Content of the Invited Lectures Volume at a glance

Geotechnical Engineering in the XXI Century: lessons learned and future challenges

Casagrande Lecture
Plenary Lecture ISSMGE President
Keynote Lectures
Bright Spark Lectures

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Gabriel Auvinet obtained a Doctor degree in Engineering from UNAM, Mexico in 1986. He is a Researcher at Instituto de Ingeniería (Institute of Engineering), UNAM (National University of Mexico) and Faculty member of UNAM Postgraduate program. He was a guest Professor in the French Universities of Grenoble (1986), Nancy (1993-1994) and Clermont (2003-2004). He has directed a large number of professional, master and doctoral theses and is author of 367 papers in Journals and National and International Conferences and 248 research reports. He is presently Head of the Geotechnical Computing Laboratory of Institute of Engineering, UNAM. He has dedicated his research work to Soil Mechanics with emphasis on special foundations and tunnels in consolidating soft soils. Simultaneously, he has developed new techniques for application of probabilistic and geostatistical methods in Civil Engineering. He has been involved as a consultant in many large projects in Mexico, Central and South America and Europe. He performed geostatistical and geomechanical analyses for the design of award-winning Rion-Antron bridge foundation in Greece. Professor Auvinet has been President of the Mexican Society for Soil Mechanics (SMIG, 1992-1993) and Vice President for North America of International Society for Soil Mechanics and Geotechnical Engineering (ISSMGE, 2009-2013). He has received a number of teaching and research awards in Mexico, France and South America. From 2001 to 2009 he chaired ISSMGE’s Technical Committee TC36: “Foundation Engineering in difficult soft soils conditions”. In 2002 he delivered the Sixteenth “Nabor Carrillo” Lecture: “Uncertainty in Geotechnical Engineering”. He is a member of the Mexican Science Academy, and National Engineering Academy of Mexico. In 2015, He received a Doctor Honoris Causa degree from Universidad Nacional de Córdoba, Argentina. He is author of the updated version (2017) of the internationally known book “The subsoil of Mexico City”.

Geotechnical engineering in spatially variable soft soils. The case of Mexico City. The 9th Arthur Casagrande Lecture

Abstract: Many large cities such as Tokyo, Bangkok, Rio de Janeiro, Recife, Bogota and, of course, Mexico City, to name only a few, were built and are still being developed on soft soils. In many cases, these cities also experience regional subsidence induced by pumping of groundwater from deep local aquifers. Among the sources of uncertainty prevailing in the geotechnical characterization of these sites, soil properties spatial variability is one of the most difficult to deal with since the associated uncertainty cannot be eliminated only by improving laboratory and field-testing techniques. For an accurate evaluation of the subsol conditions, spatial variations of the soil profile and mechanical properties together with the groundwater conditions must be assessed by performing a sufficient number of soil explorations, processing a generally large amount of data and developing either deterministic or probabilistic models of these variations. The techniques available to develop such models and some difficulties encountered to implement them are examined in this lecture. Some geotechnical analysis and design methods that take into account soft soils spatial variations are also reviewed together with constructions techniques aimed at mitigating consequences of soil variability.

The above considerations are illustrated with reference to Mexico City’s highly compressible volcanic lacustrine clays. Models of the spatial variability of these materials developed over the years for different projects using traditional and geostatistical techniques are presented. Some of the geotechnical analysis and construction methods used by geotechnical engineers to deal with soil spatial variability in this megacity once called by Terzaghi “the paradise of soil mechanics”, are also discussed.
Dr Charles W.W. Ng is currently the CLP Holdings Professor of Sustainability, Chair Professor in the Department of Civil and Environmental Engineering and Associate Vice-President for Research and Development at the Hong Kong University of Science and Technology (HKUST). He is the President of International Society for Soil Mechanics and Geotechnical Engineering (2017-2021).

Professor Ng earned his PhD degree from the University of Bristol, UK in 1993. After carrying out a period of post-doctoral research at the University of Cambridge between 1993 and 1995, he returned to Hong Kong and joined HKUST as Assistant Professor in 1995 and rose through the ranks to become Chair Professor in 2011. Professor Ng was elected an Overseas Fellow from Churchill College, Cambridge University, in 2005 and was also elected as a Changjiang Scholar (Chair Professor in Geotechnical Engineering) by the Ministry of Education in China in 2010. He is Fellow of the Institution of Civil Engineers, the American Society of Civil Engineers, the Hong Kong Institution of Engineers and the Hong Kong Academy of Engineering Sciences. Currently, he is an Associate Editor of the Canadian Geotechnical Journal.

Professor Ng has published some 320 SCI journal articles and 250 conference papers and delivered more than 50 keynotes and state-of-the-art reports in 6 continents. He is the main author of two reference books: (i) Soil-structure Engineering of Deep Foundations, Excavations and Tunnels by Thomas Telford, (ii) Advanced Unsaturated Soil Mechanics and Engineering, and (iii) Plant-Soil slope Interaction by Taylor & Francis. He has received many awards including the 2017 Telford Premium Prize from the Institution of Civil Engineers, UK, the Henry Adams Award from the Institution of Structural Engineers, UK, the first Tan Swan Beng Award from the Southeast Asian Geotechnical Society, and the R. M. Quigley Award from the Canadian Geotechnical Society three times for his three best papers published in 2007, 2012 & 2016.

Interplay between ecology and unsaturated soil mechanics for bioengineered landfill covers and slopes

Abstract: The negative impact of climate change calls for additional sustainable and environmentally friendly techniques to be developed for the improvement of the engineering performance of civil infrastructure, such as landfill covers and slopes. Bioengineering using vegetation can be considered and promoted as a low-cost, aesthetically pleasant solution for greening landfill covers and improving shallow slope stabilisation. The mechanical effects of vegetation as soil reinforcement have been extensively studied, but the hydrological effects of vegetation on soil shear strength and water permeability are unclear. This study therefore presents an interdisciplinary research programme consisting of laboratory and field tests and centrifuge modelling. The programme explores the hydrological effects of plants on the performance of final landfill covers and slope stabilisation. Results show that suction induced by plants under a novel vegetated three-layer landfill cover is preserved better than that under a bare cover even after an extreme rainfall event with a return period of greater than 1000 years in Hong Kong. The laboratory tests and field trials demonstrate that the vegetated three-layer landfill cover system using recycled concrete can effectively minimise percolation at humid climate even without a geomembrane. Novel artificial root systems are developed for the centrifuge model tests. Heart-shaped roots have stronger pull-out resistance and higher preserved suction (hence higher soil shear strength) compared with tap- or plate-shaped roots. The heart-shaped root architecture is thus the most effective type in producing stabilisation effects on slopes.
Keynote Lecture

Osvaldo Flores. Obtained his B.A. in Civil Engineering from the Technological Institute of Durango and his master’s and doctoral degrees in Soil Mechanics from the Faculty of Engineering of the National Autonomous University of Mexico (UNAM). He was professor of the postgraduate engineering program at the Benemérita Autonomous University of Puebla (FI-BUAP) from 1998 to May 2008. He has been professor of the master’s degree program in Soil Mechanics at the Faculty of Engineering of UNAM since 2007. He was coordinator of the master’s degree program in Geotechnical Engineering of the FI-BUAP from 2004 to May 2008. He has been member of the Institute of Engineering of the UNAM since 2008. He is currently responsible for the Laboratory of Soil Mechanics of the Institute of Engineering of the UNAM and has directed several undergraduate, specialty and master’s theses.

President of the technical committee on tailings of the Mexican Society of Geotechnical Engineering (SMIG) and member of the review committee of the norm NOM-141-SEMARNAT-2003, which is related to the design and construction of tailings dams in Mexico. He participates as consultant in the design and instrumentation of laboratory equipment (soil mechanics) and in the design and review of tailings dams in Mexico.

His main areas of knowledge are the experimental determination of static and dynamic mechanical parameters of soils, design and stability review of tailings storage facilities, and automation and instrumentation of equipment to determine mechanical parameters of soils in the field and laboratory. He has collaborated in several projects comprising design and structural assessment of tailings storage facilities.

Technical Session #1
Laboratory and in situ testing

Keynote Lecture

Mechanical and hydraulic parameters of tailings, field and laboratory techniques

Abstract: The development of geotechnical models of the solid waste forming a tailings dam has become relevant due to the important worldwide growth of the mining industry. Since a dam is built in most cases using tailings, there is an important presence of water within the retention zone. Therefore, it is essential to carry out a thorough geotechnical characterization using both in-situ and laboratory tests to estimate mechanical (static and dynamic) and hydraulic parameters that allow development of a representative geotechnical model of the tailings storage facility to conduct static and dynamic stability analyses.

This work describes the most common in-situ and laboratory techniques used to estimate mechanical and hydraulic parameters of tailings along with characteristic results, and with emphasis on those used to develop geotechnical models to carry out stability analyzes of the structures.
Keynote Lecture

Dr. Jorge G. Zornberg is Professor in Geotechnical Engineering at the University of Texas at Austin. He earned his B.S. from the National University of Cordoba (Argentina), his M.S. from the PUC of Rio de Janeiro (Brazil), and his Ph.D. from the University of California at Berkeley (USA). As a researcher, his focus has been on soil reinforcement interaction, geosynthetics, earth retaining structures, roadways, urban and mining waste containment, unsaturated soils, and numerical and physical (centrifuge) modeling of geotechnical systems. As consultant, he has often served as expert witness in forensic investigations. Prof Zornberg served as President of the International Geosynthetics Society (IGS) from 2010 to 2014. He was elected “fellow” of ASCE, society in which he currently serves as chair of its G-I Technical Committee on Geosynthetics.

He has authored over 400 technical publications, edited a number of proceedings and book chapters, and been awarded three patents. Prof Zornberg has been invited to deliver keynote lectures in numerous events around the world. He has also received many prestigious awards, including the Mercer Lecture, ASCE’s Croes Medal, IGS’ Award, ASCE’s Collingwood Prize, and IGS’ Young Member Award, as well as the Presidential Early Career Award for Scientists and Engineers (PECASE) awarded by the President of the United States.

Keynote Lecture

Centrifuge Technology for Characterization of Expansive Clays

Abstract: Characterization of soil volumetric strains as an additional variable within the framework of unsaturated hydraulic characteristics adds complexity to the already intricate, non-linear relationships representing the response of the volumetric water content and hydraulic conductivity as a function of matric suction. From the experimental point of view, proper characterization of the unsaturated hydraulic characteristics of expansive clays is not only complicated by the need to control an additional variable (volume changes), but also because these soils have particularly low hydraulic conductivity values, which adds significant challenges in terms of testing time and accuracy of measurements. Because of these conceptual and experimental complexities, the characterization of unsaturated hydraulic properties of expansive clays has remained a largely unexplored issue so far.

This investigation uses centrifuge technology as an alternative to alleviate the shortcomings in the characterization of the unsaturated hydraulic characteristics, and associated volumetric changes, of expansive clays. Specifically, centrifuge technology was adopted for continuous and expeditious measurement of the changing soil moisture content, suction, hydraulic conductivity and void ratio that occur during unsaturated flow processes. The use of centrifuge technology allowed accurate and expeditious determination of the swelling of clays, including the determination of the swell-stress relationship. Determination of this relationship is particularly relevant because, while the financial losses caused by problems associated with expansive clays correspond to the highest costs associated with natural hazards in the US, expansive clay characterization is typically based on only index soil properties because of the significant time required when using conventional methods in design projects.

The new centrifuge approach developed in this study for characterization of the swelling of clays involves soil samples subjected to water infiltration during comparatively small testing periods. The results indicate that, in spite of the significantly more practical and expeditious characteristics of the new approach, the predicted swell-stress curve is the same as that obtained using time-consuming conventional experimental techniques. The centrifuge approach was found to be particularly appropriate for determination of the Potential Vertical Raise, a magnitude that has often be used for the design of roads founded on expansive clays.
Keynote Lecture

Prof. Arduino has taught geotechnical engineering at the University of Washington since 1997. His primary research interest are in computational geomechanics with emphasis in constitutive modeling of soils, finite element analysis, meshless techniques, soil structure interaction, and hazard analysis. Much of his current research is in the area of landslide and debris flow simulation, soil-structure interaction, nonlinear wave propagation in geologic media, and performance-based earthquake engineering. He has conducted research for the National Science Foundation, the Pacific Earthquake Engineering Research (PEER) Center, and the Washington State Department of Transportation (WSDOT). He is a member of the National Academies Committee on Geological and Geotechnical Engineering, ASCE EM Inelasticity and ER Earth and Retaining Structures committees and served on the editorial board of the ASCE Journal of Geotechnical and Geo-environmental Engineering. Prof. Arduino is a member of GEER and was part of the reconnaissance teams after the 2010 Maule earthquake, 2011 Great Japan earthquake, and 2017 Morelos-Puebla Mexico earthquake. Arduino has also served as a consultant to private firms and government agencies in the U.S. and abroad.

Implementation, verification and validation of bounding surface constitutive models for site response analysis

Abstract: Human and economic losses caused by earthquake-induced soil liquefaction underscore the importance of assessing liquefaction hazards, both by determining whether a soil is likely to liquefy and by estimating consequences that these events may cause. Numerical simulations have proven to be useful for these purposes. Reliable numerical analysis requires constitutive models to represent the in-situ soil behavior as well a general loading and drainage conditions. Comprehensive verification and validation studies of implemented material models in specific numerical platforms are also necessary and imperative for successful deployment of advanced numerical tools.

This work concentrates on the fundamentals of two recently developed constitutive model, PM4Sand and PM4Silt, and their numerical implementation in the finite element platform OpenSees. Using conventional bounding surface plasticity and critical state concepts, carefully tailored for liquefaction conditions and silt soils, the models can achieve reasonable approximations of desired behavior including pore pressure generation and dissipation, limiting strains, and cyclic mobility with a straightforward calibration process. A verification study offers the opportunity to directly compare the response of the models implemented in three different frameworks, OpenSees, FLAC, and PLAXIS, using stress point, element model, 1D, and 2D analyses. A validation study demonstrates the model capability in capturing realistic soil behavior under different scenarios including case histories, large-scale shake table test, and centrifuge experiments.
Keynote Lecture

**Assembling a Unified Soil Mechanics Theory**

**Abstract:** When Karl von Terzaghi applied the effective stress principle in the soil mechanics theory, the strength and volumetric behavior of saturated soils could be clearly understood and general constitutive models for these materials could be established. In the last twenty years, it has been shown that the principle of effective stresses can also be applied to unsaturated materials and that the same equations used for the strength and volumetric behavior of saturated soils can be used for unsaturated materials. These developments open the door to create general constitutive models that include the phenomena of suction hardening, hysteresis of the retention curve and hydro-mechanical coupling for unsaturated and compacted materials leading to a unified soil mechanics theory.
Field Studies of Stone Columns and Geosynthetic-Encased Columns

Abstract: Ground improvement techniques are commonly required for construction on soft clays. In general, the most traditional construction techniques use a combination of prefabricated vertical drains, temporary surcharge, reinforcement, stabilising berms or staged construction. In order to achieve shorter construction times, alternative techniques may be adopted. Examples of these include: lightweight fills, vacuum preloading, temporary surcharge, geosynthetic-reinforced pile-supported embankments, stone columns, geosynthetic-encased columns and cement injection techniques such as deep mixing. This keynote lecture will present the results of two recent case studies in which vibro stone columns and encased columns were used to strengthen a soft clayey foundation supporting embankment loading.
Keynote Lecture

Anne Lemnitzer
Invited Lecturer

Anne Lemnitzer is an Associate Professor at the University of California, Irvine (USA). She received her Engineering Diploma Degree (Dipl.-Ing.) at the University of Applied Science in Leipzig, Germany, Master’s degrees from the California State University Long Beach and the University of CA, Los Angeles (UCLA), and a PhD degree from UCLA. Her research interests include experimental soil-structure-interaction, underground structures, deep foundations, and sensor instrumentation. She serves in many capacities and is currently Co-editor in chief for the Deep Foundations Journal, Associate Editor for the ASCE’s Journal of Geotechnical & Geoenvironmental Engineering (JGGE), and Chair of the Geo-Institute’s Earth Retaining Structures Technical Committee. She recently won DFI’s President’s Award, NSF’s Career Award and ADSC’s President’s Award. At UC Irvine she teaches the undergraduate and graduate coursework in geotechnical engineering. If not in the lab or at the construction site, Anne loves spending time pursuing her passion for photography and challenging herself on ski slopes around the world.

Technical Session # 6
Foundations and retaining structures

Keynote Lecture

Laterally Loaded Pile Behavior at Soil-Rock-Impedance Contrast

Abstract: At zones of strong impedance contrast in which there is a significant change in stiffness between adjacent geomaterial layers, Winkler-based analysis methods predict abrupt changes in the internal pile reaction force effects for laterally-loaded foundation elements. In particular, the sudden de-amplification of moment when transitioning from a soft to stiff layer is accompanied by amplification of pile shear. From a design perspective, this is problematic when considering large lateral loads and moments acting on drilled shafts, because it can result in bulky transverse reinforcement designs that pose constructability challenges. This paper will review the challenges associated with the lateral performance of piles in zones with strong stiffness contrasts and present a large-scale experimental research program that investigates the lateral load transfer of rock-socketed deep foundation elements. The study seeks to better understand the ability of numerical and analytical methodologies in capturing the behavior at impedance interfaces, compare such with experimental observations, and derive lessons for the construction industry in how to optimize the design requirement using performance-based predictions for deep foundations embedded in stiff materials.
Samuel G. Paikowsky
Invited Speaker

Dr. Paikowsky holds a B.S. in Civil Engineering and a M.Sc. in Geotechnical Engineering from the Technion, Israel Institute of Technology and a Sc.D. in Geotechnical Engineering from MIT. Dr. Samuel Paikowsky is a Professor at the University of Massachusetts Lowell. Sam is also the President of Geo-Dynamica Inc. He has 40 years of experience in geotechnical related consulting, research and engineering projects. His expertise is in the field of deep foundations, reliability based design, testing and analysis, and has been involved in projects worldwide.

Sam headed the NCHRP ultimate and serviceability limit states deep and shallow foundation reliability-based design research that transferred the use of LRFD to database-founded design methodology.

Sam has delivered keynote lectures in all the stress-wave application to deep foundation conferences over the past 20 years with the most recent being held by ASTM in 2018. Sam recently received the Osterberg award at the 2019 DFI SuperPile in Seattle, WA.

Keynote Lecture

The Application of Dynamic Analyses for Testing of Non-Uniform Deep Foundations

Abstract: Dynamic pile testing allows examination of the capacity and integrity of deep foundations. The analysis of stress wave propagation in piles is based on the application of the one-dimensional wave equation (1-D WE) for either matching measured to calculated signals (e.g. CAPWAP) or to analyze modeled impact conditions (e.g. GRL WEAP).

The 1-D WE, a simplified formulation of three-dimensional (3-D) wave propagation for uniform, slender elastic rods is relevant to most driven piles. Plugged pipe piles, however, violate the basic assumptions made for the 1-D WE, and hence may provide questionable results when the traditional methods are applied to analyze them. Drilled foundations are often irregular in shape, and the dynamic test interpretation for these foundations remains a challenge as well.

Both of these non-uniform deep foundation testing and analysis are discussed. The plugging mechanism of open-ended piles is reviewed along with the influence of artificially plugged piles on pile resistance and performance dynamically and statically. A large-scale testing from the Sakonnet River Bridge project in Rhode Island, USA, is used to illustrate the issue and the need for correct physical modeling of the stress wave propagation in plugged piles. Such formulation, in which the spatial stress transformation is allowed for, is developed and demonstrated.

Drop weight testing of non-uniform drilled foundations is illustrated via a case history of unique drilled foundation design, construction, and testing in Tema Port, Ghana. To investigate the validity of the applied analyses, stress wave propagation simulations were conducted using the 1-D WE via WEAP and CAPWAP and were compared to 3-D WE using the PLAXIS finite element Method (FEM) software. The non-uniformity effects on the stress propagation can be observed via the FEM and hence compared to solutions which traditionally utilize the 1-D WE.

The case histories and analyses presented reveal the need for understanding the implication of utilizing the 1-D WE for non-uniform deep foundations and the ways to resolve it. The plugged pile case requires alternative mathematical modeling. The non-uniform drilled foundation analysis with the prevailing method, results in accurate solution for the overall capacity (under strain compatibility of the construction materials) but with limited accuracy for the resistance distribution.
Dr. Werner Bilfinger is a civil engineer graduated from the University of São Paulo, where he also got his Master and PhD degrees. He works with design and consultancy since graduation mainly in infrastructure projects, including tunnels, dams, hydro projects, roads and railroads, maritime structures, airports, slopes and foundations in Brazil, the Americas, Europe and Africa. His activities also include the analyses of losses for insurers and insured, as well as participation in arbitrations as technical advisor. He is active member of technical societies, being Brazilian representative in Working Group 19 (Conventional Tunnelling) of the International Tunnelling Association, and Technical Committee 207 (Soil Structure Interaction) of the ISSMGE. He published more than 40 papers in journals and conferences. He participated in the organization of several conferences, being co-editor of the World Tunnel Congress 2014 proceedings and chairman of 9th International Symposium on Geotechnical Aspects of Underground Excavations in Soft Ground. He was chairman of the Brazilian Tunnelling Committee for the term 2017-2018.

Tunneling through the rock-soil interface

Abstract: Constructive methods, soil treatment and conditioning, and tunnel lining depend fundamentally of ground and hydro-geological conditions. In homogeneous ground, after adequate definition of the parameters above, independent of specific difficulties, construction becomes, after the initial learning curve, a repetitive, uniform and, normally, controlled process, either using conventional or mechanical tunneling method. Often difficulties arise when varying ground conditions are encountered along the tunnel alignment, especially if ground behavior presents significant contrasts in deformability, shear strength and permeability. In geological environments where soft ground overlays rock and tunnels have to be built crossing this interface, the above-mentioned contrasts normally occur at the same location. The most significant recent tunnel failures in Brazil occurred close to rock-soil interface, showing the necessity of a review of current design and construction practice. This paper intends to discuss main challenges associated to the rock-soil interface in the light of recent tunnel failures and present suggestions for robust design and construction methods.
Offshore Wind Turbine Foundations
State of the Art

Abstract: The huge growth and intense development in the European offshore wind power sector over the last decade have created significant achievements within the wind turbine foundation technology. The state of the art focusing on geotechnical design aspects for Offshore Wind Turbine (OWT) foundations and important aspects for installation are presented in this paper. In place operational experience based on structural health monitoring campaigns and future trends are also discussed.
Foundation design in offshore carbonate sediments — building on knowledge to address future challenges

Abstract: Carbonate sediments are prevalent in many major offshore oil and gas basins, as well as a growing number of regions assigned to offshore wind development. Identified as difficult from an engineering perspective, the failure to properly characterize and design for these sediments has adversely influenced several projects. This paper provides a brief geological perspective, and identifies broad trends and characteristics to be considered when defining the engineering properties of such materials. An overview of the challenges faced when founding offshore structures in such sediments is provided, drawing on experience gained over the last 30 years, and with an emphasis on current and emerging issues.
Keynote Lecture

Sustainable Pavement Foundations with Chemically Stabilized Quarry By-products

Abstract: Quarry by-products (QB) are an industrial by-product of aggregate quarry processes. They are typically less than ¼ in. (6 mm) in size and consist of coarse, medium, and fine sand particles, and a small clay/silt fraction. Quarry by-products are found abundantly all over the crushed rock extraction facilities in Illinois where they are produced during blasting, crushing, washing, and screening operations. Recent research conducted at the Illinois Center for Transportation (ICT) has evaluated the characteristics of QB materials collected from different quarries across the State of Illinois, and studied potential uses of QB in pavement applications. Because the Unconfined Compressive Strength (UCS) for QB materials was quite low, Portland cement and Class C fly ash chemical admixture stabilizers were used to improve the strength properties of QB materials which resulted in 10 to 30 times increases in laboratory determined UCS compared to virgin unstabilized QB samples. Such significant increases observed in the strength of stabilized QB materials have indicated suitability of QB for sustainable pavement applications. Full-scale test sections were constructed next with chemically stabilized QB base/subbase applications over a subgrade having a California Bearing Ratio (CBR) of 6% to represent medium volume flexible pavement applications. The test sections were evaluated for performance using Accelerated Pavement Testing (APT), which spanned over two years to include effects of harsh winter freeze. Field testing and forensic analysis techniques included Falling Weight Deflectometer (FWD) tests before and after trafficking, hot mix asphalt coring, Dynamic Cone Penetrometer (DCP) profiling of subsurface layers, and trenching to determine actual thicknesses and contribution of each pavement layer to the measured surface rutting. In general, results from APT and forensic analyses indicated satisfactory results and improved rutting performance.
Keynote Lecture

Technical Session # 10
Natural Hazards

Marcos Massao Futai is currently an Associate Professor in the Department of Structural and Geotechnical Engineering at the University of Sao Paulo. He is a Civil Engineer (Federal University of Mato Grosso). He received his Master and PhD degrees in Geotechnical Engineering from the Federal University of Rio de Janeiro. He was an Academic Visitor at the University of Cambridge (2015-2016). Prof. Futai has published some 25 papers in international journals and 130 conferences papers. Prof. Futai was the head of the Civil Engineering Graduate Program – University of Sao Paulo (2012 – 2015). He was the former President (2011-2012) of the Regional Sao Paulo Nucleus of the Brazilian Association of Soils Mechanics and Geotechnical Engineering (ABMS) and a member of the following committees: Unsaturated Soils; Field Tests; Foundation. He currently is the General Secretary of the Rock Mechanics Technical Committee of ABMS – 2019-2020 and Head of the Research Group of Geotechnical Engineering Applied to Infrastructure (GeoInfraUSP). The research and consultancy interests include embankment on soft clay, wind turbine foundation, landslides and climate change, rock mechanics, tunnel, dam, reinforced soil, geosynthetics.

Tropical Climate Condition and Disasters due to Landslides

Abstract: The economic losses and deaths caused by natural disasters are growing worldwide. The tropical climate contributes to forming thick soils and heavy rainstorms, which is why landslide disasters are very common in countries such as Brazil. Rainfall may act as a preparatory agent to trigger landslides and is the main cause of slope failure. Water commands the instability process, and this may occur in unsaturated or saturated soils. Reduced suction, soil saturation or increased water table depend on the interaction of the soil with the climate conditions. In normal conditions, rainfall infiltration is the main source of water from the slopes. On occupied hillsides, there may be an outflow of wastewater, and other cases may involve leakages from water or sewage pipes, which may also contribute to infiltration. Many the disasters in Brazil occurred in the Serra do Mar, a mountain range extending for about 1,500 km along the southeast coast of Brazil. Disasters related to landslides in the Serra do Mar were observed to happen in less than ten years and to depend on climate conditions. Shallow landslides in colluvial and residual soils are very common in tropical regions, mainly associated with periods of heavy rainfall. Two historical disaster cases were selected to understand the mechanisms of the instabilization of shallow landslides during extreme rainfall associated with the disaster of the Cubatao Mountain and of the Mountain Region of Rio de Janeiro. In January 1985, 1,500 shallow landslides devastated the Cubatao Mountain located in the State of Sao Paulo. The latest serious disaster occurred in the Mountain Region of Rio de Janeiro in January 2011 and more than 3,500 landslides caused 1,500 fatal victims. Most movements were shallow landslides along with debris flow, mudflow, flow rotational landslides and rock fall. The instability mechanisms in tropical soil depend on climate and geological conditions. In both cases, infiltration is defined by the unsaturated condition (soil water retention curve, conductivity function, unsaturated shear strength) because the surface always remains unsaturated. However, in the Cubatao Mountain, the landslides were triggered near the saturation, and in the Mountain Region of Rio de Janeiro, positive pore-water-pressure must have occurred.
Keynote Lecture

Developments in Landslide Analysis Methodologies

Dr. Fredlund received his training from the University of Saskatchewan and Texas A&M University and has published over 50 research papers on topics related to database design, finite element modeling, and unsaturated soil knowledge-based systems. In 1997 he started SoilVision Systems Ltd. with a database software product called SoilVision which could be used to estimate unsaturated soil behavior. He has since directed the development of eight finite element software packages covering areas of groundwater flow, contaminant transport, geothermal analysis, air-flow analysis, stress / deformation, and slope stability.

More recent work has involved supervising the development of the state-of-the-art 2D/3D SVSLOPE slope stability software and the SVDESIGNER 3D conceptual modeling software. This work has continued with the expansion of 3D slope stability analysis into the areas of mining such as the analysis of open pits, tailings dams, power dams and performing landslide risk analysis.

Abstract: Some of the first analytical tools developed in soil mechanics aimed at evaluating the stability of slopes. In recent years there has been numerous changes proposed on how best to model the behavior of slopes and the mechanisms of instability. "Limit Equilib-
Keynote Lecture

Manuel R. Villarraga H.
Invited Lecturer

Manuel R. Villarraga H. is a Civil Engineer graduated from the National University of Colombia (UN) and he obtained a Master engineering degree in geotechnical engineering from The National Autonomous University of Mexico (UNAM).

He has been involved in geotechnical research, consulting and education for more than 28 years. He is a professor of geotechnical engineering for undergraduate and graduate levels at the National University of Colombia; giving courses such as foundation engineering, geotechnical earthquake engineering and water flow in porous media. He has been Head of the Master Degree in Geotechnical Engineering of the National University of Colombia at Medellin, and invited professor of the University EAFIT and Pedagogical and Technological University of Tunja. The supervision of more than 25 postgraduate thesis have been the result of his intensive educational and research activities on soil dynamics of tropical soils, soil-structure interaction and geotechnics of solid waste landfills. Also, he is author or co-author of 35 scientific papers and presentations in national and international congress.

As a consulting engineer, he has been involved in national and international (South and Central America) projects related to seismic risk analysis, design, rehabilitation and improvement of dams, static and dynamic soil-structure interaction, design and operation of solid waste landfills and hydropower plants. He was senior specialist engineer and Head of the Geotechnical and Geology Department in the consultant company INTEGRAL S.A. Since 2003, he is the CEO of the civil engineering company INTEINSA.

The Colombian Association of Engineers has awarded him the Lorenzo Codazzi National Award of Engineering Grants in 2000 by the seismic zoning and the instrumentation setup of the Medellin city. Also, he has been awarded the G. Leonards Award twice (in 2000 and 2007) for the best work presented in the national Geotechnical conferences.

Keynote Lecture

Risk assessment and rehabilitation of earth dams in Antioquia, Colombia

Abstract: The Department of Antioquia is located at the north-west of Colombia, in a region characterized by an intermediate seismic hazard and tropical climate, with high rainfall and medium to high temperatures.

There are several types of geological formations, mostly igneous and metamorphic rocks which generate deep residual soils profiles. Typically, these residual soils are covered by fresh or weathered slope deposits.

Taking into account the important water supply, since the middle of the XX century 10 big earth dams has been built in the region. These dams were built with the residual soils from igneous and metamorphic rocks. The high natural water content of these residual soils, between 5 to 10% higher to the optimum value, implied particular compaction techniques.

This lecture analyses the evolution of several characteristics of these dams and deals with the static and dynamic risk assessment of some of them, considering the current standards. Typical engineering problem of these structures and corrective works are presented.
Alberto Sayao is a civil engineer graduated from PUC-Rio, with a Ph.D. degree (1989) in Geotechnical Engineering from the University of British Columbia (UBC, Canada), where he returned as a Visiting Professor in 1999.

Former President of ABMS - Brazilian Geotechnical Society, from 2004 to 2008; Elected Full Member of ANE - National Academy of Engineering of Brazil, in 2011.

He is currently an elected Member of the CBDB Deliberative Board - Brazilian Committee on Large Dams, Secretary General at ANE, and Associate Professor at PUC-Rio, where he has already supervised about 80 Master and Doctoral theses.

He has authored two books: “Handbook of Slope Stabilization” (Springer, 2004) and “History of Geotechnical Engineering in Brazil” (ABMS, 2010).

Keynote Lecture

**Dam engineering in Brazil**

Abstract: Brief presentation of the historic evolution of Dam Engineering in Brazil, with emphasis on the design and construction considerations of large Hydro Electric projects in the Amazon and other regions of the country, with different geologic and climatic conditions, followed by a brief discussion on the main causes and lessons learned from four recent serious accidents of Açú (end of construction) and Algodões (full reservoir) earth dams, and Fundão and Brumadinho (tailings dams) disasters. The lecture shall be concluded with a brief description of four current research topics on dam safety, of practical interest: design implications for increasing the reservoir elevation and improving the energy production at the 30 years old Curuá-Una earth dam; assessment of the Probability of Failure of Santa Branca earth dam, and a new method for the life time prediction of the altered basalt rockfill at the Marimbondo Dam, subject to rapid weathering conditions.
Nonlinear Dynamic Analyses of Austrian Dam in the 1989 Loma Prieta Earthquake

Abstract: Two-dimensional nonlinear dynamic analyses (NDAs) of Austrian Dam in the 1989 Mw=6.9 Loma Prieta Earthquake are presented using the finite difference program FLAC 8.0 with the user-defined constitutive model PM4Silt (Boulanger and Ziotopoulou 2018) and following engineering procedures common in practice. This relatively homogenous, 55-m high embankment dam was comprised primarily of low-plasticity clayey sands and clayey gravels. The dam experienced peak ground accelerations of 0.4–0.6g during the earthquake and developed extensive cracking with crest settlements up to 859 mm. The engineering properties of the compacted embankment materials are estimated based on the available ICU triaxial compression and resonant column test data. NDAs were performed using two alternative calibrations for the PM4Silt model and four different input motions. The computed responses are shown to be in reasonable agreement with the observed crest settlements, embankment deformation patterns, and excess pore pressures. Limitations in the material characterizations and analysis procedures and their possible effects on the analysis results are discussed.
Keynote Lecture

Professor Vern Schaefer, Ph.D., P.E. is the James M. Hoover Professor of Geotechnical Engineering in the Civil, Construction and Environmental Engineering Department at Iowa State University. He specializes in foundations, slope stability & landslides, earth retention systems, and ground improvement. He has a B.S. in civil engineering from South Dakota State University, a M.S. in geotechnical engineering from Iowa State University, and a Ph.D. in civil engineering from Virginia Tech. Prof. Schaefer has over 140 publications and numerous research reports from 52 funded research projects between 1987 and 2018, with research expenditures over $9.5 million. As the Principal Investigator and Project Manager for the SHRP 2 R02 project Geotechnical Solutions for Soil Improvement, Rapid Embankment Construction, and Stabilization of the Pavement Working Platform, Prof. Schaefer led a team of 12 researchers and over 40 graduate students in the development of the GeoTechTools system, the highly regarded web-based information and guidance system for more than 50 ground improvement and geoconstruction technologies.

Technical Session # 13
Ground Improvement

Keynote Lecture
Past, Present, and Future of Ground Improvement in the Americas

Abstract: Ground improvement methods have developed markedly over the past six decades, to the point where they are routinely used in geotechnical design and construction. Their development, evolution and use in the Americas is discussed and summarized. A large number of ground improvement methods can be employed to overcome poor soil site conditions; and the growth in methods, products, systems and engineering tools has resulted in a very large body of knowledge. Selection of the most appropriate technology is a complex undertaking that depends upon integration of available knowledge and expertise as well as site specific factors. These factors are discussed in relation to the essential elements for success of a ground improvement project. GeoTechTools, a web-based ground improvement information and guidance system, developed to summarize and organize this knowledge to facilitate informed decisions, can be used for engineering and construction practice that incorporates these essential elements.
Richard J. Chalaturnyk is a Professor of Geotechnical Engineering in the Department of Civil and Environmental Engineering at the University of Alberta and holds the Energy Simulation Chair in Reservoir Geomechanics as well as the ATIP Industry Chair in Reservoir Geomechanics for Unconventional Resources. At the University of Alberta, Rick has created the Reservoir Geomechanics Research Group, working primarily in the area of unconventional resource geomechanics, geological storage of CO₂ and has established GeoREF – a Geomechanical Reservoir Experimental Facility at the University of Alberta designed specifically for high temperature/high pressure testing that includes additive manufacturing (3D printing) capacity for producing reservoir rocks. He was involved in the IEA GHG Weyburn-Midale CO₂ Storage and Monitoring Research Project since its inception and is currently active as a member of the scientific and engineering research committee for the Aquistore project in Saskatchewan and several other CCS initiatives. Dr. Chalaturnyk served as Chair of a Canadian Standards Association Technical Committee that developed CSA Z741-12, a standard for the geological storage of CO₂.

Keynote Lecture

Geotechnical Engineering Innovation to Advance CCUS-From Smart Rocks to the Aquistore Project

Abstract: Carbon capture and storage (CCS) is a key technology to enable Canada and arguably, the world to meet our greenhouse gas emissions reductions targets. Geotechnical Engineering plays a critical role in achieving success with CCS because a one key element of the full value chain of CCS technologies requires that the capacity of subsurface formations to receive and safely store CO₂ over long periods of time be assessed. Relatively few projects have been executed globally that allow us to fully demonstrate the full spectrum of geotechnical engineering workflows for the geological storage of CO₂. There has been, however a great many research-level experimental and numerical studies that post direct relevance to full scale field projects. This keynote lecture will attempt to highlight the many decisions associated required for field scale projects that challenge current research efforts, with a particular focus on the Aquistore CO₂ Storage Project which is an integral component of SaskPower’s Boundary Dam CO₂ Capture Project and located in southeastern Saskatchewan, Canada. The Boundary Dam Project is one of the world’s first commercial post-combustion carbon capture, utilization, and storage projects where CO₂ is captured at SaskPower’s Boundary Dam coal-fired power plant and is primarily used for CO₂-EOR operation. Experience with other large-scale projects will also be discussed in the context of geotechnical engineering decisions for the geological storage of CO₂.
Carlo Viggiani graduated in Civil Engineering in 1960 at the University of Napoli; PhD in Geotechnical Engineering in Napoli in 1969.

He has been teaching in the Universities of Pavia, Cosenza, Potenza; from 1974 to 2011 he has been Professor of Foundation Engineering at the University of Napoli Federico II, where is at present Emeritus Professor.

C.V. has been State of the Art Reporter at the International Conferences on Soil Mechanics and Geotechnical Engineering in New Delhi, 1994 (Mitigation of Natural Hazards: Landslides and Subsidence) and in Osaka, 2005 (Pile foundations). He is Author or Co-Author of 4 books and more than 200 technical papers.

His research topics include Theory of Consolidation, Soil-Structure Interaction for Shallow and Deep Foundations, Geotechnics for the Conservation of Monuments and Historic Sites. He has been Chairman of TC19 (later TC301) (Preservation of Monuments and Historic Sites) of the ISSMGE and has been involved in the conservation of a number of monuments affected by geotechnical problems.

From 1990 to 2002 he has been member of the International Committee for the Safeguard of the Leaning Tower of Pisa and is presently member of the Monitoring and Surveillance Committee of the Tower. His interest to the Tower dates back to 1963.

C.V. has been involved, as geotechnical consultant, in the design and construction of a number of civil engineering structures; among them earth dams, civil and industrial buildings, bridges, tunnels and underground constructions, stabilisation of landslides. He acted as consultant for Italian Railways and Underground Transportation Systems in Rome, Napoli, Torino, Bologna, Firenze. He has been involved in the design of the suspension bridge over the Messina Straits.

Keynote Lecture

The behaviour of an ancient tower through history and monitoring

Abstract: Geotechnical Engineering plays often a significant role in the conservation of historical buildings and monuments; this is particularly true for ancient towers, where soil structure interaction is a very important aspect.

From the viewpoint of an engineer, the peculiarity of any intervention on historical structures is the requirement of respecting their integrity, besides guaranteeing the safety. While the attainment of safety is a relatively straightforward matter for a well trained and experienced engineer, the respect of integrity is a much more difficult matter, since the concept itself of integrity has many facets and is somewhat elusive.

To conceive and implement any intervention intended to safeguard a monument, a clear understanding of its mechanisms of behaviour is essential. Such an understanding may be obtained by a careful reconstruction of its history and a complete observation of its actual behaviour by a proper monitoring program.

These concepts are exemplified referring to a famous medieval Italian tower: the leaning tower of Pisa.
Forensic Geotechnical Engineering. Some Cases in Mexico City

This paper describes some experiences of geotechnical faults known as Forensic Geotechnical Engineering, or "History Cases". Most of the cases are related to the works of the subway in Mexico City, in which the author has developed most of his professional activity for more than thirty years.

Each one of the cases is analyzed and discussed in depth, including background, problem statement, presentation of the failure, analysis of the causes that originated it and finally the lessons learned. The failures mentioned in this paper occurred in Mexico City in the 1980s. The lessons learned are considered the core part of forensic geotechnical engineering since they allow us to know the causes of failures and take them into account in similar constructive processes. At the same time, they can be taken as case studies in the academy to transmit these experiences to future engineers.
Keynote Lecture

Dr. Carlos Carranza-Torres is a Professor in the Department of Civil Engineering at the University of Minnesota, Duluth Campus (UMD). Dr. Carranza-Torres has 20 years experience working in the industry of geotechnical engineering (full time since 1998 and as part-time consultant since 2008) and 10 years experience working in academia (since 2008 as an Associate Professor and since 2017 as a full-time tenured Professor at UMD). At the university he teaches or have taught undergraduate and graduate courses in rock mechanics, soil mechanics, geotechnical design, engineering geology, numerical analysis, design of excavations and others. His field of research is in the development of analytical and numerical techniques for the practical treatment of geo-mechanics problems. In the geotechnical engineering industry, he has worked first as project engineer and later on, as independent consultant for various geotechnical engineering groups involved in excavation projects for civil and mining engineering applications, in the US and overseas. Dr. Carranza-Torres has served in the editorial board of various geotechnical engineering journals, including the role of co-editor-in-chief of Engineering Geology (from 2013-2015).

Analytical and numerical study of the stability of shallow circular cavities in weak rocks

Abstract: This keynote lecture focuses on the problem of determining the stability of shallow circular cavities in frictional cohesive ground (weak rocks or soils) assumed to obey a Mohr-Coulomb failure criterion. Methods traditionally used to analyze stability of shallow excavations are reviewed first. A method based on the application of limit analysis and strength reduction techniques in full numerical analysis is chosen for evaluating stability conditions of shallow cavities in this study. Application of a scalar factor of safety for shallow tunnels is introduced and dimensionless groups of variables controlling the stability of the openings are identified. The stability of shallow circular cavities in purely cohesive ground and in cohesive-frictional ground are discussed in detail and observations of practical interest are highlighted. Comparison of stability results obtained with the proposed analytical equations and with full numerical analyses and with approaches used by other authors are discussed. The effect of water in the ground and inside the excavation on the obtained factor of safety is reviewed. Similarities of controlling groups of variables for the cases of shallow tunnels and slopes are highlighted. The concept of mechanical similarity of shallow tunnels and slopes excavated in frictional-cohesive ground is also introduced.
Advances in the teaching of Geotechnical Engineering in Peru

Abstract: In Peru, the university formation in geotechnical engineering has a starting point in the contribution of professor Emilio Le Roux Catter in 1946 in the old School of Engineers, today National University of Engineering. It is then that the Soil Mechanics course was created within the civil engineering teaching curriculum.

In the decade of the 60th, thanks to the visit of renowned experts in Soil Mechanics, the specialty of Soil Mechanics receives dynamism, giving courses on: Soil Mechanics applied to Transport Roads and Soil Mechanics applied to Earth Dams. The Soil Mechanics and Pavement Laboratories were implemented in the National University of Engineering and in the Pontifical Catholic University of Peru.

In 1971, the UNI created the Graduate School and later the Master of Science Civil Engineering with a major in Geotechnics, giving a great boost to the teaching and application of Geotechnics in Peru, which came to fruition during the 1980s and in the mid-1980s, with the work of the Peruvian Committee on Soil Mechanics, Foundations and Rocks Mechanics and with the implementation of the first Peruvian Technical Standard for Soil Mechanics E-050.

Since 2011, techniques for measuring stress, deformation and water flow have been improved both in-situ and in laboratory. On the other hand, the continuous presence of seismic movements has motivated that twenty universities from the country led by the National University of Engineering, consider that the topics of dynamic characterization of soils should be integrated into the training of Civil Engineering students for which have installed a network of accelerographic stations, which favor the research carried out by undergraduate and graduate students and teachers in the area of Geotechnical Seismic Engineering.
Dr. Lyesse Laloui is chaired full professor and Director of the Soil Mechanics Laboratory at the Swiss Federal Institute of Technology, EPFL, Lausanne, where he developed a major research group in the area of Geomechanics for Geo-energy. He is also adjunct professor at Duke University, USA, and advisory professor at Hohai University, China. He is the recipient of an Advanced ERC (European Research Council) Grant for his project BIOGEOS (BIO-mediated GEO-material Strengthening). He wrote and edited 12 books and published over 300 peer reviewed papers. His work is cited more than 4800 times with an h-index of 34 (Scopus). He is the Editor in Chief of the International journal Geomechanics for Energy and the Environment. He is the recipient of the “Excellent Contributions Award” of the International Association for Computer Methods and Advances in Geomechanics, the “2012 Vardoulakis Lecture” from the University of Minnesota, the “12th G.A. Leonards Lecture” from the University of Purdue, the “2016 RM Quigley Award” from the Canadian Geotechnical Society and the 30th Roberval Award at the French Academy of Science in 2018. He has been involved as an expert in several international projects and acts as a consultant in civil, geotechnical and geothermal engineering, including legal and arbitration cases. He acted as the Chair of the Evaluation Panel of Civil and Geological Engineering R&D Units of Portugal in 2018. The patented “Geosynthetic element for soil bio-improvement” is currently being developed in the context of the start-up MeduSoil. He is also developing another start-up (GEOEG) in the area of Energy Geotechnologies.

Keynote Lecture

Experimental Analyses on the Multiphysical Phenomena Governing Energy Pile Behavior

Abstract: Energy piles are exposed to temperature variations during their lifetime, due to their unique role combining structural support and geothermal heat exchange. Temperatures in the piles and in the surrounding soils fluctuate on a daily and seasonal basis which may cause axial displacements, additional axial stresses and changes in shaft resistance along energy piles. Furthermore, soils in the vicinity of the energy piles experience volumetric strains and changes in shear strength which may eventually have an impact on the structural behavior of energy piles. To understand the extent of temperature changes on energy piles, soils and soil-pile interfaces, various in-situ and laboratory tests have been performed. The goal of this paper is provide details regarding in-situ and laboratory tests performed on energy piles, as well as to compile an observational framework in understanding the mechanics of soils, structures and the interaction between them in consequence of thermal actions.
Dr. Tugce Baser is an Assistant Professor in the Department of Civil Engineering at the University of Illinois Urbana-Champaign, specializing in Geotechnical Engineering. Her research interests include unsaturated soil mechanics, energy geotechnics, permafrost mechanics, and sustainable geo-energy applications. Over the past five years, Dr. Baser has been awarded honors by international institutions and invited as a keynote speaker. She received her PhD degree in Geotechnical Engineering from University of California San Diego in 2017. Dr. Baser is a member of ISSMGE, ASCE G-I, and CGS where she is actively engaged with the student, professional, and diversity development.

**Bright Spark Lecture**

**Thermal Energy Storage in Borehole Arrays Installed in Unsaturated Soils**

Abstract: In the last decades, much attention has been given to provide sustainable solutions for energy-related needs of society due to the increase in energy demands with growing population associated with economic development. This includes using the subsurface as thermal energy resources such as in Borehole Thermal Energy Storage (BTES) systems, an innovative approach to provide heating and cooling of the buildings through geothermal heat exchangers installed in the subsurface. This study highlights on the role of vadose zone on coupled thermo-hydraulic response of a BTES system specifically focusing on how the coupled heat transfer and water flow processes and coupled thermo-hydraulic constitutive properties of soils may be exploited to enhance heat injection and heat retention in an array of geothermal borehole heat exchangers. The results from laboratory and field experiments and numerical simulations, which can crucially contribute to the sustainable thermal energy strategies and the design, confirm the good performance of BTES system in the vadose zone. Further, economic and environmental impacts of BTES systems were evaluated using a eco-efficiency analysis, a Life Cycle Assessment approach. The results indicate that BTES systems can efficiently reduce energy consumption and CO₂ emissions which make these systems more feasible and environmentally friendly.
Bright Spark Lecture

Carlos Omar Vargas Moreno
Mexico
Graduated from Technological Institute of Durango in Mexico. MSc degree obtained in 2015 from the National Autonomous University of Mexico (UNAM). Co-author of the book “Assessment of vulnerability to the liquefaction of sands” edited by the Mexican Society of Geotechnical Engineering (SMIG), for which was awarded with the “Nabor Carrillo Flores” Research Award in 2017 granted by the College of Civil Engineers of Mexico. He has published fourteen technical articles related to: soil liquefaction, site response analysis, tailings dam, numerical modeling and soft soils topics, obtained from academic work and professional practice.

He is employed of the Department of Soil Mechanics of the Federal Electricity Commission (CFE) in Mexico. Professional experience in the development of geotechnical design and analysis projects, including the following: Design of tailings dams for mining infrastructure, design of shallow and deep foundations and design of tunnels and tunnel shafts in soft soils. Currently, he is professor in the postgraduate course of National Autonomous University of Mexico (UNAM) campus Acatlan (FES-Acatlan) since 2018. Professor at the Bachelor’s Degree Program in Deep Foundations for UNAM-FES-Acatlan since 2016. He has taught the course of liquefaction analysis for SMIG and courses for a private industry in Lima, Peru. He has been part of the board of the Mexican Society for Geotechnical Engineering from the period of 2017 to 2018.

Special Session SE1
Young Geotechnical Engineers

Bright Spark Lecture

Analysis and seismic design of tailings dams and liquefaction assessment

Abstract: The increasing of the mining industry in Latin America, combined with the high seismic conditions of some regions, represents a major challenge for geotechnical engineers in relation to the mining waste disposal design. Earthquakes are one of the principal causes of failure in this kind of structures, which are mainly attributed to liquefaction, whose consequences have been catastrophic such as cases history of Mochikoshi Tailings dams, Japan (1978); Cerro Negro and El Cobre, Chile (1965) and Amatista, Nazca, Peru (1996). Therefore, one of the main aspects in the seismic design of these structures is related to the possible liquefaction of the tailings, due to the characteristics of these materials. This paper presents the design criteria, geotechnical characterization and the seismic stability assessment of a tailings dam. This work is presented from practice approach, with emphasis on considerations that involved the dynamic analysis of a project at the design stage and the evaluation of liquefaction in this structure. The analysis results, interpretation and conclusions are presented based in local and international guidelines.
Bright Spark Lecture

Marlisio Oliveira Cecilio Junior
Brazil

After graduating as a Civil Engineer from the Federal University of Santa Catarina - UFSC, he was granted his Master of Sciences degree on Geotechnical Engineering from the Polytechnic School of University of São Paulo-USP.

Since then, he worked for Figueiredo Ferraz, Bureau de Projetos and Tüv Süd, completing ten years of experience on design and consultancy of tunnels, retaining structures, slopes and dams. Currently, he is a PhD candidate at the University of Wollongong, Australia.

He published dozens of technical articles internationally. His awards include the best oral presentation at the 3rd Brazilian Tunnelling Congress, best technical article on the XV Panamerican Conference on Soil Mechanics and Geotechnical Engineering and finalist for the category “Young Tunneller of the Year” on the ITA-Awards.

Marlisio was the first president for the Young Members Group of the Brazilian Tunneling Committee. He engaged in the organization and scientific committees of international conferences. As a representative member of ISSMGE’s TC 204, he helped bringing their international symposium for the first time to the Americas, as the symposium vice-president.

Special Session SE1
Young Geotechnical Engineers

Bright Spark Lecture

Personal Account on Reliability Analyses, from a Young Geotechnical Engineer

Abstract: The use of deterministic stability analyses for geotechnical works is still common practice. Such analyses consider a single set of input parameters and therefore a single result is taken as definitive and compared to limits established by codes. However, a deterministic stability assessment taken as satisfactory may be associated with a probability of failure considered as high. This is why one approach should not suppress the other, they should rather be complementary. A similar comment can be made for the probability of failure, while a small value may not be accepted within a densely occupied urban scenario and a high value may be considered satisfactory within an uninhabited area. This is why the risk should also be evaluated rather than solely the probability of failure. Discussions concerning the risk of failure instead of mere deterministic approaches have significant importance, bearing in mind either insurance needs or the development of projects that are both more reliable and cost-effective.