

BIWE-08: Multi-Scale Mechanics (Prof. Zastra / Dr. Richter)

Contents

- 1) Introduction
 - Different material scales
 - Main procedure of multi-scale mechanics
- 2) Some basics in the mechanics of solid continua
 - Tensor calculus
 - Theory of elasticity
- 3) Fundamental concepts of multi-scale mechanics
 - Representative volume elements
 - Averaging of continuum quantities; boundary conditions
 - Overall material behavior
- 4) Elastic solids with micro-cavities and micro-cracks
 - Elastic solids with traction-free micro-cavities
 - Elastic solids with traction-free micro-cracks
- 5) Elastic solids with micro-inclusions
 - Concept of equivalent eigenstrain and eigenstress
 - Eshelby's tensor
 - Examples of elastic solids with elastic micro-inclusions
- 6) Concluding remarks
 - Sequential and integrated multi-scale approaches
 - Numerical homogenization; FE^2 method
 - RVE's and unit cells

Prerequisite Knowledge

- Good knowledge in mathematics, tensor calculus and continuum mechanics; successful participation in module BIWO-02
- Basic knowledge in finite element methods

Topics of Project and Master Thesis

- see topics offered by the Institute of Mechanics and Shell Structures

Literature

- S. Nemat-Nasser, M. Hori: Micromechanics: Overall Properties of Heterogeneous Materials, Elsevier, Amsterdam, 1999
- H.J. Böhm: A Short Introduction to Basic Aspects of Continuum Micromechanics, Wien, 1998 (3)
(<http://www.ilsb.tuwien.ac.at/links/downloads/ilsbrep206.pdf>)
- T.I. Zohdi, P. Wriggers: Introduction to Computational Micromechanics, Springer, Berlin, 2005

Links for possible Topics of Master Thesis

- Please contact for possible Topics the colleagues of the Institute of Mechanics and Shell Structures directly.