Institut für
Angewandte Mathematik

Leibniz
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Hannover

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Announcement for SoSe 2021
Numerical methods for coupled variational inequality systems (CVIS)

Contents and Structure of this Class: This course is devoted to numerical methods for coupled variational inequality systems. It means, we consider problems which are basically a PDE system with a coupling and a variational inequality constraint that has to be fulfilled.

- In part I, we start with two representative examples: the obstacle problem and fluid-structure interaction and refresh numerical tools as FEM, time-stepping schemes, nonlinear and linear solvers, inequality constraints as well as the basic definitions of interfaces.
- In part II, we classify CVISs, namely nonstationary, nonlinear, coupled differ- ential equations subject to inequality constraints.
- In part III of this course, we focus on coupled problems and multiphysics PDEs.
- In part IV, we discuss different approaches to handle inequality constraints numerically; from simple penalization to Lagrange multipliers.
- All concepts are substantiated with algorithms and numerical tests in the theoretical and practical exercises.

Literature:

- Book: T. Wick; *Multiphysics Phase-Field Fracture: Modeling, Adaptive Discretizations, and Solvers* Radon Series on Computational and Applied Mathematics, Band 28, de Gruyter, 2020. `https://www.degruyter.com/view/title/523232?tab_body=toc`
- Book: N. Kikuchi, J. T. Oden; *Contact problems in elasticity: a study of variational inequalities and finite element methods.* Society for Industrial and Applied Mathematics, 1988.
- K. Mang, T. Wick; *Numerical Methods for Variational Phase-Field Fracture Problems.* - Hannover : Institutionelles Repositorium der Leibniz Universität Hannover, 2019. `https://www.repo.uni-hannover.de/handle/123456789/5175`

Recommended prerequisites:

- Numerical methods for partial differential equations; see e.g., `https://www.repo.uni-hannover.de/handle/123456789/9301`
- Numerical methods for nonlinear and coupled problems
- C++ (for the practical exercises)

Language: The class and the exercises will be taught in English language. The lectures are on Tuesday 10:15 to 11:45 am and Wednesday 10:15 to 11:45 am. The exercises are on Thursday 10:15 to 11:45 am and 16:15 to 17:45 pm.

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