

MATHEMATICS of COMPUTATION

AMERICAN MATHEMATICAL SOCIETY

EDITED BY

James H. Bramble Susanne C. Brenner E. W. Cheney James W. Demmel Walter Gautschi, Managing Editor Eugene Isaacson James N. Lyness Harald Niederreiter Jorge J. Nocedal Syvert P. Nørsett Andrew M. Odlyzko Frank W. J. Olver John E. Osborn Stanley Osher Carl Pomerance René Schoof L. Ridgway Scott **Daniel Shanks** Chi-Wang Shu Frank Stenger Hans J. Stetter G. W. Stewart Nico M. Temme Vidar Thomée Lars B. Wahlbin Hugh C. Williams John W. Wrench, Jr.

PROVIDENCE, RHODE ISLAND USA

ISSN 0025-5718

Mathematics of Computation

This journal publishes research articles in computational mathematics. Areas covered include numerical analysis, the application of computational methods, algorithms for advanced computer architectures, computational number theory and algebra, and related fields. Table errata and reviews of books in areas related to computational mathematics are also included.

Subscription information. Mathematics of Computation is published quarterly. Subscription prices for Volumes 62 and 63 (1994) are \$262 list; \$210 institutional member; \$170 member of CBMS organizations; \$157 individual AMS member. A late charge of 10% of the subscription price will be imposed upon orders received from nonmember institutions and organizations after January 1 of the subscription year. Subscribers outside the United States and India must pay a postage surcharge of \$9; subscribers in India must pay a postage surcharge of \$18. Expedited delivery to destinations in North America \$13; elsewhere \$40.

Back number information. For back issues see the AMS Catalog of Publications.

Subscriptions and orders should be addressed to the American Mathematical Society, P.O. Box 5904, Boston, MA 02206-5904. *All orders must be accompanied by payment*. Other correspondence should be addressed to P.O. Box 6248, Providence, RI 02940-6248.

Unpublished Mathematical Tables. The editorial office of the journal maintains a repository of Unpublished Mathematical Tables (UMT).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. All tables and correspondence concerning the UMT should be sent to Walter Gautschi, Chairman, Editorial Committee, Mathematics of Computation, Department of Computer Sciences, Purdue University, West Lafayette, IN 47907.

Copying and reprinting. Individual readers of this publication, and nonprofit libraries acting for them, are permitted to make fair use of the material, such as to copy an article for use in teaching or research. Permission is granted to quote brief passages from this publication in reviews provided the customary acknowledgment of the source is given.

Republication, systematic copying, or multiple reproduction of any material in this publication (including abstracts) is permitted only under license from the American Mathematical Society. Requests for such permission should be addressed to the Manager of Editorial Services, American Mathematical Society, P.O. Box 6248, Providence, RI 02940-6248. Requests can also be made by e-mail to reprint-permission@math.ams.org.

The appearance of the code on the first page of an article in this journal indicates the copyright owner's consent for copying beyond that permitted by Sections 107 or 108 of the U.S. Copyright Law, provided that the fee of \$1.00 plus \$.25 per page for each copy be paid directly to the Copyright Clearance Center, Inc., 222 Rosewood Drive, Danvers, MA 01923. This consent does not extend to other kinds of copying, such as copying for general distribution, for advertising or promotional purposes, for creating new collective works, or for resale.

Mathematics of Computation is published quarterly by the American Mathematical Society at 201 Charles Street, Providence, RI 02904-2213. Second-class postage is paid at Providence, Rhode Island. Postmaster: Send address changes to Mathematics of Computation, American Mathematical Society, P.O. Box 6248, Providence, RI 02940-6248.

- © Copyright 1994 by the American Mathematical Society. All rights reserved.

 Printed in the United States of America.

This publication was typeset using AMS-T_EX, the American Mathematical Society's T_EX macro system.

10 9 8 7 6 5 4 3 2 1 99 98 97 96 95 94

Author	Title	Page
Aberth, Oliver	Computation of topological degree using interval arithmetic, and applications	171
Amodio, Pierluigi & Mazzia, Francesca	Backward error analysis of cyclic reduction for the solution of tridiagonal systems	
Anderson, Malcolm R.	See: Edmondson, Genet M., Seberry, Jennifer & Anderson, Malcolm R	351
Arora, K.	See: Lavoie, J. L., Grondin, F., Rathie, A. K. & Arora, K	267
Bai, Zhaojun	Error analysis of the Lanczos algorithm for the nonsymmetric eigenvalue problem	209
Bailey, Ralph W.	Polar generation of random variates with the t-distribution	779
Baines, M. J.	Algorithms for optimal discontinuous piecewise linear and constant L_2 fits to continuous functions with adjustable nodes in one and two dimensions	
Bartolomeo, J. & He, Matthew	On Faber polynomials generated by an m-star	277
Bendali, A. & Souilah, M.	Consistency estimates for a double-layer potential and application to the numerical analysis of the boundary-element approximation of acoustic scattering by a penetrable object	
Browkin, J. & Brzeziński, J.	Some remarks on the <i>abc</i> -conjecture	931
Brunner, Hermann	Iterated collocation methods for Volterra integral equations with delay arguments	581
Brzeziński, J.	See: Browkin, J. & Brzeziński, J	931
BUCHMANN, J., POHST, M. & SCHMETTOW, J. GRAF V.	On unit groups and class groups of quartic fields of signature (2, 1)	387
BUTLER, GREG	An inductive schema for computing conjugacy classes in permutation groups	363
CHAMBERS, LL. G.	A quick way of obtaining an approximate solution to a Sturm-Liouville problem	577
Cikánek, Petr	A special extension of Wieferich's criterion	923
Coppersmith, Don	Solving homogeneous linear equations over $GF(2)$ via block Wiedemann algorithm	333
Couture, Raymond & L'Ecuyer, Pierre	On the lattice structure of certain linear congruential sequences related to AWC/SWB generators	799
Crandall, Richard & Fagin, Barry	Discrete weighted transforms and large-integer arithmetic	305
Cremona, J. E. & Whitley, E.	Periods of cusp forms and elliptic curves over imaginary quadratic fields	407
Drezner, Zvi	Computation of the trivariate normal integral	289
Duinvestiin, A. J. W.	Simple perfect squared squares and 2×1 squared rectangles of order 25	325
DUMMIT, D. S. & HAYES, DAVID	Rank-one Drinfeld modules on elliptic curves	875

Author	Title	Page
Edmondson, Genet M., Seberry, Jennifer & Anderson, Malcolm R.	On the existence of Turyn sequences of length less than 43	351
EHRICH, SVEN	Error bounds for Gauss-Kronrod quadrature formulae	295
Eichenauer-Herrmann, Jürgen	Improved lower bounds for the discrepancy of inversive congruential pseudorandom numbers	783
Eichenauer-Herrmann, Jürgen & Ickstadt, Katja	Explicit inversive congruential pseudorandom numbers with power of two modulus	787
Ernvall, R. & Metsänkylä, T.	Computation of the zeros of p -adic L -functions. II	391
Fagin, Barry	See: Crandall, Richard & Fagin, Barry	305
Falk, Richard S. & Osborn, John E.	Remarks on mixed finite element methods for problems with rough coefficients	1
Förster, Klaus-Jürgen	On a theorem of C. Posse concerning Gaussian quadrature of Chebyshev type	719
Frey, Gerhard & Rück, Hans-Georg	A remark concerning <i>m</i> -divisibility and the discrete logarithm in the divisor class group of curves	865
Georg, Kurt & Tausch, Johannes	Some error estimates for the numerical approximation of surface integrals	755
Göttfert, Rainer	An acceleration of the Niederreiter factorization algorithm in characteristic 2	831
Grinfeld, Michael	See: Tourigny, Yves & Grinfeld, Michael	155
Grondin, F.	See: Lavoie, J. L., Grondin, F., Rathie, A. K. & Arora, K	267
Ha-Duong, T. & Joly, P.	On the stability analysis of boundary conditions for the wave equation by energy methods. Part I: The homogeneous case	539
Hamina, Martti & Saranen, Jukka	On the spline collocation method for the single-layer heat operator equation	41
Hayes, David	See: Dummit, D. S. & Hayes, David	875
He, Matthew	See: Bartolomeo, J. & He, Matthew	277
Hiss, Gerhard	The 3-modular characters of the Rudvalis sporadic simple group and its covering group	851
Hou, Thomas Y. & Le Floch, Philippe G.	Why nonconservative schemes converge to wrong solutions: error analysis	497
Ickstadt, Katja	See: Eichenauer-Herrmann, Jürgen & Ickstadt, Katja	787
Jiang, Guangshan & Shu, Chi-Wang	On a cell entropy inequality for discontinuous Galerkin methods	531
Joly, P.	See: Ha-Duong, T. & Joly, P	539
Kaneko, Hideaki & Xu, Yuesheng	Gauss-type quadratures for weakly singular integrals and their application to Fredholm integral equations of the second kind	739
Khobalatte, Brahim & Perthame, Benoit	Maximum principle on the entropy and second-order kinetic schemes	119
Lavoie, J. L., Grondin, F., Rathie, A. K. & Arora, K.	Generalizations of Dixon's theorem on the sum of a $_3F_2$.	267
LE FLOCH, PHILIPPE G.	See: Hou, Thomas Y. & Le Floch, Philippe G	497
L'ECUYER, PIERRE	See: COUTURE, RAYMOND & L'ECUYER, PIERRE	799

Author	Title	Page
LEMPKEN, W. &	The structure of the projective indecomposable modules of $3M_{22}$ in characteristic 2	841
Staszewski, R. Li, Ren-Cang	On perturbations of matrix pencils with real spectra	231
Li, Shoufu	B-convergence properties of multistep Runge-Kutta	231
2, 5, 5, 5, 5, 5	methods	565
Liu, Jinn-Liang	A finite difference method for symmetric positive differential equations	105
Lorentzen, Lisa	Divergence of continued fractions related to hypergeometric series	671
Mastroianni, Giuseppe & Monegato, Giovanni	Polynomial approximations of functions with endpoint singularities and product integration formulas	725
Mazzia, Francesca	See: Amodio, Pierluigi & Mazzia, Francesca	601
Metsänkylä, T.	See: Ernvall, R. & Metsänkylä, T.	391
Mollin, R. A. & Williams, H. C.	Quadratic residue covers for certain real quadratic fields .	885
Monegato, Giovanni	See: Mastroianni, Giuseppe & Monegato, Giovanni .	725
Monegato, Giovanni	The numerical evaluation of a 2-D Cauchy principal value integral arising in boundary integral equation methods	765
Neuman, Edward	A new formula for box splines on three-directional meshes	227
Niederreiter, Harald	Factoring polynomials over finite fields using differential equations and normal bases	819
Osborn, John E.	See: Falk, Richard S. & Osborn, John E	1
Palencia, C.	On the stability of variable stepsize rational approximations of holomorphic semigroups	93
Perthame, Benoit	See: Khobalatte, Brahim & Perthame, Benoit	119
Ронѕт, М.	See: Buchmann, J., Pohst, M. & Schmettow, J. Graf v.	387
RABIER, PATRICK J. & RHEINBOLDT, WERNER C.	On the computation of impasse points of quasi-linear differential-algebraic equations	133
RATHIE, A. K.	See: Lavoie, J. L., Grondin, F., Rathie, A. K. & Arora, K	267
RHEINBOLDT, WERNER C.	See: Rabier, Patrick J. & Rheinboldt, Werner C	133
Rück, Hans-Georg	See: Frey, Gerhard & Rück, Hans-Georg	865
Saranen, Jukka	See: Hamina, Martti & Saranen, Jukka	41
SCHMETTOW, J. GRAF V.	See: Buchmann, J., Pohst, M. & Schmettow, J. Graf v.	387
Seberry, Jennifer	See: Edmondson, Genet M., Seberry, Jennifer & Anderson, Malcolm R	351
Shu, Chi-Wang	See: Jiang, Guangshan & Shu, Chi-Wang	531
Souilah, M.	See: Bendali, A. & Souilah, M	65
Staszewski, R.	See: Lempken, W. & Staszewski, R	841
Tausch, Johannes	See: Georg, Kurt & Tausch, Johannes	755
Tezuka, Shu	The k-dimensional distribution of combined GFSR sequences	809
Thomée, Vidar & Wahlbin, Lars B.	Long-time numerical solution of a parabolic equation with memory	477
Tourigny, Yves & Grinfeld, Michael	Deciphering singularities by discrete methods	155
VERFÜRTH, R.	A posteriori error estimates for nonlinear problems. Finite element discretizations of elliptic equations	445

Author	Title	Page
Wahlbin, Lars B.	See: Thomée, Vidar & Wahlbin, Lars B	477
WHITLEY, E.	See: Cremona, J. E. & Whitley, E	407
Williams, H. C.	See: Mollin, R. A. & Williams, H. C	885
Woźnicki, Zbigniew I.	The Sigma-SOR algorithm and the optimal strategy for the utilization of the SOR iterative method	619
Xu, Yuan	Recurrence formulas for multivariate orthogonal polynomials	687
Xu, Yuan	A characterization of positive quadrature formulae	703
Xu, Yuesheng	See: Kaneko, Hideaki & Xu, Yuesheng	739
Yamamura, Ken	The determination of the imaginary abelian number fields with class number one	899
Ye, Qiang	A breakdown-free variation of the nonsymmetric Lanczos algorithms	179
Yin, Guangyan	Sinc-collocation method with orthogonalization for singular Poisson-like problems	21
Živković, Miodrag	A table of primitive binary polynomials	385



MATHEMATICS OF COMPUTATION

AMERICAN MATHEMATICAL SOCIETY

EDITED BY

James H. Bramble

Susanne C. Brenner

E. W. Cheney

James W. Demmel

Walter Gautschi, Managing Editor

Eugene Isaacson

James N. Lyness

Harald Niederreiter

Jorge J. Nocedal

Syvert P. Nørsett

Andrew M. Odlyzko

Frank W. J. Olver

John E. Osborn

Stanley Osher

Carl Pomerance

René Schoof

L. Ridgway Scott

Daniel Shanks

Chi-Wang Shu

Frank Stenger

Hans J. Stetter

G. W. Stewart

Nico M. Temme

Vidar Thomée

Lars B. Wahlbin

Hugh C. Williams

John W. Wrench, Jr.

PROVIDENCE, RHODE ISLAND USA

Mathematics of Computation

This journal publishes research articles in computational mathematics. Areas covered include numerical analysis, the application of computational methods, algorithms for advanced computer architectures, computational number theory and algebra, and related fields. Table errata and reviews of books in areas related to computational mathematics are also included.

Subscription information. Mathematics of Computation is published quarterly. Subscription prices for Volumes 62 and 63 (1994) are \$262 list; \$210 institutional member; \$170 member of CBMS organizations; \$157 individual AMS member. A late charge of 10% of the subscription price will be imposed upon orders received from nonmember institutions and organizations after January 1 of the subscription year. Subscribers outside the United States and India must pay a postage surcharge of \$9; subscribers in India must pay a postage surcharge of \$18. Expedited delivery to destinations in North America \$13; elsewhere \$40.

Back number information. For back issues see the AMS Catalog of Publications.

Subscriptions and orders should be addressed to the American Mathematical Society, P.O. Box 5904, Boston, MA 02206-5904. *All orders must be accompanied by payment*. Other correspondence should be addressed to P.O. Box 6248, Providence, RI 02940-6248.

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. All tables and correspondence concerning the UMT should be sent to Walter Gautschi, Chairman, Editorial Committee, Mathematics of Computation, Department of Computer Sciences, Purdue University, West Lafayette, IN 47907.

Copying and reprinting. Individual readers of this publication, and nonprofit libraries acting for them, are permitted to make fair use of the material, such as to copy an article for use in teaching or research. Permission is granted to quote brief passages from this publication in reviews provided the customary acknowledgment of the source is given.

Republication, systematic copying, or multiple reproduction of any material in this publication (including abstracts) is permitted only under license from the American Mathematical Society. Requests for such permission should be addressed to the Manager of Editorial Services, American Mathematical Society, P.O. Box 6248, Providence, RI 02940-6248. Requests can also be made by e-mail to reprint-permission@math.ams.org.

The appearance of the code on the first page of an article in this journal indicates the copyright owner's consent for copying beyond that permitted by Sections 107 or 108 of the U.S. Copyright Law, provided that the fee of \$1.00 plus \$.25 per page for each copy be paid directly to the Copyright Clearance Center, Inc., 222 Rosewood Drive, Danvers, MA 01923. This consent does not extend to other kinds of copying, such as copying for general distribution, for advertising or promotional purposes, for creating new collective works, or for resale.

Mathematics of Computation is published quarterly by the American Mathematical Society at 201 Charles Street, Providence, RI 02904-2213. Second-class postage is paid at Providence, Rhode Island. Postmaster: Send address changes to Mathematics of Computation, American Mathematical Society, P.O. Box 6248, Providence, RI 02940-6248.

© Copyright 1994 by the American Mathematical Society. All rights reserved.

Printed in the United States of America.

The paper used in this book is acid-free and falls within the guidelines established to ensure permanence and durability.

 This publication was typeset using AMS-TEX, the American Mathematical Society's TEX macro system.

 10 9 8 7 6 5 4 3 2 1 99 98 97 96 95 94

MATHEMATICS OF COMPUTATION CONTENTS

Vol. 62, No. 205 Janua	ıry :	1994
Richard S. Falk and John E. Osborn, Remarks on mixed finite elem methods for problems with rough coefficients		1
Guangyan Yin, Sinc-collocation method with orthogonalization for sin lar Poisson-like problems	_	21
Martti Hamina and Jukka Saranen, On the spline collocation method the single-layer heat operator equation		41
A. Bendali and M. Souilah, Consistency estimates for a double-layer tential and application to the numerical analysis of the boundarelement approximation of acoustic scattering by a penetrable objective.	ary-	65
C. Palencia, On the stability of variable stepsize rational approximation of holomorphic semigroups		93
Jinn-Liang Liu, A finite difference method for symmetric positive dif- ential equations	fer- 	105
Brahim Khobalatte and Benoit Perthame, Maximum principle on the tropy and second-order kinetic schemes		119
Patrick J. Rabier and Werner C. Rheinboldt, On the computation of passe points of quasi-linear differential-algebraic equations		133
Yves Tourigny and Michael Grinfeld, Deciphering singularities by discremethods		155
Oliver Aberth, Computation of topological degree using interval armetic, and applications		171
Qiang Ye, A breakdown-free variation of the nonsymmetric Lanczos al rithms	_	179
Zhaojun Bai, Error analysis of the Lanczos algorithm for the nonsymme eigenvalue problem		209
Edward Neuman, A new formula for box splines on three-direction meshes	nal	227
Ren-Cang Li, On perturbations of matrix pencils with real spectra		231
J. L. Lavoie, F. Grondin, A. K. Rathie, and K. Arora, Generalizations Dixon's theorem on the sum of a ${}_{3}F_{2}$		267
J. Bartolomeo and Matthew He, On Faber polynomials generated by	an	
<i>m</i> -star		277
Zvi Drezner, Computation of the trivariate normal integral		289
Sven Ehrich, Error bounds for Gauss-Kronrod quadrature formulae.	• • •	295
Richard Crandall and Barry Fagin, Discrete weighted transforms and lar integer arithmetic	_	305
A. J. W. Duijvestijn, Simple perfect squared squares and 2 × 1 squarectangles of order 25		325

Don Coppersmith, Solving homogeneous linear equations over $GF(2)$ via	
block Wiedemann algorithm	333
Genet M. Edmondson, Jennifer Seberry, and Malcolm R. Anderson, On the	
existence of Turyn sequences of length less than 43	351
Greg Butler, An inductive schema for computing conjugacy classes in per-	
mutation groups	363
Miodrag Živković, A table of primitive binary polynomials	385
J. Buchmann, M. Pohst, and J. Graf v. Schmettow, On unit groups and	
class groups of quartic fields of signature (2, 1)	387
R. Ernvall and T. Metsänkylä, Computation of the zeros of p-adic L-	
functions. II	391
J. E. Cremona and E. Whitley, Periods of cusp forms and elliptic curves	
over imaginary quadratic fields	407
Reviews and Descriptions of Tables and Books	431
Lorentzen and Waadeland 1, Brezinski 2, Press, Teukolsky, Vetterling,	
and Flannery 3a,b, Atkinson 4, Griewank and Corliss, Editors 5,	
Cheney, Chui, and Schumaker, Editors 6, Ames 7, Bank, Editor 8,	
Heiliö, Editor 9, Rathbun 10, Rathbun and Granlund 11, Rathbun	
and Granlund 12	
Microfiche Supplements	
A. J. W. Duijvestijn, Simple perfect squared squares and 2×1 squared	
rectangles of order 25	
Miodrag Živković, A table of primitive binary polynomials	

Vol. 62, No. 206 April 1	1994
R. Verfürth, A posteriori error estimates for nonlinear problems. Finite	
element discretizations of elliptic equations	445
Vidar Thomée and Lars B. Wahlbin, Long-time numerical solution of a	
parabolic equation with memory	477
Thomas Y. Hou and Philippe G. Le Floch, Why nonconservative schemes	
converge to wrong solutions: error analysis	497
Guangshan Jiang and Chi-Wang Shu, On a cell entropy inequality for dis-	
continuous Galerkin methods	531
T. Ha-Duong and P. Joly, On the stability analysis of boundary conditions for the wave equation by energy methods. Part I: The homogeneous	
case	539
Shoufu Li, B-convergence properties of multistep Runge-Kutta methods	565
Ll. G. Chambers, A quick way of obtaining an approximate solution to a	
Sturm-Liouville problem	577
Hermann Brunner, Iterated collocation methods for Volterra integral equa-	
tions with delay arguments	581
Pierluigi Amodio and Francesca Mazzia, Backward error analysis of cyclic	
reduction for the solution of tridiagonal systems	601

Zbigniew I. Woźnicki, The Sigma-SOR algorithm and the optimal strategy	
for the utilization of the SOR iterative method	619
M. J. Baines, Algorithms for optimal discontinuous piecewise linear and	
constant L_2 fits to continuous functions with adjustable nodes in one	
and two dimensions	645
Lisa Lorentzen, Divergence of continued fractions related to hypergeomet-	
ric series	671
Yuan Xu, Recurrence formulas for multivariate orthogonal polynomials.	687
Yuan Xu, A characterization of positive quadrature formulae	703
Klaus-Jürgen Förster, On a theorem of C. Posse concerning Gaussian	
quadrature of Chebyshev type	719
Giuseppe Mastroianni and Giovanni Monegato, Polynomial approxima-	
tions of functions with endpoint singularities and product integration	
formulas	725
Hideaki Kaneko and Yuesheng Xu, Gauss-type quadratures for weakly sin-	
gular integrals and their application to Fredholm integral equations	
of the second kind	739
Kurt Georg and Johannes Tausch, Some error estimates for the numerical	
approximation of surface Integrals	755
Giovanni Monegato, The numerical evaluation of a 2-D Cauchy principal	
value integral arising in boundary integral equation methods	765
Ralph W. Bailey, Polar generation of random variates with the t-distribu-	
tion	779
Jürgen Eichenauer-Herrmann, Improved lower bounds for the discrepancy	,
of inversive congruential pseudorandom numbers	783
Jürgen Eichenauer-Herrmann and Katja Ickstadt, Explicit inversive con-	. 05
gruential pseudorandom numbers with power of two modulus	787
Raymond Couture and Pierre L'Ecuyer, On the lattice structure of certain	
linear congruential sequences related to AWC/SWB generators	799
Shu Tezuka, The k -dimensional distribution of combined GFSR sequences	
809	
Harald Niederreiter, Factoring polynomials over finite fields using differ-	
ential equations and normal bases	819
Rainer Göttfert, An acceleration of the Niederreiter factorization algorithm	
in characteristic 2	831
W. Lempken and R. Staszewski, The structure of the projective indecom-	
posable modules of $\hat{3}M_{22}$ in characteristic 2	841
Gerhard Hiss, The 3-modular characters of the Rudvalis sporadic simple	
group and its covering group	851
Gerhard Frey and Hans-Georg Rück, A remark concerning m-divisibility	
and the discrete logarithm in the divisor class group of curves	865
D. S. Dummit and David Hayes, Rank-one Drinfeld modules on elliptic	
curves	875
R. A. Mollin and H. C. Williams, Quadratic residue covers for certain real	
quadratic fields	885
Ken Yamamura, The determination of the imaginary abelian number fields	
with class number one	899
Petr Cikánek, A special extension of Wieferich's criterion	923
J. Browkin and J. Brzeziński, Some remarks on the abc-conjecture	931

Reviews and Descriptions of Tables and Books	941
Hackbusch and Trottenberg, Editors 13, Keyes, Chan, Meurant,	
Scroggs, and Voigt, Editors 14, Koyama 15, Funaro 16, Allgower and	
Georg, Editors 17	
Microfiche Supplement	
D. S. Dummit and David Hayes, Rank-one Drinfeld modules on	
elliptic curves	

Editorial Information

As of February 3, 1994, the backlog for this journal was approximately 1 issue. This estimate is the result of dividing the number of manuscripts for this journal in the Providence office that have not yet gone to the printer on the above date by the average number of articles per issue over the previous twelve months, reduced by the number of issues published in six months (the time necessary for editing and composing a typical issue).

A Copyright Transfer Agreement is required before a paper will be published in this journal. By submitting a paper to this journal, authors certify that the manuscript has not been submitted to nor is it under consideration for publication by another journal, conference proceedings, or similar publication.

Information for Authors and Editors

The first page must consist of a descriptive title, followed by an abstract that summarizes the article in language suitable for workers in the general field (algebra, analysis, etc.). The descriptive title should be short, but informative; useless or vague phrases such as "some remarks about" or "concerning" should be avoided. The abstract must be brief and reasonably self-contained. Included with the footnotes to the paper, there should be the 1991 Mathematics Subject Classification representing the primary and secondary subjects of the article. This may be followed by a list of key words and phrases describing the subject matter of the article and taken from it. A list of the numbers may be found in the annual index of Mathematical Reviews, published with the December issue starting in 1990, as well as from the electronic service e-MATH [telnet e-MATH.ams.com (or telnet 130.44.1.100). Login and password are e-math]. For journal abbreviations used in bibliographies, see the list of serials in the latest Mathematical Reviews annual index. When the manuscript is submitted, authors should supply the editor with electronic addresses if available. These will be printed after the postal address at the end of each article.

Electronically prepared manuscripts. The AMS encourages submission of electronically prepared manuscripts in $\mathcal{A}_{\mathcal{M}}\mathcal{S}$ -TeX or $\mathcal{A}_{\mathcal{M}}\mathcal{S}$ -LeTeX because properly prepared electronic manuscripts save the author proofreading time and move more quickly through the production process. To this end, the Society has prepared "preprint" style files, specifically the amsppt style of $\mathcal{A}_{\mathcal{M}}\mathcal{S}$ -TeX and the amsart style of $\mathcal{A}_{\mathcal{M}}\mathcal{S}$ -LeTeX, which will simplify the work of authors and of the production staff. Those authors who make use of these style files from the beginning of the writing process will further reduce their own effort. Electronically submitted manuscripts prepared in plain TeX or LeTeX do not mesh properly with the AMS production systems and cannot, therefore, realize the same kind of expedited processing. Users of plain TeX should have little difficulty learning $\mathcal{A}_{\mathcal{M}}\mathcal{S}$ -TeX, and LeTeX users will find that $\mathcal{A}_{\mathcal{M}}\mathcal{S}$ -LeTeX is the same as LeTeX with additional commands to simplify the typesetting of mathematics.

Guidelines for Preparing Electronic Manuscripts provides additional assistance and is available for use with either AMS-TEX or AMS-LATEX. Authors with FTP access may obtain Guidelines from the Society's Internet node e-MATH.ams.org (130.44.1.100). For those without FTP access Guidelines can be obtained free of charge from the e-mail address guide-elec@math.ams.org (Internet) or from the Customer Services Department, American

Mathematical Society, P.O. Box 6248, Providence, RI 02940-6248. When requesting *Guidelines*, please specify which version you want.

At the time of submission, authors should indicate if the paper has been prepared using AMS-TEX or AMS-LATEX. The Manual for Authors of Mathematical Papers should be consulted for symbols and style conventions. The Manual may be obtained free of charge from the e-mail address cust-serv@math.ams. org or from the Customer Services Department, American Mathematical Society, P.O. Box 6248, Providence, RI 02940-6248. The Providence office should be supplied with a manuscript that corresponds to the electronic file being submitted.

Electronic manuscripts should be sent to the Providence office immediately after the paper has been accepted for publication. They can be sent via e-mail to pub-submit@math.ams.org (Internet) or on diskettes to the Publications Department, American Mathematical Society, P.O. Box 6248, Providence, RI 02940-6248. When submitting electronic manuscripts please be sure to include a message indicating in which publication the paper has been accepted. No corrections will be accepted electronically. Authors must mark their changes on their proof copies and return them to the Providence office. Authors and editors are encouraged to make the necessary submissions of electronically prepared manuscripts and proof copies in a timely fashion.

An author should submit the original and two copies of the manuscript and retain one copy. The author may suggest an appropriate editor for his paper. All contributions intended for publication and all books for review should be addressed to Walter Gautschi, Chairman, Editorial Committee, Mathematics of Computation, Department of Computer Sciences, Purdue University, West Lafayette, Indiana 47907. The date received, which is published with the final version of an accepted paper, is the date received in the office of the Chairman of the Editorial Committee, and it is the responsibility of the author to submit manuscripts directly to this office.

Any inquiries concerning a paper that has been accepted for publication should be sent directly to the Editorial Department, American Mathematical Society, P. O. Box 6248, Providence, RI 02940-6248.

Editorial Committee

WALTER GAUTSCHI, Chairman. Department of Computer Sciences, Purdue University, West Lafayette, IN 47907; E-mail: wxg@cs.purdue.edu

ANDREW M. ODLYZKO, AT&T Bell Laboratories, 600 Mountain Avenue, Murray Hill, NJ 07974; E-mail: amo@research.att.com

FRANK W. J. OLVER, Institute for Physical Science and Technology, University of Maryland, College Park, MD 20742; *E-mail*: olver@bessel.umd.edu

LARS B. WAHLBIN, Department of Mathematics, Cornell University, Ithaca, NY 14853; E-mail: wahlbin@math.cornell.edu

Technical Editor

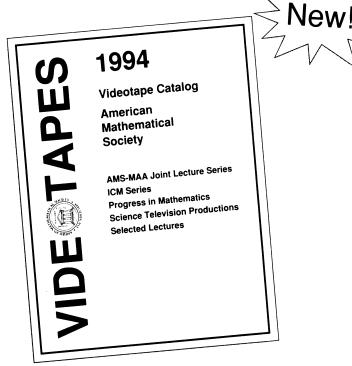
ERIKA GAUTSCHI, Department of Computer Sciences, Purdue University, West Lafayette, IN 47907; E-mail: exg@cs.purdue.edu

Board of Associate Editors

JAMES H. BRAMBLE, Department of Mathematics, Cornell University, Ithaca, NY 14853; E-mail: bramble@math.cornell.edu

- SUSANNE C. BRENNER, Department of Mathematics, University of South Carolina, Columbia, SC 29208; E-mail: brenner@math.scarolina.edu
- E. W. CHENEY, Department of Mathematics, University of Texas at Austin, Austin, TX 78712-1082; E-mail: cheney@cs.utexas.edu
- JAMES W. DEMMEL, Computer Science Division, University of California, Berkeley, CA 94720; *E-mail*: demmel@cs.berkeley.edu
- EUGENE ISAACSON, Courant Institute of Mathematical Sciences, New York University, 251 Mercer Street, New York, NY 10012; E-mail: isaacson@acf7.nyu.edu
- JAMES N. LYNESS, Argonne National Laboratory, 9700 South Cass Avenue, Argonne, IL 60439; E-mail: lyness@mcs.anl.gov
- HARALD NIEDERREITER, Institute for Information Processing, Austrian Academy of Sciences, Sonnenfelsgasse 19, A-1010 Vienna, Austria; *E-mail*: nied@qiinfo.oeaw.ac.at
- JORGE J. NOCEDAL, Department of Electrical Engineering and Computer Science, Northwestern University, Evanston, IL 60208-3118; *E-mail*: nocedal@eecs.nwu.edu
- SYVERT P. NØRSETT, Division of Numerical Mathematics, The University of Trondheim and The Norwegian Institute of Technology, Alfred Getz vei 1, N-7034 Trondheim-NTH, Norway; E-mail: norsett@imf.unit.no
- JOHN E. OSBORN, Department of Mathematics, University of Maryland, College Park, MD 20742; E-mail: jeo@julia.umd.edu
- STANLEY OSHER, Department of Mathematics, University of California, Los Angeles, CA 90024; E-mail: sjo@math.ucla.edu
- CARL POMERANCE, Department of Mathematics, The University of Georgia, Athens, GA 30602; E-mail: carl@math.uga.edu
- RENÉ SCHOOF, Dipartimento di Matematica, Università degli Studi di Trento, I-38050 Povo (Trento), Italy; E-mail: schoof@itnvax.cineca.it
- L. RIDGWAY SCOTT, Department of Mathematics, University of Houston, Houston, TX 77204-3476; E-mail: scott@casc.math.uh.edu
- DANIEL SHANKS, Department of Mathematics, University of Maryland, College Park, MD 20742; E-mail: dns@gaby.umd.edu
- CHI-WANG SHU, Applied Mathematics Division, Brown University, Providence, RI 02912-0001; E-mail: shu@cfm.brown.edu
- FRANK STENGER, Department of Computer Science, University of Utah, Salt Lake City, UT 84112; E-mail: stenger@cs.utah.edu
- HANS J. STETTER, Institut für Numerische Mathematik, Technische Universität Wien, Wiedner Hauptstrasse 6-10, A-1040, Wien, Austria; E-mail: stetter@uranus.tuwien.ac.at
- G. W. STEWART, Department of Computer Science, University of Maryland, College Park, MD 20742; E-mail: stewart@thales.cs.umd.edu
- NICO M. TEMME, Stichting Mathematisch Centrum, Centrum voor Wiskunde en Informatica, Kruislaan 413, 1098 SJ Amsterdam, The Netherlands; *E-mail*: nicot@cwi.nl
- VIDAR THOMÉE, Mathematics Department, Chalmers University of Technology, S-412 96 Göteborg, Sweden; E-mail: thomee@math.chalmers.se
- HUGH C. WILLIAMS, Department of Computer Science, University of Manitoba, Winnipeg, Manitoba, Canada R3T 2N2; E-mail: Hugh_Williams@csmail.cs.umanitoba.ca
- JOHN W. WRENCH, JR., 102 Mt. Olivet Boulevard, Frederick, MD 21701

FREE Videotape Catalog!



Great Teaching Tools!

This broad collection of videotaped lectures helps to preserve a portrait of today's distinguished mathematicians while capturing the interest and enthusiasm of the speakers as they present material in their fields of expertise. The lectures are expository and are useful in courses, seminars, and general assemblies for students as well as researchers in the mathematical sciences community.

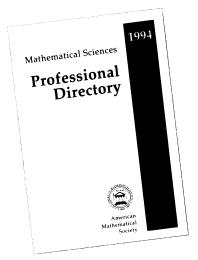


Order your FREE Catalog Today!

1-800-321-4AMS

American Mathematical Society, P.O. Box 6248, Providence, RI 02940-6248





Mathematical Sciences

Professional Directory

The *Mathematical Sciences Professional Directory* is a handy reference to a wide variety of organizations of interest to the mathematical community. Updated annually, the *Directory* lists:

- officers, committee members and key staff of over 30 organizations including the AMS, MAA, SIAM, the American Statistical Association, the Institute of Mathematical Statistics, the Association for Computing Machinery, the National Council of Teachers of Mathematics, the National Academy of Sciences, and the American Association for the Advancement of Science
- addresses and telephone numbers of key staff
- mathematical sciences personnel of federal funding agencies
- departments of mathematical sciences in colleges and universities across the United States and Canada
- department chairs
- mathematical units of nonacademic organizations.

1991 Mathematics Subject Classification: 00 ISBN 0-8218-0183-X, 227 pages (softcover), March 1994 List price \$50, Institutional member \$40 To order, please specify PRODIR/94MC



CONTEMPORARY MATHEMATICS

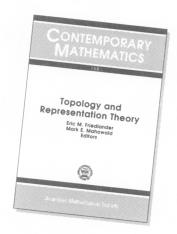
Volumes 158 & 159

Topology and Representation Theory

Eric M. Friedlander and Mark E. Mahowald. Editors

During 1991–1992, Northwestern University conducted a special emphasis on the topic "The Connections between Topology and Representation Theory". The year's activities culminated in a conference in May 1992. This volume contains the papers presented at the conference which were designed to introduce current trends to graduate students and nonspecialists familiar with algebraic topology.

1991 Mathematics Subject Classification: 55, 20 ISBN 0-8218-5165-9, 318 pages (softcover), February 1994 Individual member \$29, List price \$48, Institutional member \$38 To order, please specify CONM/158MC

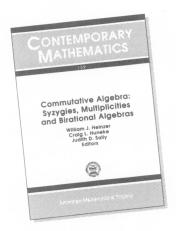


Commutative Algebra: Syzygies, Multiplicities, and Birational Algebra

William J. Heinzer, Craig L. Huneke, and Judith D. Sally, *Editors*

This volume contains refereed papers on themes explored at the AMS-IMS-SIAM Summer Research Conference held at Mount Holyoke College in 1992. The major themes of the conference were tight closure Hilbert functions, birational algebra, free resolutions and the homological conjectures, Rees algebras, and local cohomology.

1991 Mathematics Subject Classification: 13; 14 ISBN 0-8218-5188-8, 444 pages (softcover), February 1994 Individual member \$37, List price \$61, Institutional member \$49 To order, please specify CONM/159MC





American Mathematical Society & Centre de Recherches Mathématiques



CRM Monograph Series



Volume 1

Free Random Variables

D. V. Voiculescu, K. J. Dykema, and A. Nica

This book represents the first comprehensive introduction to free probability theory, a highly noncommutative probability theory with independence based on free products instead of tensor products. Basic examples of this kind of theory are provided by convolution operators on free groups and by the asymptotic behavior of large Gaussian random matrices. In addition to researchers and graduate students in mathematics, this book is of interest to physicists and others who use random matrices.

1991 Mathematics Subject Classification: 46; 47, 60 ISBN 0-8218-6999-X, 70 pages (hardcover), December 1992 Individual member \$23, List price \$39, Institutional member \$31 To order, please specify CRMM/1MC



Volume 2

Applied Integral Transforms

M. Ya. Antimirov, A. A. Kolyshkin, and Rémi Vaillancourt

The first section of this book, which proceeds mainly by examples and includes exercises, requires little mathematical background and can be considered an introduction to the subject of integral transforms. In the second part of the book, the method of integral transforms is used to solve modern applied problems in convective stability, temperature fields in oil strata, and eddy current testing. The choice of topics reflects the authors' research experience and involvement in industrial applications.

1991 Mathematics Subject Classification: 35; 76, 80, 78, 44 ISBN 0-8218-6998-1, 265 pages (hardcover), February 1993 Individual member \$40, List price \$66, Institutional member \$53 To order, please specify CRMM/2MC



FIELDS INSTITUTE COMMUNICATIONS

New Series!

Fields Institute Communications features proceedings and lecture notes growing out of the various activities at The Fields Institute for Research in Mathematical Sciences located in Waterloo, Ontario, Canada. The publications evolve from each year's main program. Control Theory, the 1992 program, produced interdisciplinary work in applied mathematics, computer science, control theory, aerospace, civil, electrical, mechanical and systems engineering, and physics. For 1993 the program focused on dynamical systems. For 1994 the main program is L-functions.

Volume 1

Dynamics and Control of Mechanical Systems: The Falling Cat and Related Problems

Michael J. Enos, Editor

This book contains a collection of papers presented at the Fields Institute workshop, "The Falling Cat and Related Problems," held in March 1992. The theme of the workshop was the application of methods from geometric mechanics and mathematical control theory to problems in the dynamics and control of freely rotating systems of coupled rigid bodies and related nonholonomic mechanical systems. This book is useful in providing insight into this new and exciting area of research.

1991 *Mathematics Subject Classification:* 70, 58, 93, 49. ISBN 0-8218-9200-2, 280 pages (hardcover) July 1993. **Individual member \$52**, List price \$87, Institutional member \$70. **To order, please specify FIC/1MC**

Volume 2

Control of Flexible Structures

K. A. Morris, Editor

This book contains papers presented at the workshop "Problems in Sensing, Identification, and Control of Flexible Structures," held in June 1992 at the Fields Institute. Topics range from theoretical research on the well-posedness of systems to experimental implementations of various controllers. This book is a useful resource for control theorists, engineers, and mathematicians interested in this important field of research.

1991 *Mathematics Subject Classification*: 93, 70. ISBN 0-8218-9201-0, 243 pages (hardcover) July 1993. **Individual member \$49**, List price \$82, Institutional member \$66. **To order, please specify FIC/2MC**



Proceedings of Symposia in Applied Mathematics

Volumes 46 & 47

The Unreasonable Effectiveness of Number Theory

Stefan A. Burr, Editor

This book is based on the AMS Short Course, "The Unreasonable Effectiveness of Number Theory", held in Orono, Maine, in August 1991. This short course provided some views into the great breadth of applications of number theory outside cryptology and highlighted the power and applicability of number theoretic ideas. This book will appeal to a general mathematical audience and researchers in other areas of science and engineering who wish to learn how number theory is being applied outside of mathematics. All of the chapters are written by leading specialists in number theory and provide excellent introductions to various applications.

Proceedings of Symposia in APPLIED MATHEMATICS

Volume 46

The Unreasonable Effectiveness of Number Theory

Stefan A. Burr, Editor

American Mathematical Society

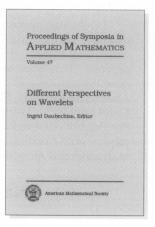
1991 Mathematics Subject Classification: 11 ISBN 0-8218-5501-8, 125 pages (hardcover), November 1992 List price \$37, Individual member \$22, Institutional member \$30 To order, please specify PSAPM/46MC

Different Perspectives on Wavelets

Ingrid Daubechies, Editor

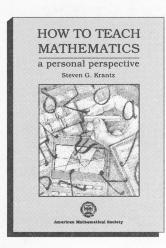
The wavelet transform can be seen as a synthesis of ideas that have emerged since the 1960s in mathematics, physics, and electrical engineering. The papers in this book attempt to give some theoretical and technical shape to this intuitive picture of wavelets and their uses. The papers collected here were prepared for an AMS Short Course on Wavelets and Applications, held at the Joint Mathematics Meetings in San Antonio in January 1993.

1991 Mathematics Subject Classification: 35, 42, 46, 62, 94 ISBN 0-8218-5503-4, 205 pages (hardcover), December 1993 List price \$45, Individual member \$27, Institutional member \$36 To order, please specify PSAPM/47MC





An essential teaching tool!



HOW TO TEACH MATHEMATICS

a personal perspective

Steven G. Krantz Washington University

Intended primarily for the graduate student or novice instructor, this book is also appropriate for those who have been teaching for many years because it highlights the finer points of excellent mathematics teaching. Professor Krantz addresses

- specific methods for successful mathematics teaching
- · how to deal with students who beg for grades
- · how to use applications effectively
- proper ways to choose a textbook
- how to deal with sensitive issues such as cheating, bribery, sexual harassment, and much more!

Lively and humorous, yet serious and sensible, this book is a practical guide to teaching mathematics. With an emphasis on the classroom, *How to Teach Mathematics* addresses specific objectives, situations, and problems in the teaching process. This book is an essential teaching tool.

About the author: Stephen G. Krantz is currently a Professor at Washington University in St. Louis, Missouri. Professor Krantz was awarded the UCLA Alumni Foundation Distinguished Teaching Award in 1979, has authored 80 scholarly papers and 7 books, was awarded the Chauvenet Prize for expository writing by the Mathematical Association of America, and is an internationally recognized scholar.

Call for information about bulk order discounts.

ISBN 0-8218-0197-X, 76 pages (softcover), July 1993 List price \$21, Individual member \$13, Institutional member \$17 To order, please specify HTM/MC



(Continued from back cover)

Raymond Couture and Pierre L'Ecuyer, On the lattice structure of certain linear	
congruential sequences related to AWC/SWB generators	799
Shu Tezuka, The k-dimensional distribution of combined GFSR sequences	809
Harald Niederreiter, Factoring polynomials over finite fields using differential equa-	
tions and normal bases	819
Rainer Göttfert, An acceleration of the Niederreiter factorization algorithm in char-	
acteristic 2	831
W. Lempken and R. Staszewski, The structure of the projective indecomposable	
modules of $3M_{22}$ in characteristic 2	841
Gerhard Hiss, The 3-modular characters of the Rudvalis sporadic simple group	
and its covering group	851
Gerhard Frey and Hans-Georg Rück, A remark concerning m-divisibility and the	
discrete logarithm in the divisor class group of curves	865
D. S. Dummit and David Hayes, Rank-one Drinfeld modules on elliptic curves .	875
R. A. Mollin and H. C. Williams, Quadratic residue covers for certain real quadratic	
fields	885
Ken Yamamura, The determination of the imaginary abelian number fields with	
class number one	899
Petr Cikánek, A special extension of Wieferich's criterion	923
J. Browkin and J. Brzeziński, Some remarks on the abc-conjecture	931
Reviews and Descriptions of Tables and Books	941
Hackbusch and Trottenberg, Editors 13, Keyes, Chan, Meurant, Scroggs, and	,
Voigt, Editors 14, Koyama 15, Funaro 16, Allgower and Georg, Editors 17	
Microfiche Supplement	
D. S. Dummit and David Hayes, Rank-one Drinfeld modules on elliptic curves	
2. 5. 2 ammit and Paris Hayes, Rank-one Printed modules on emptic cut ves	

MATHEMATICS OF COMPUTATION CONTENTS

Vol. 62, No. 206 April 1	994
R. Verfürth, A posteriori error estimates for nonlinear problems. Finite element	445
discretizations of elliptic equations	445
Vidar Thomée and Lars B. Wahlbin, Long-time numerical solution of a parabolic equation with memory	477
Thomas Y. Hou and Philippe G. Le Floch, Why nonconservative schemes converge	
to wrong solutions: error analysis	497
Guangshan Jiang and Chi-Wang Shu, On a cell entropy inequality for discontinuous	
Galerkin methods	531
T. Ha-Duong and P. Joly, On the stability analysis of boundary conditions for the	
wave equation by energy methods. Part I: The homogeneous case	539
Shoufu Li, B-convergence properties of multistep Runge-Kutta methods	565
Ll. G. Chambers, A quick way of obtaining an approximate solution to a Sturm-	
Liouville problem	577
Hermann Brunner, Iterated collocation methods for Volterra integral equations	
with delay arguments	581
Pierluigi Amodio and Francesca Mazzia, Backward error analysis of cyclic reduction	
for the solution of tridiagonal systems	601
Zbigniew I. Woźnicki, The Sigma-SOR algorithm and the optimal strategy for the	
utilization of the SOR iterative method	619
M. J. Baines, Algorithms for optimal discontinuous piecewise linear and constant	
L_2 fits to continuous functions with adjustable nodes in one and two dimen-	
sions	645
Lisa Lorentzen, Divergence of continued fractions related to hypergeomet-	
ric series	671
Yuan Xu, Recurrence formulas for multivariate orthogonal polynomials	687
Yuan Xu, A characterization of positive quadrature formulae	703
Klaus-Jürgen Förster, On a theorem of C. Posse concerning Gaussian quadrature	
of Chebyshev type	719
Giuseppe Mastroianni and Giovanni Monegato, Polynomial approximations of func-	
tions with endpoint singularities and product integration formulas	725
Hideaki Kaneko and Yuesheng Xu, Gauss-type quadratures for weakly singular	
integrals and their application to Fredholm integral equations of the second	720
kind	739
Kurt Georg and Johannes Tausch, Some error estimates for the numerical approx-	755
imation of surface Integrals	755
Giovanni Monegato, The numerical evaluation of a 2-D Cauchy principal value	765
integral arising in boundary integral equation methods \dots Ralph W. Bailey, Polar generation of random variates with the t -distribu-	103
	779
Jürgen Eichenauer-Herrmann, Improved lower bounds for the discrepancy of in-	119
versive congruential pseudorandom numbers	783
Jürgen Eichenauer-Herrmann and Katja Ickstadt, Explicit inversive congruential	103
pseudorandom numbers with power of two modulus	787
(Continued on inside back of	cover)



0025-5718(199404)62:206;1-M