



ALERT Geomaterials

Alliance of Laboratories in Europe for Education, Research and Technology

<http://alertgeomaterials.eu>

34th ALERT Workshop and School

Aussois, 25th September to 30th September 2023

Preliminary Program

(July 2023)



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34th ALERT Workshop Program

Aussois, 25th September 2023

SESSION I: Energy geomechanics

Coordinators: Jean-Michel PEREIRA (ENPC, France), Diego MANZANAL (UPM, Spain), Carlos SANTAMARINA (GeorgiaTech, USA)

8:20 – 8:30 Opening of the 34th ALERT Workshop

Cino VIGGIANI (Université Grenoble-Alpes, France), President of ALERT.

8:30 – 8:40 Opening Session

Diego MANZANAL (UPM, Spain), Jean-Michel PEREIRA (ENPC, France), Carlos SANTAMARINA (GeorgiaTech, USA).

8:40 – 9:15 Invited lecture

Towards a better understanding of gas migration mechanisms in plastic clays

Anne-Catherine DIEUDONNÉ
TU Delft, The Netherlands

9:15 – 9:35 Multiphase flow through granular material under hydro-mechanical loading

Rana AL NEMER, Giulio SCIARRA, Julien RETHORE
Ecole Centrale de Nantes, France

9:35 – 9:55 Phase-field Modelling of Drying Induced Cracks in Initially Water Saturated Porous Media

Chenyi LUO¹, Lorenzo SANAVIA², Laura DE LORENZIS¹
¹ETHZ, Switzerland; ²University of Padua, Italy

9:55 – 10:15 Mechanics and Physics of Meniscus Instability in Drying of Granular Media

R. Y. CHEN¹, F. I. WU¹, B. MIELNICZUK^{1,2}, A. GUEVEL¹, M. VEVEAKIS¹, T. HUECKEL¹
¹Duke University, USA; ²BJM, France

10:15 – 10:45 COFFEE BREAK



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- 10:45 – 11:05** Fracture mechanics-based modeling of three-dimensional fluid-driven frictional ruptures
Mathias LEBIHAIN¹, Alexis SAEZ², Brice LECAMPION²
¹Ecole des Ponts, France ; ²EPFL, Switzerland
- 11:05 – 11:25** A Phase-Field Discrete Element Method to study chemo-mechanical coupling in granular materials in the context of energy geostorage
Alexandre SAC-MORANE¹, Hadrien RATTEZ¹, Manolis VEVEAKIS²
¹UC Louvain, Belgium; ²Duke University, USA
- 11:25 – 11:45** Mechanical behaviour of hollow glass microsphere-lightened cement pastes for CO₂ geological storage
Christian MARTIN^{1,2}, Teresa M PIQUE³, Siavash GHABEZLOO², Jean-Michel PEREIRA², Diego MANZANAL⁴
¹UNPSJB, Argentina; ²Ecole des Ponts ParisTech, France; ³YTEC, Argentina; ⁴UPM, Spain
- 11:45 – 12:05** Geometry and porosity influence mechanics of indentation in soft rocks
Tejas G MURTHY
Indian Institute of Science, Bangalore, India
- 12:05 – 12:30** **DISCUSSION I**
Role of discontinuities; Material characterization and modelling;
What level of complexity?
- 12:30 – 14:00** **LUNCH**
- 14:00 – 14:35** **Invited lecture**
Transforming the underground into a huge electrical plug of renewable energies
Ioannis STEFANOU
Ecole Centrale de Nantes, France
- 14:35 – 14:55** Geomechanical reservoir modelling with Thermodynamics-based Artificial Neural Networks (TANNs)
Farah RABIE, Daniel ARNOLD, Helen LEWIS, Vasily DEMYANOV
Heriot-Watt University, UK
- 14:55 – 15:15** Thermo-poromechanical Coupled Processes in Deep Geothermal Energy Systems
Nicolas ESPINOZA, Matthew MCLEAN
The University of Texas at Austin, USA
- 15:15 – 15:35** Geotechnical gravitational energy storage: Numerical comparison of a near-surface and a deep-surface system
Luis MUGELE, Hans Henning STUTZ
Karlsruhe Institute of Technology, Germany



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- 15:35 – 15:55** Upscaling the yield surface of rocks from digital microstructures to study Underground Hydrogen Storage feasibility
Martin LESUEUR¹, Hadrien RATTEZ², Manolis VEVEAKIS³
¹TU Delft, The Netherlands; ²UC Louvain, Belgium; ³Duke University, USA
- 15:55 – 16:15** Effect of stress anisotropy on chalk influx
M. KATTIS, E. PAPAMICHOS
Aristotle University of Thessaloniki, Greece
- 16:15 – 16:40** **COFFEE BREAK**
- 16:40 – 17:00** **DISCUSSION II**
Scale, scale, scale
- 17:00 – 17:10** **Perspectives and Closure**
- 17:30 – 18:00** **ALERT General Assembly**
- 18:00 – 20:00** **Poster Session (intermediate level) and aperitif**
- 20:00** **DINNER**



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34th ALERT Workshop Program

Aussois, 26th September 2023

SESSION II: Special Session on Extraterrestrial geomechanics

Coordinators: Pierre DELAGE (Ecole des Ponts ParisTech, France), Felipe PRADA (Aarhus University, Denmark)

- 8:30 – 8:35 Session Opening**
Pierre DELAGE (Ecole des Ponts ParisTech, France), Felipe PRADA (Aarhus University, Denmark)
- 8:35 – 9:05** Mars' structure based on seismometer data (from both Marsquakes and meteorite impacts)
Philippe LOGNONNÉ (Institut de Physique du Globe de Paris, France).
- 9:05 – 9:35** Impacts and low gravity, asteroids
Naomi MURDOCH (ISAE Supaero Toulouse, France).
- 9:35 – 10:05** Frozen lunar soils
Pooneh MAGHOUL (Polytechnique Montréal, Canada)
- 10:05 – 10:30 COFFEE BREAK**
- 10:30 – 11:00** Surface properties detected from analysing surface waves at the InSight site
Cédric SCHMELBACH (ETH Zurich, Switzerland)
- 11:00 – 11:30** Seismic waves in frozen regolith
Taïchi KAWAMURA (Institut de Physique du Globe de Paris, France).
- 11:30 – 12:00** Geological characterisation and geomechanical properties of surface soils
Pierre DELAGE (Ecole des Ponts ParisTech, France).



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12:00 – 14:30 LUNCH

15:00 – 17:00 ALERT Board of Directors

17:30 – 18:30 ALERT PhD Prize 2023

18:30 – 19:30 ALERT Special Lecture 2023

How particle-scale simulations can underpin empiricism in soil mechanics

Professor Catherine O'SULLIVAN (Imperial College, UK).

20:00 BANQUET



34th ALERT Workshop Program

Aussois, 27th September 2023

SESSION III: Anisotropy in geomaterials: theory, experiments and modelling

Coordinators: Eleni GEROLYMATOU (TU Clausthal, Germany), Cino VIGGIANI (Université Grenoble-Alpes, France), Angelo AMOROSI (Sapienza University of Rome, Italy)

8:20 – 8:30 Opening Session

Eleni GEROLYMATOU (TU Clausthal, Germany), Cino VIGGIANI (Université Grenoble-Alpes, France), Angelo AMOROSI (Sapienza University of Rome, Italy)

8:30 – 9:10 Keynote lecture

Stress-induced elastic anisotropy in sand: examining the interplay between fabric and contact forces
G. BUSCARNERA

9:10 – 9:35

The link between interparticle friction and stress anisotropy in 1D compression of clay
C. O'SULLIVAN, Y. NAKAMICHI, S. BANDERA, T. MORIMOTO, P. TANGNEY, S. ANGIOLETTI-UBERTI

9:35 – 10:00

Fabric anisotropy of clays: thermodynamics-based modelling from the reversible response up to critical state
F. ROLLO, A. AMOROSI

10:00 – 10:25

On the significance of sand fabric anisotropy on the response of shallow foundations under various loading paths
A. PAPADIMITRIOU, Y. CHALOULOS, Y. DAFALIAS

10:25 – 10:50 COFFEE BREAK

10:50 – 11:15

Inherent anisotropy due to particle shape: An experimental approach using X-ray tomography
G. PINZÓN, G. VIGGIANI, E. ANDÒ, A. TENGATTINI

11:15 – 11:40

Influence of the fine sand content on the initial anisotropy in binary mixtures
S. SCHMIDT, I. HERLE



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- 11:40 – 12:05** Probing anisotropy in natural sensitive clays
A. CASARELLA, G. BIRMPILIS, J. DIJKSTRA, E. ROUBIN, M. KARSTUNEN
- 12:05 – 12:30** Experimental investigation of cracking mechanisms in layered rocks under uniaxial compression: the influence of intragranular and intergranular porosity
C. CASELLE, G. UMILI, D. COSTANZO, L. PELLEGRINO, G. CARNEVALE, F. DELA PIERRE, P. SÉNÉCHAL
- 12:30 – 14:00** **LUNCH**
- 14:00 – 14:40** **Keynote lecture**
Experimental investigation on fabric anisotropy effects on sand and clay response under monotonic and cyclic loading
T. WICHTMANN
- 14:40 – 15:05** Anisotropy in granular geomaterials: hollow cylinder experiments, DEM
M. POURAGHA, G. MEDICUS, P. SELVARAJAH, S. SIVATHAYALAN
- 15:05 – 15:30** Influence of anisotropy in FE modelling of geotechnical problems
M. CUDNY
- 15:30 – 15:55** GPFEM investigation of anisotropic permeability effects on piezocone test interpretation
M. PREVITALI, M. CIANTIA, L. MONFORTE, M. ARROYO
- 15:55 – 16:20** Sand constitutive modelling considering the effect of fabric anisotropy
A. PETALAS
- 16:20 – 16:30** **Perspectives and Closure**
- 20:00** **DINNER**



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34th ALERT Doctoral School

Aussois, 28th September 2023

Machine Learning (ML) in Geomechanics

Coordinators:

Prof. Ioannis Stefanou, EC-Nantes, France

Prof. Félix Darve, Université Grenoble-Alpes, France

DAY 1:

8:30 – 9:00 Introduction to the School
Félix DARVE (Université Grenoble-Alpes, France)

9:00 – 10:00 Overview of Machine Learning
Ioannis STEFANOUE (EC-Nantes, France)

10:00 – 10:30 COFFEE BREAK

10:30 – 12:00 Introduction to regression methods – Theory
Filippo MASI (The University of Sydney, Australia)

12:00 – 13:30 LUNCH

13:30 – 15:00 Hands-on introduction to regression methods
Filippo MASI (The University of Sydney, Australia)

15:00 – 15:30 COFFEE BREAK

15:30 – 16:30 Unsupervised topological learning
Noël JAKSE (Université Grenoble-Alpes, France)

16:30 – 17:45 Introduction to classification methods
Noël JAKSE (Université Grenoble-Alpes, France)

17:45 – 19:00 “Data-Driven” modeling of geomaterials
Konstantinos KARAPIPERIS (ETH Zürich, Switzerland)

20:00 DINNER



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34th ALERT Doctoral School

Aussois, 29th September 2023

Machine Learning (ML) in Geomechanics

Coordinators:

Prof. Ioannis Stefanou, EC-Nantes, France

Prof. Félix Darve, Université Grenoble-Alpes, France

DAY 2:

8:30 – 10:30 Non-Euclidean machine learning for multiscale geomechanics
WaiChing SUN (Columbia University, USA)

10:30 – 11:00 COFFEE BREAK

11:00 – 12:00 Introduction to Artificial Neural Networks
Filippo GATTI (Université Paris-Saclay, France)

12:00 – 13:30 LUNCH

13:30 – 15:30 Hands-on introduction to Artificial Neural Networks Part I
Filippo GATTI (Université Paris-Saclay, France)

15:30 – 16:00 COFFEE BREAK

16:00 – 17:00 Hands-on introduction to Artificial Neural Networks Part II
Filippo GATTI (Université Paris-Saclay, France)

17:00 – 19:00 Hands-on Physics and Thermodynamics based Artificial Neural Networks
Filippo MASI (The University of Sydney, Australia) & Ioannis STEFANO
(EC-Nantes, France)

20:00 DINNER



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34th ALERT Doctoral School

Aussois, 30th September 2023

Machine Learning (ML) in Geomechanics

Coordinators:

Prof. Ioannis Stefanou, EC-Nantes, France

Prof. Félix Darve, Université Grenoble-Alpes, France

DAY 3:

8:30 – 10:00 Introduction to Reinforcement learning
Alexandros STATHAS (EC-Nantes, France), Diego GUTIERREZ-ORIBIO (EC-Nantes, France) & Ioannis STEFANO (EC-Nantes, France)

10:00 – 10:30 **COFFEE BREAK**

10:30 – 12:00 Hands-on Introduction to Reinforcement learning
Diego GUTIERREZ-ORIBIO (EC-Nantes, France), Alexandros STATHAS (EC-Nantes, France) & Ioannis STEFANO (EC-Nantes, France)

12:00 – 12:30 Closure of the school
Felix DARVE (Université Grenoble-Alpes, France) & Ioannis STEFANO (EC-Nantes, France)

12:30 – 14:00 **LUNCH**