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16th International Conference of the International Association
for Computer Methods and Advances in Geomechanics

16th
IACMAG

TORINO 20~~22~~²³

grenoble · milano

CHALLENGES *and* **INNOVATIONS**
in **GEOMECHANICS**

TORINO • ITALY
30 August • 2 September
2022

CONFERENCE PROGRAMME



16th
IACMAG
TORINO 2022 grenoble · milano

*Welcome to
Torino*

CHALLENGES *and* INNOVATIONS *in* GEOMECHANICS

16th International Conference of the International Association for Computer Methods and Advances in Geomechanics

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► **ENDORSEMENTS**

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► WELCOME MESSAGE

The XVI International Conference on Computer Methods and Advances in Geomechanics is sponsored by IACMAG (International Association of Computer Methods and Advances in Geomechanics) and organised by the Politecnico di Torino, Department of Structural and Geotechnical Engineering.

Three cities in the heart of Europe, Torino, Grenoble and Milano, jointly host the events to symbolise the evergreen need for across borders cooperation.

The general theme of the conference is ‘Challenges and Innovation in Geomechanics’. Never the title was so appropriate! The conference was originally planned to take place in July 2020. The outbreak of the Coronavirus brought a new and unexpected challenge to the whole world and, on our small way, to the Organizing Committee. In light of this development, the conference was postponed, first to May 2021 then substituted by an online warming up event and finally to 2022, thus permitting us to celebrate 50 years since the first IACMAG conference. A rich programme awaits the attendees and we are happy if our effort was able to keep the geomechanics community going, despite all.

With the hope that the challenge that we had to face is over, we wish to welcome all attendees in Torino, the first capital in the history of Italy, where you will have the opportunity to appreciate more about the Italian history, culture, way of life and cuisine.

Marco Barla (*Chair*)

Alice Di Donna (*co-Chair*)

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Alessandra Insana (*General Secretary*)

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Daichao Sheng, *Australia*

Hema J. Siriwardane, *USA*

Kenichi Soga, *USA*

Jean Sulem, *France*

Claudio Tamagnini, *Italy*

Chun'an Tang, *China*

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Hai-Sui Yu, *UK*

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Jidong Zhao, *Hong Kong*

▶ INVITED SPEAKERS

KEYNOTE LECTURES



Chloé Arson • Georgia Institute of Technology, USA
Coupling continuum damage mechanics and discrete fracture models: a geomechanics perspective.

We present numerical methods to simulate the propagation of discrete fractures embedded in a damaged zone. Anisotropic Continuum Damage Mechanics models are implemented in the Finite Element Method (FEM). An arc length control resolution algorithm is used for softening models. Damage and energy thresholds are defined to mark the beginning of crack coalescence. When that threshold is reached, damaged finite elements are replaced by cohesive elements that represent a discrete fracture. We compare the performance of the extended FEM to that of Cohesive Zone Models to simulate mixed mode fracture propagation in geomaterials, fault dynamics and hydraulic fracturing.



Lyesse Laloui • Swiss Federal Institute of Technology, Switzerland
Tailor-made soil properties by bio-geochemical means.

Among the non-conventional soil consolidation techniques, bio-mineralization has been a central focus of research for the past decade. At its core, Microbially Induced Calcium Carbonate Precipitation (MICP) is a multi-physical phenomenon, resulting in a natural CaCO₃ bio-cement, capable of improving the mechanical properties of geomaterials. At the confluence of many disciplines, the technique is also proposed as a solution for a diverse range of geotechnical and geo-environmental applications. In order to better elucidate the fundamental mechanisms governing the process and thereby enabling better predictability and optimization, a holistic understanding of MICP is achieved through multiple levels of study, each with specific focuses and challenges, namely the microscopic, geotechnical laboratory and, field scale applications. A focus will be devoted to the multiphysical modelling of the chemo-bio-mechanical interactions at the constitutive as well as boundary problem levels.



Jean Sulem • Laboratoire Navier, Ecole des Ponts ParisTech, IFSTTAR, CNRS, France
New advances in strain localization analysis: application to seismic faulting and compaction banding.

Strain localization zones in the form of shear bands or compaction bands in geomaterials are observed across scales from sub-millimetric (grain size) to kilometric scale (geological structures). Triggering and evolution of such narrow zones of localized deformation depend on many factors. The mechanical behavior of geomaterials is central for the formation of such zones. However, thermal, pore-pressure

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and chemical effects play a crucial role in shear and compaction banding. Temperature increase and activation of chemical reactions such as mineral dehydration, carbonate decomposition, as well as dissolution/precipitation control the triggering and the evolution of localized deformation zones. Moreover, the inherent heterogeneous microstructure of geomaterials plays a significant role during strain localization. As for faults, compaction bands significantly influence the stress field and fluid transport. Localized compaction in porous rocks dramatically reduces permeability across the compaction zone, providing highly anisotropic channelling of fluid flow in reservoir rocks. Change of permeability and compartmentalizing of fluid flow resulting from the presence deformation bands is thus of major importance in geo-energy systems.



Juan Carlos Santamarina • King Abdullah University of Science and Technology, Saudi Arabia
Energy geoengineering: in need of robust numerical tools.

Geotechnology has a central role to play across the energy field for all kind of energy resources, including fossil fuels, nuclear energy and renewable sources; in this context, properly extended geotechnical concepts gain critical relevance. Challenging problems in the field of energy geoengineering require robust numerical tools to analyze and model the complex coupled processes involved throughout all stages, from planning and design, to reservoir management and long-term monitoring. Examples include localizations (strains and flow), emergent phenomena in coupled processes, repetitive thermo-hydro-mechanical loadings, heterogeneity (including fractured rock masses), and time effects (fluids and matrix). Additional concepts discussed during the presentation address the evolving strategies for knowledge generation in engineering and science, the essential elegance of complementary analytical solutions, the choice of constitutive models, and the development of multi-dimensional databases for the selection of self-consistent model parameters.

ONLINE KEYNOTE LECTURES



Kenichi Soga • University of California, USA
Large deformation modelling of soil-pore fluid coupled problems using the Material Point Methods.

Geological and geotechnical hazards, such as landslides, debris flows, soil erosion and excavation collapses, involve large mass movement of granular solids and fluids as a multi-phase system. Modern numerical methods can simulate large mass movements and there is an opportunity to utilize such methods to evaluate the risks of catastrophic damage if earth movement occurs. The talk will introduce the latest development in the Material Point Method to model the large deformation behavior of fluid saturated soil. Particular attention is made to the way to simulate the coupled soil-pore fluid interaction occurring during large soil deformation.



Ahmed Elgamal • University of California, USA

Nonlinear seismic response of ground-structure systems: developments and challenges.

Current computational platforms allow unprecedented opportunities for conducting seismic soil-structure interaction simulations. In geomechanics, capabilities such as coupled solid–fluid formulations and incremental-plasticity approaches allow for representation of the involved seismic response. Recent research that facilitated such endeavors in terms of response of ground-foundation-structure systems will be presented. Representative numerical results will be shown for a number of large-scale soil-structure systems. Graphical user-interfaces for conducting routine three-dimensional (3D) simulations will be discussed, as an important element in support of wider adoption and practical implementation.

In this context, Performance-Based Earthquake Engineering (PBEE) analysis of bridge-ground systems is highlighted as topical application.



Hannah Wanhuan Zhou • University of Macau, China

Physics-informed machine learning for settlement analysis of immersed tunnels.

In the service period of an immersed tunnel, settlement prediction is crucial for its safety assessment and maintenance. The settlement prediction of an immersed tunnel faces several uncertainties, including the complex stratigraphic conditions, errors of measurement, etc.

In this talk, a physics-informed machine learning method is proposed for the settlement analysis of immersed tunnels. A case study with the designed parameters showed that the proposed method can overcome 20% of noise with only three groups of training data. The Markov Chain Monte Carlo algorithm and Bayesian theory are employed to calculate the credible interval of the prediction. Finally, the method is applied in the settlement prediction of the immersed tunnel of Hong Kong-Zhuhai-Macao Bridge.

MERCER LECTURE



Roland Kerry Rowe • Queen's University, Canada

Geosynthetics for construction on soft foundation soils.

This lecture examines the use of geosynthetics for the construction on soft soils ranging from peat to rate sensitive soft clay and silt. The lecture highlights the value of numerical modelling in conjunction with quality laboratory work and monitoring of field cases. The value of calibrating advanced numerical models against field data is illustrated for a range of soil reinforcement cases, some relative straightforward and some extremely complicated. The models are then used to develop design guidelines and provide new insights regarding the benefits and limitations of soil reinforcement. The lecture concludes by discussion a current challenge for numerical analysis.



Alessandro Tarantino • University of Strathclyde, UK
Clay Micromechanics: state of the art and perspectives.

The macroscopic response of geomaterials is controlled by the processes occurring at the microscale. Understanding these processes is key to interpret experimental data, understand fundamental modes of stress-strain behaviour, inform ‘continuum’ macroscopic constitutive models, and develop quantitative predictive tools based on Discrete Element Method (DEM) approaches. Unlike granular materials, mechanisms at the particle scale controlling macro-mechanical behaviour of clays are still largely ignored. This special lecture reviews the state-of-the art of the experimental and numerical research on clay micromechanics and discusses major research challenges. It gathers the experience gained by a number of research groups affiliated to the International Research Centre for Clay Micromechanics.



Giovanni Grasselli • University of Toronto, Canada
Modelling failure in layered geological formations - FDEM: a micro-mechanical approach that bridges across scales.

The hybrid finite/discrete element model (FDEM) is an innovative numerical technology that combines the advantages of large-strain finite elements with those of the discrete elements, allowing for explicitly modelling the propagation of cracks into heterogeneous brittle materials, as well as the interaction between their different constituent phases and materials. By modelling these physical interactions at the micro-scale, FDEM is able to reproduce the response of excavation in layered and bedded rock at multiple scales as an emergent property of the model. Following an overview of the FDEM basic principles, failure process observed in shale rock will be presented and discussed within the invited lecture.



Helmut F. Schweiger • Graz University of Technology, Austria
Numerical simulation of CPT with the Sand and Clay Model (CASM) including effects of bonding.

The numerical simulation of cone penetration tests (CPT) is still a challenge because large deformations and displacements have to be considered. In this work the Particle Finite Element Method code G-PFEM, which employs an updated Lagrangian description, is utilized. The use of linear elements in combination with a stabilized mixed formulation and frequent remeshing of critical regions ensures computational efficiency. The well known Sand and Clay Model has been extended to account for effects of bonding and the influence of the degree of bonding and the rate of debonding on calculated cone resistance is evaluated for cone penetration in silt.



Patrick Selvadurai • McGill University, Canada

Multi-phasic approaches for estimating THM properties of heterogeneous rocks.

In the geosciences, heterogeneous rocks are perhaps the norm and the estimation of THM properties presents a distinct challenge particularly when the rocks exhibit low permeability.

An example is the Cobourg limestone that is found in southern Ontario, Canada, where the permeabilities can range from 10^{-23} m^2 to 10^{-19} m^2 . Added to the low permeability is the presence of distinct nodular regions of calcite minerals that are separated by calcite-quartzite partings containing a nominal amount of clay. The porosities of the former are lower than the latter and are restricted to nodular regions with sizes that can vary from 25 mm to 75 mm. To preserve the concept of a representative volume element, the dimensions of the samples tested to evaluate the THM properties should be greater than 150 mm. This makes the process of saturation of the sample and permeability testing a challenging task. The estimation of the permeability also requires time-consuming experimentation. The methodology advocated in the research is to take advantage of multi-phasic theories developed by Voigt, Reuss, Hill, Hashin-Shtrikman, Walpole and others for composite materials to estimate the geomechanical properties relevant to THM modelling. As examples, we consider the estimation of the Biot coefficient for the heterogeneous solid by considering the skeletal compressibility of the heterogeneous material through experiments and the solid phase compressibility through a multi-phasic approach. Similarly, the permeability characteristic of the heterogeneous Cobourg limestone first focuses on the estimation of the phasic permeabilities of the dominant species. The effective estimates for the permeability of the heterogeneous rock are compared with estimates derived from the Wiener bounds and the Hashin-Shtrikman bounds for transport properties.

HOST LECTURE



Marco Barla • Politecnico di Torino, Italy

The tale of two tunnels.

Time dependent behaviour of geomaterials may pose intriguing challenges to tunnels.

Careful numerical modelling considering viscous constitutive behaviour, calibrated on time dependent laboratory testing and monitoring data, may allow to manage the threat and predict future behaviour. Two peculiar examples from the Appennines are discussed where the tunnel lining was affected by time dependent deformation of the claylike materials. The slow deformation rate of a DSGSD, interacting with the tunnels through a shear zone of Palombini shale is stressing the lining of the Sparvo twin tunnel. The talk will illustrate the activities undertaken to keep the tunnel open, assuring safety to the users. The second example will describe the design of repair works to be undertaken to demolish and rebuild the concrete lining of the close-by Monte Mario motorway tunnel, heavily affected by clay swelling deformation.

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▶ PROGRAMME AT A GLANCE

MONDAY • 29 th AUGUST		
	Torino	Grenoble
14:00		Short course MULTISCALE NUMERICAL MODELLING OF GEOMATERIALS
14:30	ELGIP Climate Change Adaptation Working Group Meeting <i>(for Elgip members only)</i>	
17:45		
18:30		
19:00		<i>Social dinner (for Short Course participants only)</i>

TUESDAY • 30 th AUGUST			
	Torino	Grenoble	Milano
8:30			Short course MULTI-PHYSICS PROCESSES IN GEOMECHANICS BY COUPLED NUMERICAL ANALYSIS
8:45			
9:00	ELGIP Climate Change Adaptation Working Group Meeting <i>(for Elgip members only)</i>	Short course MULTISCALE NUMERICAL MODELLING OF GEOMATERIALS	
13:00			
14:30	Short course ENERGY TUNNELS FOR A SELF-SUSTAINABLE METRO		
14:45			
16:30			
16:45			
18:45			
Torino • Castello del Valentino			
19:00 21:00	Welcome reception		

WEDNESDAY • 31 st AUGUST					
<i>Politecnico di Torino - Main Building</i>					
8:30	Onsite registration				
Aula Magna					
9:00	Opening Ceremony <i>Marco Barla (Chair) • John Carter (President)</i> <i>Giuseppe Ferro (President of DISEG and President of Ordine Ingegneri Torino)</i>				
9:45	Keynote Lecture Coupling continuum damage mechanics and discrete fracture models: a geomechanics perspective. <i>Chloé Arson, USA</i>				
10:30	<i>Coffee break</i>				
11:00	Host Lecture The tale of two tunnels. <i>Marco Barla, Italy</i>				
11:45	Keynote Lecture Tailor-made soil properties by bio-geochemical means. <i>Lyesse Laloui, Switzerland</i>				
12:30	<i>Lunch time</i>				
<i>Cittadella Politecnica - Corte Interrata - Rooms I • Parallel Sessions</i>					
	Room 1	Room 3	Room 7	Room 8	Room 10
13:45	<u>Section 1</u> Methods and tools Constitutive modelling. <i>(part 1)</i>	<u>Mini Symposium</u> Quantification and reduction of uncertainty in geomechanical numerical models. <i>(part 1)</i>	<u>Section 1</u> Methods and tools Laboratory testing, field testing and monitoring.	IACMAG Board Meeting	<u>Section 2</u> Applications in geotechnical engineering Natural Slopes.
16:00	<i>Coffee break</i>				
16:30	<u>Section 3</u> Environmental geotechnics Waste disposal, soil atmosphere interaction and ice mechanics.	<u>Mini Symposium</u> Quantification and reduction of uncertainty in geomechanical numerical models. <i>(part 2)</i>	<u>Mini Symposium</u> Complex formations with a block-in-matrix fabric and field testing.	<u>Section 1</u> Methods and tools Reliability and risk analysis.	IJOG Board Meeting
18:00 18:45	Room 1 • Innovation Hub and Cocktail				

CHALLENGES and INNOVATIONS in GEOMECHANICS

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THURSDAY - 1 st SEPTEMBER					
Politecnico di Torino - Main Building					
Aula Magna					
Online Keynote Lectures					
9:00	Large deformation modelling of soil-pore fluid coupled problems using the Material Point Method. <i>Kenichi Soga, USA</i>				
9:30	Nonlinear seismic response of ground-structure systems: developments and challenges. <i>Ahmed Elgamal, USA</i>				
10:00	Physics-informed machine learning for settlement analysis of immersed tunnels. <i>Hannah Wanhuan Zhou, China</i>				
10:30	Coffee break				
11:00	<p>Keynote Lecture</p> <p>New advances in strain localization analysis: application to seismic faulting and compaction banding. <i>Jean Sulem, France</i></p>				
11:45	<p>Keynote Lecture</p> <p>Energy geoengineering: in need of robust numerical tools. <i>Carlos Santamarina, Saudi Arabia</i></p>				
12:30	Lunch time	Next IACMAG Selection Committee Meeting			
Cittadella Politecnica - Corte Interrata - Rooms I - Parallel Sessions					
	Room 1	Room 3	Room 7	Room 8	Room 10
13:45	<p>Section 3 Environmental geotechnics</p> <p>Ground improvements, reinforcement, geosynthetics. (part 1)</p>	<p>Section 2 Applications in geotechnical engineering</p> <p>Surface and near surface structures: excavations, foundations, tunnels. (part 1)</p>	<p>Section 4 Geomechanics for energy</p> <p>Energy geostructures.</p>	<p>Section 2 Applications in geotechnical engineering</p> <p>Deep structures: tunnels, caverns, mines.</p>	<p>Section 1 Methods and tools</p> <p>Constitutive modelling. (part 2)</p>
16:00	Coffee break				
16:30 18:45	<p>Section 3 Environmental geotechnics</p> <p>Ground improvements, reinforcement, geosynthetics. (part 2)</p>	<p>Section 2 Applications in geotechnical engineering</p> <p>Surface and near surface structures: excavations, foundations, tunnels. (part 2)</p>	<p>Section 4 Geomechanics for energy</p> <p>Underground storage and geothermal energy.</p>	<p>Mini Symposium Building and infrastructure response to ground movement.</p>	<p>Section 4 Geomechanics for energy</p> <p>Gas, petroleum and offshore engineering.</p>
19:30	Banquet and Awards Ceremony				

FRIDAY - 2nd SEPTEMBER

Cittadella Politecnica - Corte Interrata - Rooms I - Parallel Sessions

	Room 1	Room 3	Room 7	Room 8	Room 10
9:00	<p>Mini Symposium Advanced constitutive modelling of soils in practical applications. (part 1)</p>	<p>Mini Symposium Material point method in computational geomechanics.</p>	<p>Section 2 Applications in geotechnical engineering Earthquake and dynamics. (part 1)</p>	<p>Mini Symposium Large strain problems in geomechanics.</p>	<p>Section 1 Methods and tools Coupled and multiphase modelling. (part 1)</p>
10:30	<i>Coffee break</i>				
11:00	<p>Mini Symposium Advanced constitutive modelling of soils in practical applications. (part 2)</p>	<p>Section 2 Applications in geotechnical engineering Dams and earthstructures.</p>	<p>Section 2 Applications in geotechnical engineering Earthquake and dynamics. (part 2)</p>	<p>Section 1 Methods and tools Constitutive modelling. (part 3)</p>	<p>Section 1 Methods and tools Coupled and multiphase modelling. (part 2)</p>
12:30	<i>Lunch time</i>				
Politecnico di Torino - Main Building					
Aula Magna					
13:45	<p>Mercer Lecture Geosynthetics for construction on soft foundation soils. <i>Ronald Kerry Rowe, Canada</i></p>				
14:30	<p>Special Lecture Clay micromechanics: state of the art and perspectives. <i>Alessandro Tarantino, UK</i></p>				
15:00	<p>Special Lecture Modelling failure in layered geological formations - FDEM: a micro-mechanical approach that bridges across scales. <i>Giovanni Grasselli, Canada</i></p>				
15:30	<p>ePIC (PROMISING INVESTIGATOR CONTEST)</p>				
16:00	<i>Coffee break</i>				

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FRIDAY - 2 nd SEPTEMBER	
Politecnico di Torino - Main Building	
Aula Magna	
16:30	<u>Special Lecture</u> Numerical simulation of CPT with the Clay and Sand Model (CASM) including effects of bonding. <i>Helmut Schweiger, Austria</i>
17:00	<u>Special Lecture</u> Multi-phasic approaches for estimating THM properties of heterogeneous rocks. <i>Patrick Selvadurai, Canada</i>
17:30 18:00	Closing ceremony

SATURDAY - 3 rd SEPTEMBER	
Torino	
8:30 14:00	Technical visits

► **SCIENTIFIC PROGRAMME**

WEDNESDAY • AUGUST 31, 2022

Politecnico di Torino Main Building

08:30 Onsite registration

Aula Magna

09:00 **Opening Ceremony**

Marco Barla (Chair) • John Carter (President)

Giuseppe Ferro (President of DISEG and President of Ordine Ingegneri Torino)

09:45 **Keynote lecture** • Chair: John Carter - Australia

Coupling continuum damage mechanics and discrete fracture models: a geomechanics perspective.

Chloé Arson - USA

10:30 *Coffee break*

11:00 **Host lecture** • Chair: Georgios Anagnostou - Switzerland

The tale of two tunnels. *Marco Barla - Italy*

11:45 **Keynote lecture** • Chair: Donatella Sterpi - Italy

Tailor-made soil properties by bio-geochemical means. *Lyesse Laloui - Switzerland*

12:30 *Lunch (Corte Interrata courtyard)*

Cittadella Politecnica - Corte Interrata, Rooms I

Parallel Sessions

Room 1

Section 1 • METHODS AND TOOLS

13:45 **Constitutive modelling (part 1)** • Chairs: G. Della Vecchia, Italy - M. Tafili, Germany

Constitutive behaviour of brittle layered rocks using a 3D anisotropic Hoek & Brown model.

F. Marinelli, N. Zalamea, G. Cammarata, S. Brasile - France

The strength reduction method in clay hypoplasticity. *T. Kadlicek, D. Mašín - Czech Republic*

An anisotropic clay plasticity model for the cyclic resistance. *F. Palmieri, M. Taiebat, Y. F. Dafalias - Canada*

Effect of claystone small-scale characteristics on the variability of micromechanical response and on microcracking modelling. *B. Pardoen, P. Bésuelle, S. Dal Pont, P. Cosenza, J. Desrues - France*

On the influence of multiple episodes of cyclic loading and reconsolidation on the behavior of monopiles embedded in fine-grained soils. *J. Duque, M. Ochmański, D. Mašín - Czech Republic*

Assessment of stress paths around large-diameter loaded piles under lateral cyclic loading. *X. Cheng, A. Diambra, E. Ibraim - UK*

Limitations of classic constitutive soil models and their suitability to represent tailings behaviour. *A. Halliday, C. Vulpe, A. Fourie, A. Arenas - Australia*

A new sand constitutive model for pre- and post-liquefaction stages. *M. Yang, M. Taiebat, Y. F. Dafalias - Canada*

16:00 *Coffee break*

Section 3 • ENVIRONMENTAL GEOTECHNICS

16:30 **Waste disposal, soil atmosphere interaction and ice mechanics**

Chairs: N. Guarena, M. Manassero - Italy

An integrated system to monitor soil-atmosphere interaction. *B. De Carvalho, B. Lopes, R. Dainese, A. Tarantino - UK*

Relevance of chemico-osmotic and electro-osmotic phenomena in bentonite-based barriers. *N. Guarena, A. Dominijanni, M. Manassero - Italy*

Numerical modelling of the assembly of big bags to optimize landfill disposal. *A. Insana, M. Barla, A. Minardi, C. Stimamiglio, G. Stevan, M. Manassero - Italy*

Analysis of the mechanical behavior of the Laurichard rock glacier (French Alps) in the recent climatic changes. *S. Melki, D. Daudon, X. Bodin, E. Thibert - France*

Numerical modelling of water-vapor migration and phase transformation in unsaturated freezing soils. *F. Shan, J. Teng, X. Yan, S. Zhang, D. Sheng - China*

On the role of soil properties and initial conditions in the response of river levees to flood events. *C. Rossignoli, M. Caruso, D. Sterpi - Italy*

Room 3

MINI SYMPOSIUM

13:45 **Quantification and reduction on uncertainty in geomechanical models (part 1)**

Chairs: M. Ferronato, L. Gazzola - Italy

Integration of data assimilation techniques in geomechanical modelling: ensemble smoother with multiple data assimilation analysis. L. Gazzola, M. Ferronato, M. Frigo, P. Teatini, C. Zoccarato - Italy

A surrogate model for fast land subsidence prediction and uncertainty quantification. C. Zoccarato, M. Ferronato, P. Teatini - Italy

Bayesian uncertainty quantification for geomechanical models at micro and macro scales. H. Cheng, V. Magnanimo, T. Shuku, S. Luding, T. Weinhart - The Netherlands

Prediction of frictional jacking forces using Bayesian inference. S. Chian Jong, D. Ek Leong Ong, E. Oh, C. Siung Choo - Australia (video recorded)

Efficient implementation of the Bayesian inversion by MCMC with acceleration of posterior sampling using surrogate models. S. Domesová, M. Béréš, R. Blaheta - Czech Republic (video recorded)

Geogenic arsenic release by iron-oxides reductive dissolution in aquifer systems. G. Ceriotti, A. Guadagnini - Italy

16:00 *Coffee break*

MINI SYMPOSIUM

16:30 **Quantification and reduction on uncertainty in geomechanical models (part 2)**

Chairs: M. Ferronato, L. Gazzola - Italy

A step towards quantifying the uncertainty of the soil mechanical response through the use of genetic algorithms. X. Zhao, J. Schorr, A. A.A. Peña Olarte, R. Cudmani - Germany

Options for the implementations of data assimilation for geotechnics. M. Mohsan, P. J. Vardon, F. C. Vossepoel - The Netherlands

Water retention curves of clayey soils by artificial neural networks. X. Ding, A. El-Zein - Australia

Estimation of soil water retention curves by inversion of the Richards equation: a comparison of nature-inspired and gradient algorithms. M. Hanna, A. El-Zein - Australia

Room 7

Section 1 • METHODS AND TOOLS

13:45 **Laboratory testing, field testing and monitoring** • Chairs: *M. Barbero, Italy - C. Sandor, Hungary*

Monitoring of dry granular flows in unsteady state down an inclined chute. *F. Zarattini, A. Pol, F. Gabrieli - Italy*

Evaluating the potentiality of x-ray tomography on the quality assessment of grouted soils.
A. Fraccica, G. Spagnoli, E. Romero, M. Arroyo - Spain

Can LS-DEM be used to simulate cyclic behavior of sand?
H. P. Jostad, H. D. V. Khoa, K. Karapiperi, J. Andrade - Norway

Multi-scale study of grain crushing in granular soils. *G. Guida, F. Casini - Italy*

Effects of contamination and dry density on dielectric properties of soils with different specific surface area. *H. Yu, A. Orangi, F. Lin, G. A. Narsilio - Australia*

Particle segmentation of 3D silt images from X-ray μ -CT for fabric analysis.
A. Valverde Shancho, D. Wijewickreme - Canada

Evaluation of strain recovery and stress sensitivity of asphalt binders containing warm-mix asphalt additive and anti-stripping agent. *S. Rani, R. Ghabchi, M. Zaman, S. Ashik Ali - USA*

16:00 *Coffee break*

MINI SYMPOSIUM

16:30 **Complex formations with a block-in-matrix fabric and field testing**

Chairs: M. Barbero, M. L. Napoli, C. Scavia - Italy

Modelling of bimrock/bimsoil structures by means of circular particles packed in R2.
A. Ariza-Triana, E. A. Montoya-Araque, L. O. Suarez-Burgoa - Colombia

3D slope stability analyses of a complex formation with a block-in-matrix fabric. *M. L. Napoli - Italy*

From ground investigation to the geotechnical model in structurally complex formations.
P. Ruggeri, V. M. E. Fruzzetti, G. Scarpelli - Italy

An empirical method for predicting the strength of bim materials using modifications of Lindquist's and Leps' approaches. *H. Sonmez, E. Medley, A. Kalender, G. Dagdelenler, N. Tunar Ozcan, M. Ercanoglu - Turkey*

Improved limit equilibrium methods for evaluating the shear strength of bimrocks during bintests.
H. Zhang, D. Boldini - Italy

Room 8

13:45 **IACMAG Board Meeting**

16:00 *Coffee break*

Section 1 • METHODS AND TOOLS

16:30 **Reliability and risk analysis** • Chairs: *M. Castelli, A. M. Ferrero - Italy*

A numerical study on controlling parameters for runout distance of landslides.
M. Lu, B. N. Xiong, M. Zhou, J. Zhang - China

Bayesian analysis, multilinear regression and modern machine learning algorithms applied for soil probabilistic characterization. *F. Peruzzo - Italy*

Reliability-based partial factors considering spatial variability of strength parameters.
D. Varkey, M. A. Hicks, A. P. van den Eijnden - The Netherlands

Reliability assessment for internal stability design of MSE walls. *R. J. Bathurst - Canada*

Liquefaction assessment and soil spatial variation.
J. L. González Acosta, A. P. van den Eijnden, M. A. Hicks - The Netherlands

Reliability analysis of earth slopes using direct coupling.
A. T. Siacara, G. F. Napa-García, A. T. Beck, M. M. Futai - Brazil (video recorded)

Influence of heterogeneity on the elastic contact problems in geotechnical engineering.
K. Liu, W. Yuan, Y. Wang - China (video recorded)

Room 10

Section 2 • APPLICATIONS IN GEOTECHNICAL ENGINEERING

13:45 **Natural Slopes** • Chairs: *F. Antolini, M. Pirulli - Italy*

Rockfall hazard analysis at small scale: a numerical study for the estimation of representative slope parameters. *M. Castelli, G. Torsello, G. Vallero - Italy*

CHALLENGES *and* INNOVATIONS *in* GEOMECHANICS

16th International Conference of the International Association for Computer Methods and Advances in Geomechanics

WEDNESDAY • AUGUST 31, 2022

A rigorous variant of the shear strength reduction method and its usage in slope stability.
S. Sysala, E. Hrubešová, Z. Michalec, F. Tschuchnigg - Czech Republic

Climate change effects on slope stability. *M. Oggero, A. Insana, M. Barla - Italy*

The significance of entrainment on debris flow modelling: the case of Hunnedalen, Norway.
H. Vicari, S. Nordal, V. Thakur - Norway

16:00 *Coffee break*

16:30 **IJOG Board Meeting**

Room 1

Innovation Hub and Cocktail • Moderator: *Alice Rosiello - Italy*

18:00 Welcome and introduction to the Innovation Hub.
Alice Rosiello, Tech Transfer, Politecnico di Torino - Marco Barla, DISEG, Politecnico di Torino

18:10 ENERTUN • The novel energy segmental lining for TBM tunnels.
Alessandra Insana, Politecnico di Torino

18:15 DIGITAL PROJECT • Horizon construction.
Paolo Fantini, Systra SWS SpA

18:20 GEOTHERMSKIN • A very shallow energy wall to decarbonize the thermal demands of buildings.
Maria Romana Alvi, Politecnico di Torino

18:25 OPTIALP • A new frontier of optical fiber sensing for landslide/avalanche risk mitigation.
Giuseppe Rizzelli Martella, Politecnico di Torino, Geosolving Srl

18:30 GEOSOLVING • Solutions for geo-engineering.
Francesco Antolini, Geosolving Srl

18:35 HARPACEAS in the geotechnical world.
Samuele Perni, Harpaceas Srl

18:40 TUNNELEYE • Innovative systems for mobile inspection and tunnel maintenance.
Melissa Dahanayaka, Pizzi Terra S.r.l.

THURSDAY • SEPTEMBER 1, 2022

Politecnico di Torino Main Building

Aula Magna

Online keynote lectures • Chair: *Gioacchino Viggiani - France*

09:00 **Large deformation modelling of soil- pore fluid coupled problems using the Material Point Method.**
Kenichi Soga - USA

09:30 **Nonlinear seismic response of ground-structure systems: developments and challenges.**
Ahmed Elgamal - USA

10:00 **Physics-informed machine learning for settlement analysis of immersed tunnels.**
Hannah Wanhuan Zhou - China

10:30 *Coffee break*

11:00 **Keynote lecture** • Chair: *Helmut Schweiger - Austria*
New advances in strain localization analysis: application to seismic faulting and compaction banding.
Jean Sulem - France

11:45 **Keynote lecture** • Chair: *Marcelo Sanchez - USA*
Energy geoen지니어ing: in need of robust numerical tools. *Carlos Santamarina - Saudi Arabia*

12:30 *Lunch (Corte Interrata courtyard)*

12:30 **Next IACMAG Selection Committee Meeting**

Cittadella Politecnica - Corte Interrata, Rooms I

Parallel Sessions

Room 1

Section 3 • ENVIRONMENTAL GEOTECHNICS

13:45 **Ground improvements, reinforcement, geosynthetics (part 1)**
Chairs: R. Bathurst, Canada - D. Cazzuffi, Italy

CHALLENGES *and* INNOVATIONS in GEOMECHANICS

16th International Conference of the International Association for Computer Methods and Advances in Geomechanics

THURSDAY - SEPTEMBER 1, 2022

Finite element analysis of soil arching in piled embankment.

N. Kumar Meena, S. Nimbalkar, B. Fatahi - Australia

Comparative study on the coefficient of radial consolidation determined from various methods.

S. Prabavathy, K. Rajagopal, K. Pitchumani - India

Soil nail wall design practice in USA. *S. Shu - USA*

Numerical analysis of the mechanical response of anchored wire meshes.

K. Boschi, C. di Prisco, L. Flessati, N. Mazzon - Italy

Free field ground vibration due to ground improvement induced vibration.

P. Chakraborty, A. Das - India (video recorded)

Construction of a geosynthetic-reinforced soil bridge abutment in Slovenia.

P. Jelušič, B. Žlender - Slovenia

Prediction of extra confinement offered by cellular inclusion under three-dimensional stress stat.

P. Punetha, S. Nimbalkare - Australia

16:00 *Coffee break*

Section 3 • ENVIRONMENTAL GEOTECHNICS

16:30 **Ground improvements, reinforcement, geosynthetics (part 2)**

Chairs: R. Bathurst, Canada - D. Cazzuffi, Italy

Effects of carbonate distribution inhomogeneity on the improvement level of bio-cemented sands: a DEM study.

A. Zhang, A. C. Dieudonné - The Netherlands

Shear strength and excess pore water pressure response of fiber-reinforced class F fly ash.

S. Teli, A. Sachan - India

Numerical validation of strains in geogrids embedded in bridge abutments.

P. Jelušič, B. Žlender - Slovenia

A displacement based study on Seismic coefficient (k_h) for stiffer Wrap-faced GRS Wall system.

A. Ray, B. Harsha, T. Srusti, A. Prashant - India

Performance improvement of ballasted railway tracks for high-speed rail operations.

P. Punetha, S. Nimbalkar - Australia

DEM modelling of a plate bearing capacity test on a mesh-soil system. *A. Pol, F. Gabrieli - Italy*

Comparative grouting tests with two micro-cement types. *D. Grassi, R. Castellanza, G. Spagnoli - Italy*

Unravelling the effect of medium's structural heterogeneity on microbially induced calcite precipitation: an image processing algorithm for time-lapse imaging experiments in meter-long microfluidics.

A. Elmaloglou, D. Terzis, P. De Anna, L. Laloui - Switzerland

Modelling the development of settlements of earth embankments on piled foundations.

V. Mangraviti, L. Flessati, C. di Prisco - Italy

Room 3

Section 2 • APPLICATIONS IN GEOTECHNICAL ENGINEERING

13:45 **Surface and near surface structures: excavations, foundations, tunnels (part 1)**

Chairs: D. Boldini, Italy - I. Moore, Canada

A procedure for 3D modelling of very large geotechnical structures: open cast coal mine case.

J. Jerman, M. El Sayed, D. Mašín, T. Kadlíček - Czech Republic

Assessment of tunnel stability: safety factors and numerical techniques. *C. Callari - Italy*

Evaluation of wind turbine-foundation degradation.

R. K. Gondle, P. U. Kurup, C. Niezrecki - USA (video recorded)

Numerical analysis of mechanical characteristics of joint structure of steel pipe sheet pile foundation.

Y. Miyazaki, Y. Sawamura, S. Kusaba, M. Kimura, T. Nishihara, T. Kosaka, M. Hattori,

K. Maekawa - Japan (video recorded)

Evaluation of damaged zone during cross-passage excavation by means of CPT test result analysis.

G. Quaglio, F. Peruzzo, M. Merlo, P. Grasso - Italy

On the use of embedded beam formulations for the numerical analysis of deep foundations.

A. N. Granitzer, F. Tschuchnigg - Austria

16:00 *Coffee break*

Section 2 • APPLICATIONS IN GEOTECHNICAL ENGINEERING

16:30 **Surface and near surface structures: excavations, foundations, tunnels (part 2)**

Chairs: A. Insana, Italy - B. Martínez-Bacas, Spain

Numerical investigation of failure mechanism during pullout of root inspired anchorages.

I. Vego, F. Ceccato, P. Simonini, J. D. Frost, S. D. Mallett, S. Cola - Italy

Influence of load inclination on bearing capacity of footing resting on slope.

A. A. Saurkar, A. Kumar, B. Singh, M. Mukherjee - India (video recorded)

Numerical studies on soil structure interaction of integral railway bridges with different backfills.

A. Stastny, F. Tschuchnigg - Austria

Coupled multibody and finite element modelling of track settlement.

C. D. Foster, S. Kulkarni - UK (video recorded)

Approximate accounting for corrosion in estimation of strain demand on buried pipelines subject to ground displacements. *P. R. Jadhav, D. Wijewickreme - Canada*

Room 7

Section 4 • GEOMECHANICS FOR ENERGY

13:45 **Energy geostructures** • Chairs: *A. Di Donna, France - I. Prodan, Romania*

Testing of a novel energy wall system in Torino. *M. Baralis, M. Barla - Italy*

Analytical modelling of energy geostructures. *A. F. Rotta Loria - USA*

A case study of isolated foundations on energy piles - from design to implementation.

I. Prodan, O. Bujor, A. Popa, H. Ban - Romania

A case study on the application of energy tunnels in Sydney, Australia. *N. Makasis, G. A. Narsilio - Australia*

On the thermal activation of Turin metro line 2 tunnels.

M. Barla, M. Baralis, A. Insana, S. Aiassa, F. Antolini, F. Vigna, F. Azzarone, P. Marchetti - Italy

Energy tunnels for deicing of a bridge deck in alpine region. *M. Baralis, A. Insana, M. Barla - Italy*

Investigating the effectiveness of energy tunnels in cooling underground substations.

A. Bidarmaghz, N. Makasis, W. Fei, G. A. Narsilio - Australia

Numerical modelling of thermo-active micropiles. *D. Salciarini, F. Cecinato - Italy*

Effect of domain size in the modelled response of thermally-activated piles.

M. Zito, T. M. Bodas Freitas, P. J. Bourne-Webb, D. Sterpi - Italy

Behaviour of energy pile-soil interface in frozen conditions: a design for robustness.

E. Ravera, L. Laloui - Switzerland

Thermal performance assessment of an energy lining for the Lyon-Turin base tunnel.

M. R. Alvi, A. Insana, M. Barla - Italy

16:00 *Coffee break*

Section 4 • GEOMECHANICS FOR ENERGY

16:30 **Underground storage and geothermal energy** • *Chairs: B. Lopes, UK - D. Salciarini, Italy*

Deformation and vertical permeability variations induced by freeze-thaw cycles in over-consolidated silty clays. *G. Dalla Santa, A. Galgaro, F. Tateo, S. Cola - Italy*

Thermal activation of tunnel infrastructures: city-scale solutions for Basel, Switzerland.

J. Epting, M. Baralis, R. Künze, M. H. Mueller, A. Insana, M. Barla, P. Huggenberger - Italy

Effect of particle connectivity on heat transfer in granular materials using complex networks.

W. Fei, G. A. Narsilio, M. M. Disfani - Australia

Numerical modelling of hydraulic fracture propagation and comparison with microseismic data at a field site. *H. Siriwardane, C. Hulcher - USA*

Room 8

Section 2 • APPLICATIONS IN GEOTECHNICAL ENGINEERING

13:45 **Deep structures: tunnels, caverns, mines** • *Chairs: C. Callari, D. Peila - Italy*

Analysis of the stability of openings excavated in anisotropic rocks. *C. Deangeli, M. Cardu, D. Martinelli - Italy*

Back-analysis of shaft and galleries' geomechanics behaviour in the Meuse / Haute-Marne underground laboratory. *M. Janutolo Barlet, M. Monfared, F. Martin, O. Bril, G. Armand, M. Camusso - France*

Numerical simulation of swelling in tunnels. *M. Barla, A. Insana - Italy*

A simple parametric numerical model to assist the design of repair works and maintenance of tunnels.

S. De Feudis, A. Insana, M. Barla - Italy

CERN, HL-LHC project: numerical modelling and design challenges for the new underground facilities at point 5.

D. Merlini, F. Gianelli, M. Falanesca, G. Bella, A. Lopez Hernandez - Switzerland

CHALLENGES *and* INNOVATIONS *in* GEOMECHANICS

16th International Conference of the International Association for Computer Methods and Advances in Geomechanics

THURSDAY • SEPTEMBER 1, 2022

Numerical modelling of face extrusion in shield tunnelling through squeezing ground.
T. Pferdekämper, A. Vrakas, G. Anagnostou - Switzerland

16:00 *Coffee break*

Mini Symposium

16:30 **Building and infrastructure response to ground movement**

Chair: D. Boldini - Italy

Building response to Line 9 EPB tunnelling in Barcelona. A case study.
A. Di Mariano, A. Franza, V. Limatola, A. Gens, E. Bilotta - Italy

Tunnelling-induced displacements and damage on framed structures: comparison between numerical models. *D. Boldini, N. Losacco, A. Franza, S. Miraei - Italy*

Soil-structure interaction in the coupled model of a residential building.
B. Martinez-Bacas, A. Caballero, D. Simic, J. M. Gomez - Spain

Numerical analysis of a deep excavation in front of MarmorKirken, Copenhagen.
F. M. Soccodato, G. Tropeano - Italy

Numerical model calibration and validation of mechanized tunnel excavation of Milan underground line 5.
M. Schoen, R. Hölter, D. Boldini, A. Alimardani Lavasan - Germany

Soil-pipe interactions under permanent ground deformations. *I. Moore - UK*

Interaction between tunnel excavations and historical structures in Rome: a fully coupled structural and geotechnical approach. *A. Amorosi, S. Rampello, M. Sangirardi - Italy*

Mitigation of tunneling effects via pre-installed barriers: the case of Line C of Rome underground.
L. Masini, S. Rampello, L. Fantera, E. Romani - Italy

Room 10

Section 1 • METHODS AND TOOLS

13:45 **Constitutive modelling (part 2)** • *Chairs: G. Della Vecchia, M. R. Migliazza - Italy*

Elasto-plastic coupling in soils: a thermodynamic-based approach. *F. Rollo, A. Amorosi - Italy*

Simulation of viscoplastic material behavior in numerical models. *S. Leppla - Germany*

Hypoplastic model for clays with stiffness anisotropy. *J. Duque, D. Mašín, W. Fuentes - Czech Republic*

Liquefaction instability analysis using extended Mohr-Coulomb model under axisymmetric conditions.
S. Sharma, V. Parol, A. Prashant - India

Three-dimensional constitutive model for dry granular materials under different flow regimes.
I. Redaelli, P. Marveggio, C. di Prisco - Italy

Measuring and modelling cyclic response of dense sand under partially drained conditions.
H. P. Jostad, P. Carotenuto, S. Yusuke, N. Sivasithamparam - Norway

Prediction of strength-band of methane hydrate-bearing sand by elastoplastic constitutive model considering microstructure of gas hydrates.

H. Iwaj, T. Kawasaki, H. Cho - Japan (video recorded)

16:00 *Coffee break*

Section 4 • GEOMECHANICS FOR ENERGY

16:30 **Gas, petroleum and offshore engineering** • Chairs: *F. Cecinato, Italy - M. Sanchez, USA*

Molecular interactions of major mineral constituents with kerogen in Green River oil shale.
K. S. Katti, H. M. Nasrullah Faisal, K. B. Thapa, D. R. Katti - USA

Fully-coupled multiscale poromechanical simulation relevant for underground gas storage.
K. Ramesh Kumar, H. T. Honorio, H. Hajibeygi - The Netherlands

Advanced soil constitutive models and their applications to offshore geotechnical problems.
H. Sabetamal, D. Sheng, J. P. Carter - Australia

Impact of water saturation on the bulk modulus of gas shales and its stress dependency.
J. Kim, A. Ferrari, R. Ewy, L. Laloui - Switzerland

Finite element modelling of tunnel settlements under cyclic loading.
M. Tafili, T. Wichtmann - Germany

A simple analytical model of the damping ratio considering effect of particle breakage.
M. Saqib, A. Das, N. Ranjan Patra - India

FRIDAY SEPTEMBER 2, 2022

Cittadella Politecnica - Corte Interrata, Rooms I

Parallel Sessions

Room 1

Mini Symposium

09:00 **Advanced constitutive modelling of soils in practical applications (part 1)**

Chair: A. Amorosi, Italy

Parallelized numerical optimization for parameter fitting of an advanced elasto-viscoplastic model with an open source implementation. *T. A. Vergote, L. Chun Fai, C. Siau Chen - Singapore*

Evolving elastic and plastic fabric anisotropy in granular materials: theoretical and applied implications. *A. Amorosi, F. Rollo, Y. F. Dafalias - Italy*

On validation of a two-surface plasticity model for soil liquefaction analysis.

M. T. Manzari, M. A. El Ghoraiby - USA (video recorded)

Evaluation of seismic response of rectangular underground structures in liquefiable soils.

T. Zhu, R. Wang, J. Zhang, H. Liu - China (video recorded)

10:30 *Coffee break*

Mini Symposium

11:00 **Advanced constitutive modelling of soils in practical applications (part 2)**

Chair: A. Amorosi, Italy

Finite deformation modelling of cone penetration tests in saturated structured clays.

M. O. Ciantia, K. Oliynyk, C. Tamagnini - UK

Water retention curves of clayey soils by artificial neural networks with uneven datasets.

X. Ding, A. El-Zein - China

Effects of pore pressure on wandering in structural natural frequency. *P. Kowalczyk, A. Gajo - Italy*

Modelling extreme oedometric unloading of a high plasticity overconsolidated clay with two anisotropic bounding surface plasticity models.

E. M. Kinslev, O. Hededal, I. Rocchi, V. Zania - Denmark

Room 3

Mini Symposium

09:00 **Material point method in computational geomechanics** • Chairs: F. Ceccato, C. Tamagnini - Italy

Insights into suction caisson installation utilising the material point method.

M. Stapelfeldt, B. Bienen, J. Grabe - Germany

Development of a robust coupled material point method.

X. Zheng, J. L. González Acosta, G. Remmerswaal, P. J. Vardon, F. Pisanò, M. A. Hicks - The Netherlands

Implementing dynamic boundary conditions with the material point method.

P. Do Chinh, P. J. Vardon, L. González Acosta, M. A. Hicks - The Netherlands

Numerical analysis of rain-induced slope failure by using the MPM-SPH coupling method.

Y. Nakamichi, S. Sugie, T. Takeyama - Japan

Large strain analysis of unsaturated heterogeneous slopes with MPM.

V. Girardi, F. Ceccato, A. Yerro, P. Simonini, F. Gabrieli - Italy

Multiscale modelling of anchor pull-out in sand. *W. Liang, J. Zhao, K. Soga - China (video recorded)*

10:30 *Coffee break*

Section 2 • APPLICATIONS IN GEOTECHNICAL ENGINEERING

11:00 **Dams and earthstructures** • Chairs: C. Jommi, The Netherlands - B. Schneider-Muntau, Austria

Seismic response analysis of earth dam with geostatistical method and 3-D survey.

R. Ohashi, S. Nishimura, M. Kaneshige, T. Shibata, T. Shuku - Japan

Safety evaluation of an arch-gravity dam based on a small displacement hydromechanical coupled model.

N. M. Azevedo, M. B. Farinha, G. Freitas, J. R. Almeida - Portugal

A procedure to design geosynthetic-reinforced earth-retaining walls under seismic loadings.

D. Gaudio, L. Masini, S. Rampello - Italy

Stability assessment of a tailings storage facility using a non-local constitutive model accounting for anisotropic strain-softening.

M. G. Sottile, N. A. Labanda, A. Kerguelén, I. A. Cueto, A. O. Sfriso - Argentina

Load factors for the estimation of internal forces in the stem of cantilever retaining wall with shear key under seismic loading. *P. R. Jadhav, G. Chand, A. Prashant - India*

A procedure to design geosynthetic-reinforced earth-retaining walls under seismic loadings. *D. Gaudio, L. Masini, S. Rampello - Italy*

Room 7

Section 2 • APPLICATIONS IN GEOTECHNICAL ENGINEERING

09:00 **Earthquake and dynamics (part 1)** • Chairs: *S. Foti, Italy - B. K. Maheshwari, India*

Evaluation of field sand liquefaction including partial drainage under low and high overburden using a generalized bounding surface model. *P. Sattamino, A. Zirpoli, S. Perni - Italy*

Numerical investigation on seismic performance of a piled-raft foundation with grid-form DMWs. *Y. Shigeno, K. Yamashita, J. Hamada - Japan*

Influence of soil non-linear behaviour on the selection of input motion for dynamic geotechnical analysis. *F. Genovese - Italy*

The effects of soil-released high frequency motion on a structure. *P. Kowalczyk - Italy*

10:30 *Coffee break*

Section 2 • APPLICATIONS IN GEOTECHNICAL ENGINEERING

11:00 **Earthquake and dynamics (part 2)** • Chairs: *S. Foti, Italy - B. K. Maheshwari, India*

Liquefaction and post liquefaction response of coal ash using cyclic simple shear. *A. Shrivastava, A. Sachan - India*

Estimation of normal, inverse, and irregular earth profile using different global optimization techniques from active MASW survey. *S. Paul, P. Viswakarma, A. Prashant - India*

Seismic settlement of combined piled raft foundation of nuclear power plant on soft soil. *M. Firoj, B. K. Maheshwari - India*

Room 8

Mini Symposium

09:00 **Large strain problems in geomechanics** • Chairs: *G. Anagnostou, A. Vrakas - Switzerland*

A nonlocal elasto-plastic model for structured soils at large strains for the particle finite element method.

L. Monforte, M. O. Ciantia, J. M. Carbonell, M. Arroyo, A. Gens - UK

Simulation of cavity expansion with the clay and sand model using G-PFEM.

L. Hauser, H. F. Schweiger - Austria

Micromechanics of pile cyclic response in sand. *M. O. Ciantia - UK*

Discrete element modelling of compound rockfall fence nets.

M. Previtali, M. O. Ciantia, S. Spadea, R. Castellanza, G. Crosta - Italy

Large deformation finite element analysis of CPT in calcareous sands.

H. Pei, D. Wang, Z. Yin, Q. Liu, J. Zheng - China (video recorded)

10:30 *Coffee break*

Section 1 • METHODS AND TOOLS

11:00 **Constitutive modelling (part 3)** • Chairs: *K. Katti, USA - V. Zania, Denmark*

A new constitutive approach for simulating solid- to fluid-like phase transition in dry and saturated granular media. *P. Marveggio, I. Redaelli, C. di Prisco - Italy*

A semi-micromechanical framework for anisotropic sands.

H. Bayraktaroglu, M. I. A. Hicks, M. Korff - The Netherlands

HySand: a new constitutive model for sand under cyclic loading.

L. E. J. Simonin, G. T. Houlsby, B. W. Byrne - UK

Automatic parameter calibration of two advanced constitutive models.

J. Macháček, S. Siegel, P. Staubach, H. Zachert - Germany

An image point identification rule for 3D bounding surface plasticity models.

H. Moghaddasi, N. Khalili, B. Shahbodagh, G.A. Esgandani, A. Khoshghalb - Australia

PFEM modelling of strain localization processes in non-local multiplicative plasticity.

K. Oliynyk, M. O. Ciantia, C. Tamagnini - UK

CHALLENGES *and* INNOVATIONS in GEOMECHANICS

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FRIDAY - SEPTEMBER 2, 2022

A robust solution to address overshooting in bounding surface plasticity models.

L. Chen, J. Ghorbani, C. Zhang, J. Kodikara - Australia

Numerical study on the effect of hydrate saturation on the geo-mechanical behavior of gas hydrate sediments. *S. Wani, R. I. Samala, R. Kannan Kandasami, A. Chaudhuri - India*

12:30 *Lunch (Corte Interrata courtyard)*

Room 10

Section 1 • METHODS AND TOOLS

9:00 **Coupled and multiphase modelling (part 1)** • Chairs: *S. Mufti, India - G. Musso, Italy*

Molecular origin of compressibility and shear strength of swelling clays.

D. R. Katti, K. B. Thapa, H. M. N. Faisal, K. Katti - USA

An elasto-plastic framework for the chemo- mechanical behavior of low to medium activity clays.

G. Scelsi, G. Della Vecchia, G. Musso - Italy

An optimized pore network model for unsaturated soil permeability determination. *S. Mufti, A. Das - India*

Numerical methods for simulation of coupled hydro-mechanical processes in fractured porous media.

M. Bérés, R. Blaheta, S. Domesová, D. Horák - Czech Republic (video recorded)

Improving efficiency, stability, and accuracy of finite element solutions for solving dynamic contact problems involving unsaturated soils. *J. Ghorbani, L. Chen, J. Kodikara, J. P. Carter, J. S. McCartney - Australia*

A critical review of the effect of temperature on clay inter-particle forces and its effect on macroscopic thermal behaviour of clay. *A. Casarella, M. Pedrotti, A. Tarantino, A. Di Donna - France*

10:30 *Coffee break*

Section 1 • METHODS AND TOOLS

11:00 **Coupled and multiphase modelling (part 2)** • Chairs: *S. Mufti, India - G. Musso, Italy*

Integrated modelling of fully coupled two-phase surface and subsurface flow.

Y. Zhu, T. Ishikawa, S. Siva Subramanian - Japan (video recorded)

Undrained processes in unsaturated soils: analytical formulations of pore pressure coefficient.

A. Tuttolomondo, A. Ferrari, L. Laloui - Switzerland

A robust implementation of dynamic evolution of fluid-driven fractures.
M. Vahab, M. R. Hirmand, K. D. Papolia, N. Khalili - Australia (video recorded)

Politecnico di Torino Main Building

Aula Magna

- 13:45 **Mercer Lecture** • Chair: Annamaria Cividini - Italy
Geosynthetics for construction on soft foundation soils. *Ronald Kerry Rowe - Canada*
- 14:30 **Special Lecture** • Chair: Deepankar Choudoury - India
Clay Micromechanics: state of the art and perspectives. *Alessandro Tarantino - UK*
- 15:00 **Special Lecture** • Chair: Nasser Khalili - Australia
Modelling failure in layered geological formations - FDEM: a micro-mechanical approach that bridges across scales. *Giovanni Grasselli - USA*
- 15:30 **ePIC (Promising Investigator Contest)** • Chair: Iulia Prodan - Romania
Micromechanics of pile cyclic response in sand. *M.O. Ciantia - UK*
Influence of soil non-linear behaviour on the selection of input motion for dynamic geotechnical analysis. *F. Genovese - Italy*
3D Slope stability analyses of a complex formation with a block-in-matrix fabric. *M. L. Napoli - Italy*
Analytical modelling of energy geostructures. *A. Rotta Loria - USA*
- 16:00 *Coffee break*
- 16:30 **Special Lecture** • Chair: David Masin - Czech Republic
Numerical simulation of CPT with the Clay and Sand Model (CASM) including effects of bonding. *Helmut Schweiger - Austria*
- 17:00 **Special Lecture** • Chair: Musharraf Zaman - USA
Multi-phasic approaches for estimating THM properties of heterogeneous rocks. *Patrick Selvadurai - Canada*
- 17:30 **Closing ceremony**

► TECHNICAL VISITS

Registration is mandatory and can be completed through the registration form on the web site.



Construction site of the new multi-storey underground car park

During the technical visit it will be possible to take a look at the equipment and at the construction techniques employed.

The novelty of the entire construction is the use of energy geostructures: with its 172 diaphragm walls it will be indeed the first application in Italy in terms of size of the thermal activation technology.

Turin Metro Line 1: ENERTUN & West extension construction site

The visit will start at Bengasi station, the South terminus of Turin Metro Line 1, where a prototype of the ENERTUN segmental lining is installed. After a view of the energy tunnel geothermal plant below the platform, a journey by metro will lead towards the very opposite terminus, Fermi. Here the construction site of Turin ML1 West extension will be illustrated.



Underground Turin Tour

An exciting tour “at the center of the earth” to discover the “downstairs” city which many times has saved and given shelter, in history, to the “upstairs” inhabitants. The itinerary descends to a depth of 15 meters, to visit the eighteenth-century tunnels of the Pietro Micca Museum, the famous Royal ice depots under Porta Palazzo, the mysterious infernots of the Baroque palaces. The secret Turin waits to be unveiled...

► INNOVATION HUB

Wednesday - August 31, 2022 - 6 p.m. • Cittadella Politecnica - Corte Interrata, Rooms I

The innovation hub initiative at IACMAG aims at giving substance to the challenges and innovation in geomechanic conference themes from a more practical and society-oriented point of view.

Innovative companies and start ups working in the field of civil and geotechnical engineering are given the opportunity to show their best know-how, solutions and services in front of a wide international and highly recognized audience.

► SOCIAL EVENTS

Welcome cocktail reception

The welcome cocktail reception will take place on Tuesday August 30, from 7:00 p.m. to 9:00 p.m., at the Castello del Valentino, viale Mattioli 9 in Torino. A nice ice-breaking occasion to meet old and new colleagues. This event is included in the registration fee. Admittance will be limited to badge holders.

Social dinner

The social dinner, will be held on Thursday September 1, 8:30 p.m., at Carlina Restaurant & Bar (Piazza Carlo Emanuele II, 15).

A guided walking city centre tour starting at 7:00 p.m. from the restaurant is included in the participation fee. Participation fee: € 80,00. Admittance to the restaurant will be limited to ticket holders.



Castello del Valentino



Piazza Carlina

CHALLENGES and INNOVATIONS in GEOMECHANICS

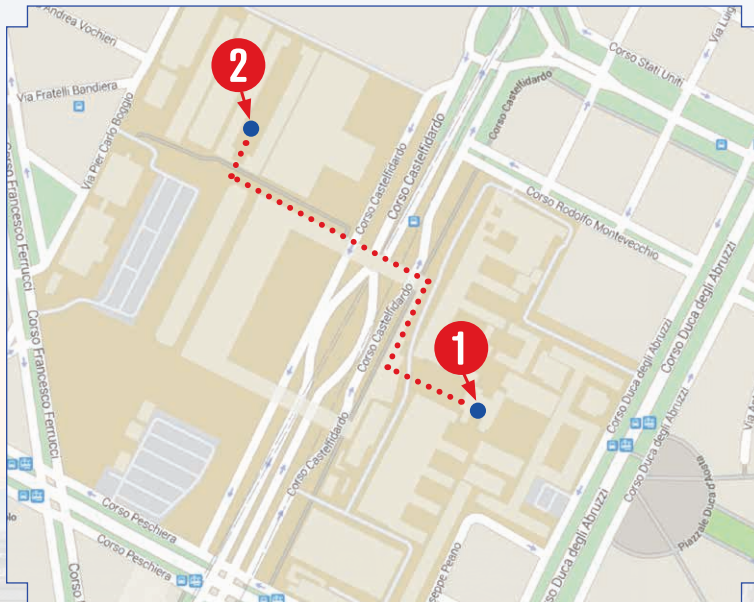
16th International Conference of the International Association for Computer Methods and Advances in Geomechanics

► CONFERENCE INFORMATION

The conference areas

The conference will be held at the Politecnico di Torino. Conference facilities will be located both in the Politecnico main campus (pedestrian access from corso Duca degli Abruzzi 24 entrance) and in the Aule I (Rooms I) of the Cittadella Politecnica, Corte Interrata area (pedestrian access via Corso Castelfidardo 34/A entrance) situated at a few minutes' walking distance from the main building.

CONFERENCE VENUE MAP



**1. POLITECNICO DI TORINO
MAIN CAMPUS
AULA MAGNA (Plenary Sessions)**
Corso Duca degli Abruzzi, 24

**2. POLITECNICO DI TORINO
CITTADELLA POLITECNICA
CORTE INTERRATA
ROOMS I (Parallel Sessions)**
Corso Castelfidardo, 34/A

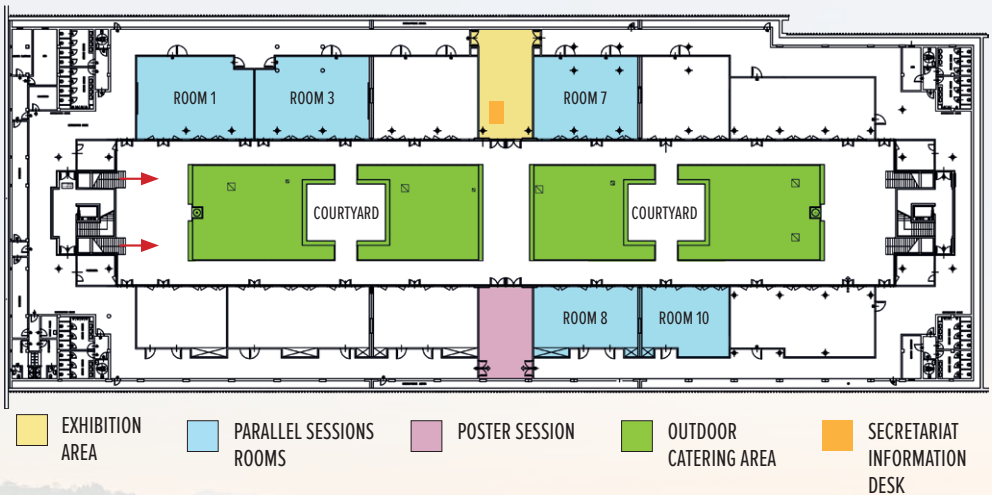
From 1 to 2,
five minutes' walking
distance

Meeting rooms

Daily plenary sessions, including the opening ceremony and session on Wednesday August 31, will be held at the Aula Magna, the main university conference room located in the Politecnico main campus.

Parallel sessions and Poster session will take place in the Rooms I located at the Cittadella Politecnica, Corte Interrata area (pedestrian access from Corso Castelfidardo 34/A entrance).

This area will also host catering areas and exhibition spaces.



Instructions for presenters

Speakers are required to be in the meeting room at least 10 minutes before their session begins.

Sessions are tightly scheduled, the allotted time for presentation (10 minutes) must be strictly observed.

Each conference room will be equipped with computers. Presentations on USB stick must be loaded in advance (e.g. during breaks) on the conference room laptops. For further information, presenters are required to refer to session chairs or conference staff at the session meeting rooms. For organizational reasons, use of personal laptops for presentations is discouraged.

Registration

Pre-registered participants will receive their name badge with a QRcode by e-mail a few days before the conference. They can collect their conference kit at the organizing secretariat desk located in the foyer of the Aula Magna (Politecnico main campus, ground floor, entrance at corso Duca degli Abruzzi 24) as of Wednesday August 31. A secretariat desk will also be available in the lobby of the Corte Interrata (Rooms I).

CHALLENGES *and* INNOVATIONS *in* GEOMECHANICS

16th International Conference of the International Association for Computer Methods and Advances in Geomechanics

Covid-19 safety measures

The National Health authorities' Covid-19 risk mitigation rules applicable at the time of the conference will be observed. More information can be obtained on the conference website.

Badges

All delegates and exhibitors are kindly requested to always wear their name badge. Entrance to meeting rooms will be limited to regularly enrolled participants.

Language

Official language will be English. No simultaneous translation will be provided.

Coffee breaks and lunches

Coffee points will be located close to the parallel sessions rooms at the Corte Interrata (Rooms I). Buffet lunches will be served in the catering area (outside courtyard or building lobbies) at the Corte Interrata (Rooms I). See conference programme for exact coffee break and lunch times.

Tourist information

An information point of the city tourist agency TurismoTorino will be available at the conference venue on Wednesday August 31 from 08:30 to 12:30 and on Thursday September 1 from 08:30 to 12:30. The main tourist information point is located in the city centre (Piazza Castello) and it is open from Monday to Sunday from 9.00 to 19.00. Phone: +39 011535181.

How to get to the conference venue

The Politecnico is located close to the city centre. It can be reached from the city centre in a short time by metro or bus.

The closest metro station is Vinzaglio (about 10 minutes' walking distance from both the Politecnico main building and the parallel sessions venue the Cittadella Politecnica).

Many bus and tram lines have stops at the Politecnico. Bus lines 58/33/ 12 and tram line 10 stop near the Politecnico main building entrance (corso Duca degli Abruzzi 24). Bus line 12 stops in front of the Cittadella Politecnico entrance (corso Castelfidardo 34/A). Bus line Star 1 stops at about 300 metres from the same entrance. Other bus or tram lines (e.g. lines 33, 42 and 15) have also stops not far from the Politecnico.

And if you like to walk, it takes about 30 minutes from Porta Nuova railway station in the city centre.

LIABILITY - Registered congress participants agree that neither the Organizing Committee nor the conference Secretariat are liable or assume any responsibility for damage or injuries to persons or property during the congress. Participants are advised to arrange for their own health, travel and personal insurances. The congress organization does not cover individuals against cancellation of bookings, theft or damage to belongings.

► GENERAL INFORMATION

Currency

The Euro is the national currency. Automatic cash dispenser and bank exchanges are plentiful. Most hotels, restaurants and shops accept the usual credit cards.

Banks

The nearest bank with cash dispenser is the Banca Unicredit located inside the Politecnico main building. Opening times, from Monday to Friday: from 8.30 to 13.30 and from 14.40 to 16.10.

Post office

The nearest post office is located inside the Politecnico main building. Opening times, from Monday to Friday: from 8:30 to 14:00.

Medical service

A medical service for first aid (infermeria) is available in the Politecnico main building. Opening times, from Monday to Friday: from 8:00 to 18:00.

Shopping

Torino offers both luxury and characteristic shops. Most of the luxury shops are located in the city centre on via Roma: fashion boutiques, jewellery shops, perfume shops and food and wine stores which feature the best of the regional products. Then there are the characteristic shops in the little alleys of the inner city, full of cafes and craftshops. Torino has a little bit (or, as is often the case, a lot) of everything and for all budgets as well.

Eating

Torino is well known for its local cuisine, which is considered among the best in Italy. Restaurants are usually open from 12:00 to 14:30 and from 19:30 to 22:30. For those who prefer something different to the classic menus, Torino proposes a most pleasant alternative: wine bars. Torino is also renowned for the ability of its pastrycooks.

Museums

Torino offers a wide choice of museums: from the Egyptian Museum, the most important collection in the world after Cairo, to the Sabauda (Savoyard) picture gallery, from the Cinema Museum, located in the Mole Antonelliana the 167-metre tower symbol of Torino, to the recently renovated Automobile Museum. Besides its collections of old and modern art, Torino is also an important centre for contemporary art. Museums are usually open from Tuesday to Sunday and closed on Mondays.

DISCLAIMER - All best endeavours will be made to present the congress programme as published. However, the congress Organizing Committee and the Secretariat reserve the right to alter or cancel, without prior notice, any arrangements, timetables, plans or other items relating directly or indirectly to the congress, for any cause beyond our reasonable control. The congress Organizing Committee and the Secretariat are not liable for any loss or inconvenience caused as a result of such alteration.

CHALLENGES and INNOVATIONS in GEOMECHANICS

16th International Conference of the International Association for Computer Methods and Advances in Geomechanics

▶ EXHIBITORS

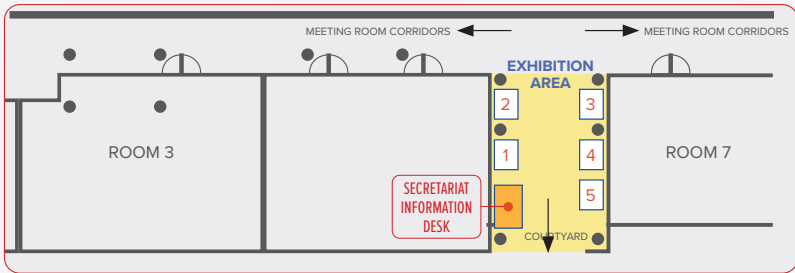
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3.  GeothermSkin

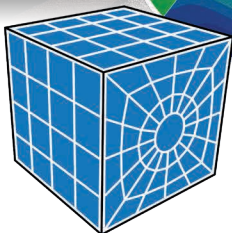
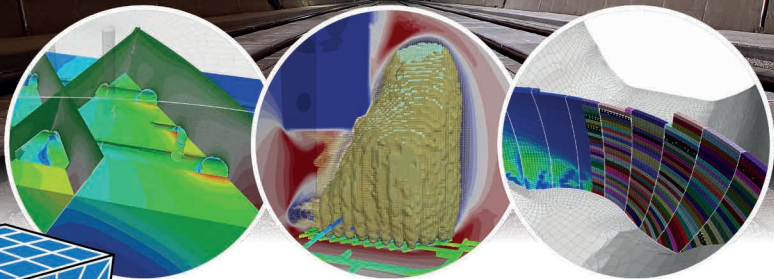
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Cittadella Politecnica - Corte Interrata, Rooms I


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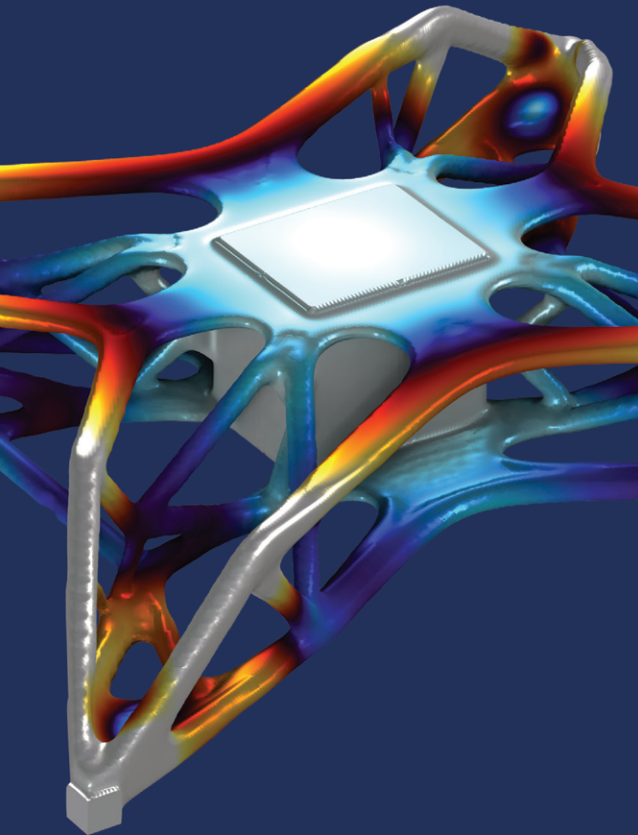
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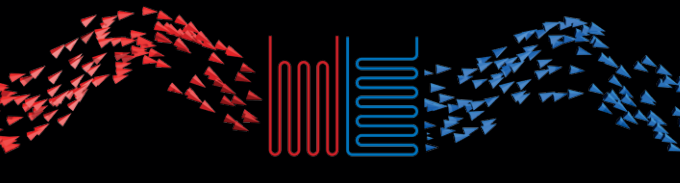
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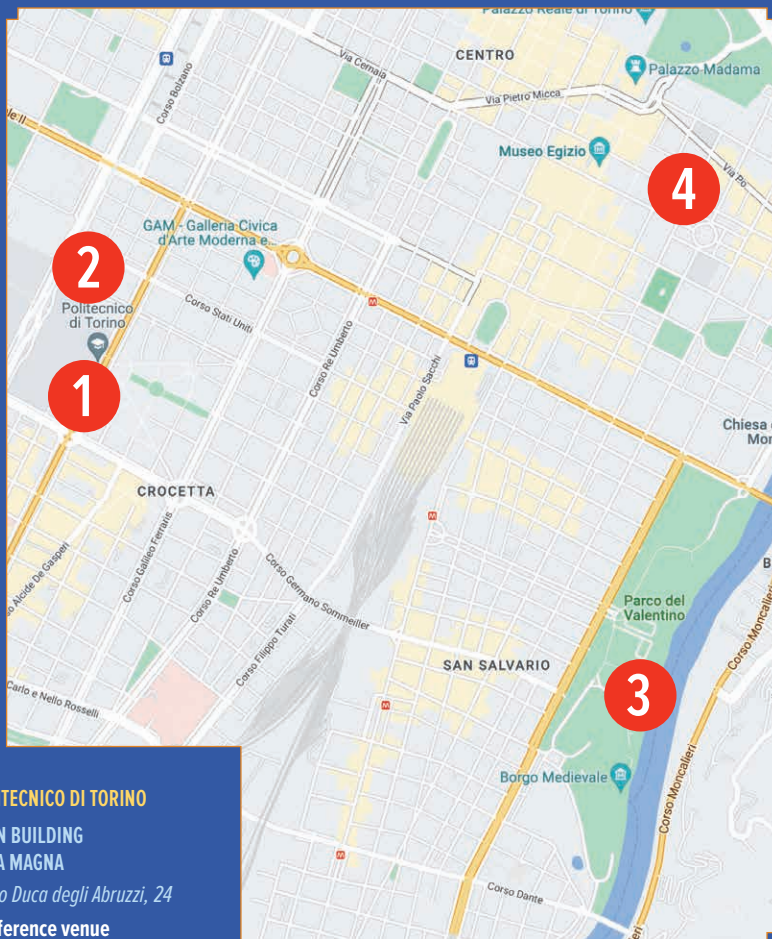
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1. POLITECNICO DI TORINO

MAIN BUILDING
AULA MAGNA

Corso Duca degli Abruzzi, 24

Conference venue

2. POLITECNICO DI TORINO

CITADELLA POLITECNICA
CORTE INTERRATA ROOMS I

Corso Castellidardo, 34/A

Conference venue

3. CASTELLO DEL VALENTINO

Viale Mattioli, 39

**Welcome cocktail
reception venue**

4. CARLINA RESTAURANT & BAR

*Piazza Carlo Emanuele II, 15
(Piazza Carlina)*

Social dinner venue



16th International Conference of the International Association
for Computer Methods and Advances in Geomechanics

16th
IACMAG
TORINO 20²²22 grenoble · milano

CHALLENGES *and* INNOVATIONS
in GEOMECHANICS

TORINO • ITALY
30 August • 2 September 2022

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