

CE 560 Advanced Soil Mechanics

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Textbook:

Wood, D.M. (1990). Soil Behaviour and Critical State Soil Mechanics, Cambridge University Press.

Engineers use numerical tools for complex and critical projects involving soils. Constitutive equations are generally used and the characteristic features of stress versus strain must be reflected in these models. These features are usually defined by experimental data. Engineers have to make an intelligent decision for selecting the appropriate constitutive equations and choosing the correct material parameters. Therefore, understanding constitutive models is of great importance.

The main purpose of this course is to learn the essential properties of basic constitutive equations for soils. Only isotropic elasticity and plasticity will be handled. The course will focus on the mathematical theory of plasticity, simple plasticity models together with the numerical implementation of some models. The complex plasticity models will be briefly introduced. They will be covered in another course. The numerical implementation should employ the models through conventional paths from which experimental data can be obtained. Then, constitutive equations can be critically evaluated.

Grading: There are one mid-term examination (30%) and a final examination (40%). 20% of the examination portion will be expunged. The homework assignment is a significant portion of the final grade (50%).

TENTATIVE COURSE OUTLINE:

1. Introduction
2. Review of Basic concepts
 - a. Vectors and Tensors, Direct and Indicial Notation
 - b. Transformation of Bases
 - c. Stress, Strain, and Linear Elasticity
3. Plasticity Models I
 - Elastic and Plastic Strains
 - Elastic-Plastic models for geomaterials
 - Yielding, deviator plasticity: flow rule
 - Hardening: isotropic and/or kinematic hardening, plastic potentials
4. A particular elastic-plastic model: Cam clay
5. Plasticity Models II
 - Mohr-Coulomb, Drucker-Prager, Cap models, Critical state Models, Nested Surface Models, Bounding Surface Models, Invariant models
6. Integration algorithm – return mapping algorithm