ALERT Geomaterials
Alliance of Laboratories in Europe for Education, Research and Technology
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34th ALERT Workshop and School

Aussois, 25th September to 30th September 2023

Preliminary Program

(August 2023)

ALERT Geomaterials
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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 LUO[1], Lorenzo SANAVIA[2], Laura DE LORENZIS[1]
[1]ETHZ, Switzerland; [2]University of Padua, Italy

9:55 – 10:15 Mechanics and Physics of Meniscus Instability in Drying of Granular Media
R. Y. CHEN[1], F. I. WU[1], B. MIELNICZUK[1,2], A. GUEVEL[1], M. VEVEAKIS[1], T. HUECKEL[1]
[1]Duke University, USA; [2]BJM, France

10:15 – 10:45 **COFFEE BREAK**

10:45 – 11:05 Fracture mechanics-based modeling of three-dimensional fluid-driven frictional ruptures
Mathias LEBIHAIN[1], Alexis SAEZ[2], Brice LECAMPION[2]
[1]Ecole des Ponts, France ; [2]EPFL, 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-MORANE[1], Hadrien RATTEZ[1], Manolis VEVEAKIS[2]
[1]UC Louvain, Belgium; [2]Duke 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 PIQUE[3], Siavash GHABEZLOO[2], Jean-Michel PEREIRA[2], Diego MANZANAL[4]
[1]UNPSJB, Argentina; [2]Ecole des Ponts ParisTech, France; [3]YTEC, Argentina; [4]UPM, 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

15:35 – 15:55 Upscaling the yield surface of rocks from digital microstructures to study Underground Hydrogen Storage feasibility
Martin LESUEUR[1], Hadrien RATTEZ[2], Manolis VEVEAKIS[3]
[1]TU Delft, The Netherlands; [2]UC Louvain, Belgium; [3]Duke 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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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	Interacting with asteroid surfaces in very low gravity Naomi MURDOCH (ISAE Supaero Toulouse, France).
9:35 – 10:05	Seismic waves in frozen regolith Taïchi KAWAMURA (Institut de Physique du Globe de Paris, France).
10:05 – 10:30	**COFFEE BREAK**
10:30 – 11:00	Geological characterisation and geomechanical properties of surface soils at the InSight landing site Pierre DELAGE (Ecole des Ponts ParisTech, France).
11:00 – 11:30	Near surface elastic properties derived from seismic observations at the InSight site site Cédric SCHMELBACH (ETH Zurich, Switzerland)
11:30 – 12:00	Thermal properties of the Martian Soil at the InSight landing site Matthias GROTT (DLR - German Aerospace Center, Berlin, Germany)

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

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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 and S. SINGH (Northwestern University)

9:10 – 9:35 The link between interparticle friction and stress anisotropy in 1D compression of clay
C. O'SULLIVAN (Imperial College London), Y. NAKAMICHI (Imperial College London), S. BANDERA (University of Pavia), T. MORIMOTO (University of Tokyo), P. TANGNEY (Imperial College London), S. ANGIOLETTI-UBERTI (Imperial College London)

9:35 – 10:00 Fabric anisotropy of clays: thermodynamics-based modelling from the reversible response up to critical state
F. ROLLO and A. AMOROSI (Sapienza University of Rome)

10:00 – 10:25 On the significance of sand fabric anisotropy on the response of shallow foundations under various loading paths
A. PAPADIMITRIOU (National Technical University of Athens), Y. CHALOULOS (GR8-GEO Engineering Consultants), Y. DAFALIAS (University of California Davis USA, National Technical University of Athens Greece, Institute of Thermomechanics Czech Republic)

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 (Laboratoire MatéIS, INSA Lyon), G. VIGGIANI (Université Grenoble Alpes), E. ANDÒ (École Polytechnique Fédérale de Lausanne), A. TENGATTINI (Université Grenoble Alpes)

11:15 – 11:40 Influence of the fine sand content on the initial anisotropy in binary mixtures
S. SCHMIDT, I. HERLE (Technische Universität Dresden)

11:40 – 12:05 Probing anisotropy in natural sensitive clays
A. CASARELLA (Chalmers University of Technology), G. BIRMPILIS (Chalmers University of Technology), J. DIJKSTRA (Chalmers University of Technology), E. ROUBIN (Université Grenoble Alpes), M. KARSTUNEN (Chalmers University of Technology)

12:05 – 12:30 Experimental investigation of cracking mechanisms in layered rocks under uniaxial compression: the influence of intragranular and intergranular porosity
C. CASELLE (Politecnico di Torino), G. UMILI (Politecnico di Torino), D. COSTANZO (Politecnico di Torino), L. PELLEGRINO (Politecnico di Torino), G. CARNEVALE (Politecnico di Torino), F. DELA PIERRE (Politecnico di Torino), P. SÉNÉCHAL (Université de Pau et des Pays de l'Adour)

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 (Ruhr Universität Bochum)

14:40 – 15:05 Anisotropy in granular geomaterials: hollow cylinder experiments, DEM simulations, and constitutive modelling
M. POURAGHA (Carleton University), G. MEDICUS (University of Innsbruck), P. SELVARAJAH (Carleton University), S. SIVATHAYALAN (Carleton University)

15:05 – 15:30 Influence of anisotropy in FE modelling of geotechnical problems
M. CUDNY (Gdańsk University of Technology)

15:30 – 15:55 GPFEM investigation of anisotropic permeability effects on piezocone test interpretation
M. PREVITALI (University of Dundee), M. CIANTIA (University of Dundee), L. MONFORTE (Universitat Politècnica de Catalunya), M. ARROYO (Universitat Politècnica de Catalunya)

15:55 – 16:20 Sand constitutive modelling considering the effect of fabric anisotropy
A. PETALAS (Durham University)

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 STEFANOU (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 STEFANOU (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 STEFANOU (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 STEFANOU (EC-Nantes, France)
12:00 – 12:30	Closure of the school Felix DARVE (Université Grenoble-Alpes, France) & Ioannis STEFANOU (EC-Nantes, France)
12:30 – 14:00	**LUNCH**