Einladung zum Oberseminar Wissenschaftliches Rechnen

Julius-Maximilians-Universität Würzburg
Lehrstuhl für Wissenschaftliches Rechnen IX

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Control methods for the optimization of plasma scenarios in a tokamak

The peaceful use of nuclear fusion for energy production on earth is a multinational research effort with high impact on the future energy sector. One of the most promising technologies to achieve this goal is currently the tokamak, a torus shaped reactor that uses strong magnetic fields to confine plasma and to achieve the extreme conditions to start the fusion reaction. The knowledge accumulated over many years on different experiments will culminate in the upcoming novel tokamak ITER constructed in Cadarache, France.

In this talk we will present our work towards optimal control methods for the optimisation of experimental scenarios in tokamaks. It is based on modelling the evolution of plasma equilibrium at the resistive diffusion timescale in the presence of external poloidal field circuits and passive structures. This so-called Grad/Hogan model separates into two low-dimensional subproblems: The axisymmetric free-boundary plasma equilibrium problem and the one-dimensional system of transport and diffusion equations. The equilibrium problem, also known as the Grad-Shafranov equation, is a non-linear elliptic problem for the poloidal flux function. The transport and diffusion equations, basically hydrodynamic equations and resistive diffusion formulated in the curvilinear coordinate system induced by the level lines of the poloidal flux function, are non-linear advection-diffusion equations. The unknowns of the system of transport and diffusion equations determine in some non-linear fashion the profile of the toroidal current density, the non-linear righthand side of the Grad-Shafranov equation. The poloidal flux on the other hand determines coefficients in the system of transport and diffusion equations. Devising stable numerical methods for a self-consistent simulation of equilibrium and transport and diffusion is an active area of research with many open problems, but highly important for scenario development and control.

Ort: Raum 30.02.003 (2. Stock) (Mathegeb. 30 West) Zeit: Montag, 14.11.2016, 13.00 Uhr

Zu diesem Vortrag laden wir Sie herzlich ein.

gez. Prof. Dr. Alfio Borzì
gez. Prof. Dr. Roland Griesmaier