Information on the Course
Computational Inelasticity

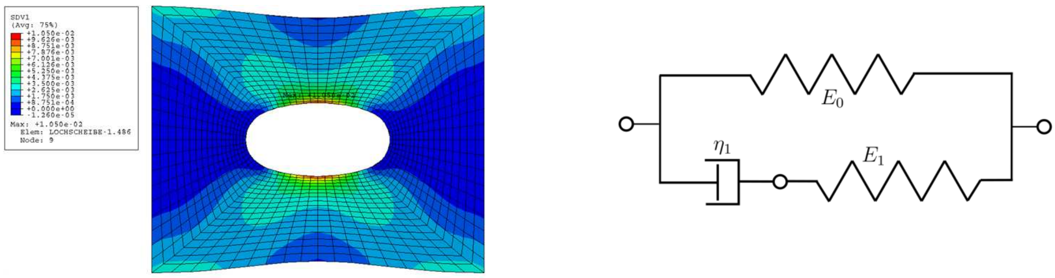

Figure: Local equivalent plastic strains (left), Maxwell element for viscoelasticity (right)

Contents of the lecture

The lecture provides an introduction into the principles and the theory of the finite element method for inelastic material behavior. Special emphasis is put on inelastic material laws within the framework of generalized standard materials (Halphen und Nguyen, 1974). For solving non-linear equations and non-linear systems of equations, Newton's method and modifcations of it are discussed. Time integration methods and stability issues are presented. In the tutorial, special material laws are implemented using the commercial FE software Abaqus.

Dates, Credits, Contact

Lecture	Wed, 09:45 - 11:15, R308.1 at ITM-KM, bldg. 10.23, 3rd fl.
First Lecture	Wed, April 22nd, 09:45 - 11:15
Tutorial	t.b.d. in 1st lecture
First Tutorial	t.b.d. in 1st lecture
SWS / Credits / Exam	2+2 SWS / 5+1 CP / oral examination
Language	English / German (depending on the audience)
Course material	will be available in ILIAS
Contact	Prof. Dr.-Ing. Thomas Böhlke, Dr.-Ing. Tom-Alexander Langhoff M.Sc. Johannes Gisy, M.Sc. Lukas Speichinger

Literature

[1] J. C. Simo & T. J. R. Hughes: Computational Inelasticity. Springer, 1998.

[2] T. Belytschko, W. K. Liu & B. Moran: Nonlinear FE for Continua and Structures. JWS, 2000.

[3] A. Bertram: Elasticity and Plasticity of Large Deformations. Springer, 2008.

[4] B. Halphen & Q. S. Nguyen: Plastic and visco-plastic materials with generalized potential, Mech. Res. Commun. 1(1), 43–47 (1974)

Recommendation

This course on MSc level is suitable for students with a high interest and good background in engineering mechanics. Knowledge of the contents of the course “Computational Elasticity” is strongly recommended. The students should be familiar with tensor calculus. Basic knowledge of the linear static finite element method and of a commercial FE software package like ABAQUS is highly recommended. Also basics in numerical mathematics and numerical algebra are assumed.

Contents of the lecture

- **Basics of Thermoviscoplasticity**
  Thermodynamic consistency, geometrical vs. physical non-linearity, rate dependent vs. rate independent, von Mises plasticity, KKT condition
- **Basics of Viscoelasticity**
  Rheological models, Maxwell model, viscosity, linear and non-linear behavior
- **Generalized Standard Materials**
  Internal variables, free energy and dissipation potential, potential relations, algorithmic consistent tangent stiffness
- **Elements of Numerical Mechanics**
  Galerkin discretization in non-linear FEM, Solution of non-linear equations, Newton method, static condensation, time discretization, time integration algorithms