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Recent Advances in PDEs: Analysis, Numerics and Control

In Honor of Prof. Fernández-Cara's 60th
Birthday

 Springer

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Introduction

This book contains the main results of the talks given at the workshop “Recent Advances in PDEs: Analysis, Numerics and Control”, which took place in Sevilla (Spain) on January 25–27, 2017. The work comprises 13 contributions given by high-level researchers in the partial differential equation (PDE) area to celebrate the 60th anniversary of Enrique Fernández-Cara (University of Sevilla).

The aim of this book is to present a representative selection of the talks given at the workshop, aiming to disseminate the latest scientific results and to envisage new challenges in Control and inverse problems, Analysis of Fluid mechanics and Numerical Analysis.

The Editors warmly thank all the speakers and participants for their contributions to the Workshop, which ensured its success. In particular, we would like to acknowledge the efforts of all the speakers who have contributed to this volume. We are also grateful to the Scientific Committee, Tomás Chacón Rebollo (University of Seville), Tomás Caraballo Garrido (University of Seville), Oleg Imanuvilov (Colorado State University) and Nader Masmoudi (Courant Institute, New York) for their efforts during preparation of the Workshop. We extend our thanks and gratitude to all sponsors and supporting institutions for their valuable contributions: SEMA, SMAI, University of Seville, IMUS and the Spanish Ministry of Economy and Competitiveness, which awarded the grants MTM2015-69875-P, MTM2015-64577-C2-1-R, MTM2015-63723-P, MTM2014-53309-P and MTM2013-41286-P.

The Editors would also like to express their gratitude to Prof. Enrique Fernández-Cara for having agreed to receive this tribute in celebration of his 60th birthday and would like to present here the words of thanks that were expressed by Prof. Enrique Fernández-Cara to all participants of the Workshop, colleagues and collaborators.

Sevilla, Spain
Sevilla, Spain
Sevilla, Spain
Córdoba, Spain
May 2018

Anna Doubova
Manuel González-Burgos
Francisco Guillén-González
Mercedes Marín Beltrán

Foreword

“Dear friends, dear colleagues,

With your permission, I would like to say some words.

First of all, I must express my deep gratitude to all of you for coming to Seville and participating in this meeting and, of course, for coming to this wonderful place to share these moments with me. It seems that the unique thing the organisers have not been able to arrange is the weather

Of course, very special thanks to the organisers of this workshop, my colleagues and former students Mercedes Marín, Francisco Guillén, Manolo G. Burgos and Anna Doubova. Also, many thanks to the members of the Scientific Committee and to all other colleagues and former and present students.

Definitively, I can see that the outcome of this meeting is much more than what I deserve. Indeed, the talks we are having these days confirm this to me. Very sincerely, I see that, this time, the tribute is of first class and I am not sure to be the same.

In my academic career, several crucial moments have determined where I am today. And I am very happy for this. Let me indicate them:

1. The first crucial moment was in 1978, when I decided to try to work in the differential equations and numerical analysis fields. I started a contact with our professor Antonio Valle, who unfortunately passed away in 2014.

I will always be very grateful to Professor Valle. Thanks to him, I got a grant from the French Government to make a thesis in INRIA and Paris 6, under the direction of Roland Glowinski.

2. This was a second crucial moment. With me, Roland Glowinski solved a bi-objective problem as he is, as a master: he taught me a maximal amount of things using a minimal amount of time. Of course, this was for me the starting point of a long list of contacts with many people: first, Henri Berestycki, whom I began to work with; and then I met Americo Marrocco, Olivier Pironneau, Pierre-Louis Lions, Frédéric Hecht, María Jesús Esteban and also François Murat, Jean-Michel Coron, Jean-Pierre Puel, Lucio Boccardo, etc.

3. There was a third very relevant moment a few years later, in 1984. At that time, after defending several theses in our laboratory, we were scientifically a little bit disoriented and even lost. I remember that several of us made a 2-week visit to Paris, where we met François Murat. After a very pleasant and friendship conversation, François suggested to study in detail theoretical and numerical problems concerning the Navier-Stokes equations.

And we did it.

4. A fourth important moment was my contact with Jacques Simon in 1989. Together, we gave a continuation to our analysis of the Navier-Stokes equations and we started to work on optimum design and related topics. I have always appreciated his ability to be at the same time deep and useful in analysis. I have had a lot of interesting conversations with him on Mathematics but also on other subjects (not always in agreement). Moreover, thanks to him, not only me but also many other colleagues had the chance to contact his former students Jerome Lemoine and Didier Bresch.
5. Then, towards 1994, I met again Enrique Zuazua and Jean-Pierre Puel. I knew them since the 1980s but it was only later that we began to work together. Thanks to them, I have learned a lot of things on control theory, in particular on the controllability of linear and nonlinear PDEs. With Enrique, we worked hard on the control of linear and semilinear heat equations. With Jean-Pierre (and then Oleg Imanuvilov and Sergio Guerrero), we found some results for the Navier-Stokes and related systems. In this area, my more recent contacts with Jean-Michel Coron and Arnaud Münch have also been decisive, making it possible to get new results.

And I must also mention Assia Benabdallah and Chérif Ammar-Khodja and Otared Kavian

6. Finally, I cannot forget my contacts with a lot of people in Brazil, Mexico and Chile. This started in 2002, with Marko Antonio Rojas-Medar and Jose Luiz Boldrini. More or less at 2004, I met Luz De Teresa and then I met Fágner Araruna, Pablo Braz, Juan Límaco and others. All these collaborations have been fantastic to me from both the professional and personal viewpoints and I am also very grateful for this.

I have always believed that our activities must be guided by the following:

- (a) First, we must teach. In fact, we are mainly paid for this. We must educate and train students and young people as much as we can. This will be our stimulus and maybe our legacy.
- (b) Then, we must work together and collaborate. Today, it does not seem reasonable to isolate and work alone. Very probably, this is not the best way to be successful.
- (c) Finally, we must progress. I understand this verb in the widest sense: progress in science and methods, progress in the choice of subjects and also progress in the way of life of our institutions. We have to be sensible to the evolution that our institutions need and we have to help them to achieve their goals.

I think that the situation of our laboratory is nowadays very satisfactory although, of course, many things remain still to be done. At a larger scale, I find that the situation is also very encouraging. Indeed, most of us are attached to an Institute of Mathematics with more than 100 members (about 40 of them are full professors) which is active in practice in all areas and is able to present a highly performant activity in the last years. In spite of a lot of difficulties, the work of several colleagues gave rise to these units, at present led by Manuel González Burgos and Tomás Chacón.

They seem excellent tools to grow in mathematics. We can dispose of structures sufficiently rich to receive students, young researchers and visitors and sufficiently powerful to support high-level programs with appropriate activities.

So, although very modestly, I feel proud to have been able to contribute to these tasks.

Thank you very much, Rosa.

And thank you very much to you all for your attention.”

Sevilla, Spain
January 2017

Enrique Fernández-Cara



Workshop on “Recent Advances in PDEs: Analysis, Numerics and Control”

In honor of
Enrique Fernández Cara
for his 60th
birthday



January
25th - 27th
2017

Plenary speakers

Farid Ammar Khodja
Fágnér Araruna
David Arcoya
Assia Benabdallah
Alfredo Bermúdez
Didier Bresch
Eduardo Casas
Ramón Codina
Jean-Michel Coron
Luz de Teresa
Roland Glowinski

Otared Kavian
Juan Limaco
Arnaud Münch
François Murat
Carlos Parés
Victor Pérez-García
Francisco Periago
Jean-Pierre Puel
Marko Rojas-Medar
Jacques Simon
Enrique Zuazua



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Short Biography

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