



Geomechanics for energy and the environment: experiments, mechanisms and models;

Visiting Professor: Prof. Tomasz HUECKEL (Duke University - Durham, North Carolina, USA)

Short description of the lecture:

This course is aimed at developments in Geomechanics focused on its applications to the problems involving a variable environment and advances in technologies of energy production from the ground. These two areas: environment and energy, are expected to dominate technological agenda for the forthcoming decades. The reason for that is two-fold: first, there is world-wide crisis of environment endangerment related to the geosphere: soil and groundwater pollution by accidental spills and industrial wasting, CO₂ emission driven reduction of fossil fuel usage and/or inadequate isolation of pollutants; and second, there is a host of new sources of energy related to geosphere. In both cases, there is an emerging new fundamental research concerning the effects of chemical, thermal and biological variables on mechanical properties and mechanical variables of soil and rock materials, and vice versa the effects of mechanical variables as stress, strain, damage affecting chemical and biological, physical or thermal processes and properties that require a multi-disciplinary approach. The levels of these couplings are multiple and often poorly recognized.

The course includes: introduction to geomechanical modeling; thermo-mechanics; chemo-mechanics and physico-mechanics (mainly evaporation) of geomaterials, as well as references to the pertinent technologies. Both theory and experimental/physical base are discussed.

Contents:

- Introduction and Motivation:
- Engineering issues in Environmental Geomechanics and Energy Geomechanics (2 hours)
- Environmental softening or hardening mechanisms in elasto-plasticity of geomaterials (4 lecture hours):

Basic Cam Clay Model, multiple hardening mechanisms, compensatory hardening modes, stress-strain-constitutive laws, multi-scale aspects in environmental mechanics, multi-physics aspects in environmental mechanics.



- Coupled thermo-mechanics of soils (3 lectures hours):
Basic experimental findings of thermo-mechanics of soils, Thermo-plasticity drained thermal deformability of soils, thermal failure in soils, typical large-scale problems in thermo-mechanics.
- Coupled chemo-mechanics of soils (3 lecture hours):
Basic concepts in geo-chemistry, principal problems in chemo-mechanics: osmotic swelling, chemical consolidation, dissolution effects, pressure solution, chemically affected permeability, non-reactive chemo-elasticity and chemo-plasticity, reactive chemo-plasticity.
- Coupled hygro-mechanics of soils (2 lecture hours):
Problems in desiccation of soils and unsaturated soils: drying shrinkage and cracking of dehydrating materials.
- Closure (1 lecture hour)

Terminy wykładów			
Data	Dzień tyg.	Godzina	Sala
2015-06-08	Pn	9.15-12.00	GG 300
2015-06-09	Wt	9.15-12.00	GG 300
2015-06-10	Śr	9.15-12.00	GG 300
2015-06-11	Cz	9.15-12.00	GG 300
2015-06-12	Pt	9.15-12.00	GG 300