

Mathematics of Computation

Coden: MCMPAF

Volume 27, Number 121

Pages 1–220

January 1973

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

ALSTON S. HOUSEHOLDER, Department of Mathematics, Ayres Hall, The University of Tennessee, Knoxville, Tennessee 37916

JOHN W. WRENCH, JR., Naval Ship Research and Development Center, Bethesda, Maryland 20034

Board of Associate Editors

JAMES W. DANIEL, Department of Mathematics, University of Texas at Austin, Austin, Texas 78712

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

HEINZ-OTTO KREISS, Computer Science Department, University of Uppsala, Uppsala, Sturegaten 4, Sweden

YUDELL L. LUKE, Department of Mathematics, University of Missouri at Kansas City, Kansas City, Missouri 64110

JAMES N. LYNES, Argonne National Laboratory, 9700 South Cass Avenue, Argonne, Illinois 60439

BERESFORD PARLETT, Department of Computer Science, University of California, Berkeley, California 94720

PHILIP RABINOWITZ, Department of Applied Mathematics, The Weizmann Institute of Science, Rehovot, Israel

DANIEL SHANKS, Naval Ship Research and Development Center, Bethesda, Maryland 20034

HANS J. STETTER, Institut für Numerische Mathematik, Technische Hochschule Wien, Karlsplatz 13, A-1040 Wien, Austria

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 \$24.00. All back volumes are available. For Volumes 1–19 (1943–1965), prices are \$20.00 per volume; for Volumes 20–23 (1966–1969), \$24.00 per volume and Volumes 24–26 (1970–1972), \$30.00 per volume.

Unpublished Mathematical Tables

The editorial office of the journal maintains a repository of Unpublished Mathematical Tables (UMT).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

Copyright © 1973, American Mathematical Society
Second-class postage paid at Providence, Rhode Island, and at additional mailing offices

Mathematics of Computation

A Quarterly Journal

Edited by

EUGENE ISAACSON, Chairman

JAMES H. BRAMBLE	JAMES W. DANIEL	WALTER GAUTSCHI
DONALD GOLDFARB	A. S. HOUSEHOLDER	HEINZ-OTTO KREISS
YUDELL L. LUKE	JAMES N. LYNESS	BERESFORD PARLETT
PHILIP RABINOWITZ	DANIEL SHANKS	HANS J. STETTER
	JOHN W. WRENCH, JR.	

XXVII

NOS. 121-124

1973

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_∞ 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 κ	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

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 12 , COCHRAN 7 , GASTINEL 4 , GEL'FOND 3 , MARTZ 8 , MORRIS 11 , NEWMAN 9 , REID, Editor 5 , ROBERTS & SHIPMAN 6 , SARD & WEIN- TRAUB 1 , SCHÖNHAGE 2 , YATES 10 .	
TABLE ERRATA	219
ABRAMOWITZ & STEGUN 500 .	
MICROFICHE SUPPLEMENT	
A Catalogue of Combinatorial Geometries JOHN E. BLACKBURN, HENRY H. CRAPO & DENIS A. HIGGS	
A Comparison of Algorithms for Rational l_∞ Approximation C. M. LEE & F. D. K. ROBERTS	

Information for Contributors

Manuscripts should be typewritten double-spaced in the format used by the journal. For journal abbreviations, see the latest *Mathematical Reviews* volume 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, and by AMS (MOS) subject classification numbers. If a list of key words and phrases is included, it will be printed as a footnote on the first page. A list of the classification numbers may be found in the Index to Mathematical Reviews, Volume 39 (June 1970).

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.