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

Group Seminar

Groups: Computational Methods for Direct Field Problems, Inverse Problems, Optimization and Optimal Control & Analysis of Partial Differential Equations

Prof. Jens Lang
Darmstadt University of Technology

"On Global Error Estimation and Control for Reaction-Diffusion Equations"

In this talk I will report on some joint activities with Jan Verwer (Center for Mathematics and Computer Science, Amsterdam) and Kristian Debrabant (TU Darmstadt) regarding efficiency and reliability questions for initial-boundary value problems. First, systems of ODEs are considered. Existing popular codes focus on efficiency by adaptively optimizing time grids in accordance to local error control. The reliability question, that is, how large are the global errors, has received much less attention. We have implemented classical global error estimation based on the first variational equation, and global error control, for which we have used the property of tolerance proportionality.
We have found, using the Runge-Kutta-Rosenbrock method ROS3P as example integrator, that the classical approach is remarkably reliable. For reaction-diffusion equations, the ODE approach is combined with estimates for the spatial truncation errors based on Richardson extrapolation.
Numerical examples are used to illustrate the reliability of the estimation and control strategies.

Friday, October 31, 2008, 9:00
Johannes Kepler Universität, HF136