

Introduction

In the period of July 1 to December 31, 2006, a program entitled “Asymptotic Behaviour in Fluid Mechanics” took place at the Centre Bernoulli of the Ecole Polytechnique Fédérale de Lausanne. Special emphasis was given to the asymptotic study of fluid dynamical problems. The reason why this topic took a central role is twofold. First, in the modelling of fluids in physics, chemistry, biology, or engineering, small parameters arise in a very natural way. They usually appear due to imperfections or to the scaling of some parameters in the model which are considered small when compared with other, dominant, ones. Second, in fluid dynamics, the term “asymptotic” also refers to the long time behaviour. This long time behaviour can have stability properties, which are preserved under some types of perturbations. For practical as well as theoretical purposes, it is important to understand the long time and not only the short time dynamical properties of the solution. These questions and many other problems related to them have been addressed during this special program, in the framework of classical systems like the Euler or Navier–Stokes equations, of various geophysical fluid equations, of non-Newtonian fluid systems, etc. The main topics under study included

- long time behaviour of solutions
- small obstacles in a fluid
- thin domain problems
- rotating fluids
- problems with oscillating initial data
- problems related to the vanishing viscosity limit
- nonlinear waves
- bifurcation problems

The papers in this volume address all of these contemporary research topics in fluid dynamics. This special issue contains papers based on presentations at the following conferences and workshops: “Asymptotic behaviour in fluid mechanics” (July 24–28), “Rotating fluids in geophysics” (September 19–22), “Compressible fluids” (October 26–27), “Non-Newtonian fluids” (November 23–24), and “Perspectives in fluid dynamics” (December 4–8). All speakers at these conferences were invited to contribute to this special issue. The papers of those who decided to submit their work underwent the usual rigorous refereeing process of the journal.

In parallel, a fourteen week intensive doctoral course on the Euler and Navier–Stokes equations was given. In addition, there were also other shorter intensive courses focussed on various research topics and many weekly seminars. The courses and

seminars given during the program are not included in this volume.

This special semester was organized together with D. Iftimie. His dedication and effort in organizing this semester with us are greatly appreciated.

We thank Chris Jones, Coordinating Editor of Physica D at the time when the special-issue papers were submitted, for the opportunity offered to the participants of this special semester to disseminate their results in this journal. We are grateful to Arjen Doelman, the editor responsible for special issues when the papers were initially submitted. He has been a constant source of support during the time we were dealing with all the papers and the referees and he has helped us collaborate with the journal.

We thank the staff of the Centre Bernoulli, Christiane de Paola, Sabrina Martone, and Talya Vanwoerden who have assisted us on a day to day basis during the entire six months period and who have been crucial in the logistic part of the conference and workshop organization. Our gratitude goes also to Patrick Saladino, the system manager of the Centre Bernoulli, for his dedication and extraordinary efficiency with all the computer and system problems; he has ensured that our program never experienced any inconveniences linked to the network.

Last, but not least, we thank the EPFL and the Swiss National Science Foundation for their support that has made this activity possible and has offered the visitors excellent working conditions.

Tudor Ratiu
*Section de Mathématiques,
Ecole Polytechnique Fédérale de Lausanne,
CH - 1015 Lausanne,
Switzerland*
E-mail address: Tudor.Ratiu@epfl.ch

Geneviève Raugel*
*CNRS, Laboratoire de Mathématiques d'Orsay,
Université Paris-Sud,
Orsay Cedex, F-91405,
France*
E-mail address: genevieve.raugel@math.u-psud.fr

Available online 18 April 2008

* Corresponding editor.