DEPARTMENT OF ENGINEERING

UNIVERSITY OF CAMBRIDGE

# Module 5R7:

# Advanced Numerical Methods in Geomechanics

**Leader**: Professor Kenichi Soga

**Timing:** Lent Term

**Prerequisites:** This graduate module is available to first year research students (PhD or MPhil).

**Structure:** 8 afternoon classes, one per week.

**Mode of Assessment:** Coursework

**AIMS**

This module introduces numerical modelling of geotechnical problems to graduate students. The specific aims are

- To formulate geotechnical problem as a well posed boundary value problem (boundary and initial conditions, free-surface problems)
- To introduce the basics of geotechnical finite element method (drained, undrained and coupled analysis), selective and reduced integration
- To perform finite element analysis of geotechnical structures and critically validate results of the analysis
- To model geotechnical processes (fills, excavation, subsurface flow)
- To introduce various soil models, familiarize with the derivation of model parameters from the element laboratory tests and express constitutive models in tensor form and implement them into a finite element code

**SYLLABUS**

1. Introduction to finite element method
2. Plastic model – Mohr Coulomb model
3. Plastic model – Cam clay model
4. More advanced soil models
5. PLAXIS demonstration
6. Discussion on Coursework 2
7. FEA for geotechnical problems
8. Discussion on the results of Exercise 2

**COURSEWORK**

***Report A: Cam-clay simulations using MATLAB***
***Report B: Modelling of tunnel excavation in clay using PLAXIS***

**OBJECTIVES**

On completion of the module, students should be able to:

- Develop soil models in three dimensional tensorial form
- Perform non-linear finite element analysis of geotechnical problems
- Define appropriate boundary conditions and stress/strain measures
- Assess the results with deformation plots and stress path plots

**ASSESSMENT**

| *Material:* | *Marks* |
|---|---|
| Report A: | 50% |
| Report B: | 50% |