

MATHEMATISCHES FORSCHUNGSINSTITUT OBERWOLFACH

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**Mini-Workshop: Recent Developments on Approximation
Methods for Controlled Evolution Equations**

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1 November – 7 November 2015

ABSTRACT. This mini-workshop brought together mathematicians engaged in partial differential equations, functional analysis, numerical analysis and systems theory in order to address a number of current problems in the approximation of controlled evolution equations.

Mathematics Subject Classification (2010): 93C20, 93C25, 65Mxx.

Introduction by the Organisers

The mini-workshop *Recent Developments on Approximation Methods for Controlled Evolution Equations*, organised by *Birgit Jacob* (Wuppertal), *Enrique Zuazua* (Bilbao) and *Hans Zwart* (Twente) was held November 1st – 7th, 2015. This meeting was well attended with 16 participants with broad geographic representation.

Systems modelled by linear ordinary differential equations have long been studied and there exists a wide body of theory and design algorithms dealing with their control. The state describing such a system lies in a finite-dimensional vector space. This setting has its limitations, as many systems of interest, from the point of view of applications to industry and other disciplines, do not fall into this class. A more interesting generalisation is that to systems with an infinite-dimensional state space. This class includes delay systems, and systems modelled by functional differential equations and partial differential equations (PDEs), generally called *evolution equations*. This field finds applications in such diverse areas as aeronautics, mechanical and electrical engineering. Since they appear frequently

as models in these fields of applications, evolution equations with boundary control and boundary observation are of particular interest.

One of the key issues when addressing real applications is the effective control of those systems, which requires of significant effort from the point of view of mathematical analysis.

The talks were grouped into three main themes:

- Modeling and control of *real-live* problems
- Numerical analysis of PDE control
- Theoretical aspects of controller design and approximations for systems described by PDEs

In the first theme the following participants gave talks: *Rob Fey, Aitziber Ibañez, Jarmo Malinen, George Weiss.*

Furthermore, *Athanasios Antoulas, András Bátkai, Umberto Biccari, Nicolae Cîndae, Weiwei Hu, Orest Iftime, Kirsten Morris, Timo Reis* and *Hans Zwart* were the speakers of the second theme.

The last theme was covered by *Björn Augner, Birgit Jacob, Felix Schwenninger* and *Hans Zwart*. Although we have grouped them according to our themes, there was significant overlap between the approaches which stimulated many productive discussions.

The organizers and participants thank the Mathematisches Forschungsinstitut Oberwolfach for providing an inspiring setting for this mini-workshop, which allowed us to concentrate on the mathematics.

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