CIVIL-402

Geomechanics

Koliji Azad, Laloui Lyesse

Cursus	Sem.	Type
Civil Engineering	MA1, MA3	Obl.
Mechanics		Opt.
Mineur STAS Russie	H	Opt.

Language of teaching	English
Credits	3
Session	Winter
Semester	Fall
Exam	Written
Workload	90h
Weeks	14
Hours	**3 weekly**
Courses	2 weekly
Exercises	1 weekly
Number of positions	

Summary

The course aims at providing future civil engineers with the knowledge of geomechanics for professional practice. It addresses, among others, the main stress-strain constitutive models within the context of elasticity and elasto-plasticity and the estimation methods of the lateral earth pressure.

Content

• Engineering applications and challenges

• Basic concepts of continuum mechanics and geomechanics

Stress-strain behaviour of geomaterials in drained and undrained conditions
Laboratory tests with special focus on triaxial testing

• In-situ stress state

• Stress-strain constitutive frameworks

- Elasticity
  Linear and non-linear elasticity
  Applications of elastic models
- Plasticity

Plasticity principle and yield criteria for geomaterials
Critical state concept
Elasto-plastic stress-strain constitutive frameworks (among other Modified Cam Clay model)

• Time dependent behaviour of geomaterials

Real cases and time-dependent phenomena
Viscous deformations: basic concepts and experimental evidences
Visco-elasto plastic models

• Behaviour of unsaturated geomaterials

Basic concepts
Hydraulic and mechanical behaviour
Effective stress definition for unsaturated geomaterials

• Retaining structures in saturated and unsaturated geomaterials

Lateral earth pressure for saturated and unsaturated soils (Rankine's theory)
Shear strength of unsaturated geomaterials
Darcy's law for saturated and unsaturated geomaterials

- Thermo-mechanics and soil dynamics

Mechanical behaviour of soils in non-isothermal conditions
Mechanical behaviour of soils under dynamic loads

- Advanced topics in geomechanics

Energy related applications
Bio-improved soils

Keywords

Mechanical behaviour of geomaterial, Constitutive models, elasto-plasticity, numerical modelling in geomechanics, laboratory and in-situ testing

Learning Prerequisites

Required courses

Soil mechanics and groundwater seepage

Learning Outcomes

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

- Recognize the stress path(s) to which the soil is subjected in the context of the engineering application of interest
- Use methods for evaluating the in-situ stress state
- Recognize the most suitable constitutive model for the problem of interest in relation to the soil and the problem itself
- Judge capabilities and limitations of constitutive models
- Assess / Evaluate Evaluate the geotechnical parameters governing the geomechanical problem
- Choose the correct laboratory or in-situ tests for the determination of the needed parameters
- Interpret the experimental data resulting from a laboratory campaign in order to obtain the parameters of interest
- Assess / Evaluate the lateral earth pressure under different hydraulic conditions
- Use consciously a finite element software for creating a geomechanical model appropriate for the problem of interest

Transversal skills

- Set objectives and design an action plan to reach those objectives.
- Use a work methodology appropriate to the task.
- Communicate effectively with professionals from other disciplines.
- Demonstrate the capacity for critical thinking
- Use both general and domain specific IT resources and tools
- Access and evaluate appropriate sources of information.

Teaching methods

- Ex cathedra and exercices

Assessment methods

Final exam (written) 80% of the final mark
Homework 20% of the final mark

Supervision

Office hours	No
Assistants	Yes
Forum	No

Resources

Bibliography

Lectures notes and handouts given during the course

Prerequisite for

"Le contenu de cette fiche de cours est susceptible d'être modifié en raison du covid-19"