

January 1962 • Vol. 16, No. 77

Mathematics of Computation

A journal devoted to advances in numerical analysis,
the application of computational methods, mathematical tables,
high-speed calculators and other aids to computation



Formerly: Mathematical Tables and other Aids to Computation

Published Quarterly for the
National Academy of Sciences—National Research Council
By the
American Mathematical Society

Editorial Committee
Division of Mathematics
National Academy of Sciences—National Research Council
Washington, D. C.

H. POLACHEK, Chairman, Applied Mathematics Laboratory, David Taylor Model Basin, Washington 7, D. C.
ALAN FLETCHER, University of Liverpool, Liverpool 3, England
P. C. HAMMER, University of Wisconsin, Madison 6, Wisconsin
EUGENE ISAACSON, New York University, New York 3, New York
Y. L. LUKE, Midwest Research Institute, Kansas City 10, Missouri
DANIEL SHANKS, Applied Mathematics Laboratory, David Taylor Model Basin, Washington 7, D. C.
A. H. TAUB, University of Illinois, Urbana, Illinois
R. S. VARGA, Case Institute of Technology, Cleveland 6, Ohio
J. W. WRENCH, JR., Applied Mathematics Laboratory, David Taylor Model Basin, Washington 7, D. C.
D. M. YOUNG, Computing Center, University of Texas, Austin 12, Texas

Information to Subscribers

The journal is published quarterly in one volume per year with issues numbered serially since Volume I, Number 1. Starting with January, 1959 subscriptions are \$8.00 per year, single copies \$2.50. Other issues are available as follows:

Volume I (1943–1945), Nos. 10 and 12 *only* are available; \$1.00 per issue.

Volume II (1946–1947), Nos. 13, 14, 17, 18, 19, and 20 *only* available; \$1.00 per issue.

Volume III (1948–1949), Nos. 21–28 available. \$4.00 per year (four issues), \$1.25 per issue.

Volume IV–XII (1950 through 1958), all issues available; \$5.00 per year, \$1.50 per issue.

Microcard Edition

Volumes I–X (1943–1956), Nos. 1–56 are now available on Microcards and may be purchased from the Microcard Foundation, Box 2145, Madison 5, Wisconsin, at a cost of \$20.00 for the complete set. Succeeding volumes are available on request.

Information to Contributors

All contributions intended for publication in *Mathematics of Computation* and all books for review should be addressed to H. Polachek, Technical Director, Applied Mathematics Laboratory, David Taylor Model Basin, Washington 7, D. C. The author may suggest an appropriate editor for his paper. Manuscripts should be typewritten double-spaced in the format used by the journal. For journal abbreviations, see *Mathematical Reviews*, v. 21, Index, 1960. Authors should submit the original and one copy, and should retain one copy.

Subscriptions, address changes, business communications and payments should be sent to:

AMERICAN MATHEMATICAL SOCIETY
190 Hope Street
Providence 6, Rhode Island

Published Quarterly for the

NATIONAL ACADEMY OF SCIENCES—NATIONAL RESEARCH COUNCIL

By the

AMERICAN MATHEMATICAL SOCIETY
Baltimore, Maryland and Providence, Rhode Island

Copyright © 1962 by the American Mathematical Society
Printed in the United States of America
Second-class postage paid at Baltimore, Md.

MATHEMATICAL REVIEWS

A Journal Containing

REVIEWS OF MATHEMATICAL LITERATURE

Pure and Applied, of the Entire World
With full Subject and Author Indexes

This journal is an indispensable tool for all those who need to keep up with new research in pure and applied mathematics.

Each monthly issue consists of two separately bound parts A and B.

Subjects included in Part B are:

| | |
|------------------------------------|------------------------------------|
| Probability | Classical Thermodynamics, Heat |
| Statistics | Transfer |
| Numerical Methods | Quantum Mechanics |
| Computing Machines | Relativity |
| Mechanics of Particles and Systems | Astronomy |
| Statistical Thermodynamics and | Geophysics |
| Mechanics | Operations Research, Econometrics, |
| Elasticity, Plasticity | Games |
| Structure of Matter | Biology and Sociology |
| Fluid Mechanics, Acoustics | Information and Communication |
| Optics, Electromagnetic Theory, | Theory |
| Circuits | Servomechanisms and Control |

Subscriptions are accepted to cover the calendar year only. Two volumes will be published in 1962. List price for two volumes \$100. \$32.00 to members of the American Mathematical Society.

Send Subscription Orders to

AMERICAN MATHEMATICAL SOCIETY

190 Hope Street

Providence, Rhode Island

Privileges of Membership in the

AMERICAN MATHEMATICAL SOCIETY

Free Subscriptions to:

NOTICES OF THE AMERICAN MATHEMATICAL SOCIETY, published 7 times a year, includes programs of the meetings of the Society, along with news items, announcements, personal items, and abstracts of papers presented at meetings.

BULLETIN OF THE AMERICAN MATHEMATICAL SOCIETY, publishes research announcements of timely interest, texts of invited addresses and book reviews; issued bimonthly.

PROCEEDINGS OF THE AMERICAN MATHEMATICAL SOCIETY, publishes original research results; issued bimonthly.

Reduced rates for members to:

TRANSACTIONS OF THE AMERICAN MATHEMATICAL SOCIETY, devoted to the publication of research in pure and applied mathematics.

(List price, \$32.00)

\$16.00 per year

MATHEMATICAL REVIEWS, devoted to abstracts and reviews of the current mathematical literature of the world.

(List price, \$100.00)

\$32.00 per year

ALL BOOKS PUBLISHED BY THE SOCIETY available at 25% discount

NINE JOURNALS published by other institutions 20%–45% discount

Dues: \$14.00 per year

For full information write to:

THE
AMERICAN
MATHEMATICAL
SOCIETY

190 Hope Street, Providence, Rhode Island

The SIAM Review

ARTICLES

- Permutations by cutting and shuffling. *Solomon W. Golomb*
On the numerical solution of the hydrodynamic equations
 I. M. Fyfe, R. C. Eng, and D. M. Young
The number of lines in a digraph of each connectedness category
 Dorwin Cartwright and Frank Harary
The application of numerical integration to a problem in viscoelasticity
 J. R. Parks and L. Cooper
On Lanczos' algorithm for tridiagonalizing matrices
 R. L. Causey and R. T. Gregory

PROBLEMS

- A coin tossing problem. *D. J. Newman and Walter Weissblum*
A definite integral. *W. L. Bade*
The expected value of a product. *Lawrence Shepp*

SOLUTIONS

- Vorticity Interaction (Cheng). *J. E. Wilkins*
Vorticity Interaction (Cheng). *Y. L. Luke*
Vorticity Interaction (Cheng). *Jan Petersson*
Vorticity Interaction (Cheng)
 P. J. de Doelder, J. H. van Lint and M. S. Klamkin
Another Sorting Problem (van Lint). *J. H. van Lint*

BOOK REVIEWS

- Turbulence: Classic papers on statistical theory (Friedlander and Topping)*
 O. B. Björgum
Quantitative methods in pharmacology (De Jonge). *Norman R. Draper*
Finite difference equations (Levy and Lessman). *W. A. Harris, Jr.*
A treatise on the calculus of finite differences (Boole). *W. A. Harris, Jr.*
*The electrical double layer around a spherical colloid particle (Loeb, Overbeek
 and Wiersema)*. *J. W. Williams*
Numerical methods for science and engineering (Stanton)
 Preston C. Hammer
Complex variables and the Laplace transform for engineers (LePage)
 W. M. Stone
Linear graphs and electrical networks (Seshu and Reed). . *Robert E. Machol*

NEWS AND NOTICES

NOTE

In the October 1961 issue of *Mathematics of Computation*, Vol. 15, No. 76, the title page for Volume 15 is printed on the back of the last page of the Volume index. The title page for Volume 15 is published again and appears on a separate page at the end of the January 1962 issue so that it may be removed and inserted in the front of Volume 15 when bound.

Mathematics of Computation

A Quarterly Journal

Edited by

ALAN FLETCHER

P. C. HAMMER

EUGENE ISAACSON

Y. L. LUKE

DANIEL SHANKS

A. H. TAUB

R. S. VARGA

J. W. WRENCH, JR.

D. M. YOUNG

HARRY POLACHEK, *Chairman*

XV

NOS. 73-76

1961

Formerly: Mathematical Tables and other Aids to Computation

Published by the

National Academy of Sciences—National Research Council

Washington, D. C.

CLASSIFICATION OF REVIEWS

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

Mathematics of Computation

TABLE OF CONTENTS

JANUARY 1962

| | |
|--|-----|
| Correlations and Spectra for Non-Stationary Random Functions J. KAMPÉ DE FÉRIET & FRANÇOIS N. FRENKIEL | 1 |
| On Numerical Integration of Ordinary Differential Equations ARNOLD NORDSIECK | 22 |
| Triple Product Integrals of Laguerre Functions J. GILLIS & M. SHIMSHONI | 50 |
| The Behavior of Pseudo-Random Sequences Generated on Computers by the Multiplicative Congruential Method. V. D. BARNETT | 63 |
| A Note on the Convergence of Alternating Direction Methods MILTON LEES | 70 |
| Calculation of π to 100,000 Decimals DANIEL SHANKS & JOHN W. WRENCH, JR. | 76 |
| TECHNICAL NOTES AND SHORT PAPERS | |
| Characteristic Exponents of Mathieu Functions. T. TAMIR | 100 |
| An Algorithm for Solving Certain Polynomial Equations with Coefficient Parameters. ROBERT D. STALLEY | 106 |
| A Remark Concerning the Solution of the Dirichlet Problem by Finite Differences. BERNARD EPSTEIN | 110 |
| REVIEWS AND DESCRIPTIONS OF TABLES AND BOOKS. | 113 |
| LIEBERMAN & OWEN 1, STANTON 2, SHIMPUKU 3, NATIONAL PHYSICAL LABORATORY 4, ROSENTHAL & RODDEN 5, SOLODOVNIKOV 6, BEN- DANIEL & CARR 7, FREVEL & TURLEY 8, SAGAN 9, COLEMAN, BOZMAN & MEGGERS 10, ORCUTT, GREENBERGER, KORBEL & RIVLIN 11, DRESHER 12, LAYTON, SMITH & CHATFIELD 13, KÄMMERER 14, LEEDS & WEINBERG 15, PETERSON 16, UNGAR 17 | |
| TABLE ERRATA. | 126 |
| ADAMS & HIPPISELY 307 | |
| CORRIGENDA. | 126 |
| ASCHER, GREENBERGER KRAVITZ | |

Published Quarterly for the

National Academy of Sciences—National Research Council

By the

American Mathematical Society