35th ALERT Doctoral School 2024: Numerical methods in geomechanics

Coordinators

Claudio Tamagnini (University of Perugia, Italy)

Lorenzo Sanavia (University of Padua, Italy)

Manuel Pastor (Universidad Politécnica de Madrid, Spain)

Objectives

The main goal of this School is to provide PhD students with a sound knowledge of computational Geomechanics. The School will include lectures on:

(1) Basic: providing the fundamentals of the numerical techniques used

(2) Advanced and research: the students will learn special techniques to deal with non linear problems, dynamics, integration of constitutive equations.

(3) Practical. We believe that practise is fundamental when learning a computational technique. Therefore, we will provide a group of sessions where the students, with the help of instructors, will practise with the finite element code GeHoMadrid.

Contents

(1) Basic

- Introduction to FEM: Elliptic problems. Elasticity (MP)
- Transient problems of parabolic and hyperbolic type (MP)
- Practical aspects of FEM computations (PM)
- Constitutive modelling in plasticity (CT)
- Hydro-mechanical coupling in saturated materials (LS)

(2) Advanced and Research topics

- Hydro-mechanical coupling in unsaturated materials (LS)
- Computational Plasticity (I) (PM)
- Computational Plasticity (II) (CT)
- FEM modelling of non isothermal variably saturated soils (LS)
- Viscoplasticity in soils (CDP)
- Generalized Plasticity for unsaturated soils (DM)
- Introduction to Isogeometric analysis (CT)

(3) Practical sessions (PM, DM, MP)

- Introduction to GeHoMadrid. Pre and Post processing
- Choosing the right element: element technology. Bending and locking
- Introduction to Plasticity: plastification of an homogeneous specimen
- Introduction to localization. Formation of a shear band in a simple 2D specimen
- Footing on a purely cohesive soil layer. Initial conditions. FoS
- Water in soil. 1D consolidation
- Footing on an elastic saturated soil

October 3rd, 2024

Introduction to FEM, constitutive modelling and the numerical code

8:45 -9:00 Introduction to the School
Claudio Tamagnini (University of Perugia, Italy), Lorenzo Sanavia (University of Padua, Italy), Manuel Pastor (Universidad Politécnica de Madrid, Spain)

9:00 – 10:00 Introduction to the Finite Element Method
Manuel Pastor (Universidad Politécnica de Madrid, Spain)

10:00 – 11:00 Theory of Plasticity
Claudio Tamagnini (University of Perugia, Italy)

11:00 – 11:30 COFFEE BREAK

11:30 – 12:30 Time dependent problem:. seepage and dynamics
Manuel Pastor (Universidad Politécnica de Madrid, Spain)

12:30 – 14:00 LUNCH

14:00 - 15:00 Practical aspects of FEM
Pablo Mira (Universidad Politécnica de Madrid and CEDEX, Spain)

PRACTICAL SESSIONS: Pablo Mira, Diego Manzanal, Manolo Pastor (Universidad Politécnica de Madrid, Spain)

15:00 - 15:45 Introduction to GeHoMadrid and GID

15:45 – 16:15 COFFEE BREAK

16:15 - 17:00 FEM technology: bending and locking

17:00 – 18:00 Plasticity I (homogeneous specimen)

18:00 – 19:00 Localization I: plane strain specimen

20:00 DINNER

October 4th, 2024

Mathematical and numerical modelling

9:00 – 10:00 Coupled behaviour (saturated geomaterials)
Lorenzo Sanavia (University of Padua, Italy)

10:00 – 11:00 Computational Plasticity (I)
Pablo Mira (Universidad Politécnica de Madrid and CEDEX, Spain)

11:00 – 11:30 COFFEE BREAK

11:30 – 12:30 Thermo-hydro-mechanical coupling in variably saturated geomaterials
Lorenzo Sanavia (University of Padua, Italy)

12:30 – 14:00 LUNCH

14:00 - 15:00 Viscoplasticity
Claudio Di Prisco (Politecnico di Milano, Italy)

15:00 - 15:45 Computational Plasticity (II)
Claudio Tamagnini (University of Perugia, Italy)

PRACTICAL SESSIONS: Pablo Mira, Diego Manzanal, Manolo Pastor (Universidad Politécnica de Madrid, Spain)

15:45 – 16:15 COFFEE BREAK

16:15 - 17:00 Footing on a cohesive soil

17:00 – 18:00 1D consolidation

18:00 – 19:00 Consolidation under a footing

20:00 DINNER

October 3rd, 2015

Computational modelling

9:00 – 10:00 Modelling of unsaturated soil with Generalized plasticity
Diego Manzanal (Universidad Politécnica de Madrid, Spain)

10:00 – 11:00 FEM modelling of non-isothermal variably saturated soils (quasi-statics and dynamics)
Lorenzo Sanavia (University of Padua, Italy)

11:00 – 11:30 COFFEE BREAK

11:30 – 12:30 Introduction to Isogeometric analysis & Closure of the School
Claudio Tamagnini (University of Perugia, Italy)

12:30 – 14:00 LUNCH