Center for Scientific Computation And Mathematical Modeling

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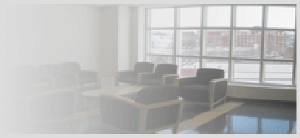

A Program Announcement

Analytical and Computational Challenges of Incompressible Flows at High Reynolds Number

May 17 – May 21, 2004

Organizers: Tom Hou, Jian-Guo Liu, Helena Lopes, Milton Lopes, Eitan Tadmor

Invited Participants

Russell Caflisch, UCLA
Dongho Chae, Sungkyunkwan University
Peter Constantin, University of Chicago
Diego Cordoba, University of Madrid
Charles Doering, University of Michigan
Manoussos Grillakis, University of Maryland
Yan Guo, Brown University
Tom Hou, CalTech
Dragos Iftimie, University of Lyon
Igor Kukavica, University of Southern California
Dave Levermore, University of Maryland
Doron Levy, Stanford University
Fang-Hua Lin, New York University
Jian-Guo Liu, University of Maryland
Helena Lopes, UNICAMP and Penn State University
Milton Lopes, UNICAMP and Penn State University
Alex Mahalov, Arizona State University
Anna Mazzucato, Penn State University
Robert Pego, University of Maryland
Steve Shkoller, University of California - Davis
Eitan Tadmor, University of Maryland
Sijue Wu, University of Michigan
Zhouping Xin, Chinese University

SCIENTIFIC BACKGROUND. High Reynolds number flow is a classical research theme that retains its vitality at several levels, from real-world applications, through physical and computational modeling, up to rigorous mathematical analysis. There are two reasons for the continued relevance of this topic. The first is the ubiquity of such flows in situations of practical interest, such as blood flow in large caliber vessels, fluid-structure interaction, aerodynamics, geophysical and astrophysical flow modeling. The second issue is that, despite of half a century of vigorous efforts, there is still a lack of systematic understanding how different scales interact to form the inertial range from a smooth initial condition. The description of the behavior of solutions of the Navier-Stokes equations at high Reynolds number is at the heart of the problem, and surprisingly, mathematical analysis seems to be a promising route for gaining insight. Is singularity formation of incompressible flows at high Reynolds number necessary for the formation of the inertial range in a turbulent flow? or is the dynamical generation of extremely small but finite scales sufficient for this purpose? The choice of the singularity problem for the incompressible Navier-Stokes equation as one of the seven Millennium prize problems highlights the fundamental role that mathematical analysis may yet play in this subject, while attesting to the quality of the mathematical challenge posed by problems| in this area.

GOALS

- to examine the ongoing research on the mathematical analysis of incompressible flows;
- to identify promising avenues of research;
- to formulate a number of problems that are at once tractable and have potential to provide further insight into the nature of high Reynolds number flows.

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