

COURSE IN SOIL MODELING

October 14th to 18th, 2024

Introduction:

NTNU's Geotechnical Group together with Dr. Medicus from University of Innsbruck offers a PhD Course in Soil Modelling from October 14th to 18th, 2024.

Background:

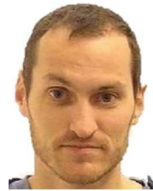
This course provides a background for development and application of the soil models used in continuum-based computer codes for geotechnical applications. The course focuses on soil behaviour, elastoplastic theory, hypo- and hyperplasticity, selected material models and their parameters. It also provides some insight into numerical implementation of soil models. 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. Then the important concept of critical state soil mechanics is reviewed. The course introduces both hypo- and hyperplasticity as frameworks in addition to elastoplasticity. Model calibration is also covered, especially in hypoplasticity. The lecture in hyperplasticity starts with principles of thermodynamics. Further, models based on Critical State Soil Mechanics with

volumetric hardening are covered with a thermodynamic perspective. An introduction to more advanced models, including rate dependency, 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:



Dr.
[Gertraud Medicus](#)
University of
Innsbruck



Professor
[Gustav Grimstad](#)
NTNU



Dr.
[Seyed Ali Ghoreishian Amiri](#)
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. A written exam is offered in December 2024. 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. To get access to the exam, participants from outside NTNU must register as students at NTNU and pay a semester fee. PhD candidates need to document their PhD status by contacting phd@ibm.ntnu.no.

Preliminary Schedule

PhD course in Soil Modelling

Mon. 10:00 – 16:00 BASIC CONCEPTS OF STRESS AND STRAIN TENSORS, ELASTO-PLASTICITY AND CSSM
Stress invariants and yield criteria. Stress and strain measures. Elasticity. Plasticity (yield), flow and hardening rules. Review of the concept of critical state soil mechanics (CSSM). Understanding different yield surfaces and plotting them. Small classroom exercises during the day.

16:00 – 18:00 Exercises at the end of the day.

Tue. 08:15 – 16:00 HYPOPLASTICITY
Introduction to hypoplasticity (sand and clay versions by von Wolffersdorff and Mašín). Connection to CSSM.

16:00 – 18:00 Exercises at the end of the day.

Wed. 08:15 – 12:00 MODEL CALIBRATION
Using calibration tools finding values for model input parameters and getting better understanding of the parameters. With hands on exercises.

12:15 – 16:00 HYPERPLASTICITY
From principles of thermodynamics to hyperplasticity,

Legendre transformations. Small exercises during the afternoon. Derivation of different Mohr-Coulomb variants.

16:00 – 18:00 Exercises at the end of the day.

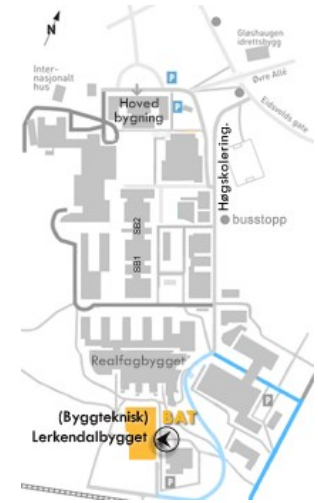
Thu. 08:15 – 16:00 HYPERPLASTICITY
Extending to pre-failure nonlinearity and strength varying with density and stress level. Derivation of different version of the Modified Cam Clay model and adding rate dependency.

16:00 – 18:00 Exercises at the end of the day.

Fri. 08:15 – 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 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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