

Proceedings of Symposia in APPLIED MATHEMATICS

Volume 67, Part 1

Hyperbolic Problems: Theory, Numerics and Applications

Plenary and Invited Talks

Proceedings of the Twelfth International
Conference on Hyperbolic Problems

June 9–13, 2008

Center for Scientific Computation
and Mathematical Modeling

University of Maryland, College Park

Eitan Tadmor

Jian-Guo Liu

Athanasios Tzavaras

Editors



American Mathematical Society

Hyperbolic Problems: Theory, Numerics and Applications

Plenary and Invited Talks

This page intentionally left blank

Proceedings of Symposia in
APPLIED MATHEMATICS

Volume 67, Part 1

**Hyperbolic Problems:
Theory, Numerics
and Applications**

Plenary and Invited Talks

Proceedings of the Twelfth International
Conference on Hyperbolic Problems
June 9–13, 2008
Center for Scientific Computation
and Mathematical Modeling
University of Maryland, College Park

Eitan Tadmor
Jian-Guo Liu
Athanasios Tzavaras
Editors



American Mathematical Society
Providence, Rhode Island

EDITORIAL COMMITTEE

Mary Pugh Lenya Ryzhik Eitan Tadmor (Chair)

2000 *Mathematics Subject Classification*. Primary 35Lxx, 35M10, 35Q30, 35Q60, 35R35, 65Mxx, 65Nxx, 65Txx, 65Yxx, 65Z05, 74B20, 74Jxx, 76Rxx, 76Txx, 80A32, 80Mxx, 85F05.

Library of Congress Cataloging-in-Publication Data

International Conference on Non-linear Hyperbolic Problems (12th : 2008 : University of Maryland)

Hyperbolic problems : theory, numerics, and applications : plenary & invited talks : Twelfth International Conference on Hyperbolic Problems, June 9–13, 2008, Center for Scientific Computation and Mathematical Modeling, University of Maryland, College Park / Eitan Tadmor, Jian-Guo Liu, Athanasios E. Tzavaras, editors.

p. cm. — (Proceedings of symposia in applied mathematics ; v. 67)

Includes bibliographical references and index.

ISBN 978-0-8218-4728-5 (alk. paper)(Set)—ISBN 978-0-8218-4729-9 (alk. paper)(Part 1)—ISBN 978-0-8218-4730-5 (alk. paper) (Part 2)

1. Differential equations, Hyperbolic—Congresses. 2. Differential equations, Nonlinear—Congresses. I. Tadmor, Eitan. II. Liu, Jian-Guo. III. Tzavaras, Athanasios E., 1958—IV. Title.

QA377.I563 2008
515'.3535—dc22

2009023286

Copying and reprinting. Material in this book 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 Acquisitions Department, American Mathematical Society, 201 Charles Street, Providence, Rhode Island 02904-2294, USA. Requests can also be made by e-mail to reprint-permission@ams.org.

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.)

© 2009 by the American Mathematical Society. All rights reserved.

The American Mathematical Society retains all rights
except those granted to the United States Government.

Copyright of individual articles may revert to the public domain 28 years
after publication. Contact the AMS for copyright status of individual articles.

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.

Visit the AMS home page at <http://www.ams.org/>

10 9 8 7 6 5 4 3 2 1 14 13 12 11 10 09

Contents

Part 1: Plenary and Invited Talks

Preface	xiii
List of sponsors	xv
List of all HYP2008 participants	xvii
PLENARY TALKS	
Multidimensional shock waves and surface waves SYLVIE BENZONI-GAVAGE* AND JEAN-FRANÇOIS COULOMBEL	3
Shock reflection-diffraction phenomena and multidimensional conservation laws GUI-QIANG CHEN* AND MIKHAIL FELDMAN	25
Study on Mach reflection and Mach configuration SHUXING CHEN	53
Nonlinear regularizing effect for conservation laws FRANÇOIS GOLSE	73
Numerical methods for hyperbolic systems with singular coefficients: Well-balanced scheme, Hamiltonian preservation, and beyond SHI JIN	93
Some recent results on the critical surface quasi-geostrophic equation: A review ALEXANDER KISELEV	105
Why hyperbolic and kinetic models for cell populations self-organization? BENOÎT PERTHAME	123
Flows on networks and complicated domains BENEDETTO PICCOLI	135
INVITED TALKS	
Global solutions for a hyperbolic model of multiphase flow DEBORA AMADORI* AND ANDREA CORLI	161
On the convergence rate for the Glimm scheme FABIO ANCONA* AND ANDREA MARSON	175

Analysis and computation for the semiclassical limits of the ground and excited states of the Gross-Pitaevskii equation WEIZHU BAO* AND FONG YIN LIM	195
Conservation laws: Transonic flow and differential geometry GUI-QIANG CHEN, MARSHALL SLEMROD*, AND DEHUA WANG	217
A survey on the L^1 comparison of entropy weak solutions to Euler equations in the large with respect to physical parameters CLEOPATRA CHRISTOFOROU	227
Low regularity solutions of the Maxwell-Dirac system PIERO D'ANCONA, DAMIANO FOSCHI, AND SIGMUND SELBERG*	243
Stabilization for discontinuous Galerkin methods applied to systems of conservation laws ANDREAS DEDNER* AND ROBERT KLÖFKORN	253
Ill-posedness for bounded admissible solutions of the 2-dimensional p -system CAMILLO DE LELLIS	269
Applications of dispersive estimates to the acoustic pressure waves for incompressible fluid problems DONATELLA DONATELLI* AND PIERANGELO MARCATI	279
Stability in the L^1 norm via a linearization method for nonlinear hyperbolic systems PHILIPPE G. LEFLOCH	299
A review of semiconductor models: Global solvability and hierarchy SHINYA NISHIBATA* AND MASAHIRO SUZUKI	315
Author Index	331

Part 2: Contributed Talks

Preface	xiii
List of sponsors	xv
List of all HYP2008 participants	xvii

CONTRIBUTED TALKS

Two-dimensional transport equation with Hamiltonian vector fields GIOVANNI ALBERTI, STEFANO BIANCHINI, AND GIANLUCA CRIPPA*	337
Analytic regularization of an inverse problem for a system of conservation laws AMAURY ALVAREZ, GUSTAVO HIME*, AND DAN MARCHESIN	347

On the finite weak solutions to a system in quantum fluid dynamics PAOLO ANTONELLI* AND PIERANGELO MARCATI	359
Accuracy of modeling error estimates for discrete velocity models KONDO ASSI AND MARC LAFOREST*	369
The Riemann solution for three-phase flow in a porous medium ARTHUR AZEVEDO, APARECIDO DE SOUZA*, FREDERICO FURTADO, AND DAN MARCHESIN	379
Non-oscillatory central schemes for 3D hyperbolic conservation laws JORGE BALBÁS* AND XIN QIAN	389
A conservative, positivity preserving scheme for advection-diffusion-reaction equations in biochemical applications JOACHIM BENZ, ANDREAS MEISTER*, AND PHILIPP ANDREA ZARDO	399
On the spectrum of a rank two modification of a diagonal matrix for linearized fluxes modelling polydisperse sedimentation STEFAN BERRES* AND TATIANA VOITOVICH	409
Invariant manifolds for viscous profiles of a class of mixed hyperbolic-parabolic systems STEFANO BIANCHINI AND LAURA SPINOLO*	419
Nonlinear iterative solvers for unsteady Navier-Stokes equations PHILIPP BIRKEN* AND ANTONY JAMESON	429
An approximate Riemann solver for ideal MHD based on relaxation FRANÇOIS BOUCHUT, CHRISTIAN KLINGENBERG*, AND KNUT WAAGAN	439
Numerical solution of an inverse problem for a scalar conservation law modelling sedimentation RAIMUND BÜRGER, ANÍBAL CORONEL*, AND MAURICIO SEPÚLVEDA	445
A conservation law with discontinuous flux modelling traffic flow with abruptly changing road surface conditions RAIMUND BÜRGER*, KENNETH KARLSEN, AND JOHN TOWERS	455
Numerical investigation of finite difference schemes for nonconservative hyperbolic systems MANUEL CASTRO, PHILIPPE LEFLOCH, MARÍA LUZ MUÑOZ-RUIZ*, AND CARLOS PARÉS	465
Relaxed schemes for nonlinear evolutionary PDEs FAUSTO CAVALLI, GIOVANNI NALDI, GABRIELLA PUPPO, AND MATTEO SEMPlice*	477
Global asymptotic effects of the structure of combustion waves in porous media GREGORY CHAPIRO*, GUSTAVO HIME, ALEXEI MAILYBAEV, DAN MARCHESIN, AND APARECIDO DE SOUZA	487

Multiscale dynamics of 2D rotational compressible Euler equations – an analytical approach BIN CHENG	497
Finite volume methods on unstructured Voronoi meshes for hyperbolic conservation laws IVAN CHRISTOV, ILYA MISHEV, AND BOJAN POPOV*	507
On the continuum modeling of crowds RINALDO COLOMBO*, GIANCARLO FACCHI, GIULIO MATERNINI, AND MASSIMILIANO ROSINI	517
Balance laws as quasidifferential equations in metric spaces RINALDO COLOMBO AND GRAZIANO GUERRA*	527
Simulation of rain-water overland-flow OLIVIER DELESTRE*, STÉPHANE CORDIER, FRANÇOIS JAMES, AND FRÉDÉRIC DARBOUX	537
On the vanishing viscosity approximation in the vectorial case CARLOTTA DONADELLO	547
Counterexamples to the sonic and detachment criteria VOLKER ELLING	557
Well-balanced high order scheme for 2-layer shallow water flows JÖRN THIES FRINGS* AND SEBASTIAN NOELLE	565
High-order finite volume schemes for wave propagation in stratified atmospheres FRANZ FUCHS*, ANDREW MCMURRY, AND SIDDHARTHA MISHRA	575
High-order finite volume schemes for shallow water equations with topography and dry areas JOSÉ GALLARDO*, MANUEL CASTRO, AND CARLOS PARÉS	585
Riemann solvers for conservation laws at a node MAURO GARAVELLO* AND BENEDETTO PICCOLI	595
Reduced basis method for explicit finite volume approximations of nonlinear conservation laws BERNARD HAASDONK* AND MARIO OHLBERGER	605
Error estimate for the local discontinuous Galerkin scheme of a diffusive-dispersive equation with convolution JENNY HAINK	615
Cauchy problem for capillarity Van der Waals model BORIS HASPOT	625
Viscous conservation laws with discontinuous initial data HARUMI HATTORI	635
Parallel computation of large amplitude shocks for a system of conservation laws with small data GUSTAVO HIME AND VÍTOR MATOS*	643

Convergence of front tracking and the Glimm scheme for a model of the flow of immiscible gases HELGE HOLDEN, NILS HENRIK RISEBRO, AND HILDE SANDE*	653
Global existence and incompressible limit of weak solutions to the multi-dimensional compressible magnetohydrodynamics XIANPENG HU AND DEHUA WANG*	663
Construction of conservative systems HELGE KRISTIAN JENSSEN* AND IRINA KOGAN	673
Collisionless magnetic reconnection in a five-moment two-fluid electron-positron plasma EVAN JOHNSON* AND JAMES ROSSMANITH	683
Finite difference scheme for a nonlinear damped wave equation derived from brain modulation MOUHAMAD JRADEH	693
Convergent finite element methods for compressible barotropic Stokes systems KENNETH KARLSEN AND TRYGVE KARPEN*	705
A hybrid scheme for flows in porous media SMADAR KARNI* AND GERARDO HERNÁNDEZ-DUEÑAS	715
Discrete involutions, resonance, and the divergence problem in MHD FRIEDEMANN KEMM	725
Two-layer shallow water system and its applications JIHWAN KIM* AND RANDALL LEVEQUE	737
Asymptotic rarefaction waves for balance laws with stiff sources WANDERSON LAMBERT* AND DAN MARCHESIN	745
Comparison of staggered and cell-centered Lagrangian and ALE hydrodynamical methods RICHARD LISKA*, RAPHAËL LOUBÈRE, PIERRE-HENRI MAIRE, JÉRÔME BREIL, STÉPHANE GALERA, AND PAVEL VÁCHAL	755
On the entropy stability of Roe-type finite volume methods MÁRIA LUKÁČOVÁ - MEDVIDĚVÁ* AND EITAN TADMOR	765
Entropy stability of Roe-type upwind finite volume methods on unstructured grids AZIZ MADRANE* AND EITAN TADMOR	775
A robust high order VFRoe scheme for shallow water equations FABIEN MARCHE* AND CHRISTOPHE BERTHON	785
Vorticity preserving schemes using potential-based fluxes for the system wave equation SIDDHARTHA MISHRA* AND EITAN TADMOR	795
Half space problem for the compressible Navier-Stokes equation TOHRU NAKAMURA* AND SHINYA NISHIBATA	805

Computing the effective Hamiltonian for a time-dependent Hamiltonian MARTIN NOLTE* AND DIETMAR KRÖNER	815
Initial boundary value problems for compressible Euler equations with damping RONGHUA PAN AND KUN ZHAO*	825
A relaxation method for modeling two-phase shallow granular flows MARICA PELANTI* AND FRANÇOIS BOUCHUT	835
Riemann problem for Born-Infeld systems YUE-JUN PENG AND JÉRÉMY RUIZ*	845
Stability of traveling waves in thin liquid films driven by gravity and surfactant ELLEN PETERSON, MICHAEL SHEARER*, THOMAS WITELSKI, AND RACHEL LEVY	855
Piecewise parabolic method on a local stencil for hyperbolic conservation laws MIKHAIL POPOV AND SERGEY USTYUGOV*	869
A numerical study of magnetic reconnection: A central scheme for Hall MHD XIN QIAN*, JORGE BALBÁS, AMITAVA BHATTACHARJEE, AND HONGANG YANG	879
Accuracy of stabilized residual distribution for shallow water flows including dry beds MARIO RICCHIUTO AND ANDREAS BOLLERMANN*	889
Using the entropy production rate to enhance artificial compression OLIVIER ROUCH* AND PAUL ARMINJON	899
Blow up of smooth solutions to the barotropic compressible magnetohydrodynamic equations with finite mass and energy OLGA ROZANOVA	911
High order well balanced schemes for systems of balance laws GIOVANNI RUSSO* AND ALEXANDER KHE	919
Transport of mass, momentum and energy in zero-pressure gas dynamics VLADIMIR SHELKOVICH	929
On a model of granular flow WEN SHEN	939
A simple unified coordinates method for compressible homogeneous two-phase flows KEH-MING SHYUE	949
Courant-Friedrich's hypothesis and stability of the weak shock DMITRY TKACHEV* AND ALEKSANDER BLOKHIN	959
Unstaggered central schemes for MHD and SMHD RONY TOUMA	967
Stability of planar stationary wave for damped wave equation with nonlinear convection in half space YOSHIHIRO UEDA*, TOHRU NAKAMURA, AND SHUICHI KAWASHIMA	977

The minimum entropy approximation to the radiative transfer equation DANIEL WRIGHT*, MARTIN FRANK, AND AXEL KLAR	987
Author Index	997

This page intentionally left blank

Preface

The International Conference on “Hyperbolic Problems: Theory, Numerics and Applications”, HYP2008, was held in the University of Maryland on June 9-13, 2008. This was the twelfth meeting in the biennial international series of HYP conferences which originated in 1986 at Saint-Etienne, France, and over the last twenty years has become one of the highest quality and most successful conference series in Applied Mathematics.

More than 220 participants from 26 countries attended the HYP2008 conference. It provided a unique forum to exchange and stimulate new ideas from different avenues in academia, industry and government labs. The conference has brought together leading researchers from different disciplines to address theoretical, modeling and computational issues in solving hyperbolic PDEs arising from a variety of applications. Their lectures and the full HYP2008 program can be found at the conference website <http://www.hyp2008.umd.edu/speakers.htm>. Among the HYP2008 participants there were 40 young researchers that were provided with financial support to attend the conference, and we would like to acknowledge in this context the generous support for HYP2008 provided by the sponsors listed below.

A forum on “Open Challenges” was held as part of the HYP2008 program. Led by Thanos Tzavaras, panel members Denis Serre, Peter Markovich, Tai-Ping Liu, François Golse and Randy LeVeque reflected on possible future research directions. Promoting new cross disciplinary interactions among researchers and practitioners could prove to be the ultimate success of HYP2008.

A highlight of HYP2008 was the conference banquet with the keynote speech delivered by Professor Constantine Dafermos. Professor Dafermos is credited with many pioneering contributions for the theory of hyperbolic equations and it was indeed a unique occasion to share his excellent review of the early days as well as his projections into the future of the field.

More than eighty contributions were assembled in this two-volume book, reflecting the high-level quality presentations made in HYP2008, while covering a diverse range of topics in theory, numerics and applications assembled under the umbrella of “hyperbolic problems”.

We take this opportunity to thank the members of the HYP2008 Scientific Committee (listed at <http://www.hyp2008.umd.edu/organization.htm#sc>) for their expertise in selection of invited speakers and reviewing the contributed papers for these volumes. Finally, we would like to express our appreciation to Agi Alipio, William Burns and Jean LaFonta from the Center for Scientific Computation and Mathematical Modeling in the University of Maryland, for their dedicated work on

HYP2008: Ms. Alipio as the coordinator of HYP2008, Mr. Burns as the system administrator, and Mr. LaFonta who was in charge of the local organization and assembling these proceeding, have all made a truly exceptional work.

Eitan Tadmor, Jian-Guo Liu, Thanos Tzavaras

University of Maryland, College Park

May 2009

List of Sponsors

We gratefully acknowledge the support from the following sponsors:

- National Science Foundation
- Office of Naval Research (ONR)
- Center for Scientific Computation and Mathematical Modeling, University of Maryland
- Department of Mathematics, University of Maryland
- Air Force Office of Scientific Research (AFOSR)
- Fields Institute
- Institute for Mathematics and its Applications, through its Participating Institution Program
- Institute for Physical Science and Technology, University of Maryland



HYP 2008

This page intentionally left blank

List of all HYP2008 Participants

Name	Affiliation	Status
Debora Amadori	University of L'Aquila	invited speaker
Fabio Ancona	University of Bologna	invited speaker
Stuart Antman	University of Maryland	participant
Paolo Antonelli	University of L'Aquila	participant
Paul Arminjon	University of Montreal	participant
Agissilaos Athanassoulis	INRIA	participant
Prashant Athavale	University of Maryland	student
Jorge Balbas	California State University, Northridge	participant
Weizhu Bao	National University of Singapore	invited speaker
Sylvie Benzoni-Gavage	University of Lyon 1	plenary speaker
Stefan Berres	Universidad Católica de Temuco	participant
Philipp Birken	University of Kassel	participant
Animikh Biswas	University of North Carolina-Charlotte	participant
Andreas Bollermann	RWTH Aachen University	participant
Benjamin Boutin	CEA Saclay	student
Jerome Breil	CELIA	participant
Alberto Bressan	Penn State University	scientific committee
Raimund Bürger	Universidad de Concepción	participant
Miroslav Cada	Seminar for Applied Mathematics	participant
Tony Chan	NSF (National Science Foundation)	participant
Grigori Chapiro	Instituto de Matematica Pura e Aplicada - IMPA	student
Li Chen	Tsinghua University	participant
Gui-Qiang Chen	Northwestern University	plenary speaker
Shuxing Chen	Fudan University	plenary speaker
Jing Chen	City University of Hong Kong	student
Juan Cheng	Institute of applied physics and computational mathematics	participant
Bin Cheng	University of Michigan	participant
Alina Chertock	North Carolina State University	invited speaker
Kyu Yong Choi	UMCP	participant
Cleopatra Christoforou	University of Houston	invited speaker
Rinaldo Colombo	Brescia University	participant
Jeffery Cooper	University of Maryland	participant
Anibal Coronel	Universidad del Bio-Bio	participant
Gianluca Crippa	University of Parma	participant
Constantine Dafermos	Brown University	scientific committee

Jesus DaMota	Universidade Federal de Goiás	participant
Camillo de Lellis	Universität Zürich	invited speaker
Andreas Dedner	University of Freiburg	invited speaker
Pierre Degond	Université Paul Sabatier	scientific committee
Olivier Delestre	CNRS d'Orléans	student
Laurent Demanet	Stanford University	participant
Roger Denlinger	US Geological Survey	participant
Aparecido DeSouza	Universidade Federal de Campina Grande	participant
Qian Ding	Northwestern University	student
Oleg Diyanov	Neurok Software LLC	participant
Carlotta Donadello	SISSA-ISAS	student
Donatella Donatelli	University of L'Aquila	invited speaker
Renjun Duan	City University of Hong Kong	student
Ritesh Dubey	Indian Institute of Information Technology	participant
Roland Duclous	Center For Intense Laser and Application & Institute of Mathematics of Bordeaux	student
Mohamed Abderrahman Ebde	Ecole Normale Supérieure	student
Ahmad El Hajj	Université d'Orléans	participant
Volker Elling	University of Michigan	participant
M. Ali Etaati	Eindhoven University of Technology	student
Kirsten Fagnan	University of Washington	student
Haitao Fan	Georgetown University	participant
Igor Fedotov	Tshwane University of Technology	participant
Tatiana Fedotova	University of Witwatersrand	participant
Razvan Fetecau	Simon Fraser University	participant
Michael Fisher	University of Maryland	plenary speaker
Cynthia Flores	California State University-Northridge	student
Hermano Frid	Institute of Pure and Applied Mathematics-IMPA	participant
Jörn Frings	RWTH Aachen	participant
Franz Fuchs	University of Oslo	student
Jose M. Gallardo	University of Málaga	participant
Mauro Garavello	University of Eastern Piedmont	participant
David George	University of Washington	participant
Marte Godvik	Norwegian University of Sciences and Technology	student
Francois Golse	École Polytechnique	plenary speaker and scientific committee
Manoussos Grillakis	University of Maryland	invited speaker
Graziano Guerra	Università degli Studi di Milano-Bicocca	participant
Carsten Gundlach	University of Southampton	participant
Jeffrey Haack	University of Wisconsin	student
Bernard Haasdonk	University of Münster	participant
Jenny Haink	University of Stuttgart	student
Ammar Hakim	Tech-X Corporation	participant
Harald Hanche-Olsen	Norwegian University of Science and Technology	participant
Boris Haspot	Université Paris XII	participant

Harumi Hattori	West Virginia University	participant
Cory Hauck	Los Alamos National Laboratory	participant
Gerardo Hernandez-Duenas	University of Michigan	student
Sash Hier-Majumder	University of Maryland	participant
Gustavo Hime	IMPA	participant
Helge Holden	Norwegian University of Science and Technology	participant
Juhi Jang	Institute for Advanced Study	participant
Kris Jenssen	Penn State	participant
Xiaomei Ji	Stony Brook University	student
Shi Jin	University of Wisconsin	plenary speaker and scientific committee
Alec Johnson	University of Wisconsin - Madison	student
Anne Jorstad	UMD - AMSC	student
Mouhamad Jradeh	MAPMO LABORATORY	student
Kenneth Karlsen	University of Oslo	scientific committee
Smadar Karni	University of Michigan	participant
Trygve Karper	University of Oslo	student
Peter Kauf	ETH Zürich	participant
Friedemann Kemm	Brandenburgische Technische Universität Cottbus	participant
David Ketcheson	University of Washington	student
Barbara Keyfitz	Fields Institute and University of Houston	scientific committee
Alexander Khe	Lavrentyev Institute of Hydrodynamics	participant
Jihwan Kim	University of Washington	student
Alex Kiselev	University of Wisconsin - Madison	plenary speaker
Christian Klingenberg	Wuerzburg University, Germany	participant
Ujjwal Koley	CMA, Oslo	student
Assi Kondo	École Polytechnique de Montréal	student
Dietmar Kroener	University of Freiburg	scientific committee
Jagbandhu Kumar	fds	participant
Alexander Kurganov	Tulane University	participant
Bongsuk Kwon	Indiana University	student
Young-Sam Kwon	University of Maryland	participant
Marc Laforest	École Polytechnique de Montréal	participant
James Lambers	Stanford University	participant
Wanderson Lambert	Instituto de Matematica Pura e Aplicada - IMPA	participant
Philippe LeFloch	Université Paris VI	invited speaker
Thomas Lepoutre	INRIA Rocquencourt and Université Pierre et Marie Curie (Paris)	student
Randall LeVeque	University of Washington	participant
C. Levermore	University of Maryland	participant
Doron Levy	University of Maryland	participant
Xiaolin Li	SUNY at Stony Brook	participant
Xiantao Li	Penn State University	invited speaker
Tong Li	University of Iowa	participant
Fong Yin Lim	National University of Singapore	participant
Chi-Tien Lin	Providence University	participant
Richard Liska	Czech Technical University	participant
Jie Liu	University of California Irvine	participant

Jian-Guo Liu	University of Maryland	co-chair
Tai Ping Liu	Stanford University	scientific committee
Helena Lopes	Universidade Estadual de Campinas	scientific committee
Tianshi Lu	Brookhaven National Laboratory	participant
Maria Lukacova	Hamburg University of Technology	participant
Matei Machedon	University of Maryland	participant
Aziz Madrane	Airbus/Institut for Aerospace-Technology	participant
Kamyar Malakpoor	Korteweg de Vries Institute for Mathematics	student
Reza Malek-Madani	ONR / Naval Academy	participant
Kyle Mandli	University of Washington	student
Pierangelo Marcati	Università degli Studi di L'Aquila	scientific committee
Sandrine Marchal	Institut Elie Cartan de Nancy	student
Fabien Marche	Université Montpellier 2	participant
Dan Marchesin	Instituto Nacional de Matematica Pura e Aplicada	participant
Peter Markowich	University of Cambridge	plenary speaker
Andrea Marson	University of Padova	participant
Vitor Matos	Universidade do Porto	participant
Andreas Meister	University of Kassel	participant
Siddhartha Mishra	University of Oslo	participant
Tomas Morales de Luna	Universidad de Málaga	participant
María Luz Muñoz Ruiz	Universidad de Málaga	participant
Tohru Nakamura	Kyushu University	participant
Wladimir Neves	Federal University of Rio de Janeiro	participant
Toan Nguyen	Indiana University	student
Shinya Nishibata	Tokyo Institute of Technology	invited speaker
Sebastian Noelle	RWTH Aachen University of Technology	participant
Martin Nolte	University of Freiburg	student
Kyle Novak	Air Force Institute of Technology	participant
Sergei Novikov	University of Maryland	plenary speaker
John Osborn	University of Maryland	participant
Stanley Osher	UCLA	plenary speaker
Grigorios Panagakos	UMD-UMCP	student
Marica Pelanti	École Normale Supérieure - Paris	participant
Benoit Perthame	Université Pierre et Marie Curie	plenary speaker
Benedetto Piccoli	Istituto per le Applicazioni del Calcolo Mauro Picone	plenary speaker
Ramon Plaza	IIMAS-UNAM	participant
Bojan Popov	Texas A&M University	participant
Fabio Priuli	NTNU	participant
Gabriella Puppo	Politecnico di Torino	participant
Mahmoud Qafsaoui	E.S.T.A.C.A.	participant
Xin Qian	University of New Hampshire	student
Xavier Raynaud	NTNU	participant
Oscar Reula	Universidad Nacional de Cordoba	participant
Christian Ringhofer	Arizona State University	invited speaker
James Rossmannith	University of Wisconsin - Madison	participant
Olivier Rouch	University of Montreal	student

Olga Rozanova	Moscow State University	participant
Bruno Rubino	University of L'Aquila	participant
Jeremy Ruiz	University of Clermont-Ferrand II	student
Giovanni Russo	University of Catania, Italy	participant
Yuri Rykov	Keldysh Institute of Applied Mathematics	participant
Leonid Ryzhik	University of Chicago	scientific committee
Jacques Sainte-Marie	INRIA - Saint-Venant Laboratory	participant
Hilde Sande	Norwegian University of Science and Technology	student
Sigmund Selberg	Norwegian University of Science and Technology	invited speaker
Matteo Semplice	University of Milan	participant
Susana Serna	University of California Los Angeles	participant
Denis Serre	École Normale Supérieure de Lyon	scientific committee
Nikolaos Sfakianakis	Wolfgang Pauli Institute	participant
Michael Shearer	North Carolina State University	participant
Vladimir Shelkovich	St.-Petersburg State Architecture and Civil Engineering University, Russia	participant
Wen Shen	Penn State University	participant
Vidya Prasad Shukla	National Institute of Technology, Durgapur, India	participant
Keh-Ming Shyue	National Taiwan University	participant
Marshall Slemrod	University of Wisconsin - Madison	invited speaker
Kyungwoo Song	Kyung Hee University	participant
Konstantinos Spiliopoulos	University of Maryland	student
Laura V. Spinolo	Northwestern University	participant
Samuel Stechmann	Courant Institute, New York University	participant
Christina Steiner	RWTH Aachen University	participant
Shaowei Su	Northwestern University	student
Weiran Sun	Center for Scientific Computation and Mathematical Modeling	student
Eitan Tadmor	University of Maryland	co-chair
Saul Teukolsky	Cornell University	plenary speaker
Benjamin Texier	Université Paris-Diderot (Paris VII)	participant
Manuel Tiglio	University of Maryland	participant
Dmitry Tkachev	Institute of Mathematics	participant
Manuel Torrilhon	ETH Zürich	participant
Andrea Tosin	Istituto per le Applicazioni del Calcolo "Mauro Picone" - Consiglio Nazionale delle Ricerche	student
Rony Touma	Lebanese American University	participant
Konstantina Trivisa	University of Maryland	participant
Suman Tumuluri	Université Paris VI	student
Athanasios Tzavaras	University of Maryland	co-chair
Yoshihiro Ueda	Graduate School of Mathematics, Kyushu University	student
Suleyman Ulusoy	University of Oslo	participant
Stefan Vater	Freie Universität Berlin	student
Knut Waagan	National Center for Atmospheric research	participant
David Wagner	University of Houston	participant

Dehua Wang	University of Pittsburgh	participant
Dongming Wei	University of Maryland	participant
Xin Wen	Institute of Computational Mathematics, Chinese Academy of Sciences	participant
Michael Westdickenberg	Georgia Institute of Technology	participant
Daniel Wright	ETH, Zürich	participant
Hao Wu	University of Wisconsin - Madison	student
Bokai Yan	University of Wisconsin - Madison	student
Xu Yang	University of Wisconsin-Madison	student
Shantia Yarahmadian	Indiana University	student
Wenjun Ying	Duke University	participant
Jim Yorke	University of Maryland	participant
Shih-Hsien Yu	National University of Singapore	participant
Mei Zhang	City University of Hong Kong	student
Linbao Zhang	University of Maryland	student
Kun Zhao	Georgia Institute of Technology	student
Yuxi Zheng	Penn State University	participant
Weigang Zhong	Statistical and Applied Mathematical Sciences Institute/NC State Univ.	participant

This page intentionally left blank

Index

- Alberti, Giovanni, 337
Alvarez, Amaury, 347
Amadori, Debora, 161
Ancona, Fabio, 175
Antonelli, Paolo, 359
Arminjon, Paul, 899
Assi, Kondo, 369
Azevedo, Arthur, 379
- Bianchini, Stefano, 337, 419
Balbás, Jorge, 389,879
Bao, Weizhu, 195
Benz, Joachim, 399
Benzoni-Gavage, Sylvie, 3
Berres, Stefan, 409
Berthon, Christophe, 785
Bhattacharjee, Amitava, 879
Birken, Philipp, 429
Blokhin, Aleksander, 959
Bollermann, Andreas, 889
Bouchut, François, 439, 835
Breil, Jérôme, 755
Bürger, Raimund, 445, 454
- Castro, Manuel, 465
Cavalli, Fausto, 477
Chapiro, Gregory, 487
Chen, Gui-Qiang, 25, 217
Chen, Shuxing, 53
Cheng, Bin, 497
Christoforou, Cleopatra, 227
Christov, Ivan, 507
Colombo, Rinaldo, 517, 527
Cordier, Stéphane, 537
Corli, Andrea, 161
Coronel, Aníbal, 445
Crippa, Gianluca, 337
- D’Ancona, Piero, 243
Darboux, Frédéric, 537
Dedner, Andreas, 253
De Lellis, Camillo, 269
Delestre, Olivier, 537
de Souza, Aparecido, 379, 487
Donatelli, Donatella, 279
Donadello, Carlotta, 547
- Elling, Volker, 557
- Facchi, Giancarlo, 517
Foschi, Damiano, 243
Frank, Martin, 987
Frings, Jörn Thies, 565
Fuchs, Franz, 575
Furtado, Frederico, 379
- Galera, Stéphane, 755
Gallardo, José, 585
Garavello, Mauro, 595
Golse, François, 73
Guerra, Graziano, 527
- Haasdonk, Bernard, 605
Haink, Jenny, 615
Haspot, Boris, 625
Hattori, Harumi, 636
Hernández-Dueñas, Gerardo, 715
Hime, Gustavo, 347, 487, 643
Holden, Helge, 653
Hu, Xianpeng, 663
- James, François, 537
Jameson, Antony, 429
Jenssen, Helge, 673
Jin, Shi, 93
Johnson, Evan, 683

- Jradeh, Mouhamad, 693
- Karlsen, Kenneth, 455, 705
- Karni, Smadar, 715
- Karper, Trygve, 705
- Kawashima, Shuichi, 977
- Kemm, Friedemann, 725
- Khe, Alexander, 919
- Kim, Jihwan, 737
- Kiselev, Alexander, 105
- Klar, Axel, 987
- Klingenberg, Christian, 439
- Klöfkorn, Robert, 253
- Kogan, Irina, 673
- Kröner, Dietmar, 815
- Laforest, Marc, 369
- Lambert, Wanderson, 745
- LeFloch, Philippe, 299, 465
- LeVeque, Randall, 737
- Levy, Rachel, 855
- Liska, Richard, 755
- Loubère, Raphaël, 755
- Lukáčová - Medvidóv; Mária , 765
- Luz Muñoz-Ruiz, María, 465
- Madrane, Aziz, 775
- Mailybaev, Alexei, 487
- Maire, Pierre-Henri, 755
- Marcati, Pierangelo, 359
- Marche, Fabien, 379
- Marchesin, Dan, 347, 379, 487, 745
- Marson, Andrea, 175
- Maternini, Giulio, 517
- Matos, Vítor, 643
- McMurry, Andrew, 575
- Meister, Andreas, 399
- Mishev, Ilya, 507
- Mishra, Siddhartha, 575, 795
- Nakamura, Tohru, 805
- Naldi, Giovanni, 477
- Nishibata, Shinya, 805
- Noelle, Sebastian, 565
- Nolte, Martin, 815
- Ohlberger, Mario, 605
- Pan, Ronghua, 825
- Parés, Carlos, 585
- Pelanti, Marica, 835
- Peng, Yue-Jun, 845
- Perthame, Benoît, 123
- Peterson, Ellen, 855
- Piccoli, Benedetto, 135, 595
- Popov, Bojan, 507
- Popov, Mikhail, 869
- Puppo, Gabriella, 477
- Qian, Xin, 389, 879
- Ricchiuto, Mario, 889
- Risebro, Nils, 653
- Rosini, Massimiliano, 517
- Rossmann, James, 683
- Rouch, Olivier, 899
- Rozanova, Olga, 911
- Ruiz, Jérémy, 845
- Russo, Giovanni, 919
- Sande, Hilde, 653
- Selberg, Sigmund, 243
- Semplice, Matteo, 477
- Sepúlveda, Mauricio, 445
- Shearer, Michael, 855
- Shelkovich, Vladimir, 929
- Shen, Wen, 939
- Shyue, Keh-Ming, 949
- Slemrod, Marshall, 217
- Spinolo, Laura, 419
- Suzuki, Masahiro, 315
- Tadmor, Eitan, 765, 775, 795
- Tkachev, Dmitry, 959
- Touma, Rony, 967
- Towers, John, 455
- Ueda, Yoshihiro, 977
- Ustyugov, Sergey, 869
- Váchal, Pavel, 755
- Voitovich, Tatiana, 409
- Waagan, Knut, 439
- Wang, Dehua, 663

Witelski, Thomas, 855

Wright, Daniel, 987

Yang, Hongang, 879

Yin Lim, Fong, 195

Zardo, Philipp, 399

Zhao, Kun, 825

This page intentionally left blank

Titles in This Series

- 67 **Eitan Tadmor, Jian-Guo Liu, and Athanasios E. Tzavaras, Editors**, Hyperbolic problems: Theory, numerics and applications (College Park, Maryland, June 2008)
- 66 **Dorothy Buck and Erica Flapan, Editors**, Applications of knot theory (San Diego, California, January 2008)
- 65 **L. L. Bonilla, A. Carpio, J. M. Vega, and S. Venakides, Editors**, Recent advances in nonlinear partial differential equations and applications (Toledo, Spain, June 2006)
- 64 **Reinhard C. Laubenbacher, Editor**, Modeling and simulation of biological networks (San Antonio, Texas, January 2006)
- 63 **Gestur Ólafsson and Eric Todd Quinto, Editors**, The radon transform, inverse problems, and tomography (Atlanta, Georgia, January 2005)
- 62 **Paul Garrett and Daniel Lieman, Editors**, Public-key cryptography (Baltimore, Maryland, January 2003)
- 61 **Serkan Hoşten, Jon Lee, and Rekha R. Thomas, Editors**, Trends in optimization (Phoenix, Arizona, January 2004)
- 60 **Susan G. Williams, Editor**, Symbolic dynamics and its applications (San Diego, California, January 2002)
- 59 **James Sneyd, Editor**, An introduction to mathematical modeling in physiology, cell biology, and immunology (New Orleans, Louisiana, January 2001)
- 58 **Samuel J. Lomonaco, Jr., Editor**, Quantum computation: A grand mathematical challenge for the twenty-first century and the millennium (Washington, DC, January 2000)
- 57 **David C. Heath and Glen Swindle, Editors**, Introduction to mathematical finance (San Diego, California, January 1997)
- 56 **Jane Cronin and Robert E. O'Malley, Jr., Editors**, Analyzing multiscale phenomena using singular perturbation methods (Baltimore, Maryland, January 1998)
- 55 **Frederick Hoffman, Editor**, Mathematical aspects of artificial intelligence (Orlando, Florida, January 1996)
- 54 **Renato Spigler and Stephanos Venakides, Editors**, Recent advances in partial differential equations (Venice, Italy, June 1996)
- 53 **David A. Cox and Bernd Sturmfels, Editors**, Applications of computational algebraic geometry (San Diego, California, January 1997)
- 52 **V. Mandrekar and P. R. Masani, Editors**, Proceedings of the Norbert Wiener Centenary Congress, 1994 (East Lansing, Michigan, 1994)
- 51 **Louis H. Kauffman, Editor**, The interface of knots and physics (San Francisco, California, January 1995)
- 50 **Robert Calderbank, Editor**, Different aspects of coding theory (San Francisco, California, January 1995)
- 49 **Robert L. Devaney, Editor**, Complex dynamical systems: The mathematics behind the Mandelbrot and Julia sets (Cincinnati, Ohio, January 1994)
- 48 **Walter Gautschi, Editor**, Mathematics of Computation 1943–1993: A half century of computational mathematics (Vancouver, British Columbia, August 1993)
- 47 **Ingrid Daubechies, Editor**, Different perspectives on wavelets (San Antonio, Texas, January 1993)
- 46 **Stefan A. Burr, Editor**, The unreasonable effectiveness of number theory (Orono, Maine, August 1991)
- 45 **De Witt L. Sumners, Editor**, New scientific applications of geometry and topology (Baltimore, Maryland, January 1992)
- 44 **Béla Bollobás, Editor**, Probabilistic combinatorics and its applications (San Francisco, California, January 1991)
- 43 **Richard K. Guy, Editor**, Combinatorial games (Columbus, Ohio, August 1990)
- 42 **C. Pomerance, Editor**, Cryptology and computational number theory (Boulder, Colorado, August 1989)
- 41 **R. W. Brockett, Editor**, Robotics (Louisville, Kentucky, January 1990)

TITLES IN THIS SERIES

- 40 **Charles R. Johnson, Editor**, Matrix theory and applications (Phoenix, Arizona, January 1989)
- 39 **Robert L. Devaney and Linda Keen, Editors**, Chaos and fractals: The mathematics behind the computer graphics (Providence, Rhode Island, August 1988)
- 38 **Juris Hartmanis, Editor**, Computational complexity theory (Atlanta, Georgia, January 1988)
- 37 **Henry J. Landau, Editor**, Moments in mathematics (San Antonio, Texas, January 1987)
- 36 **Carl de Boor, Editor**, Approximation theory (New Orleans, Louisiana, January 1986)
- 35 **Harry H. Panjer, Editor**, Actuarial mathematics (Laramie, Wyoming, August 1985)
- 34 **Michael Anshel and William Gewirtz, Editors**, Mathematics of information processing (Louisville, Kentucky, January 1984)
- 33 **H. Peyton Young, Editor**, Fair allocation (Anaheim, California, January 1985)
- 32 **R. W. McKelvey, Editor**, Environmental and natural resource mathematics (Eugene, Oregon, August 1984)
- 31 **B. Gopinath, Editor**, Computer communications (Denver, Colorado, January 1983)
- 30 **Simon A. Levin, Editor**, Population biology (Albany, New York, August 1983)
- 29 **R. A. DeMillo, G. I. Davida, D. P. Dobkin, M. A. Harrison, and R. J. Lipton**, Applied cryptology, cryptographic protocols, and computer security models (San Francisco, California, January 1981)
- 28 **R. Gnanadesikan, Editor**, Statistical data analysis (Toronto, Ontario, August 1982)
- 27 **L. A. Shepp, Editor**, Computed tomography (Cincinnati, Ohio, January 1982)
- 26 **S. A. Burr, Editor**, The mathematics of networks (Pittsburgh, Pennsylvania, August 1981)
- 25 **S. I. Gass, Editor**, Operations research: mathematics and models (Duluth, Minnesota, August 1979)
- 24 **W. F. Lucas, Editor**, Game theory and its applications (Biloxi, Mississippi, January 1979)
- 23 **R. V. Hogg, Editor**, Modern statistics: Methods and applications (San Antonio, Texas, January 1980)
- 22 **G. H. Golub and J. Olinger, Editors**, Numerical analysis (Atlanta, Georgia, January 1978)
- 21 **P. D. Lax, Editor**, Mathematical aspects of production and distribution of energy (San Antonio, Texas, January 1976)
- 20 **J. P. LaSalle, Editor**, The influence of computing on mathematical research and education (University of Montana, August 1973)
- 19 **J. T. Schwartz, Editor**, Mathematical aspects of computer science (New York City, April 1966)
- 18 **H. Grad, Editor**, Magneto-fluid and plasma dynamics (New York City, April 1965)
- 17 **R. Finn, Editor**, Applications of nonlinear partial differential equations in mathematical physics (New York City, April 1964)
- 16 **R. Bellman, Editor**, Stochastic processes in mathematical physics and engineering (New York City, April 1963)
- 15 **N. C. Metropolis, A. H. Taub, J. Todd, and C. B. Tompkins, Editors**, Experimental arithmetic, high speed computing, and mathematics (Atlantic City and Chicago, April 1962)
- 14 **R. Bellman, Editor**, Mathematical problems in the biological sciences (New York City, April 1961)
- 13 **R. Bellman, G. Birkhoff, and C. C. Lin, Editors**, Hydrodynamic instability (New York City, April 1960)

For a complete list of titles in this series, visit the
AMS Bookstore at www.ams.org/bookstore/.

