



IMETUM Lecture Series

Workshop-Series IMETUM Lecture

Optimal Control Meets Medical Imaging Sciences: Applications, Formulations and Fast Solvers

March 5, 2015 | 02.00-03.30pm

Institute of Medical Engineering (IMETUM) | Lecture Hall E.126

Invited Speaker

Dr. Andreas Mang | University of Texas at Austin, USA

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Member of George Biros's Parallel Algorithms for Data Analysis and Simulation Group (PADAS)*

Abstract

My current work focuses on computational inverse problems governed by systems of partial differential equations (PDEs). In particular, I am interested in the development and implementation of efficient algorithms for the solution of large-scale control problems with PDEs as state equations.

We will review two applications. The first part of the talk will focus on the calibration of a model of brain tumor growth with respect to medical imaging data. The ultimate goal of this work is to provide a systematic way to aid clinical decision-making by means of patient specific model predictions. The key difficulties of our formulation are a computationally expensive parameter-to-observation map as well as uncertainties about the observation. We will discuss approaches to tackle these challenges and showcase results for synthetic and real world problems.

In the second part of this talk we will discuss an efficient black box solver for constrained diffeomorphic image registration. In our formulation, the deformation map is represented by its velocity. We will discuss different regularization schemes. We will see that the associated optimality conditions are a system of space-time non-linear multi-component PDEs that is challenging to solve in an efficient way. We will experimentally assess numerical accuracy, computational efficiency and deformation regularity of our scheme.

This is joint work with Amir Gholaminejad and George Biros.

TUM host of this Lecture Series is Prof. Björn Menze / Assistant Professor in Computer Science.