Einladung zum Mathematischen Kolloquium


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Gast am Lehrstuhl Ingenieurmathematik
bei Herrn Prof. Dr. Kurt Chudej

über das Thema

**Optimal Control of a Coupled System of a Vehicle Transporting a Fluid Subject to Shallow Water Equations**

Abstract

We consider the optimal control of a vehicle transporting an open fluid basin as load. The motion of the fluid is modelled by the non-linear hyperbolic shallow water (Saint-Venant) equations, while the vehicle dynamics are described by Newtons equations of motion. The fluid basin is mounted to the vehicle by a spring-damper element. The system may be controlled by the acceleration of the vehicle.

This leads to an optimal control problem with a coupled system of partial differential equations (PDEs) and ordinary differential equations (ODEs). The PDEs and ODEs are fully coupled by boundary conditions and force terms.

We derive necessary optimality conditions rigorously and solve by a first-optimize-then-discretize approach, using Newton’s method. In particular, we employ a certain globalization strategy for semi-smooth Newton methods in Hilbert spaces here. As well we consider a first-discretize-then-optimize approach for the particular case of time optimal control. The Saint-Venant equations are discretized by means of a Lax-Friedrich scheme, involving an artificial viscosity.

Finally, we consider further examples (an elastic crane-trolley-load system, a quarter car model with free road contact) for fully coupled systems of PDEs and ODEs. We discuss their particular features and classify our problem within this context.

Beginn: 16.30 Uhr (Kaffee/Tee ab 16.00 Uhr im Seminarraum 748)
Ort: Hörsaal H 19, Gebäude Naturwissenschaften II, Universitätsgelände

gez. L. Grüne