SHORT COURSE (N. 3) / 21 June, 2008
'Basics of Continuum Mechanics and Material Theory'

ACE-X 2009 / Rome, Italy / from 22-23 June, 2009

3rd International Conference on
Advanced Computational Engineering and Experimenting

SHORT COURSE (N.3):
'Basics of Continuum Mechanics and Material Theory'

Prof. Dr. –Ing. Holm Altenbach (Lecturer)

Announcement:
Date 21 June / Time11.15– 14.15

Part 1 – Introduction
- Motivation
- Historical Remarks
- Application Examples

Part 2 – Mathematical Foundations
2.1. Tensor vs. Vector-Matrix Calculus
2.2. Tensor Algebra
2.3. Tensor Analysis

Part 3 – Geometrical Description (Kinematics)
3.3. Configurations
3.2. Strains
3.3. Strain Rates

Part 4 – Kinetics
4.1. Forces, Couples
4.2. Stresses
4.3. Static Equilibrium

Part 5 – Balances
5.1. General Balance Equation
5.2. Special Cases
5.3. Conservation Laws

Part 6 – Constitutive Theory
6.1. Basic Ideas
6.2. Constitutive Equations
6.3. Evolution Equations
6.4. Examples

The basic ideas of continuum mechanics are more and more used by engineers. In many textbooks one can find the derivations of the geometrical, kinetic, balance and constitutive equations with respect to general coordinate representations, but for engineers only two representation are mostly helpful: the index-free notation and the index notation for Cartesian coordinates. The index-free notation is important for the general understanding. For practical solutions the first steps can be shown using Cartesian coordinates.

The governing equations in continuum mechanics can be split into to main groups: the material independent and the material dependent equations. The first ones are given for solids and fluids in the same manner. The geometrical description is based on the mathematical approaches to characterize the changes of the geometry. The kinetic relations are based on the assumption that there are, for example, external loads and internal stress states. The balances are the most general from to describe the interaction of the continuum and the surrounding. The simplest case of such interaction is the pure mechanical. It can be shown that thermo-mechanical or other interactions can be presented by a similar way. The constitutive behaviour cannot be presented in a general manner. Now one has to start from the individual response of a material given by experimental data from simple and complex tests. The main question is how to restrict the general from of constitutive equation. One possibility is the assumption of material and physical symmetries and to include constrains like the incompressibility. This reduction can be made in a very effective way using the index-free tensor notation. Finally the problem of evolution equations will be discussed. Introducing inner variables describing the hardening, the damage, etc. the time-dependent changes of the material can be modelled.

A CD with slides and certificate of attendance will be given to all participants!

Registration for this course can be done under: http://www.ace-x2009.com/register.html

IMPORTANT DATES:
- ✓ Abstract Submission Deadline 27March
- ✓ Notification of Acceptance 03 April
- ✓ Early Bird Registration 17 April
- ✓ Accommodation Reservation 20 April
- ✓ **Short course 21 June**
- ✓ ACE-X 2009 22-23 Jun 2009

More information is available through:

The web page of the conference www.ace-x2009.com
Prof. Dr. –Ing. Holm Altenbach holm.altenbach@iw.uni-halle.de