

**Johann Radon Institute for
Computational and Applied Mathematics
der
Österreichischen Akademie der Wissenschaften**

Group Seminar

Groups: Computational Methods for Direct Field Problems
& Optimization and Optimal Control

Subhendu Hazra

Department of Mathematics, University of Trier

Numerical Methods for Flow Simulation and Simulation-based Optimization in Applications

Mathematical models of fluid flow problems result in non-linear (system of) Partial Differential Equations (PDEs). Due to complexity of the PDEs and/or of the application domains, analytical solutions to these equations do not exist in general. One possible alternative is to look for approximate numerical solutions. Therefore, PDE-simulation is widespread in scientific and engineering applications. As PDE-solvers mature, there is increasing interest in industry and academia in solving optimization problems governed by PDEs. These optimization problems are quite challenging since the size and the complexity of the discretized PDEs often pose significant difficulty for the contemporary optimization methods.

This talk will focus on numerical methods for such problems. Special emphasis will be given to application areas in parameter identification in multi-phase flow through porous media and in aerodynamic shape optimization. In the first problem class the PDEs are non-stationary and the optimization problems have been solved using multiples shooting methods for DAEs. In the second problem class, the involved PDEs are pseudostationary and the CFD is extremely expensive, especially when full convergence of the PDE solution is required. For these problems a new one-shot pseudo-time-stepping method, based on rSQP-methods, has been developed. This method is quite efficient since the optimality is achieved simultaneously with the feasibility of the state and the costate equations. Some of the results, obtained using these methods, will be presented.

Monday, July 21, 2008, 9:00
Johannes Kepler Universität, HF136