MEC-7010 Postgraduate course in design and optimization
Topic in spring 2013: *Introduction to higher-order continuum models*

Lectures: Thursday 14-16 (lecture hall K1308), lecturer Reijo Kouhia, K1230, tel 040-8490561, e-mail: `reijo.kouhia@tut.fi`
Lectures start on week 11, i.e. March 14th and continue to May (8×2 hours)

Motivation and goal: Classical Cauchy's continuum model do not take into account the internal structure of the material. Therefore the predictions of the classical continuum fail near sharp gradients and the wave propagation properties are unrealistic. In addition, the classical continuum cannot predict proper behaviour for strain-softening solids and the size effect.

The goal of the course is to give understanding on the basic features of higher-order continuum theories.

Literature: A.C. Eringen, *Microcontinum field theories, I. Foundations and solids*, Springer-Verlag, 1999. W. Nowacki, *Theory of asymmetric elasticity*, Pergamon-Press, 1986, and selected articles.

Requirements: Weekly exercisises and a larger assignment work. Depending on the assignment work the credits can by varying.

Content

Week 11, 14.3. Introduction and motivation

Week 12 Wave propagation and dispersion analysis

Week 14 Damage model and strain-softening solid, standard continuum and gradient elasticity

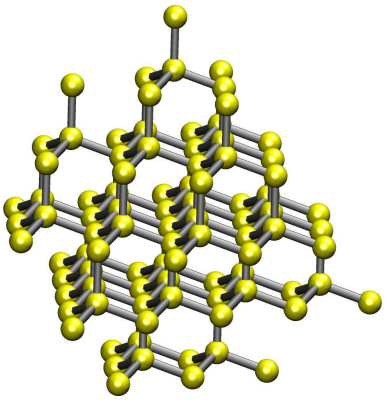
Week 15 Couple-stress theory

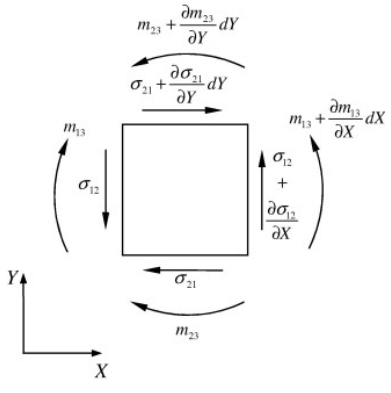
Week 16 Cosserat micropolar media, balance equations

Week 17 Cosserat micropolar media, constitutive equations

Week 18 Introduction to gradient plasticity

Week 19, lecture on Wednesday Some remarks on the numercal solution of higher-order continuum models





Silicon crystal (fig. Arndt, Griebel 2004),