Sören Bartels, Projection-free approximation of geometrically constrained partial differential equations .................................................. 1033
Dominik Schötzau, Christoph Schwab, and Thomas P. Wihler, \(hp\)-dGFEM for second-order mixed elliptic problems in polyhedra .............. 1051
Juan G. Calvo, A BDDC algorithm with deluxe scaling for \(H(\text{curl})\) in two dimensions with irregular subdomains .................................. 1085
Bernardo Cockburn, Ricardo H. Nochetto, and Wujun Zhang, Contraction property of adaptive hybridizable discontinuous Galerkin methods ................................................................. 1113
D. C. Antonopoulos and V. A. Dougalis, Error estimates for the standard Galerkin-finite element method for the shallow water equations ................................................................. 1143
Rodrigo Lecaros and Enrique Zuazua, Control of 2D scalar conservation laws in the presence of shocks ........................................... 1183
Xiong Meng, Chi-Wang Shu, and Boying Wu, Optimal error estimates for discontinuous Galerkin methods based on upwind-biased fluxes for linear hyperbolic equations ........................................ 1225
Lili Hu, Yao Li, and Yingjie Liu, A limiting strategy for the back and forth error compensation and correction method for solving advection equations ............................................................. 1263
Christophe Berthon and Christophe Chalons, A fully well-balanced, positive and entropy-satisfying Godunov-type method for the shallow-water equations .................................................... 1281
Adam Andersson and Stig Larsson, Weak convergence for a spatial approximation of the nonlinear stochastic heat equation .............. 1335
Emmanuel Gobet and Plamen Turkedjiev, Linear regression MDP scheme for discrete backward stochastic differential equations under general conditions .................................................. 1359
Alin Bostan, Guillaume Chèze, Thomas Cluzeau, and Jacques-Arthur Weil, Efficient algorithms for computing rational first integrals and Darboux polynomials of planar polynomial vector fields .... 1393
Allan Hungria, Jean-Philippe Lessard, and J. D. Mireles James, Rigorous numerics for analytic solutions of differential equations: the radii polynomial approach .................................................. 1427
Alexander Abatzoglou, Alice Silverberg, Andrew V. Sutherland, and Angela Wong, A framework for deterministic primality proving using elliptic curves with complex multiplication ...................... 1461
Daeyeol Jeon, Families of elliptic curves over cyclic cubic number fields with prescribed torsion ........................................... 1485
Loïc Grenié and Giuseppe Molteni, Zeros of Dedekind zeta functions under GRH ................................................................. 1503
Long Zhang and Kejian Xu, The tame kernel of $\mathbb{Q}(\zeta_5)$ is trivial ........ 1523
D. J. Platt and T. S. Trudgian, On the first sign change of $\theta(x) - x$ ... 1539
Editorial Information

Information on the backlog for this journal can be found on the AMS website starting from http://www.ams.org/mcom.

In an effort to make articles available as quickly as possible, articles are electronically published on the AMS website individually after proof is returned from authors and before appearing in an issue.

A Consent to Publish is required before we can begin processing your paper. After a paper is accepted for publication, the Providence office will send a Consent to Publish and Copyright Agreement to all authors of the paper. By submitting a paper to this journal, authors certify that the results have not been submitted to nor are they under consideration for publication by another journal, conference proceedings, or similar publication.

Information for Authors

Initial submission. All articles submitted to this journal are peer-reviewed. The AMS has a single blind peer-review process in which the reviewers know who the authors of the manuscript are, but the authors do not have access to the information on who the peer reviewers are. The AMS uses Centralized Manuscript Processing for initial submission. Authors should submit a PDF file using the Initial Manuscript Submission form found at www.ams.org/submission/mcom, or send one copy of the manuscript to the following address: Centralized Manuscript Processing, MATHEMATICS OF COMPUTATION, 201 Charles Street, Providence, RI 02904-2294 USA. If a paper copy is being forwarded to the AMS, indicate that it is for Mathematics of Computation and include the name of the corresponding author and contact information, such as an email address or mailing address. The author may suggest an appropriate editor for his or her paper.

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, reasonably self-contained, and not exceed 300 words. Included with the footnotes to the paper should be the 2010 Mathematics Subject Classification representing the primary and secondary subjects of the article. The classifications are accessible from www.ams.org/msc. The Mathematics Subject Classification footnote may be followed by a list of key words and phrases describing the subject matter of the article and taken from it. Journal abbreviations used in bibliographies are listed in the latest Mathematical Reviews annual index. The series abbreviations are also accessible from www.ams.org/msnhtml/serials.pdf. To help in preparing and verifying references, the AMS offers MR Lookup, a Reference Tool for Linking, at www.ams.org/mrlookup/.

Electronically prepared manuscripts. Manuscripts should be electronically prepared in \LaTeX. To this end, the Society has prepared \LaTeX author packages for each AMS publication. Author packages include instructions for preparing electronic manuscripts, samples, and a style file that generates the particular design specifications of that publication series. Articles properly prepared using the \LaTeX style file and the \texttt{\label} and \texttt{\ref} commands automatically enable extensive intra-document linking to the bibliography and other elements of the article for searching electronically on the Web.

Authors may retrieve an author package for Mathematics of Computation from www.ams.org/mcom/mcomauthorpac.html or via FTP to ftp.ams.org (login as anonymous, enter your complete email address as password, and type cd pub/author-info). The AMS Author Handbook and the Instruction Manual are available in PDF format from the author package link. The author package can also be obtained free of charge by sending email to tech-support@ams.org or from the Publication Division, American Mathematical Society, 201 Charles Street, Providence, RI 02904-2294 USA. When requesting an author package, please specify the publication in which your paper will appear. Please be sure to include your complete email address.
**After acceptance.** The source files for the final version of the electronic manuscript should be sent to the Providence office immediately after the paper has been accepted for publication. The author should also submit a PDF of the final version of the paper to the Managing Editor, who will forward a copy to the Providence office. Accepted electronically prepared manuscripts can be submitted via the web at [www.ams.org/submit-book-journal/](http://www.ams.org/submit-book-journal/), sent via email to pub-submit@ams.org, or sent on CD to the Electronic Prepress Department, American Mathematical Society, 201 Charles Street, Providence, RI 02904-2294 USA. When sending a manuscript electronically via email or CD, please be sure to include a message indicating in which publication the paper has been accepted. Complete instructions on how to send files are included in the author package.

**Electronic graphics.** Comprehensive instructions on preparing graphics are available starting from [www.ams.org/authors/journals.html](http://www.ams.org/authors/journals.html). A few of the major requirements are given here.

Submit files for graphics as EPS (Encapsulated PostScript) files. This includes graphics originated via a graphics application as well as scanned photographs or other computer-generated images. If this is not possible, TIFF files are acceptable as long as they can be opened in Adobe Photoshop or Illustrator.

Authors using graphics packages for the creation of electronic art should also avoid the use of any lines thinner than 0.5 points in width. Many graphics packages allow the user to specify a “hairline” for a very thin line. Hairlines often look acceptable when proofed on a typical laser printer. However, when produced on a high-resolution laser imagesetter, hairlines become nearly invisible and will be lost entirely in the final printing process.

Screens should be set to values between 15% and 85%. Screens which fall outside of this range are too light or too dark to print correctly. Variations of screens within a graphic should be no less than 10%.

Any graphics created in color will be rendered in grayscale for the printed version unless color printing is authorized by the Managing Editor and the Publisher. In general, color graphics will appear in color in the online version.

**AMS policy on making changes to articles after publication.** Articles are published on the AMS website individually after proof is returned from authors and before appearing in an issue. To preserve the integrity of electronically published articles, once an article is individually published to the AMS website, changes cannot be made in place in the paper. The AMS does not keep author-related information, such as affiliation, current address, and email address, up to date after a paper is electronically published.

Corrections of critical errors may be made to the paper by submitting an errata article to the Editor. The errata article will be published electronically, will appear in a future print issue, and will link back and forth on the Web with the original article.

**Secure manuscript tracking on the Web.** Authors can track their manuscripts through the AMS journal production process using the personal AMS ID and Article ID printed in the upper right-hand corner of the Consent to Publish form sent to each author who publishes in AMS journals. Access to the tracking system is available from [www.ams.org/mstrack/](http://www.ams.org/mstrack/). An explanation of each production step is provided on the web through links from the manuscript tracking screen. Questions can be sent to mcom-query@ams.org.

**Inquiries.** Any inquiries concerning a paper that has been accepted for publication that cannot be answered via the manuscript tracking system mentioned above should be sent to mcom-query@ams.org or directly to the Electronic Prepress Department, American Mathematical Society, 201 Charles Street, Providence, RI 02904-2294 USA.
Editorial Committee

SUSANNE C. BRENNER, Chair, Center for Computation & Technology and Department of Mathematics, Louisiana State University, Baton Rouge, LA 70803 USA; E-mail: mathcomp@math.lsu.edu

RONALD F. A. COOLS, Department of Computer Science, Katholieke Universiteit Leuven, Celestijnenlaan 200A, B-3001 Heverlee, Belgium; E-mail: ronald.cools@cs.kuleuven.ac.be

IGOR E. SHPARLINSKI, Department of Pure Mathematics, University of New South Wales, Sydney, NSW 2052, Australia; E-mail: igor.shparlinski@unsw.edu.au

CHI-WANG SHU, Applied Mathematics Division, Brown University, P.O. Box F, 182 George St., Providence, RI 02912-0001 USA; E-mail: mathcomp@dam.brown.edu

Board of Associate Editors

RÉMI ABGRALL, Institut für Mathematik, Universität Zürich, Winterthurerstrasse 190, CH-8057 Zürich, Switzerland; E-mail: remi.abgrall@math.uzh.ch

DANIELE BOFFI, Department of Mathematics, University di Pavia, Via Ferrata 1, 27100 Pavia PV, Italy; E-mail: daniele.boffi@unipv.it

MARTIN BURGER, Institut für Numerische und Angewandte Mathematik, Westfälisch Wilhelms-University Münster, Einsteinstr. 62, D-48149 Münster, Germany; E-mail: martin.burger@wwu.de

ZHIMING CHEN, LSEC Institute of Computational Mathematics, Chinese Academy of Sciences, Beijing 100190, China; E-mail: zmchen@lsec.cc.ac.cn

ALBERT COHEN, Laboratoire Jacques-Louis Lions, Université Pierre et Marie Curie, 4, Place Jussieu, 75005 Paris, France; E-mail: cohen@ann.jussieu.fr

QIANG DU, Columbia University, 500 W 120th Street, APAM, 200 Mudd, MC 4701, New York, NY 10027, USA; E-mail: qd2125@columbia.edu

VIVETTE GIRAULT, Laboratoire Jacques-Louis Lions, Boite Courrier 187, Université de Pierre et Marie Curie, 4, place Jussieu, 75252 Paris Cedex 05, France; E-mail: girault@ann.jussieu.fr

NICHOLAS I. M. GOULD, Department of Scientific Computing, G59, R18 STFC-Rutherford Appleton Laboratory, Chilton, Oxon OX11 0QX England; E-mail: nick.gould@stfc.ac.uk

IVAN G. GRAHAM, Department of Mathematical Sciences, University of Bath, Bath BA2 7AY, United Kingdom; E-mail: i.g.graham@bath.ac.uk

GREGOR KEMPER, Technische Universität München, Zentrum Mathematik M 11, Boltzmannstr 3, 85748 Garching, Germany; E-mail: kemper@ma.tum.de

FRANCES KUO, University of New South Wales, School of Mathematics, Sydney NSW 2052, Australia; E-mail: f.kuo@unsw.edu.au

STIG LARSSON, Department of Mathematical Sciences, Chalmers University of Technology, SE-412 96 Gothenburg, Sweden; E-mail: stig@chalmers.se

CHRISTIAN LUBICH, Universität Tübingen, Mathematisches Institut, Auf der Morgenstelle 10, 72076 Tübingen, Germany; E-mail: lubich@na.uni-tuebingen.de

GUNTER MALLE, Fachbereich Mathematik, Universität Kaiserslautern, Postfach 3049, 67653 Kaiserslautern, Germany; E-mail: malle@mathematik.uni-kl.de

JAMES MCKEE, Department of Mathematics, Royal Holloway University of London, Egham Hill, Egham TW20 0EX, United Kingdom; E-mail: james.mckee@rhul.ac.uk

MICHAEL J. MOSSINGHOFF, Department of Mathematics, Davidson College, Box 6996, Davidson, NC 28035-6996 USA; E-mail: mimossinghoff@davidson.edu

ADAM M. OBERMAN, McGill University, Department of Mathematics and Statistics, 805 Sherbrooke St W, Montreal QC H3A 0B9, Canada; E-mail: adam.oberman@mcgill.ca

CHERYL E. PRAEGER, School of Mathematics and Statistics, M019, University of Western Australia, 35 Stirling Highway, Crawley 6009, Western Australia, Australia; E-mail: praeager@maths.uwa.edu.au

CHRISTOPH SCHWAB, ETH Zürich, ETH Zentrum, HG G57.1, Ramistrasse 101, CH-8092 Zürich, Switzerland; E-mail: schwab@math.ethz.ch
Alexander Abatzoglou, Alice Silverberg, Andrew V. Sutherland, and Angela Wong, A framework for deterministic primality proving using elliptic curves with complex multiplication .................. 1461
Daeyeol Jeon, Families of elliptic curves over cyclic cubic number fields with prescribed torsion .................................................. 1485
Loïc Grenié and Giuseppe Molteni, Zeros of Dedekind zeta functions under GRH ................................................................. 1503
Long Zhang and Kejian Xu, The tame kernel of $\mathbb{Q}(\zeta_5)$ is trivial .... 1523
D. J. Platt and T. S. Trudgian, On the first sign change of $\theta(x) - x$ … 1539
MATHEMATICS OF COMPUTATION

CONTENTS

Vol. 85, No. 299 May 2016

Sören Bartels, Projection-free approximation of geometrically constrained partial differential equations .................................................. 1033
Dominik Schötzau, Christoph Schwab, and Thomas P. Wihler, $hp$-dGFEM for second-order mixed elliptic problems in polyhedral ........... 1051
Juan G. Calvo, A BDDC algorithm with deluxe scaling for $H$($\text{curl}$) in two dimensions with irregular subdomains .......................... 1085
Bernardo Cockburn, Ricardo H. Nochetto, and Wujun Zhang, Contraction property of adaptive hybridizable discontinuous Galerkin methods .......................................................... 1113
D. C. Antonopoulos and V. A. Dougalis, Error estimates for the standard Galerkin-finite element method for the shallow water equations .......................................................... 1143
Rodrigo Lecaros and Enrique Zuazua, Control of 2D scalar conservation laws in the presence of shocks ........................................... 1183
Xiong Meng, Chi-Wang Shu, and Boying Wu, Optimal error estimates for discontinuous Galerkin methods based on upwind-biased fluxes for linear hyperbolic equations ........................................ 1225
Lili Hu, Yao Li, and Yingjie Liu, A limiting strategy for the back and forth error compensation and correction method for solving advection equations ......................................................... 1263
Christophe Berthon and Christophe Chalons, A fully well-balanced, positive and entropy-satisfying Godunov-type method for the shallow-water equations ....................................................... 1281
Adam Andersson and Stig Larsson, Weak convergence for a spatial approximation of the nonlinear stochastic heat equation .......... 1335
Emmanuel Gobet and Plamen Turkedjiev, Linear regression MDP scheme for discrete backward stochastic differential equations under general conditions .................................................. 1359
Alin Bostan, Guillaume Chèze, Thomas Cluzeau, and Jacques-Arthur Weil, Efficient algorithms for computing rational first integrals and Darboux polynomials of planar polynomial vector fields .......... 1393
Allan Hungria, Jean-Philippe Lessard, and J. D. Mireles James, Rigorous numerics for analytic solutions of differential equations: the radii polynomial approach .............................................. 1427
(Continued on inside back cover)