

# Preface

This book presents recent experimental and theoretical advances in fluid dynamics in physics and engineering. It begins with invited lectures given during the International Enzo Levi Spring School 2011 held at *San Nicolas de Hidalgo Michoacán University* in Morelia, May 5–6, 2011, and invited seminars presented in the XVII National Congress of the Fluid Dynamics Division of the Mexican Physical Society, held in Guadalajara, Jalisco, Mexico, November 8–11, 2011.

The Spring School is organized every year in honour of Prof. Enzo Levi, a well-known Mexican scientist that dedicated his research to the study of fluids. He was one of the founders of the Instituto de Ingeniería (Engineering Institute) of the Universidad Nacional Autónoma de México (UNAM), and of the Instituto Mexicano de Tecnología del Agua (Mexican Institute for Water Technology) of the National Water Commission. He was the mentor of several generations of Mexican Engineers.

During the two day school, lectures were given by well-known national and international scientists. In 2011, many people attended the meeting with 50 researchers and more than a 100 graduate and undergraduate students. A wide variety of topics were presented by young national researchers that included geological structures, astrophysics, oceanography, SPH, multiphase flow, and complex fluids. Moreover, two American and one European very well-known researchers presented important aspects of fluid dynamics: instabilities that develop in rotating flows, presented by Patrice Le Gal, from Aix-Marseille University, France, a kind of solitary waves, presented by Patrick Weidman, from the University of Colorado, and spatiotemporal complexity by Michael Schatz, from Georgia Institute of Technology.

The Annual Fluid Dynamics Congress has a different format. In 2011 it lasted 4 days and was mainly constituted by short oral presentations of students and researchers. There is also a Gallery of Fluid Motion where posters exposing fluid motion photographs of special beauty are presented. The first three papers in the Gallery of Fluids correspond to the first three prizes given during the Congress. Moreover, eight invited speakers presented works related to different themes belonging to fluid dynamics. As for international well-known invited speakers,

Herman J. H. Clercx, from Eindhoven University of Technology, presented a seminar about the formation of coherent structures in 3D laminar flows; Christophe Eloy, from Aix-Marseille University, France, spoke about the hydrodynamical constraints on the shape of fishes; José Rafael Castrejon Pita, from the University of Cambridge, England talked about drop formation and the consequent problems in the printing industry; Leonardo Trujillo, from the Physics Center, IVIC, Venezuela, showed how granular media can be described from a theoretical hydrodynamical point of view, and Jorge Arreola came from San Luis Potosí, Mexico, to speak about ions transport in biological membranes. Three local speakers presented the main research areas developed in Guadalajara University: astrophysics with Silvana Navarro, who showed how symbiotic stars can eject matter via jets, oceanography with Guillermo Gutiérrez, and rheology with Armando Soltero.

The short oral presentations are organized by themes: Geophysics, Porous Media, Microfluidics, Astrophysics, Multiphase Flow, Heat Transfer, Rheology, Magnetohydrodynamics, Hydraulics, Fluid-Structure Interaction, Granular Flow, and Viscous Flow.

The book is aimed to fourth-year undergraduate and graduate students, and to scientists in the field of physics, engineering, and chemistry that have interest in fluid dynamics from the experimental and theoretical point of view. The material includes recent advances in experimental and theoretical fluid dynamics and is adequate for both teaching and research. The invited lectures are introductory and avoid the use of complicated mathematics. The other selected contributions are also adequate to fourth-year undergraduate and graduate students.

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Jaime Klapp  
Abraham Medina  
Anne Cros  
Carlos A. Vargas

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