Numerical Algorithms in Mechanics with Computer Implementation

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The pre-requisite for the course: Introduction via Applications to Calculations Using High Performance Computers

The students will get to know the basic algorithms in visco-elasticity, hyperelasticity and plasticity. They will use the finite element technique. They will implement the algorithms into their own codes that are written during exercises. The codes will use the parallel solver MUPMS. They will use remote machines in the IPPT PAN (cluster Grafen) and in the Interdisciplinary Centre for Mathematical and Computational Modelling.

Main topics:

1. Generalized trapezoidal rule.
2. Newton-Raphson algorithm.
3. Explicit time integration.
4. Viscoelasticity (linear visco-elasticity, nonlinear visco-elasticity).
5. Hyperelasticity, finite strains.
6. Plasticity, finite strains.
7. Special topics, for example, Representative Volume Element.

Exercises: implementation of the problems above employing a sparse solver.

The total number of lecture hours: 60, laboratory exercises: 30 hours, self-teaching: 60, direct tutoring and consultations: 15 hours.

ETCS Points: 6