# Mathematics of Computation

Volume 24, Number 111 July, 1970

**CODEN: MCMPAF** 

**Published by the American Mathematical Society** PROVIDENCE, RHODE ISLAND

### **Editorial Committee**

- EUGENE ISAACSON, Chairman, New York University, Courant Institute of Mathematical Sciences, 251 Mercer Street, New York, New York 10012 Assistant to the Chairman: CHARLOTTE W. JOHN
- JAMES H. BRAMBLE, Department of Mathematics, Cornell University, Ithaca, New York 14850
- C. W. CLENSHAW, Department of Mathematics, Cartmel College, University of Lancaster, Bailrigg, Lancaster, England
- WALTER GAUTSCHI, Computer Sciences Department, Purdue University, Lafayette, Indiana 47907
- DONALD GOLDFARB, Department of Computer Sciences, School of Engineering, The City College of the City University of New York, 139th Street & Convent Avenue, New York, New York 10031
- A. S. HOUSEHOLDER, Department of Mathematics, Ayres Hall, The University of Tennessee, Knoxville, Tennessee 37916
- HEINZ O. KREISS, Computer Science Department, University of Uppsala, Uppsala, Sturegatan 4, Sweden
- Y. L. LUKE, Midwest Research Institute, Kansas City, Missouri 64110
- JAMES LYNESS, Argonne National Laboratory, 9700 South Cass Avenue, Argonne, Illinois 60439
- JAMES M. ORTEGA, Computer Science Center, University of Maryland, College Park, Maryland 20740
- HARRY POLACHEK, Research Division, U.S. Atomic Energy Commission, Washington, D.C. 20545
- PHILIP RABINOWITZ, The Weizman Institute of Science, Rehovot, Israel
- DANIEL SHANKS, Naval Ship Research and Development Center, Washington, D.C. 20034
- J. W. WRENCH, JR., Naval Ship Research and Development Center, Washington, D.C. 20034

### **Information for Subscribers**

The journal is published quarterly in one volume per year, with issues numbered serially since Volume 1, Number 1. The subscription price is \$20.00. All back volumes are available. For Volumes 1–19 (1943–1965), prices are \$20.00 per volume, subsequent volumes are \$24.00.

#### **Unpublished Mathematical Tables**

The editorial office of the journal maintains a repository of Unpublished Mathematical Tables (UMT). When a table is deposited in the UMT repository a brief summary of its contents is published in the section *Reviews and Descriptions of Tables and Books*. Upon request, the chairman of the editorial committee will supply copies of any table for a nominal cost per page.

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

### AMERICAN MATHEMATICAL SOCIETY P. O. Box 6248 Providence, Rhode Island 02904

# Mathematics of Computation

## TABLE OF CONTENTS

### JULY 1970

Error Bounds for Polynominal Spline Interpolation MARTIN H. SCHULTZ	507
Some Observations on Interpolation in Higher Dimensions R. B. GUENTHER & E. L. ROETMAN	51 <b>7</b>
"Best" Interpolation, Differentiation, and Integration Approximations on the Hardy Space $H^2$ LEON WINSLOW	523
Computation of Best One-Sided $L_1$ Approximation JAMES T. LEWIS	529
The Calculation of Multidimensional Hermite Polynomials and Gram-Charlier Coefficients	537
Accelerating Convergence of Trigonometric Approximations WILLIAM B. JONES & G. HARDY	547
New Error Coefficients for Estimating Quadrature Errors for Analytic Functions PHILIP RABINOWITZ & NIRA RICHTER	561
Chebyshev Type Quadrature Formulas DAVID K. KAHANER	571
Trigonometric and Gaussian Quadrature C. J. KNIGHT & A. C. R. NEWBERY	575
Cross-Product Cubature Error Bounds FRANK G. LETHER	583
Asymptotic Properties of Minimal Integration Rules PHILIP RABINOWITZ & NIRA RICHTER	593
The Initial-Value Problem for the Equation $(tu_t)_t = u_{xx}$ ALAN SOLOMON & FAIZA SOLOMON	611
On the Numerical Solution of the Diffusion Equation ØYSTEIN TØDENES	621
A Note on Trapezoidal Methods for the Solution of Initial Value Problems A. R. GOURLAY	629
Marginal Stability and Stabilization in the Numerical Integration of Ordinary Differential Equations	635
Conditioning of Quasi-Newton Methods for Function Minimization D. F. SHANNO	647
Optimal Conditioning of Quasi-Newton Methods D. F. Shanno & P. C. Kettler	657
The Explicit Inverse of a Tridiagonal Matrix P. SCHLEGEL	665
A New Method for Computing Toroidal Harmonics HENRY E. FETTIS	667
Chebyshev Approximations for the Coulomb Phase Shift W. J. CODY & K. E. HILLSTROM	671
Complex Zeros of an Incomplete Riemann Zeta Function and of the In- complete Gamma Function	679
Lower Bounds for the Disk Packing Constant DAVID W. BOYD	697
Remark on a Conjecture of Erdös on Binomial Coefficients ANDRZEJ MAKOWSKI	705
Computing Irreducible Representations of Groups JOHN D. DIXON	70 <b>7</b>

Factoring Polynomials Over Large Finite Fields E. R. BERLEKAMP	713
Consecutive Power Residues or Nonresidues . J. R. RABUNG & J. H. JORDAN	737
Note on the Distribution of Ramanujan's Tau Function D. H. LEHMER	741
The Generalized Serial Test Applied to Expansions of Some Irrational Square Roots in Various Bases	
W. A. Beyer, N. Metropolis & J. R. Neergaard	745
<ul> <li>Reviews and Descriptions of Tables and Books</li></ul>	749
TABLE ERRATA      CAMBI 467.	763
Note	765

### **Information for Contributors**

Manuscripts should be typewritten double-spaced in the format used by the journal. For journal abbreviations, see the *Mathematical Reviews*, Volume 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. Institutions sponsoring research reported in the journal are assessed page and microfiche charges.

Each article submitted for publication must be accompanied by a brief and reasonably self-contained abstract, by AMS subject classification numbers and by a list of key words and phrases. A list of the classification numbers may be found at the end of each volume of Mathematical Reviews.

### **Microcard Edition**

Volumes 1–14 (1943–1960) are available on Microcards at \$39.00 for the complete set and may be purchased from Microcard Editions, Inc., 901 26th Street, N. W., Washington, D.C. 20037.