ME-630

Selected topics in poromechanics

Lecampion Brice

Cursus	Sem.	Type
Mechanics		Opt.

Language of teaching	English
Credits	2
Session	
Exam	Oral
Workload	60h
Hours	**28**
Courses	28
Number of positions	

Frequency

Every 3 years

Remark

Next time: Fall 2027

Summary

This course presents fundamental and selected topics of the mechanics and physics of fluid-infiltrated porous media with applications to geo-mechanics. Mathematical modeling and the techniques for the solution of the resulting initial boundary value problems will be emphasized (scaling,numerics...).

Content

Fluid infiltrated porous materials are ubiquitous in science and engineering (concrete, rocks, bones etc.). This doctoral course aims at providing 1) a fundamental basis on the mechanics of such fluid-infiltrated materials, and 2) mathematical (notably scaling and dimensional analysis) and numerical tools for the solution of the resulting multi-physics / possibly highly-nonlinear IBVP.

In particular, over the first block of the course, following parts of O. Coussy "Poromechanics" & A. H. D. Cheng "Poro-elasticity", we will cover:
Kinematics, conservation laws, fluid & porous solid constitutive relations, poroelasticity (fundamental solutions, early/late time solutions, numerical solutions), poro-elastoplasticity (with applications to rocks).

In the second block of the class, the focus will be on the growth of localized discontinuities (in the form of fractures & faults) driven by hydro-mechanical loading. It will cover i) introduction to boundary integral equations for quasi-static elasticity, ii) flow in fractures, iii) hydraulic fracture propagation, iv) fluid-driven frictional ruptures.

The examination will consist in a final oral exam.

Learning Prerequisites

Required courses

Continuum mechanics

Learning Outcomes

By the end of the course, the student must be able to:

- Construct theoretical models of poromechanics

Assessment methods

Oral exam

Resources

Moodle Link

- https://go.epfl.ch/ME-630