G. D. SMITH, Senior Lecturer in Mathematics,  
Brunel College of Advanced Technology,  
London

Designed as a textbook for students with no previous knowledge of numerical methods, this volume is also intended as a bridge to the increasing number of advanced treatises on the numerical solution of partial differential equations. The work assumes no prior training in finite-difference calculus and develops the subject clearly and in detail. Exercises and worked solutions included. *Contents:* Introduction and Finite-Difference Formulae; Parabolic Equations; Convergence, Stability, and Systematic Iterative Methods; Hyperbolic Equations and Characteristics; Elliptic Equations. References, index.

1965

190 pp.

\$5.00

## An Introduction to Numerical Linear Algebra *With Exercises*

L. Fox, Director, University Computing Laboratory, and Professor of Numerical Analysis, Oxford University

This introduction covers the practice of matrix algebra and manipulation, and the theory and practice of direct and iterative methods for solving simultaneous algebraic equations, inverting matrices, and determining the latent roots and vectors of matrices. "It seems to be an excellent book, particularly for teaching matrix algebra to students in the computer sciences."—Thomas P. Bogyo, Washington State University

1965

344 pp.

\$8.50

**Oxford University Press**  
200 Madison Ave.  
New York, N.Y. 10016

# From Pergamon

## ANNUAL REVIEW IN AUTOMATIC PROGRAMMING

Edited by **Richard Goodman**, Automatic Programming Information Center, Brighton College of Technology, England.

Here is a continuing review of the present state of knowledge in the field. Each volume contains papers written by experts on recent advances and problems yet to be solved.

Vol. 1	1960	\$12.00	Vol. 3	1963	\$12.00
Vol. 2	1961	\$12.00	Vol. 4	1964	\$12.00

## U.S.S.R. COMPUTATIONAL MATHEMATICS AND MATHEMATICAL PHYSICS

Translated from *Zhurnal vychislitel'noi matematiki i matematicheskoi fiziki*.  
Translation Editor: **R. A. Buckingham**, London.

This translation from the original Russian contains the collated works of leading Russians concerned with computational mathematics and other branches of applied mathematics.

*Bi-monthly* \$140.00

## ADVANCES IN PROGRAMMING NON-NUMERICAL APPLICATIONS TO COMPUTING MACHINES

Edited by **L. Fox**, University of Oxford Computing Library, England.  
An effective collection of recent work with many illustrated examples.

1966 230 pp. \$10.00

## NUMERICAL ANALYSIS

By **I. M. Khabaza**, Queen Mary College, University of London.

"An elementary approach to desk and computer calculation, yet it contains much advanced material. The basic approach, after a pair of chapters on digital computers and desk machines, is classical via many interpolation formulas derived by symbolic operator methods." — *Mathematics of Computation*

1965 264 pp. flexi-cover \$5.00

## DIGITAL COMPUTERS IN ACTION

By **A. D. Booth**, University of Saskatchewan.

"... one of the best introductions to digital computers and their uses that has been written. ..." *Engineering*

The book provides a full technical exposition of recent developments.

1965 160 pp. flexi-cover \$1.95

## AN INTRODUCTION TO DIGITAL COMPUTING

By **F. H. George**, Teaching Programmes Ltd., England.

The construction and operation of digital computers is described. Familiarity with elementary arithmetic is assumed.

1966 248 pp. flexi-cover \$4.50

## THE DIGITAL COMPUTER

By **K. C. Parton**, The General Electric Company Ltd., Birmingham, England.

A survey of the use and scope of a modern computer, describing how computers deal with a wide range of technical and commercial problems. The structure of computers, automatic coding and related organizational problems are discussed.

1964 132 pp. flexi-cover \$2.95

Order from your bookstore or direct from:



## PERGAMON PRESS

44-01 21st Street / Long Island City, New York 11101  
New York • Toronto • Oxford • London • Sydney  
Edinburgh • Paris • Braunschweig • Tokyo

# STATISTICAL ECONOMISTS

...at **ORI**

New responsibilities at Operations Research Incorporated involving the evaluation and analysis of governmental economic assistance programs have created unusually attractive career opportunities for economists with training and experience in mathematics and statistics.

The work is long-range and has three objectives: (1) development of effectiveness criteria for program evaluation, (2) analysis of program goals and purposes, and (3) development and comparison of alternative programs. You will find that ORI, a small,

profit-making company, offers an environment in which your efforts are quickly recognized and rewarded. Salaries are excellent, and ORI staff policies and benefits programs are geared to the needs of creative professionals. Location is at ORI's modern headquarters facility in suburban Washington, D. C.

For further information, please send your resume to: Mr. Carlton Robinson, Professional Staffing, ORI, 1400 Spring Street, Silver Spring, Maryland 20910 (suburb of Washington, D. C.)

## **OPERATIONS RESEARCH INCORPORATED**

Washington • Los Angeles • Boston

An equal opportunity employer

# LITTON SCIENTIFIC SUPPORT LABORATORY SEEKS SENIOR STATISTICIANS AND MATHEMATICIANS FOR POSITIONS IN MONTEREY, CALIFORNIA

The Litton Scientific Support Laboratory of the Data Systems Division, Litton Industries, has been awarded a long-term contract by the United States Army to provide scientific support to its Combat Developments Command Experimentation Command.

The CDCEC is established to serve as a field laboratory in conjunction with the Combat Developments Command. The mission of CDC is to formulate and document current Army doctrine, and to determine the kinds and numbers of forces and materiel needed . . . how such forces and materiel should be employed in anticipation of the nature of land warfare in the future. CDC is responsible for answering such questions as: how should the Army be equipped? how should it be organized? and how should the Army fight?

The Combat Developments Command Experimentation Command conducts field experiments at Fort Ord and the Hunter-Liggett Military Reservation to provide inputs to CDC. CDCEC engages a contractor to help plan, design, instrument and conduct its field experimentation program. The Litton Scientific Support Laboratory, headquartered at Fort Ord in the Monterey, California area, is the current contractor.

As a project member, or in a support capacity, you will assist in the design of field experiments; participate in or monitor the experiments to assure collection of data in a meaningful format; analyze field generated data and prepare inputs into the project reports. Positions require a master's degree and several years' in one or more of the following fields: error analysis, simulation and modeling, estimation theory, hypothesis testing, analysis of variances and regression analysis. A bachelor's degree plus additional experience will be acceptable in lieu of the master's degree.

Contact Mr. M. C. Harrold, P. O. Box 7601, Van Nuys, Calif.



**DATA SYSTEMS DIVISION  
LITTON INDUSTRIES**

*- an equal opportunity employer M/F -*

## CLASSIFICATION OF REVIEWS

- |  |  |
|--|--|
| A. Arithmetical Tables, Mathematical Constants | N. Interest and Investment                         |
| B. Powers                                      | O. Actuarial Science                               |
| C. Logarithms                                  | P. Engineering                                     |
| D. Circular Functions                          | Q. Astronomy                                       |
| E. Hyperbolic and Exponential Functions        | R. Geodesy   |
| F. Theory of Numbers                           | S. Physics, Geophysics, Crystallography            |
| G. Higher Algebra                              | T. Chemistry                                       |
| H. Numerical Solution of Equations             | U. Navigation                                      |
| I. Finite Differences, Interpolation           | V. Aerodynamics, Hydrodynamics, Ballistics         |
| J. Summation of Series                         | W. Economics and Social Sciences                   |
| K. Statistics                                  | X. Numerical Analysis and Applied Mathematics      |
| L. Higher Mathematical Functions               | Z. Calculating Machines and Mechanical Computation |
| M. Integrals                                   |  |

---

### Information for Contributors

Manuscripts should be typewritten double-spaced in the format used by the journal. For journal abbreviations, see *Mathematical Reviews*, v. 28, Index. An author should submit the original and one copy of the manuscript and retain one copy. The author may suggest an appropriate editor for his paper. It is recommended that the author acquaint himself with the pertinent material contained in "Information for Contributors to Mathematics of Computation" and "Manual for Authors", both of which are available upon request from the American Mathematical Society. All contributions intended for publication and all books for review should be addressed to Eugene Isaacson, Chairman, Editorial Committee, Mathematics of Computation, New York University, Courant Institute of Mathematical Sciences, 251 Mercer Street, New York, New York 10012. Beginning with the January, 1965 issue, institutions sponsoring research reported in the journal are assessed page charges.

# Mathematics of Computation

## TABLE OF CONTENTS

OCTOBER 1966

Estimates for Difference Quotients of Solutions of Poisson Type Difference Equations.....	ACHI BRANDT	473
On the Rate of Convergence of an Alternating Direction Implicit Method in a Noncommutative Case.....	OLOF B. WIDLUND	500
A Linear Three-Level Difference Scheme for Quasilinear Parabolic Equations.....	MILTON LEES	516
Separation of Zeros of the Riemann Zeta-Function....	R. SHEERMAN LEHMAN	523
Zeros of Sections of the Zeta Function. I.....	ROBERT SPIRA	542
Variations on a Theorem of Landau. Part I.	DANIEL SHANKS & LARRY P. SCHMID	551
The Calculation of Fourier Integrals	GUY DE BALBINE & JOEL N. FRANKLIN	570
Expansions Involving Hypergeometric Functions of Two Variables	ARUN VERMA	590
TECHNICAL NOTES AND SHORT PAPERS		
Interpolation by Algebraic and Trigonometric Polynomials	A. C. R. NEWBERY	597
A Note on Best Approximation in $E^n$ .....	J. T. DAY	599
A Close Approximation Related to the Error Function.	ROGER G. HART	600
Rational Approximations to the Solution of the Second Order Riccati Equation.....	WYMAN FAIR & YUDELL L. LUKE	602
On the Evaluation of the Incomplete Gamma Function..	ROY TAKENAGA	606
Doppler Broadening Integrals	VAN E. WOOD, R. P. KENAN & M. L. GLASSER	610
Singular and Invariant Matrices Under the $QR$ Transformation	BERESFORD PARLETT	611
REVIEWS AND DESCRIPTIONS OF TABLES AND BOOKS.....		616
GRADSHTEYN & RYSHIK 85, GAUSS 86, WUNDERLICH 87, LIND, MORRIS & SHAPIRO 88, LAL, JONES & BLUNDON 89, WILKINSON 90, KARPOV 91, BENNETT & HORST 92, ZABRANSKY, SIBUYA & SALEH 93, DITKIN 94, NARASIMHA 95, WAI-KWOK NG 96, THOMPSON 97, KATSURA, INOUE, HAMASHITA & KILPATRICK 98, FETTIS & CASLIN 99, FETTIS & CASLIN 100, FETTIS & CASLIN 101, EMERSLEBEN 102, SLATER 103, ROBERTS & KAUFMAN 104, LEFSCHETZ 105, LEONDES 106, RICHARDSON 107, ECKHAUS 108, COURANT & JOHN 109, ZONNEVELD 110, HOLLINGDALE & TOOTILL 111, POLLACK 112, LECHT 113, ARSAC, LENTIN, NIVAT & NOLIN 114		
TABLE ERRATA.....		639
BYRD & FRIEDMAN 397, FETTIS & CASLIN 398, ABRAMOWITZ & STEGUN 399, ERDÉLYI, MAGNUS, OBERHETTINGER & TRICOMI 400, ERDÉLYI, MAGNUS, OBERHETTINGER & TRICOMI 401, ROBERTS & KAUFMAN 402, LEHMER 403, LEHMER 404		
CORRIGENDA.....		
BURGOYNE, WRENCH, EDITOR'S NOTE.....		643
NOTES.....		
NEW JOURNALS.....		644
ANNOUNCEMENT.....		645
NEWSLETTER.....		646
INDICES TO VOLUME XX.....		
Index of Papers and Technical Notes by Authors.....		647
Index of Reviews by Author of Work Reviewed.....		649
Index of Reviews by Subject of Work Reviewed.....		652
Index of Table Errata.....		660
Index of Corrigenda.....		661
Index of Notes.....		661