

CHARTING THE PATH

# TOWARD THE FUTURE

Geotechnical Engineering Education

**JULY 2 - 4 2025** 

Proceedings of the 6<sup>th</sup> International Conference on Geotechnical Engineering Education: Charting the path toward the future, Nancy, France, July 2-4, 2025

# **Geotechnical Engineering Education 2025**

## **Edited by**

Michele Calvello, University of Salerno, Italy

Marina Pantazidou, National Technical University of Athens, Greece

Margarida Pinho-Lopes, University of Aveiro, Portugal



Proceedings of the  $6^{th}$  International Conference on Geotechnical Engineering Education: Charting the path toward the future, Nancy, France, July 2-4, 2025

## **Geotechnical Engineering Education 2025**

Edited by

Michele Calvello, University of Salerno, Italy

Marina Pantazidou, National Technical University of Athens, Greece

Margarida Pinho-Lopes, University of Aveiro, Portugal

ISBN: 978-618-84925-1-6 (Geotechnical Engineering Education 2025)

ISSN: 2732-7256 (Geotechnical Engineering Education)

to

## **Table of Contents**

| Preface  | vi          |
|--|-------------|
| Organization   | vii         |
| 3 <sup>rd</sup> John Burland Honor Lecture   |             |
| Changing attitudes, organization and scale in engineering education: The teacher as a go-betwee TC306 as a knowledge broker  | en and      |
| M. Pantazidou  | 3           |
| Invited Papers   |             |
| Undergraduate teaching of Unsaturated Soil Mechanics: building on fundamental physical mecha pave the way for geotechnical analyses  | nisms       |
| A. Amabile & A. Tarantino  | 23          |
| Teaching numerical methods or teaching with numerical methods?  F. Ceccato   | 43          |
| What role should software play in geotechnical education?  N. Utter  | 53          |
| Geosynthetics in the classroom: Educating future engineers and their instructors  J.G. Zornberg  | 63          |
| Curricula: Undergraduate, (Post)Graduate, Doctoral   |             |
| Game development-based learning curriculum module for undergraduate soil mechanics/geotech engineering classes   | nical       |
| B. Ajmera, C. Rutherford, A. Poplin, A. Emery, J. Sabrowsky & P. Chung   | 89          |
| GEOMME project: an experience-based approach to teaching sustainable landslide hazard mitig  | gation      |
| V. Capobianco, G. Gilbert, L. Piciullo, T.H. Kwon, R. Nishii, N. Watanabe, J.Y. Park & M. Uzielli  | 101         |
| A 3-year multidisciplinary project training in Mining Engineering to build bridges across the discipl <i>F. Descamps, N. Gonze, S. Vandycke, P. Ancia, T. Nikiema, O. Faÿ &amp; J.P. Tshibangu</i> | ines<br>113 |
| Geotechnical engineering knowledge base needed for the improvement of mine tailings safety<br>B. Kovacevic Zelic, M. Burecic Safran & D. Znidarcic   | 125         |
| Simplifying slope stability: What should be taught at the undergraduate level?  C.J. MacRobert   | 137         |
| Developing parallel MSc / Degree Apprenticeship pathways in Geotechnical Engineering  A. Monzer, D.V.L. Hunt, I. Jefferson & A. Royal  | 149         |

| Two decades of evolution of study program on Geotechnical Engineering at the Faculty of Civil Engineering in Skopje  J. Br. Papić, J. Josifovski, I. Peševski, M. Jovanovski & M. Maraš | 161         |  |  |  |
|---|-------------|--|--|--|
| Introducing geotechnical engineering discipline to K-12 STEM teachers for professional developm   | ent         |  |  |  |
| H. Seo & M. Yi  | 169         |  |  |  |
| An industry perspective on geotechnical engineering education and a learning approach by Tony ( LLP   | Gee         |  |  |  |
| C.H. Shields, T.Y. Yap, C.T. Toms & T. Chalmers   | 181         |  |  |  |
| Linking theory to practice: the semantic wave in a postgraduate critical state soil mechanics cours <i>T.S. da Silva Burke</i>  | se<br>199   |  |  |  |
| Teaching soil mechanics in a changing world  A.M. Tang, J.M. Pereira, F. Cuira & M. Vandamme  | 211         |  |  |  |
| Coursework: Laboratory, Field, Project-based, Numerical Methods   |             |  |  |  |
| Running remote hands-on laboratory classes in soil mechanics  D. Airey & J. Zhu   | 223         |  |  |  |
| An international coursework on the design of a retaining structure and a building competition <i>V. Dimitriadi, D. Barreto, J. Leak, A. Arnold &amp; H. Vogt</i>                        | 235         |  |  |  |
| Project-based learning on the design of retaining walls for geotechnical and civil engineering stude O. Jenck & D. Ricotier   | ents<br>245 |  |  |  |
| Using educational escape rooms in soil mechanics laboratory courses<br>K. Kluge, C. Budach & A. Kirsch  | 257         |  |  |  |
| The integration of environmental considerations into Geotechnical Engineering Education: Balanci optimization and sustainability  |             |  |  |  |
| U.S. Okyay  | 269         |  |  |  |
| A design project on retaining wall design methods adopting comprehensive site investigation and laboratory testing  |             |  |  |  |
|   | 281         |  |  |  |
| Open Resource Educational Material  |             |  |  |  |
| Development of shareable activity library for geoenvironmental engineering education G. Bohnhoff, K. Sample-Lord, J. Hubler, N. Strandberg & J. Walleser                                | 293         |  |  |  |
| Open Educational Resources for geotechnical engineering education  W. Fellin  | 303         |  |  |  |
| Settlement calculations of a motorway embankment and comparison with field measurements: An   |             |  |  |  |
| education case study  V. Xenaki & M. Pantazidou   | 315         |  |  |  |

| Applications of ICT Tools  |        |  |  |
|--|--------|--|--|
| Enhancing geotechnical site investigation and project-based education through virtual reality: the experience                              | GeoSim |  |  |
| A. Abdallah, O. Cuisinier & F. Masrouri  | 329    |  |  |
| Implementation of a blended learning strategy for geotechnical courses  L. Araújo Santos, V. Ribeiro & S. Proença                          | 339    |  |  |
| Use of virtual reality for teaching geotechnics – application to the study of an abandoned undergraine                                     |        |  |  |
| O. Deck  | 351    |  |  |
| Faculty perceptions and usage of generative AI in geotechnical engineering education<br>E. Salifu, A. Cuccurullo & S. Muguda               | 361    |  |  |
| PEGGHy - Platform for Experimental Geophysics, Geotechnics and Hydrogeology of the Graduat School of Geological Engineering, Nancy, France |        |  |  |
| J. Sausse, P. Cupillard, A. Abdallah, Y. Géraud, M. Diraison, C. Oltean, F. Golfier & O. Cuisinier   | 371    |  |  |
| Links to Research on Learning and on Engineering Education   |        |  |  |
| Teaching soil mechanics core concepts: mapping the structure of university textbooks worldwide<br>M. Calvello                              | 387    |  |  |
| Developing concept inventories for Geotechnical Engineering  A. Kirsch, W. Fellin & R. Sonnenberg  | 401    |  |  |
| Enhancing student learning in geotechnical engineering: a study on effective slide design from st perspective                              |        |  |  |
| V. Mangraviti, L. Brezzi, G. Dalla Santa, F. Gabrieli & F. Ceccato   | 415    |  |  |
| Priority Theme 1: Teaching of Unsaturated Soils  |        |  |  |
| Integrating soil suction in geotechnical education: a case study on partially saturated slope stabilianalysis in Sweden                    | ity    |  |  |
| A. Abed & M. Karstunen   | 429    |  |  |
| Why unsaturated soil mechanics is relevant to civil engineers<br>K.V. Bicalho  | 439    |  |  |
| Including unsaturated soil concepts in undergraduate courses: The UPC experience A. Ledesma, E. Romero, P.C. Prat, A. Ramon & N.M. Pinyol  | 447    |  |  |
| Teaching unsaturated seepage and wetting-collapse coupled modelling<br>N.M. Pinyol & E.E. Alonso   | 459    |  |  |
| Teaching unsaturated soil mechanics in a South African context  T.S. da Silva Burke & C.J. MacRobert                                       | 471    |  |  |
| Teaching unsaturated soil mechanics through rammed earth  C. Vulpe & C.T.S. Beckett  | 483    |  |  |

#### Priority Theme 2: Use of Numerical Modeling to Support Teaching

Short-term versus long-term stability problems in clay explained through classical figures and finite element simulations

M. Matos Fernandes, J.L. Borges & M. Pantazidou

495

Integrating advanced computational tools into geotechnical engineering education: an example of transformative learning through digital technology

H. Moghaddasi, M. Moradi, A. Tarantino & B. Ogwezi

507

The role of numerical modelling within a pedagogical framework for soil mechanics courses: implementation for stresses in soils

M. Pinho-Lopes & J. Macedo

519

Steady-state groundwater flow - combining physical models, hand-drawing and numerical solutions to study plane flownets

M. Pinho-Lopes & W. Powrie

533

Applied numerical analysis in Geotechnical Engineering: a Masters module from the perspectives of the academic, teaching assistant and students

A. Tsiampousi & P. Tantivangphaisal

547

Initial study on leveraging digital tools for geotechnical education: enhancing practical training with databases at CiviLab@CUT

S.G. Waters & E. Theron

559

Teaching the significance of numerical model validation with problem-based learning: examples from rock mechanics

P. Yiouta-Mitra 571

Author Index 583

#### **Preface**

The international conferences on Geotechnical Engineering Education (GEE) are organized by the technical committee TC306 of the International Society for Soil Mechanics and Geotechnical Engineering (ISSMGE). Geotechnical Engineering Education 2025 (GEE 2025) was organized under the auspices of the French Soil Mechanics Committee (CFMS) and the University of Loraine, with support by academic and professional French organizations and major French geotechnical engineering companies, and chaired by Professor Farimah Masrouri of Université de Loraine.

In addition to the recurrent education theme topics in GEE conferences, namely, *Curricula*, *Coursework*, *Open Resource Educational Material*, *Applications of ICT Tools* and *Links to Research on Learning and on Engineering Education*, GEE 2025 had two priority themes: *Teaching of Unsaturated Soils* (Priority Theme 1) and *Use of Numerical Modeling to Support Teaching* (Priority Theme 2). Sessions on priority themes were complemented by invited thematic presentations, fostering a lively exchange of ideas.

These proceedings are primarily a record of what the conference leaves behind. They cannot, however, convey the camaraderie that animated the event. Many attendees savored for the first time the rare luxury of dedicating two uninterrupted days to focused discussion of geotechnical engineering education — an opportunity made possible by the collegially masterful GEE 2025 hosts and the insightful authors whose contributions are collected here.

Michele Calvello Marina Pantazidou Margarida Pinho-Lopes

September 2025

## Organization

#### **GEE 2025 Organizing Committee**

Chair: Farimah Masrouri, Université de Lorraine, France

Members:

Adel Abdallah, Université de Lorraine, France Nicolas Chabrat, Université de Lorraine, France Olivier Cuisinier, Université de Lorraine, France Olivier Deck, Université de Lorraine, France

Philippe Gotteland, FNTP, France

Mahdia Hattab, Université de Lorraine, France

Orianne Jenck, Institut National Polytechnique de Grenoble, France

Rasool Mehdizadeh, Université de Lorraine, France

Sandrine Rosin, Université de Lorraine, France

#### **GEE 2025 Program Committee**

Marina Pantazidou, National Technical University of Athens, Greece (coordinator)

Gretchen Bohnhoff, University of Wisconsin at Platteville, USA

Michele Calvello, University of Salerno, Italy

Andy Leung, Hong Kong Polytechnic University, Hong Kong

Charles MacRobert, Stellenbosch University, South Africa

Farimah Masrouri, Lorraine University, France

Silvana Montoya-Noguera, Universidad EAFIT, Colombia

Margarida Pinho-Lopes, University of Aveiro, Portugal

#### **GEE 2025 Scientific Committee**

Asif Ahmed, SUNY Polytechnic Institute, USA

George Anoyatis, KU Leuven, Belgium

David Airey, University of Sydney, Australia

John Atkinson, City University, UK

Katia Bicalho, Federal University of Espírito Santo, Brazil

Giovanna Biscontin, National Science Foundation, USA (UK)

Gretchen Bohnhoff, University of Wisconsin at Platteville, USA

Susan Burns, Georgia Institute of Technology, USA

Brian Byrne, IT Carlow, Ireland

Michele Calvello, University of Salerno, Italy

Francesca Ceccato, University of Padua, Italy

Ilhan Chang, Ajou University, South Korea

Liang Cui, Lakehead University, Canada

Vasiliki Dimitriadi, Edinburgh Napier University, UK (Greece)

Silvina Echazú Lamas, Universidad Nacional de Salta, Argentina

Tugba Eskişar Tefçi, Ege University, Turkey

George Fanourakis, University of Johannesburg, South Africa

#### Geotechnical Engineering Education 2025 - Calvello, Pantazidou & Pinho-Lopes (eds)

Margarida Fernandes de Pinho Lopes, University of Aveiro, Portugal

Ana Heitor, University of Leeds, UK

Mark Jaksa, University of Adelaide, Australia

Orianne Jenck, Grenoble Alpes University, France

Polixeni Kallioglou, University of Thessaly, Greece

Mamoru Kikumoto, Yokohama National University, Japan

Emil Mejlhede Kinslev, Technical University of Denmark, Denmark

Biljana Kovačević Zelić, University of Zagreb, Croatia

Tae-Hyuk Kwon, Korea Advanced Institute of Science and Technology, South Korea

Robert Lanzafame, TU Delft, The Netherlands

Alberto Ledesma, Polytechnic University of Catalonia, Spain

Andy Leung, Hong Kong Polytechnic University, Hong Kong

Xia Li, Southeast University, China

Huabei Liu, Huazhong University of Science and Technology, China

Charles MacRobert, Stellenbosch University, South Africa

Francisco Javier Manzano Diosdado, Cádiz University, Spain

Farimah Masrouri, Lorraine University, France

Manuel Matos Fernandes, University of Porto, Portugal

Bryan McCabe, National University of Ireland Galway, Ireland

Toshifumi Mukunoki, Kumamoto University, Japan

Silvana Montoya-Noguera, Universidad EAFIT, Colombia

Hideki Ohta, Chuo University, Japan

Rolando Orense, University of Auckland, New Zealand

Anitha G. Pillai, SCMS School of Engineering & Technology, India

Marina Pantazidou, National Technical University of Athens, Greece

Muhsin Rahhal, University of Saint-Joseph, Lebanon

Anna Ramón Tarragona, Polytechnic University of Catalonia, Spain

M. Rama Rao, JNT University, Kakinada, India

Saibaba Reddy, JNT University Hyderabad, India

Rodrigo Salgado, Purdue University, USA

Klaas Siderius, Fugro Geoservices, The Netherlands

Francisco Javier Torrijo, Universitat Politècnica de València, Spain

Roberto Vassallo, University of Basilicata, Italy

Vasiliki Xenaki, Edafomichaniki SA, Greece

Jun Yang, University of Hong Kong, Hong Kong

Fayrouz Yasser, Mansoura University, Egypt