

# CONTEMPORARY MATHEMATICS

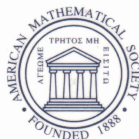
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## Fluids and Waves

### Recent Trends in Applied Analysis

Research Conference  
May 11–13, 2006  
The University of Memphis  
Memphis, TN

Fernanda Botelho  
Thomas Hagen  
James Jamison  
Editors



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**American Mathematical Society**  
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## Preface

Wave phenomena and fluid dynamics are two distinct areas of Applied Analysis concerned with spatial and temporal propagations of disturbances within a medium. Fluid dynamics deals with fluids in motion, both liquids and gases. Typical problems in fluid dynamics require an understanding of various dynamical properties of the fluid such as velocity, stresses, and temperature, as functions of space and time. Such problems are motivated by a large variety of physical phenomena and have a broad range of applications, from prediction of weather patterns to traffic engineering. On the other hand, wave phenomena arise in the long-term propagation of traveling waves within different media. Oscillations around almost fixed positions, pattern formation, existence and stability of single pulse solutions, as well as the existence of fronts, are phenomena of particular interest. Knowledge obtained from these investigations allows far-reaching conclusions in neuroscience and other areas of application.

The study of wave phenomena and fluid dynamics shares many similarities, both with respect to the principal questions raised and the solution techniques employed. Related issues at the interface of these areas of mathematics were the primary focus of the conference “Fluids and Waves – Recent Trends in Applied Analysis”, held at the University of Memphis in May 2006. This conference was sponsored by the National Science Foundation (NSF Grant DMS 0603412) and consisted of 8 plenary and more than 30 contributed talks.

This volume contains a series of papers by conference participants, highlighting not only recent mathematical advances, but also prominent bridges between these two important research areas of Applied Analysis. Mathematical topics that came to the fore included modeling aspects, existence and regularity theory, stability and instability of equilibria, asymptotic methods, stochastic effects, controllability and numerical simulation.

We are grateful to the National Science Foundation, the University of Memphis, Brooks&Cole, and Pearson-Hall for sponsorship and financial support. Special thanks to all participants in the conference and contributors to this volume. We are also particularly thankful to the American Mathematical Society for making this outstanding series of papers widely available by publishing these proceedings.

Memphis, April 2007

Fernanda Botelho

Thomas Hagen

James Jamison

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This volume contains a series of articles on wave phenomena and fluid dynamics, highlighting recent advances in these two areas of mathematics. The collection is based on lectures presented at the conference *Fluids and Waves: Recent Trends in Applied Analysis* and features a rich spectrum of mathematical techniques in analysis and applications to engineering, neuroscience, physics, and biology. The mathematical topics discussed range from partial differential equations, dynamical systems and stochastic processes, to areas of classical analysis.

This volume is intended as an introduction to major topics of interest and state-of-the-art analytical research in wave motion and fluid flows. It is helpful to junior mathematicians to stay abreast of new techniques and recent trends in these areas of mathematics. The articles here also provide a unique scientific basis for recent results and new links between current research themes. In summary, this book is a guide for experts in one field to the issues of the other, and will challenge graduate students to investigate these areas of analysis in further detail.

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