CONTINUING EDUCATION

4-day intensive course

Numerical analyses in geotechnics

Targets

The course is intended for construction professionals, civil and environmental engineers, and geologists who wish to deepen their skills in the analysis of geotechnical structures using the finite element method.

The course is delivered in English..

Prerequisites

Basic knowledge of numerical analysis of engineering problems. Basic knowledge of continuous media mechanics and soil mechanics.

Participants must bring their own laptop computer (to be used during practical applications).

Certification

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

Overview

Numerical analysis is a fundamental tool in many fields of engineering. In the context of geotechnical engineering, numerical models can be used effectively to support design and analyze the response of the soil and its interaction with structures and infrastructure.

The Finite Element Method (FEM) is the most widespread and reliable numerical technique for geotechnical analysis. The definition, interpretation and validation of FEM geotechnical models require specific approaches to deal with the specificity of this category of problems (e.g. choice of analysis domain, meshing rules, material non-linearities, hydromechanical coupling, soil-structure interaction ...).

The course focuses on the modeling process of geotechnical problems from design to validation. It provides a detailed analysis of the modeling steps with an extensive use of practical examples. During the course, each participant will have the opportunity to implement a series of practical tutorials in an open source FEM code to understand and apply the modeling concepts discussed.

The tutorial sessions will be complemented by the analysis of several complex case studies from international geotechnical projects.

Objectives

- Understand and analyze the ingredients of a coupled finite element analysis in a geotechnical environment
- Be able to implement and validate FEM analyses of coupled hydromechanical problems
- Learn, choose and calibrate the material laws best suited to the problem being analyzed
- Understand and evaluate the uncertainties associated with modeling and become aware of potential sources of error in the simulation process.
- Critically study practical examples of finite element analysis of complex geotechnical problems around the world

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Trainers

Prof. Lyesse Laloui
École Polytechnique Fédérale de Lausanne (EPFL), Switzerland

Dr. Aldo Madaschi
Nesol - Numerical Engineering Solutions, Switzerland

Method

- The course is strongly oriented towards the practical application of finite element analysis (hands-on numerical exercises)
- 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 to Geotechnical FEM Modelling (Day 1)

- The ingredients of a finite element modeling
- The choice of the simulation domain and the discretization process
- Boundary conditions in geomechanics
- Modeling strategies: model definition, pre-processing, calibration, results analysis, validation.

PART B - Hydromechanical Coupling and Constitutive Laws (Day 2)

- Basic principles of hydromechanical coupling
- Coupled problem solving techniques (reminder)
- Behavioral laws for soils: elasto-plasticity and visco-elasto-plasticity
- Calibration of behavioural laws: numerical analysis of experimental data and model adaptation.

PART C - Numerical Computer Exercises (Days 1, 2 & 3)

- Pre-processing: model and mesh definition
- Definition of a 2D static analysis
- Definition of a coupled hydromechanical analysis
- Analysis and discussion of classical geotechnical problems (e.g. 1D and 2D consolidation, road embankment construction, flow under a sheet pile ...)

PART D - Case Study Analysis of Complex Geotechnical Issues (Day 4)

- Analysis of complex analyses from international geotechnical projects
- Discussion of case studies and critical evaluation of modeling approaches

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