COURSE IN SOIL MODELING September 3-7, 2012

supplemented with a special session on CREEP MODELING OF SOFT SOILS September 10-11, 2012

Introduction:

NTNU's Geotechnical Division offers a PhD Course in Soil Modeling from September 3 to 7, 2012. The PhD course is supplemented with a special session on creep modeling in soft soils organized by the Industry-Academia Partnerships and Pathways (IAPP) project CREEP.

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 behavior, elasto-plastic theory, selected material models and their parameters. The course aims at providing a general theoretical framework for interpretation of the mechanical behavior 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 and homework assignments.

Lecturers:

Professor **Steinar Nordal**, NTNU

Professor **David Muir Wood**, University of Dundee

Professor **Hans Petter Jostad**, NGI/ NTNU

Professor **Thomas Benz**, NTNU

For the session in Creep Modeling of Soft Soils, additional lecturers have been invited, amongst them:

Professor **Minna Karstunen**, Chalmers University

Professor **Zhen-Yu Yin**, Jiao Tong University

Dr. **Evert den Haan**, DELTARES

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 in Soil Modeling (without creep addition) is a registered PhD course at NTNU: http://www.ntnu.edu/studies/courses/BA8304 . A written exam is offered in December 2012. Only candidates who successfully completed all homework assignments handed out during the course are admitted to the exam. The course is eligible for ECTS recognition with 10 ECTS credits.

The examination may also be held in parallel at other European Universities.

Registration and fees:

The total number of participants for the PhD course and the supplementing session on creep is limited to 35. Registrations will be accepted in the order they are received. Registration fee for the PhD course (September 3 to 7) is NOK 2500 and includes lecture notes. In order to get access to the exam, participants from outside NTNU must also register as students at NTNU and thus need to pay an administrative semester fee in the order of NOK 500,-. Registration for the special session on creep modeling (September 10 and 11) is offered free of charge and is independent of a possible registration for the PhD course.

Course material

Lecture notes will be available. The following text books by David Muir Wood are recommended:

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

NTNU – Trondheim
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Preliminary Schedule

PhD course in Soil Modeling (BA8304)

Mon. 03.09.12, BASIC CONCEPTS OF STRESS AND
10:00 – 18:00 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.

Tue. 04.09.12, ELASTO PLASTICITY WITH THE
8:15 – 18:00 COULOMB CRITERION
Derivation and discussion of a
simple isotropic hardening model
for effective stress analysis.
Dilatancy and contractancy during
shearing. Associated versus
nonassociated flow. Parameter
determination.

Wed. 05.09.12, CRITICAL STATE MODELS
8:15 – 18:00 Volumetric hardening model with
preconsolidation controlling yield.
Cam clay model and derivation of
the Cam clay stiffness matrix. Use
of Cam clay to simulate triaxial
tests. Exercise: A graphical
approach to Cam clay.

Thu. 06.09.12, TOWARDS EXTENDED MODELS
8:15 – 18:00 Extended Mohr-Coulomb model
with distortional hardening.
Extended models in the Cam clay
family, memory and bonding.
Modeling erosion and particle
breakage. Messages for modeling.

Fri. 07.09.12, NUMERICAL IMPLEMENTATION
8:15 – 16:00 Implicit and explicit integration
algorithms for soil models.
Implementation of soil models in
PLAXIS, ABAQUS, or other FE
codes with a similar interface.
Implementation exercise.

Creep Modeling of Soft Soils

Mon. 10.09.12, FROM EXPERIMENTAL CREEP
10:00 – 18:00 OBSERVATIONS TO SIMPLE
MODELS
Experimental observations and 1D
empirical models. Viscoplasticity.
The Soft Soil Creep model (1D and
3D) and its parameters. 1D
spreadsheet implementation of
the Soft Soil Creep model.

Tue. 11.09.12, TOWARDS EXTENDED CREEP
8:15 – 16:00 MODELS
Anisotriopy and destructuration in
creep modeling. Small strain
stiffness in creep modeling. Case
study. Outlook: Creep in other
geomaterials such as frozen soil,
peat and sand: The CREEP project.

Hotels / Accommodation

Special NTNU rates are offered if you register
through marit.skjak-brak@ntnu.no for staying at
the following three hotels:
- Augustin (www.hotel-augustin.no)
- Park (www.choicehotels.no/hotels/hotel?hotel=no092)
- Thon Hotel (www.thonhotels.no/trondheim)
Alternatively, there is a hostel that offers rooms
for about NOK 650,- (www.trondheim-vandrerhjem.no)

Venue:

NTNU – Gløshaugen
Lerkendalbygget,
Room 1-101,
Høgskoleringen 7a,
Trondheim,
Norway.

Contact and Registration

For questions on course contents please contact
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or Professor Thomas Benz thomas.benz@ntnu.no.
For registration, hotel reservation and all practical
matters please contact Marit Skjåk-Bræk
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