Teacher

Salvatore Sessa

Title

Advanced nonlinear analysis of structures using OpenSees (24h, 3 CFU)

Abstract

The course provides advanced elements of nonlinear modeling of civil engineering structures using OpenSees (Open Software for Earthquake Engineering Simulation), an object-oriented open source framework for finite element analysis that has become an important standard in the professional and research communities. The lectures' focus is on nonlinear modelling of RC and masonry walled/shell structures, soils and large-displacement models. Knowledge of nonlinear analysis of frames using OpenSees is required.

The program of the course is:

- Basics of triaxial plasticity: flow rule and consistency condition, Hill and Drucker stability criteria.
- Triaxial constitutive models for soil, concrete and masonry modelling (including elastic-orthotropic, Drucker-Prager, J2).
- Formulation of shell elements and solid elements. Modelling of masonry structures and RC shear walls.
- Modelling of foundation soils and soil-structure interaction.
- Multi-support static and dynamic analysis and relevant algorithms.
- Large-displacements finite element formulations: the corotational approach.
- Large-displacements nonlinear analysis: total potential energy, stable and unstable equilibrium configurations.
- Perturbation strategy and arc-length algorithm.
- Analysis of tensile structures and gridshells.

The course alternates theoretical lectures with modelling workshops. Students are required to contact the teacher in order to get the instructions to install some additional software useful for the course.

Prerequisites

Course of *Nonlinear modeling of RC structures using OpenSees* is strongly recommended.

Mode

Blended

Proposed date

February, 2025

Final exam

Written exam with short text answers on theorical and practical (within OpenSees framework) modeling issues

NB

Every student should have a laptop for practice lessons