

# ADVANCED NUMERICAL MODELLING IN GEOMECHANICS

Madrid, 02 - 06 June 2014

Programme



## Alert Geomaterials

with the collaboration of

ETSI de Caminos - Universidad Politécnica de Madrid (UPM) and Geotechnical Laboratory of CEDEX

The objective of this course is to provide the students with a sound basis for the study of Computational Geomechanics. The course covers the main aspects of the problem including the mathematical model, the constitutive equations, the numerical model and applications.

Different forms of mathematical model will be considered and applied as the core set of differential equations, based on different hypotheses depending on the problem addressed. This set of equations along with the constitutive equations that represent the mechanical behaviour of geomaterials will be the basis for the numerical model.

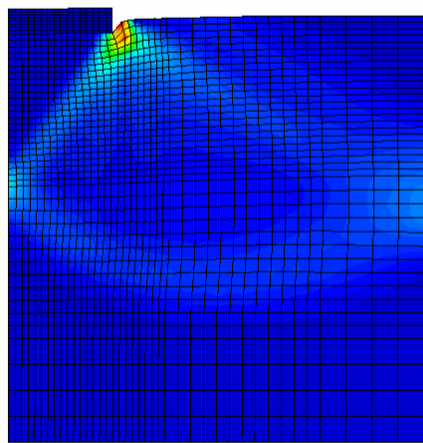
As a result of a numerical discretization procedure applied to the set of differential equations and the constitutive equations the numerical model will be obtained. Three types of model will be presented: the Finite Element Method (FEM), the Smoothed Particle Hydrodynamics (SPH) and the Materials Point Methods, in different versions. Displacement based formulations, coupled formulations, alternative dynamic formulations, landslide formulations based on the shallow water equations, etc.

The model obtained through the combination of the different ingredients will be applied to problems such as failure of footings, chemical degradation of geomaterials, landslide initiation and propagation, marine structure behaviour, etc. Some of these applications shall be described in detail in specific lectures, while others shall be presented and worked on in hands-on practical sessions with the finite element code GeHoMadrid.

<b>Organizers</b>	Manuel Pastor (UPM)	Claudio Tamagnini (Univ. di Perugia)	Pablo Mira (UPM, CEDEX)
<b>Secretary</b>	Diego Manzanal (UPM, CONICET)		

### Lecturers

Manuel Pastor	(UPM)
Claudio Tamagnini	(Univ. di Perugia)
Bernardo Schrefler	(Univ. di Padova)
Claudio di Prisco	(Politecnico di Milano)
Lorenzo Sanavia	(Univ. di Padova)
Pablo Mira	(UPM - CEDEX)
Riccardo Castellanza	(Univ. Milano-Bicocca)
J.A. Fernández Merodo	(UPM - IGM)
Diego Manzanal	(UPM - CONICET)
Miguel Martín Stickle	(UPM)
Pablo Cuéllar	(BAM Berlin)
Paola Dutto	(UPM)



### Monday, June 02<sup>nd</sup>, 2014

- 08:30 – 09:00 h Presentation
- 09:00 – 10:00 h Introduction to FEM
- 10:00 – 11:00 h Time dependent problems. Seepage
- 11:00 – 11:30 h Coffee break
- 11:30 – 12:30 h Computational Plasticity I
- 12:30 – 13:30 h Practical aspects of FEM
- 13:30 – 15:00 h Lunch
- 15:00 – 15:45 h Introduction to GeHoMadrid and GID
- 15:45 – 17:00 h FEM Technology: Bending and locking
- 16:30 – 17:00 h Coffee break
- 17:00 – 18:00 h Plasticity I (homog. specimen)

### Tuesday, June 03<sup>rd</sup>, 2014

- 09:00 – 10:00 h Dynamics: alternative formulations
- 10:00 – 11:00 h Constitutive modelling
- 11:00 – 11:30 h Coffee break
- 11:30 – 12:30 h Coupled behaviour (saturated)
- 12:30 – 13:30 h Chemical degradation
- 13:30 – 15:00 h Lunch
- 15:00 – 15:45 h Localization I: plane strain specimen
- 15:45 – 17:00 h Vertical slope (FoS)
- 16:30 – 17:00 h Coffee break
- 17:00 – 18:00 h Footing on cohesive soil (FoS)

### Wednesday, June 04<sup>th</sup>, 2014

- 09:00 – 10:00 h Hydromechanical coupling in unsat. soils
- 10:00 – 11:00 h Computational Plasticity II
- 11:00 – 11:30 h Coffee break
- 11:30 – 12:30 h Implicit integration of constitutive equations
- 12:30 – 13:30 h Behaviour of marine structures
- 13:30 – 15:00 h Lunch
- 15:00 – 15:45 h 1D Consolidation
- 15:45 – 17:00 h Consolidation under a footing
- 16:30 – 17:00 h Coffee break
- 17:00 – 18:00 h Delay failure of slope

### Thursday, June 05<sup>th</sup>, 2014

- 09:00 – 10:00 h Material Point Models (MPM)
- 10:00 – 11:00 h Generalized Plasticity for unsat. soils
- 11:00 – 11:30 h Coffee break
- 11:30 – 12:30 h FEM modelling of water saturated and unsaturated soils
- 12:30 – 13:30 h Modelling of landslide I
- 13:30 – 15:00 h Lunch
- 15:00 – 15:45 h Modelling of tunnels I
- 15:45 – 17:00 h Modelling of tunnels II
- 16:30 – 17:00 h Coffee break
- 17:00 – 18:00 h Cultural visit

### Friday, June 06<sup>th</sup>, 2014

- 09:00 – 10:00 h SHP Technique
- 10:00 – 11:00 h Landslide propagation
- 11:00 – 11:30 h Coffee break
- 11:30 – 12:30 h Viscoplasticity
- 12:30 – 13:30 h Final lecture: Beyond Geomaterials

### Important dates

- May 02, 2014.....Registration Deadline
- May 09, 2014.....List of accepted participants

### Registration fees

- Non ALERT members.....300 euros
- ALERT members.....Free of charge
- Due to pedagogic reasons, the number of participant is limited to 25

**web:** <http://alertgeomaterials.eu/category/oz-course/>  
**e-mail:** [alertmadridcourse@gmail.com](mailto:alertmadridcourse@gmail.com)

### Location

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