Vortragsankündigung im Rahmen des Seminars
Numerische Simulation von Strömungs- und Transportprozessen

Wir möchten im Rahmen unseres Seminars "Numerische Simulation von Strömungs- und Transportprozessen" der Institute IAG, IHS, IKE, IKT, IRS, ITSM, ITLR, ITV, IVD und IANS der Universität Stuttgart herzlich zu folgenden Vorträgen einladen:

**Herr Dr. Friedemann Kemm**
TU Cottbus, Lehrstuhl für Numerische Mathematik und Wissenschaftliches Rechnen

"Discrete Involutions, Resonance and the Divergence Problem in MHD"
Mittwoch, 27.08.2008, 11:00 Uhr, Hörsaal V21.01, IAG, Pfaffenwaldring 21

The problem of divergence errors is a well known issue in the simulation of plasma flows, especially in Magnetohydrodynamics. Over the years various suggestions were made how to address this problem. On the one hand there are constrained transport approaches ranging from discretization techniques on staggered grids and schemes based on the vector potential of the magnetic field, up to flux distribution methods. On the other hand, there are divergence correction methods, which artificially change the model equations. They range from projection methods and penalization techniques to the Powell correction term and Generalized Lagrange Multiplier (GLM) methods.

Besides these two main directions of research, there are schemes which work without any special technique to avoid divergence errors. Therefore, the question arises, what properties are special to these schemes.

To shed light on this problem, we employ the concept of involutions, which was introduced to the context of hyperbolic conservation laws by Dafermos. He also gives a sufficient condition for a system to be equipped with an involution. We introduce the concept of discrete involutions as an analogue to the analytic one and prove the sufficiency of Dafermos' condition for the discrete case, at least in an approximate manner.

Since the MHD equations show weakly hyperbolic or resonant hyperbolic degeneration in some points of the state space, we also have to deal with the issue of resonance. We analyze the way in which resonance might deteriorate the quality of the approximate involution. The theoretical results are validated by numerical experiments.

**Herr Fernando Betancourt**
Institut für Angewandte Analysis und numerische Simulation, Uni Stuttgart

"Finite-Volume Scheme for Friedrichs Systems with Involutions Abstract"
Mittwoch, 27.08.2008, 11:30 Uhr, Hörsaal V21.01, IAG, Pfaffenwaldring 21

In practical applications solutions of systems of hyperbolic balance laws often have to satisfy additional side conditions. We consider initial value problems for the general class of Friedrichs systems where the solutions are constrained by differential conditions given in the form of involutions. These occur in particular in electrodynamics, electro- and magnetohydrodynamics as well as in elastodynamics. Neglecting the involution on the discrete level typically leads to instabilities. To overcome this problem in electrodynamical applications it has been suggested by Munz et al. to solve an extended system. Here we suggest an extended formulation for the general class of constrained Friedrichs systems. It is proven for explicit Finite-Volume schemes that the discrete solution of the extended system converges to the weak solution of the original system for vanishing discretization and extension parameter under an appropriate scaling. Moreover we show that the involution is weakly satisfied in the limit.

Mit freundlichen Grüßen,
Prof. Dr. C.-D. Munz
Prof. Dr. C. Rohde
Prof. Dr. E. Laurien