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
offsprints 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. Manuscripts submitted for publication should be sent as a PDF via email
to walter_freiberger@brown.edu, either directly or through any one of the Editors. 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.

Publisher Item Identifier. The Publisher Item Identifier (PII) appears at the top of the first page
of each article published in this journal. This alphanumeric string of characters uniquely identifies each
article and can be used for future cataloging, searching, and electronic retrieval.

Postings to the AMS website. Articles are posted to 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 acces-
sible from www.ams.org/journals/. Subscription prices for Volume 70 (2012) are as follows: for paper
delivery, US$160; for electronic delivery, US$140. 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 outside the United States and
India must pay a postage surcharge of US$13; subscribers in India must pay a postage surcharge of
and orders for back volumes must be addressed to the American Mathematical Society, P.O. Box 845904,
Boston, MA 02284-5004, USA. All orders must be accompanied by payment. Other subscription corre-
respondence should be addressed to the American Mathematical Society, 201 Charles St., Providence, RI
02904-2294, USA. Quarterly of Applied Mathematics (Online ISSN: 1552-4485, Print ISSN: 0033-569X)
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. Periodicals postage paid at Prov-
dence, RI. POSTMASTER: Send address changes to Quarterly of Applied Mathematics, Membership
and Customer Services Department, American Mathematical Society, 201 Charles St., Providence, RI
02904-2294, USA.

© 2012 Brown University
This journal is indexed in Mathematical Reviews, Zentralblatt MATH, Science Citation Index®,
Science Citation Index® Expanded, ISI Alerting Services®, CompuMath Citation Index®,
Current Contents®/Engineering, Computing & Technology. It is also indexed by
Periodicals postage paid at Providence, Rhode Island.
Publication number 808680 (ISSN 0033-569X)
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.
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 electronically-prepared manuscripts is required, with a strong preference for \texttt{AMS-LATEX}. To assist authors in preparing electronic manuscripts, the AMS has prepared author packages. The author package includes instructions for preparing electronic manuscripts, the \textit{AMS Author Handbook}, samples, graphic creation instructions, and a style file. Though \texttt{AMS-LATEX} is the highly preferred format of LATEX, an author package is also available in \texttt{AMS-TEX}. When choosing a style file for the \textit{Quarterly of Applied Mathematics}, choose the QAM-specific journal package, made available by the American Mathematical Society at \url{www.ams.org/distribution/qam/qamauthorpac.html}. For more technical information, please visit \url{www.ams.org/authors/author-faq.html}.

Contributions to the \textit{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 \textit{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 \url{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 \textit{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. LXX, No. 3**  
**September 2012**

**Barbara Lee Keyfitz and Charis Tsikkou**, *Conserving the wrong variables in gas dynamics: A Riemann solution with singular shocks* .................................................. **407**

**Stuart S. Antman and Süleyman Ulusoyn**, *The asymptotics of heavily burdened viscoelastic rods* ................................................................. **437**

**Joshua Ballew and Konstantina Trivisa**, *Suitable weak solutions and low stratification singular limit for a fluid particle interaction model* ........................................ **469**

**Alberto Bressan, Chen Jie Liu, Wen Shen, and Fang Yu**, *Variational analysis of Nash equilibria for a model of traffic flow* ........................................ **495**

**Rustum Choksi**, *On global minimizers for a variational problem with long-range interactions* ................................................................. **517**

**Rinaldo M. Colombo, Graziano Guerra, and Wen Shen**, *Lipschitz semigroup for an integro–differential equation for slow erosion* .................. **539**

**Hermano Frid**, *Remarks on the theory of the divergence-measure fields* ........ **579**

**Tommaso Ruggeri**, *Can constitutive relations be represented by non-local equations?* ................................................................. **597**

**Marshall Slemrod**, *Chapman-Enskog ⇒ viscosity-capillarity* ........................................ **613**