

4-day intensive course

Experimental Geomechanics

Targets

The course is intended for construction professionals, civil and environmental engineers and geologists who wish to acquire basic experimental geotechnical skills and discover more advanced techniques of coupled experiments and microstructural studies.

The course is delivered in English.

Prerequisites

Basic knowledge of mechanics of porous media or soil mechanics.

References

Mécanique des sols et des roches.
Vulliet L., Laloui L., J. Zhao.
Presses Polytechniques
Universitaires Romandes, 624
pages, 2016
ISBN : 978-2-88074-961-3

Certification

A certificate of attendance is issued at the end of the course.

Overview

In the context of geotechnical engineering, the understanding of soil behavior is the basis for an efficient modelling of its response. Experimental geomechanics is currently evolving in response to the new challenges of construction (poor soil quality, increasingly high loads, etc.), environment (climate changes, natural hazards, pollution, etc.) and energy production (energy geostructures, geological storage of waste, carbon dioxide, etc.).

This course aims to present the tools that the engineers can use to investigate the experimental behavior of various soils subjected to multiphysical actions, and to determine and understand the parameters to be used according to the chosen constitutive model.

The laws of behavior of geomaterials (elastoplasticity, viscosity, partial saturation, temperature coupling, etc.) constitute the foundations of advanced geotechnics. They will be addressed in connection with the establishment of experimental programs for the determination of material parameters.

A particular focus will be put on coupled multiphysical problems in saturated and unsaturated conditions, and on the effect of temperature.

Finally, the fundamentals of the techniques for microstructural investigations (imaging) will be presented.

Objectives

- Be able to determine the most suitable experimental investigation for each geomechanical problem
- Understand and evaluate the uncertainties associated with the results of experiments and be aware of potential sources of error in experimental measurements
- Be able to determine, from the tests, the mechanical parameters appropriate to the adopted constituent model
- Learn techniques to study the hydromechanical and thermo-hydromechanical coupling of porous media
- Understand the principles of the most diffuse imaging techniques and their use for porous media investigation

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Experimental Geomechanics

Trainers

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École Polytechnique
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Methods

- Optimal equilibrium between theory and real case examples
- Training based on cutting-edge scientific achievements
- Case studies based on leading international analysis

Format

- Intensive and high density course
- Duration : 4 days
- Attendance: 4 days

Program

PART A - Introduction (Day 1)

- Definition of the objectives and methodology of the course
- Multiphysical loads in geomechanics (thermo-chemo-hydro-mechanical coupling)
- The new challenges of geotechnics: climate changes, exploitation of underground energy resources, soil improvement, CO₂ sequestration

PART B – Soil Mechanics (Day 1)

- Constitutive laws for geomaterials (elasticity, elastoplasticity, hydraulic and thermal coupling)

PART C – Laboratory and field tests (Day 2 & 3)

- *In situ* tests
- Laboratory geotechnical characterization (mechanical testing)
- Permeability of soils, steady state and transitory conditions
- The limitations and the errors in experimental measurements
- Determine the mechanical parameters to adopt in the chosen constitutive model from experimental results.

PART D – Advanced testing techniques (Day 3 & 4)

- Coupled multiphysical problems, in saturated and unsaturated conditions
- Hydraulic, thermal and chemical couplings in laboratory testing
- Microstructural investigations: identification of the dimension and structure of the porosity, fissures and heterogeneity; mineralogical analysis; advanced techniques (SEM, MIP, X-ray nano-tomography, etc.)



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