

# Preface

The International Conference *Differential Equations, Inverse Problems and Control Theory* took place at the Palazzone in Cortona (Italy), from June 16 to 21, 2013. The conference, organized by Angelo Favini and Alfredo Lorenzi, was held in collaboration with the Mathematics Department of the University of Bologna and with INdAM (Istituto Nazionale di Alta Matematica). It was attended by about 40 mathematicians from universities in a variety of countries, including France, Germany, Israel, Italy, Japan, Romania, and the USA.

As is well known, applied sciences consider situations in which one observes the evolution over time of a given system. The related models can be formulated in terms of evolution equations, mathematical structures in which the dependence on time plays an essential role. Such equations have been studied intensively in theoretical research and are the source of an enormous number of applications.

A typical class of problems that has been investigated over the years concerns the well-posedness of an evolution equation with the given initial and boundary conditions, possibly with some degeneration (the so-called DIRECT problems). However, in several situations, initial conditions are difficult to determine exactly, while measurements of the solution at different stages of its evolution might be available. Many techniques have been developed to recover, from such pieces of information, important parameters governing the evolution, such as forcing terms or diffusion coefficients. This avenue of investigation is usually referred to as INVERSE problems.

A third way to study evolution equations is to try to influence the evolution of a given system through various kinds of external action called CONTROL. Of course, control problems may vary in nature, ranging from a given system to a desired configuration in finite or infinite time, to trying to optimize a performance criterion.

Although for some time direct, inverse and control problems for evolution equations were viewed as almost independent issues, in recent years it has become clear that they can profit enormously from a strong interaction with each other. For instance, a priori estimates for solutions of partial differential equations that were originally developed to study unique continuation problems, i.e. Carleman's

estimates, have been proved to be extremely useful in studying exact controllability and inverse problems.

For these reasons, one of the main cultural goals of our initiative was to bring together experts in the above fields to speed up interaction and stimulate the development of new ideas. To achieve this aim, several conferences were organized, the most recent being the meeting *Differential Equations, Inverse Problems and Control Theory*.

This volume assembles the contributions of most of the speakers who participated in the meeting. It provides an overview that reflects the richness and vitality of the subject. All the contributions underwent peer review, in compliance with the standard procedure for the Springer INdAM Collection.

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Bari, Italy  
Bari, Italy  
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Angelo Favini  
Genni Fragnelli  
Rosa Maria Mininni

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