Advanced Geotechnical Engineering: Introduction to Computational Mechanics M1586.004200

Seoul National University
2021 Online International Summer Program

Instructor

Jinhyun Choo

Assistant Professor
The University of Hong Kong

Email: jchoo@hku.hk
Website: www.choogroup.org

Class Schedule

Dates: June 28, 2021 – July 30, 2021 (5 weeks)
Time: MWF 3:00 pm – 6:00 pm (Korean Time)
Mode of Teaching: Blended (Real-time online by default; Lecture recordings may be used as a contingency plan)

Course Objectives

The objective of this course is to provide an introductory overview of computational methods for modeling the deformation and failure of solids, with particular attention to inelastic and porous materials. By the end of this course, the students will be able to understand, formulate, implement, and apply standard methods in computational mechanics to analyze solids and structural systems in a variety of engineering applications.

Prerequisite

Familiarity with a programming language (e.g., Python, Matlab) is required to understand lectures and do assignments. Several example programs will be provided as Python Jupyter notebooks, which can be run in your own computers or in Google CoLab. It is recommended that you get familiar with these platforms before the start date. (It is quite easy if you already know any standard programming language).

Course Materials and References

Electronic copies of the lecture materials (slides) will be available online.

References (recommended but not necessary):

- Rudnicki, J.W. (2014) Fundamentals of Continuum Mechanics, Wiley.
- Moin, P. (2010) Fundamentals of Engineering Numerical Analysis, 2nd ed., Cambridge University Press.
- Hughes, T.J.R. (2000) The Finite Element Method: Linear Static and Dynamic Finite Element Analysis, Dover.
- Borja, R.I. (2013) Plasticity Modeling and Computation, Springer.

Evaluation (%)

Attendance	Assignments	Midterm	Final	Additional Evaluation	Attitude	Others (Project)	Sum
0	70	0	0	0	0	30	100

Given that the course is intended for students from diverse backgrounds, the assessment will be based on assignments (including programming) and a project. For the project, students are asked to design, propose, and carry out *their own topic* that relates to computational mechanics. There will be no exam.

Lecture Plan

- Day 1: Introduction to Tensors in Mechanics
- Day 2: Introduction to Continuum Mechanics
- Day 3: Introduction to Temporal Discretization: Generalized Trapezoidal Methods
- Day 4: Introduction to Spatial Discretization: Finite Element Method (1/2)
- Day 5: Introduction to Spatial Discretization: Finite Element Method (2/2)
- Day 6: Introduction to Nonlinear Problems and Newton's Method
- Day 7: 1D Plasticity: Theory
- Day 8: 1D Plasticity: Computation
- Day 9: J2 Plasticity: Theory
- Day 10: J2 Plasticity: Computation
- Day 11: Mohr-Coulomb Plasticity
- Day 12: Cam-Clay Plasticity
- Day 13: Algorithms for General Isotropic Plasticity
- Day 14: Poromechanics: Theory
- Day 15: Poromechanics: Computation