# QUARTERLY

OF

## APPLIED MATHEMATICS

#### EDITED BY

S. S. ANTMAN J. HUNTER B. PAUSADER
Z. ARTSTEIN G. IOOSS B. SANDSTEDE
J. A. CARRILLO I. KIM M. SLEMROD
A. CONSTANTIN P. D. MILLER J. WILKENING
S. GEMAN D. MUMFORD

CONSTANTINE DAFERMOS

Managing Editor

GOVIND MENON
Associate Managing Editor

MANAGING EDITOR 1965–2014 WALTER FREIBERGER

FOUNDER, AND MANAGING EDITOR 1943–1965 W. PRAGER

VOLUME LXXX DECEMBER · 2022 NUMBER 4

#### Quarterly of Applied Mathematics

This journal is devoted to original papers in applied mathematics which have an intimate connection with applications. It is expected that each paper will be of a high scientific standard; that the presentation will be of such character that the paper can be easily read by those to whom it would be of interest; and that the mathematical argument, judged by the standard of the field of application, will be of an advanced character.

In accordance with their general policy, the Editors welcome particularly contributions which will be of interest both to mathematicians and to scientists or engineers. Authors will receive galley proof, and offprints will be provided in electronic form free of charge. A downloadable and printable PDF of each published article will be available to authors immediately after publication. Detailed instructions will be sent with galley proofs.

Submission information. The Quarterly of Applied Mathematics 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/qam. The final decision on acceptance of a manuscript for publication is made by the Managing Editor. Simultaneous submissions (i.e., concurrent submissions to another journal) are not accepted. See Suggestions Concerning the Preparation of Manuscripts for the Quarterly of Applied Mathematics at the end of this issue.

**Publication on the AMS website.** Articles are published on the AMS website individually after proof is returned from authors and before appearing in an issue.

Copying and reprinting. Material in this journal may be reproduced by any means for educational and scientific purposes without fee or permission with the exception of reproduction by services that collect fees for delivery of documents and provided that the customary acknowledgment of the source is given. This consent does not extend to other kinds of copying for general distribution, for advertising or promotional purposes, or for resale. Requests for permission for commercial use of material should be addressed to the Division of Applied Mathematics, Brown University, 182 George Street, Box F, Providence, RI 02912.

Excluded from these provisions is material in articles for which the author holds copyright. In such cases, requests for permission to use or reprint should be addressed directly to the author(s). (Copyright ownership is indicated in the notice in the lower right-hand corner of the first page of each article.)

Subscription information. Beginning March 2005 the Quarterly of Applied Mathematics is accessible from www.ams.org/journals/. Subscription prices for Volume 80 (2022) are as follows: for paper delivery, US\$200; for electronic delivery, US\$175. Subscription renewals are subject to late fees. See www.ams.org/journals-faq for more journal subscription information. Upon request, subscribers to paper delivery of this journal are also entitled to receive electronic delivery. For back volume/back issue prices and availability, go to www.ams.org/bookstore/backvols/. For paper delivery, subscribers inside the United States must pay a postage surcharge of US\$6; subscribers outside the United States must pay a postage surcharge of US\$12.00. Subscriptions and orders for back volumes must be addressed to the American Mathematical Society, P.O. Box 845904, Boston, MA 02284-5904, USA. All orders must be accompanied by payment. Other subscription correspondence should be addressed to the American Mathematical Society, 201 Charles St., Providence, RI 02904-2213, USA.

#### © 2022 Brown University

This journal is indexed in Mathematical Reviews, Zentralblatt MATH, Science Citation  $Index^{\textcircled{\$}}$ , Science Citation  $Index^{\textcircled{\$}}$ , Science Citation  $Index^{\textcircled{\$}}$ , Larting Services  $S^{M}$ , CompuMath Citation  $Index^{\textcircled{\$}}$ , Current Contents  $S^{\textcircled{\$}}$  (Engineering, Computing & Technology. It is also indexed by Applied Science & Technology Index and abstracted by Applied Science & Technology Abstracts. Periodicals postage paid at Providence, RI and additional mailing offices.

POSTMASTER: Send address changes to Quarterly of Applied Mathematics, Membership and Customer Services Department, American Mathematical Society, 201 Charles St., Providence, RI 02904-2213, USA. Publication number 808680. Quarterly of Applied Mathematics (ISSN 0033-569X (print); ISSN 1552-4485 (online)) is published four times per year (March, June, September, and December) by Brown University, Division of Applied Mathematics, 182 George St., Providence, RI 02912, USA.

Printed in the United States of America.

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

# **QUARTERLY**

OF

## APPLIED MATHEMATICS

#### EDITED BY

S. S. ANTMAN J. HUNTER B. PAUSADER
Z. ARTSTEIN G. IOOSS B. SANDSTEDE
J. A. CARRILLO I. KIM M. SLEMROD
A. CONSTANTIN P. D. MILLER J. WILKENING
S. GEMAN D. MUMFORD

CONSTANTINE DAFERMOS

Managing Editor

GOVIND MENON Associate Managing Editor

MANAGING EDITOR 1965–2014 WALTER FREIBERGER

FOUNDER, AND MANAGING EDITOR 1943–1965 W. PRAGER

VOLUME LXXX 2022

#### ANNUAL INDEX

Ahn, Hyunjin, Seung-Yeal Ha, Doheon Kim, Franz Wilhelm Schlöder, and Woojoo Shim. The mean-field limit of the Cucker-Smale model on complete Riemannian manifolds, 403

Arguillère, Sylvain. See Hsieh, Dai-Ni

Barthwal, Rahul, and T. Raja Sekhar. Two-dimensional non-self-similar Riemann solutions for a thin film model of a perfectly soluble anti-surfactant solution, 717

Bayada, Guy, and Ionel Sorin Ciuperca. About a cavitation model including bubbles in thin film lubrication taking convection into account, 237

Bellet, Jean-Baptiste. Symmetry group of the equiangular cubed sphere, 69

de Bonis, Ida. See Raveendran, Vishnu

Cao, Xiaxia, and Wen-An Yong. Construction of boundary conditions for hyperbolic relaxation approximations II: Jin-Xin relaxation model, 787

Carles, Rémi, Kleber Carrapatoso, and Matthieu Hillairet. Large-time behavior of compressible polytropic fluids and nonlinear Schrödinger equation, 549

Carrapatoso, Kleber. See Carles, Rémi

Charon, Nicolas. See Hsieh, Dai-Ni

Chen, Yu, Xia Hao, and Longjuan Xu. Upper and lower bounds for stress concentration in linear elasticity when  $C^{1,\alpha}$  inclusions are close to boundary, 607

 $\label{lem:embedding} \mbox{Cho, Hangjun, Linglong Du, and Seung-Yeal Ha.} \quad \mbox{\it Emergence of a periodically rotating one-point cluster} \\ in a thermodynamic Cucker-Smale ensemble, 1$ 

Cirillo, Emilio N. M. See Raveendran, Vishnu

Cisneros, Jorge, and Bernard Deconinck. The numerical solution of semidiscrete linear evolution problems on the finite interval using the Unified Transform Method, 739

Ciuperca, Ionel Sorin. See Bayada, Guy

Deconinck, Bernard. See Cisneros, Jorge

Ding, Xiucai, and Thomas Trogdon. The conjugate gradient algorithm on a general class of spiked covariance matrices, 99

Du, Linglong. See Cho, Hangjun

Ennaji, Hamza, Noureddine Igbida, and Van Thanh Nguyen. Beckmann-type problem for degenerate Hamilton-Jacobi equations, 201

Fabricius, John, Salvador Manjate, and Peter Wall. Error estimates for pressure-driven Hele-Shaw flow, 575

Fokas, A. S., B. Pelloni, and D. A. Smith. *Time-periodic linear boundary value problems on a finite interval*, 481

Freistühler, Heinrich. Time-asymptotic stability for first-order symmetric hyperbolic systems of balance laws in dissipative compressible fluid dynamics, 597

Ha, Seung-Yeal. See Ahn, Hyunjin

\_\_\_\_\_. See Cho, Hangjun

Ha, Seung-Yeal, Gyuyoung Hwang, and Dohyun Kim. Two-point correlation function and its applications to the Schrödinger-Lohe type models, 669

Hakkaev, Sevdzhan, Abba Ramadan, and Atanas G. Stefanov. On the stability of the compacton waves for the degenerate KdV and NLS models, 507

Hao, Xia. See Chen, Yu

Haziot, Susanna V., Vera Mikyoung Hur, Walter A. Strauss, J. F. Toland, Erik Wahlén, Samuel Walsh, and Miles H. Wheeler. Traveling water waves — the ebb and flow of two centuries, 317

Hillairet, Matthieu. See Carles, Rémi

Hsieh, Dai-Ni, Sylvain Arguillère, Nicolas Charon, and Laurent Younes. Diffeomorphic shape evolution coupled with a reaction-diffusion PDE on a growth potential, 23

Hu, Yuxi, and Zhao Wang. Linear stability of viscous shock wave for 1-D compressible Navier-Stokes equations with Maxwell's law, 221

Huh, Hyungjin, and Dohyun Kim. Complete solvability of the inertial spin model with an averaged spin, 53

Hur, Vera Mikyoung. See Haziot, Susanna V.

Hwang, Gyuyoung. See Ha, Seung-Yeal

Igbida, Noureddine. See Ennaji, Hamza

Kim, Doheon. See Ahn, Hyunjin

Kim, Dohyun. See Ha, Seung-Yeal

\_\_\_\_\_. See Huh, Hyungjin

#### ANNUAL INDEX

Korolkov, A. I. See Shanin, A. V.

Laiadi, Abdelkader. The influence of surface tension and gravity on cavitating flow past an inclined plate in a channel, 529

Lan, Do, and Pham Thanh Tuan. On stability for semilinear generalized Rayleigh-Stokes equation involving delays, 701

Manjate, Salvador. See Fabricius, John

Martin, P. A. On Green's function for Laplace's equation in a rigid tube, 87

Muntean, Adrian. See Raveendran, Vishnu

Nguyen, Van Thanh. See Ennaji, Hamza

Ohwa, Hiroki. An L<sup>p</sup> shock admissibility condition for conservation laws, 259

Pelloni, B. See Fokas, A. S.

Ramadan, Abba. See Hakkaev, Sevdzhan

Raveendran, Vishnu, Emilio N. M. Cirillo, Ida de Bonis, and Adrian Muntean. Scaling effects on the periodic homogenization of a reaction-diffusion-convection problem posed in homogeneous domains connected by a thin composite layer, 157

Raveendran, Vishnu, Emilio N. M. Cirillo, and Adrian Muntean. Upscaling of a reaction-diffusion-convection problem with exploding non-linear drift, 641

Schlöder, Franz Wilhelm. See Ahn, Hyunjin

Sekhar, T. Raja. See Barthwal, Rahul

Shanin, A. V., and A. I. Korolkov. Diffraction by a Dirichlet right angle on a discrete planar lattice, 277

Shim, Woojoo. See Ahn, Hyunjin

Sigal, I. M. Differential equations of quantum mechanics, 451

Smith, D. A. See Fokas, A. S.

Stefanov, Atanas G. See Hakkaev, Sevdzhan

Strauss, Walter A. See Haziot, Susanna V.

Toland, J. F. See Haziot, Susanna V.

Trogdon, Thomas. See Ding, Xiucai

Tuan, Pham Thanh. See Lan, Do

Wahlén, Erik. See Haziot, Susanna V.

Wall, Peter. See Fabricius, John

Walsh, Samuel. See Haziot, Susanna V.

Wang, Zhao. See Hu, Yuxi

Wheeler, Miles H. See Haziot, Susanna V.

Xu, Longjuan. See Chen, Yu

Yong, Wen-An. See Cao, Xiaxia

Younes, Laurent. See Hsieh, Dai-Ni

## SUGGESTIONS CONCERNING THE PREPARATION OF MANUSCRIPTS FOR THE QUARTERLY OF APPLIED MATHEMATICS

The editors will appreciate the authors' cooperation in taking note of the following directions for the preparation of manuscripts. These directions have been drawn up with a view toward eliminating unnecessary correspondence, avoiding the return of papers for changes, and reducing the charges made for "author's corrections."

### Submission of Accepted Manuscripts:

Submission of manuscripts electronically-prepared in LATEX is required, with a strong preference for  $\mathcal{A}_{M}S$ -LATEX. To assist authors in preparing electronic manuscripts, the AMS has prepared author packages. The author package includes instructions for preparing electronic manuscripts, the AMS Author Handbook, samples, graphic creation instructions, and a style file. When choosing a style file for the Quarterly of Applied Mathematics, choose the QAM-specific journal package, made available by the American Mathematical Society at www.ams.org/distribution/qam/qamauthorpac.html. For more technical information, please visit www.ams.org/authors/author-faq.html.

Contributions to the *Quarterly of Applied Mathematics* should be submitted in final form. Only typographical errors should be corrected in proof; composition charges for any major deviations from the manuscript will be passed on to the *Quarterly of Applied Mathematics*. An abstract is required for all QAM manuscripts.

After the contribution has been accepted for publication, electronic files (.tex files along with .eps (or .tiff) files for figures) should be submitted via the web at www.ams.org/submit-book-journal, or sent via email to pub-submit@ams.org, or sent on CD to the Electronic Prepress Department, American Mathematical Society, 201 Charles St., Providence, RI 02904-2294 USA. When submitting electronic manuscripts via email or CD, please include a message indicating that the paper has been accepted for publication in the Quarterly of Applied Mathematics.

### **Electronic Graphics:**

Comprehensive instructions on preparing graphics are included in PDF format in the author package. Submit files for graphics as EPS (Encapsulated PostScript) files. This includes graphics originating 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 avoid the use of any lines thinner than 0.5 points in width at 100%. 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 that 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 QAM issue unless color printing is authorized by the Managing Editor and paid for by the authors. In general, color graphics will appear in color in the online QAM issue.

### CONTENTS

Vol. LXXX, No. 4 December 2	022
YU CHEN, XIA HAO, AND LONGJUAN XU, Upper and lower bounds for stress concentration in linear elasticity when $C^{1,\alpha}$ inclusions are close to boundary	607
VISHNU RAVEENDRAN, EMILIO N. M. CIRILLO, AND ADRIAN MUNTEAN, Upscaling of a reaction-diffusion-convection problem with exploding non- linear drift	641
SEUNG-YEAL HA, GYUYOUNG HWANG, AND DOHYUN KIM, Two-point correlation function and its applications to the Schrödinger-Lohe type models	669
Do Lan and Pham Thanh Tuan, On stability for semilinear generalized Rayleigh-Stokes equation involving delays	701
Rahul Barthwal and T. Raja Sekhar, Two-dimensional non-self-similar Riemann solutions for a thin film model of a perfectly soluble anti-surfactant solution	717
JORGE CISNEROS AND BERNARD DECONINCK, The numerical solution of semidiscrete linear evolution problems on the finite interval using the Unified Transform Method	739
XIAXIA CAO AND WEN-AN YONG, Construction of boundary conditions for hyperbolic relaxation approximations II: Jin-Xin relaxation model	787



0033-569X(202212)80:4\*;1-H