COURSE IN SOIL MODELING November 22nd – 29th, 2020

Introduction:

NTNU's Geotechnical Group offers a PhD Course in Soil Modelling from November 22nd to 29th, 2020.

Background:

Finite element based computer codes for geotechnical analyses are frequently used in design by consulting engineers. This course provides a background for development and application of the soil models used in such computer codes. The course focuses on soil behaviour, elasto-plastic theory, selected material models and their parameters. The course aims at providing a general theoretical framework for interpretation of the mechanical behaviour of soils. A short summary of relevant continuum mechanics theory is given in the first lectures followed by a detailed presentation of simple models based on Tresca and Coulomb. The main principles are discussed with emphasis on distortional hardening in combination with dilatancy control. Further, models based on Critical State Soil Mechanics with volumetric and distortional hardening are covered. An introduction to more advanced models is given together with a discussion of current research topics. The course will be composed of intensive lecturing in combination with guided exercises during the week and homework assignments.

Lecturers:


Professor
Steinar Nordal
NTNU

Professor
Gustav Grimstad
NTNU

Target Audience

The course is at postgraduate/PhD level. It is based on a combined mathematical and graphical approach but is designed to give a platform for practical application in geotechnical design. The course does not require any background in finite element methods, but knowledge of conventional soil mechanics is a prerequisite. The course is taught in English.

Exam and ECTS credits

The course is a registered PhD course at NTNU: http://www.ntnu.edu/studies/courses/BA8304 . A written exam is offered in December 2020. Candidates who complete the homework assignments handed out during the course are admitted to the exam. The course with exam gives 10 ECTS credits.

Registration and fees:

The total number of participants for the PhD course is limited. Registrations will be accepted in the order they are received. In order to get access to the exam, participants from outside NTNU must register as students at NTNU and pay an additional semester fee.

Course material

Lecture notes will be available as pdf.

The following textbooks by David Muir Wood are recommended:

- Soil behaviour and critical state soil mechanics. Cambridge University Press 1990.
- Geotechnical modelling. Spon Press 2004.
- Soil mechanics: a one-dimensional introduction. Cambridge University Press 2009.

The following textbook by Guy T. Houlsby and Alexander M. Puzrin is recommended:

- Principles of hyperplasticity: an approach to plasticity theory based on thermodynamic principles. Springer 2006.

Preliminary Schedule

PhD course in Soil Modelling (BA8304)

Mon. 10:00 – 18:00	BASIC CONCEPTS OF STRESS AND STRAIN TENSORS, ELASTICITY AND PLASTICITY Stress invariants and yield criteria. Stress and strain measures. Elasticity. Elasto-plasticity, flow and hardening rules with the Tresca criterion as an example. Exercises at the end of the day.
Tue. 8:15 – 18:00	ELASTO PLASTICITY USING THE COULOMB CRITERION Derivation and discussion of a simple isotropic hardening model for effective stress analysis. Dilatancy and contractancy during distortional hardening controlled by a nonassociated flow rule. Exercises at the end of the day.
Wed. 8:15 – 18:00	MORE ON DISTORTIONAL HARDENING Derivation of the Mohr-Coulomb. Extending to pre-failure nonlinearity and strength varying with density and stress level. Exercises at the end of the day.
Thu. 8:15 – 18:00	MODELS BASED ON VOLUMETRIC HARDENING From adding a cap on the Mohr-Coulomb model to Cam Clay as a fully volumetric hardening model. Adding pre-yield plasticity by kinematic hardening, adding structure and damage. Exercises at the end of the day.
Fri. 8:15 – 16:00	NUMERICAL IMPLEMENTATION Implicit and explicit integration algorithms for soil models. Implementation in PLAXIS, or codes with a similar interface. "Hands on the computer" implementation exercise.

Physical venue:

NTNU – Gløshaugen
Trondheim,
Norway.

Contact and Registration

For questions on course contents please contact Steinar Nordal steinar.nordal@ntnu.no or Gustav Grimstad gustav.grimstad@ntnu.no.
For registration and all practical matters please contact Maren Berg Grimstad +47 73 59 20 18 maren.grimstad@ntnu.no

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