Computational Modeling in Geotechnical Engineering
CVEN 5788, Spring 2015
TuTh 8:00-9:15am, ECCR 1B08, ECCE 161

Instructor: Assoc. Prof. Richard Regueiro
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Course Description:
We introduce computational modeling for geotechnical engineering applications, such as nonlinear Finite Element Analysis (FEA) of seepage, coupled soil elastoplastic consolidation, elastoplasticity models for soil and rock, and advanced computational methods for failure in soil and rock. We will use primarily the ABAQUS FEA software program for analysis of geotechnical engineering applications.

Course Objective:
To provide an introduction on nonlinear FEA for geotechnical engineering applications.

Prerequisite:
CVEN 5708 (graduate level soil mechanics), or equivalent.

Recommended:
CVEN4511/5511 (introductory finite element analysis).

Policy on Auditors: There are no CU Boulder student auditors allowed. For visiting scholars, Dr. Regueiro will consider your request on a case-by-case basis. Send an email to richard.regueiro@colorado.edu describing your research at CU-Boulder and why you need to audit this course, and provide the name of your hosting professor. There is no official Teaching Assistant for this course, so we do not have resources to support auditors. There is no guarantee your request will be granted.

Course Grading:
Problem Sets/Computing Assignments  60%
Midterm Exam (in-class)    15%
Final Project (individual)    25%

Problem Sets/Computing Assignments:
You can work together on problem sets and computing assignments but must hand in your own solutions. You are encouraged to try the problems yourself before working with other students. This will enhance your learning experience, and help prepare you for the in-class Midterm Exam, and conducting the Final Project individually.

Final Project:
The final project will involve applying FEA (or other numerical method) to solve a geotechnical engineering problem, case study, or research of interest to you. You must work individually on the final project.


Other books on reserve in the Engineering Library: http://libraries.colorado.edu/search/r?SEARCH=cven+5788
Course Outline (tentative, subject to change, depending on student projects, etc.):

1. Overview of Computational Modeling in Geotechnical Engineering (1 lecture)
   a. Finite difference versus finite element (spatial and temporal discretization)
   b. Boundary element methods
   c. Discrete element methods (particulate mechanics)
   d. Summary of commercial programs and how they are classified/used (GeoStudio, ITASCA, Plaxis, Abaqus)
   e. Review of Abaqus capabilities for Geomechanics
2. Seepage (3 weeks, Chap9)
   a. flow nets and FEA
   b. Determination of phreatic surface in embankment dam seepage
   c. Saturated versus partially saturated flow analysis (time permitting)
3. Stress analysis (2 weeks, Chap3)
   a. FEA for stress analysis: soil weight, point load, line load, surface pressure load

*Final Project Proposal Presentations (1 week, students present individually in class)

4. Consolidation (3 weeks, Chap4)
   a. Review of consolidation theory
   b. Coupled FEA for consolidation
5. Plasticity and Shear Strength of Soils (3 weeks, Chap2, 5, 6, 7, 8)
   a. Usage of soil plasticity in FEA: strength vs deformation, or both
   b. Drucker-Prager Cap Plasticity
   c. Overview of Critical State Soil Mechanics and Cam-Clay Plasticity
6. Soil Dynamics (2 weeks)
   a. Wave propagation in elastic soil, and FEA
   b. Wave propagation in elastoplastic soil, and FEA
7. Final Project Presentations (final exam period, TBD)

Honor Code:
Please refer to the following webpage: http://www.colorado.edu/policies/honor.html

Special considerations:
- If you have a disability and require special accommodations, please provide Dr. Regueiro with a letter from Disability Services outlining your needs. Refer to the webpage http://www.colorado.edu/disabilityservices
- If you have a conflict as a result of religious observances, please notify Dr. Regueiro at least 2 weeks in advance of the exam or assignment due date. http://www.colorado.edu/policies/fac_relig.html

Access to Bechtel Lab: Email the last 7 digits of your BuffOne ID to susan.rundell@colorado.edu, if you do not currently have card swipe access to the Bechtel Lab in ECCE 157, 161.