# THE 4TH INNOTECH FORUM ON GEOTECHNOLOGY
## INTERNATIONAL WEEK ON GEOTECHNOLOGY

Loke Yew Hall, The University of Hong Kong
2 June 2025

# Programme

| Time | Agenda |
|---|---|
| 08:30 | *Registration* |
| 09:00 | *Welcoming Address*<br>**Professor PAN, Wei**<br>Head of Department of Civil Engineering, The University of Hong Kong |
| 09:10 | *Opening Speech*<br>**Ir LAU, Chun-kit Ricky, JP**<br>Permanent Secretary for Development (Works),<br>Government of the Hong Kong Special Administrative Region |
| 09:20 | *Opening Ceremony and Group Photo* |
|  | Morning Session:<br>Chaired by **Ir YEUNG, Fei Jenny**<br>Deputy Head of the Geotechnical Engineering Office,<br>Civil Engineering and Development Department |
| 09:45 | *Keynote Presentation: Future Geotechnics – Hong Kong's Perspectives*<br>**Ir Dr CHEUNG, Wai-man Raymond, JP**<br>Head of the Geotechnical Engineering Office,<br>Civil Engineering and Development Department |
| 10:15 | *Keynote Presentation: Risk Mitigation on Geological Hazards in Mainland China under Climate Change*<br>**Academician YIN, Yueping**<br>Chief Geologist of China Institute of Geoenvironment Monitoring,<br>China Geological Survey |
| | **Session 1: Landslide Risk Management against Climate Change Impact** |
| 10:45 | *Landslides within Cascading Events*<br>**Professor GLADE, Thomas**<br>Professor, Department of Geography and Regional Research,<br>The University of Vienna, Austria |
| 11:00 | *Digital Twin Empowered Landslide Emergency Risk Management*<br>**Professor ZHANG, Limin**<br>Chair Professor and Head of Department of Civil and Environmental Engineering,<br>The Hong Kong University of Science and Technology |
| 11:15 | *Coffee Break* |
| 11:30 | *Climate Change and Its Impact on Landslide Disasters in Japan: Recent Research Progress*<br>**Professor WANG, Gonghui**<br>Professor, Disaster Prevention Research Institute,<br>Kyoto University, Japan |
| 11:45 | *Leveraging National and CUHK Satellites for Large-scale Landslide Monitoring and Early Warning*<br>**Professor MA, Peifeng**<br>Associate Professor, Department of Geography and Resource Management,<br>The Chinese University of Hong Kong |
| 12:00 | *AI-empowered Landslip Warning System in Hong Kong*<br>**Ir CHU, Kei-hong Edward**<br>Senior Geotechnical Engineer, Geotechnical Engineering Office,<br>Civil Engineering and Development Department |
| 12:15 | *Morning Session Panel Discussion, Q&A Session and Souvenir Presentation* |
| 12:35 | *Lunch* |

# Programme

| Time | Agenda |
|---|---|
| | Afternoon Session:<br>Chaired by **Ir Dr LEE, Siew Wei**<br>Chairman of the Geotechnical Division,<br>The Hong Kong Institution of Engineers |
| 14:00 | *Keynote Presentation: Application of Artificial Intelligence in Weather Forecasting*<br>**Dr CHAN Pak-wai, JP**<br>Director of the Hong Kong Observatory,<br>Hong Kong Observatory |
| 14:30 | *Keynote Presentation: Disaster Evolution Mechanisms and Critical Prevention Technologies for High-Position Extra-Large Complex Toppling Deformation Masses in Southwest China*<br>**Mr YANG, Tao**<br>Deputy Director of the Science and Technology Innovation Center,<br>Sichuan Geological Environment Survey and Research Center |
| | **Session 2: Data-driven Innovations for Enhancing Excellence and Resilience in Geotechnical Applications** |
| 15:00 | *Machine Learning for Landslide Dynamics Modelling*<br>**Dr LIU, Zhongqiang**<br>Senior Specialist, Norwegian Geotechnical Institute, Norway |
| 15:15 | *Trial Piles in Northern Metropolis*<br>**Mr CHIU, Yik-kan Kian**<br>Geotechnical Engineer, Geotechnical Engineering Office,<br>Civil Engineering and Development Department |
| 15:30 | *Objective Processing and Analysis of Large-scale, Multi-layer GI Datasets: Development of an Interactive Tool for Producing Site-wide Design Geotechnical Parameters*<br>**Dr GOODWIN, Saoirse**<br>Engineer, Ove Arup & Partners Hong Kong Limited |
| 15:45 | *Coffee Break* |
| 16:00 | *Utilizing Geophysical Survey Techniques to Interpret Rockhead Profiles in Urban Development*<br>**Ir LEUNG, Keith**<br>Associate Director, AECOM Asia Company Limited |
| 16:15 | *Augmenting the Role of Soil Test Database in Efficient Reliability-based Design of Ultimate and Serviceability Limit States*<br>**Professor LEUNG, Y. F. Andy**<br>Associate Professor, Department of Civil and Environmental Engineering,<br>The Hong Kong Polytechnic University |
| 16:30 | *Generative AI for 3D Subsurface Geological Modelling using Limited Site-specific Data and Prior Geological Knowledge*<br>**Professor WANG, Yu**<br>Professor, Department of Civil and Environmental Engineering,<br>The Hong Kong University of Science and Technology |
| 16:45 | *Afternoon Session Panel Discussion, Q&A Session and Souvenir Presentation* |
| 17:15 | *Closing Remarks*<br>**Ir Dr CHEUNG, Wai-man Raymond, JP**<br>Head of the Geotechnical Engineering Office,<br>Civil Engineering and Development Department |

# Welcoming Address

## Professor PAN, Wei
*Head of Department of Civil Engineering,*
*The University of Hong Kong*

Professor PAN, Wei is Head of Department of Civil Engineering of The University of Hong Kong (HKU), where he is also Executive Director of Centre for Innovation in Construction and Infrastructure Development (CICID), and Director of MiCLab and NetZeroLab. Professor PAN cocreated the concept of "modular integrated construction (MiC)" and developed the dialectical system theory to guide MiC research and development (R&D). His team established MiC R&D ecosystem for modular technology breakthroughs and innovations, which cover MiConnection (40-50 storey structures), MiCarry (over-sized module transport), MiCrane (heavy lifting), MiCarbon (decarbonised design), MiCost (cost-effectiveness), MiChain (supply chain), and MiC TFS (total factor sustainability). His research is transformative, guiding MiC adoption in many capital projects. He has authored over 380 publications and supervised over 100 postgraduate researchers. Professor PAN was elected Fellow of the Higher Education Academy in 2010, and Fellow of ICE and Fellow of HKIE in 2024. He has 30 years of working experience in academia and practice internationally including the UK, Singapore, Mainland China, and Hong Kong. Professor PAN was awarded Distinguished Young Investigator of China in 2019, the 2020 Honours List of the HKSAR, and the MiC Outstanding People in 2022.

# Guest of Honour Opening Speech

## Ir LAU, Chun-kit Ricky, JP
*Permanent Secretary for Development (Works),*
*Government of the Hong Kong Special Administrative Region*

In October 2021, Ir LAU, Ricky was appointed as the Permanent Secretary for Development (Works) to oversee public works policy and infrastructure development.

Ir LAU was the Director of Civil Engineering and Development from October 2018 to October 2021, and was responsible for overseeing the strategic planning and the implementation of various reclamation, new development area and major infrastructure projects. He joined the Hong Kong Government in 1992 as an Assistant Engineer. Before joining the Civil Engineering and Development Department in 2015, he worked in the Highways Department and the Development Bureau.

# Morning Session

## Session 1: Landslide Risk Management against Climate Change Impact

*Session Chair*

### Ir YEUNG, Fei Jenny
*Deputy Head of the Geotechnical Engineering Office,*
*Civil Engineering and Development Department*

Ir YEUNG, Jenny, currently serving as Deputy Head (Planning and Testing) at the Geotechnical Engineering Office, Civil Engineering and Development Department, HKSAR Government, holds a Bachelor of Engineering in Civil and Structural Engineering from the Hong Kong University of Science and Technology (HKUST) and a Master of Philosophy in Geotechnical Engineering from the University of Cambridge. Over the past 30 years, she has dedicated her expertise in various aspects of the Hong Kong Slope Safety System, covering geotechnical control, landslide emergency service, landslip warning, crisis communication, public education and technical development.

She has also worked in the Development Bureau, during which she was responsible for driving forward a multi-pronged land supply strategy, including cavern development and reclamation for the sustainable development of Hong Kong. She was an awardee of the Secretary for Civil Service's Commendation in recognition of her outstanding service to the Government and the public. She was also awarded the Outstanding Alumni by the Department of Civil and Environmental Engineering of HKUST.

Beyond her work in geotechnical engineering, Ir Yeung's dedication to the Hong Kong Institution of Engineers has earned her multiple prestigious honours, including the Trainee of the Year Award (1997), Young Engineer of the Year Award (2006), and the President Award (2023).

# Keynote Speech

## Ir Dr CHEUNG, Wai-man Raymond, JP
*Head of the Geotechnical Engineering Office,*
*Civil Engineering and Development Department*

Ir Dr CHEUNG, Raymond has more than thirty years' experience in civil and geotechnical engineering. He has been participated in a number of mega infrastructure projects in Hong Kong under the Airport Core Programme, including Chek Lap Kok International Airport reclamation, Airport Railway and Western Harbour Crossing, before joining the Hong Kong SAR Government in the late 1990s. He is a member of various international technical committees such as the European School Scientific Committee of Landslide Risk Assessment and Mitigation (LARAM) and the International Network on Landslide Early Warning Systems (LandAware). He is also a member of the editorial boards of various technical journals in relation to geohazards and geotechnical engineering such as Georisk and the Chinese Journal of Geotechnical Engineering. Dr CHEUNG is currently Head of the Geotechnical Engineering Office (GEO) of the Civil Engineering and Development Department overseeing the control of geotechnical works, setting geotechnical standards, testing and development of construction materials, quarrying, cavern and underground space development, the Landslip Prevention and Mitigation Programme, and the landslide emergency services. He is also steering the overall innovation and technological development of the GEO.

### Presentation Title

Future Geotechnics – Hong Kong's Perspectives

# Keynote Speech

## Academician YIN, Yueping
*Chief Geologist of China Institute of Geoenvironment Monitoring,*
*China Geological Survey*

Professor YIN, Yueping received his PhD degree at the China Academy of Geosciences in 1990. He is the Chief Geologist of the China Institute of Geo-Environment Monitoring directly under China Geological Survey, and serves as a member of the Expert Steering Committee of the China National Commission for Disaster Reduction, the Chairperson of the Expert Committee of the China Association of Geo-Hazard Prevention, and the Deputy President of China Society of rock mechanics and Engineering. He had been elected as the President of International Consortium on Landslides under UNESCO and ISDR from 2014 to 2017, and is an associate editor of《Landslides》published by Springer. Professor YIN, Yueping has conducted the researches on geological hazards and prevention since 1985. His research interests cover landslide prevention for failure mechanism, dynamics, early warning and stabilization. He has hosted national key research projects on landslide hazard assessment and prevention, especially, at the Three Gorge Reservoir, the Yangtze River. Professor Yin Yueping has published more than 200 academic papers. He was awarded for two of the National Prize of Science and Technology by the State Council. He is listed as one Highly Cited Chinese Researchers by Elsevier for years that his researches involved in Geo-risk mitigation at City and Mega Reservoir, etc.

## Presentation Title

Risk Mitigation on Geological Hazards in Mainland China under Climate Change

# Professor GLADE, Thomas

*Professor, Department of Geography and Regional Research,*
*The University of Vienna, Austria*

## Biography

Professor Dr GLADE, Thomas was appointed at University of Vienna for the chair of Physical Geography in 2006 and founded the working group ENGAGE "Geomorphic Systems and Risk research". He received his Diploma degree in 1994 from the University of Heidelberg on the subjects of Geography, Geology and Law. The master thesis was entitled "Investigations of clastic transports in the Arctic catchments of Kvikkaa and Beinbekken, NW-Spitzbergen". From 1994 to 1997, he stayed at Victoria University of Wellington, New Zealand for his PhD on "The temporal and spatial occurrence of rainstorm-triggered landslide events in New Zealand". Between 1997 to 2006, he worked on his habilitation entitled "Landslide hazard and risk - a contribution to applied geomorphology" at the University of Bonn in Germany. He serves actively in scientific networks, e.g. was Chair of the Working Group on Hazard and Risks from 2001-2010, is president of CERG since 2012 and of the geographieverband.at from 2017 to 2021, and participates in many steering committees. Furthermore, he is actively involved as external examiner of Departments (e.g. Geogr. Department at University of Zuerich), research networks (e.g. GeoX at Humboldt Foundation, CEDIM of KIT, IOER), research projects submitted to NERC, NASA, Belgium, DFG, BMBF, Humboldt research foundation, etc., and is regularly an external examiner of PhD's and habilitations. He is member in a variety of scientific boards of the scientific journals Landslides, Georisk, Finisterra, Natural Hazards and Earth System Sciences, New Zealand Geographer and is Editor-In-Chief of Natural Hazards since 2009. With a current h-Index of 57 and i-10-Index of 152, he has published more than 189 publications (157 in Engl., 32 in German) and was invited speaker on 59 occasions (50 in Engl., 9 in German). Professor Dr GLADE, Thomas has been involved in many national (InterRISK ILEWS, BioSLIDE, MoNOE, NoeSLIDE, Risk:Atlas, NoeTALUS, ExtremA2024, MillSLIDE, MoNEW, NoeDRILL) and international EU-funded projects (e.g. Casita II, MOVE, Mountain Risks, CHANGES, SEERISK, ChangingRISKS, PAMIR, PHUSICOS, PARATUS, EUMA). Thus, extensive experience in a variety of roles (e.g. contributor, coordinator, steering committee member, advisory board, etc.) is available. In addition, he teaches at all educational levels (Bachelor, Teacher education, Master, PhD) and serves as mentor for external PhD's and PostDoc's. Since 2014, he leads the advanced teaching programme OeRISK "Risk Prevention and Disaster management" (http://oerisk.at) at the Postgraduate Center of University of Vienna.

## Presentation Title

Landslide within Cascading Events

# Professor ZHANG, Limin

*Chair Professor and Head of Department of Civil and Environmental Engineering, The Hong Kong University of Science and Technology*

## Biography

Dr ZHANG, Limin is Chair Professor and Head of the Department of Civil and Environmental Engineering at the Hong Kong University of Science and Technology, as well as the Director of the Digital Cities and Smart Hazard Mitigation Laboratory. Professor ZHANG is Chair of International Society of Soil Mechanics and Geotechnical Engineering (ISSMGE)'s TC210 on Embankment Dams, Editor-in-Chief of Georisk, Special Editor of Geodata and AI, Associate Editor of ASCE's Journal of Geotechnical and Geoenvironmental Engineering, and editorial board member of Engineering Geology, Computers and Geotechnics and other journals. He is recipient of the ASCE Ralph Peck Award, the Chinese National Engineer Award, the ISSMGE's Lacasse Lecture Award and the GEOSNet's Wilson Tang Lecture Award.

## Presentation Title

Digital Twin Empowered Landslide Emergency Risk Management

## Abstract

Climate change has led to more frequent and intense rainstorms, posing significant challenges to urban areas. In this presentation, Prof. ZHANG will introduce a city-scale digital twin designed as an integrated platform for managing landslide and flood hazards and coordinating societal responses. This digital twin monitors, simulates, and displays both hazard and societal response processes, enabling more effective disaster emergency management. The implementation of the digital twin will enhance risk management capabilities, advance smart-city initiatives, and promote public education.

# Professor WANG, Gonghui

*Professor, Research Centre for Landslide Risk Cognition and Reduction, Disaster Prevention Research Institute, Kyoto University, Uji, Kyoto, Japan*

## Biography

Dr WANG, Gonghui is a full professor at the Disaster Prevention Research Institute (DPRI), Kyoto University, and serves as the head of the Research Center for Landslide Risk Cognition and Reduction at DPRI. Since earning his PhD from Kyoto University in 2000, Dr WANG has dedicated nearly three decades to landslide research at DPRI, integrating approaches from, geophysics, geotechnical engineering, engineering geology, hydrology, and geomorphology. His work has yielded significant insights, particularly on the initiation and movement mechanisms of rapid, long-runout landslides, as well as landslides induced by extreme weather events and earthquakes. He has authored more than 200 publications in leading international journals and serves as an editorial board member for several international, Chinese, and Japanese journals. Currently, Prof. WANG is the Chair of Joint Technical Committee on Natural Slopes and Landslides (JTC1) under Federation of International Geo-Engineering Societies (FedIGS), and also serves as a Director of the Japan Landslide Society.

## Presentation Title

Climate Change and Its Impact on Landslide Disasters in Japan: Recent Research Progress

## Abstract

Climate change is increasingly recognised as a major driver intensifying natural disasters, posing serious risks to communities and infrastructure worldwide. This presentation will examine how climate change influences the frequency, severity, and geographic distribution of landslide disasters in Japan. Drawing on recent case studies from regions highly vulnerable to hydro-meteorological hazards, we will explore how shifting climate patterns amplify landslide activity. We will also highlight recent research advances aimed at better understanding landslide initiation and movement mechanisms under extreme weather conditions. Topics include field monitoring studies on the influence of air tides on landslide behavior, the effects of low atmospheric pressure and strong winds on forested slope instability during typhoons, and various laboratory experiments on rainfall-triggered landslides. By examining these compounding impacts, this talk emphasises the urgent need for interdisciplinary, international collaboration in disaster preparedness, risk assessment, mitigation strategies, and strengthening community resilience.

# Professor MA, Peifeng

*Associate Professor, Department of Geography and Resource Management, The Chinese University of Hong Kong*

## Biography

Dr MA, Peifeng is currently an Associate Professor with the Department of Geography and Resource Management, The Chinese University of Hong Kong. He is the chief designer of CUHK satellite constellation. He has authored or co-authored more than 100 publications, 15 conference papers, a book edited and an international book chapter. He has also published 11 patents and 10 software copyrights. His main research interests include InSAR deformation monitoring, deep learning, and big data analytics, geohazard early warning, and sustainable development. He led to develop the world-leading InSAR processing software-eSat, which has been successfully adopted to monitor the Hong Kong-Zhuhai-Macao Bridge and the Hong Kong International Airport. The software has also been successfully applied to the monitoring of the national project-the Sichuan-Tibet Railway for slope safety monitoring. The achievements have been recognised by United Nations, CCTV, China's Daily, Science and other media. He has received prestigious awards such as Remote Sensing Young Talent Award from National Remote Sensing Centre of China, MOST, First Prize of National Science and Technology Progress Award in Surveying and Mapping, Grand Prize of National Science and Technology Progress Award in Geo-information, Best Paper of the American Association of Geographers Remote Sensing Specialty Group, and Top 25 Representative Scientific Research Achievements for the 25th Anniversary of the Hong Kong.

## Presentation Title

Leveraging National and CUHK Satellites for Large-scale Landslide Monitoring and Early Warning

## Abstract

Landslides are a major geohazard causing enormous casualties and economic losses worldwide. Like human's health conditions, slopes should also be monitored regularly to build a safe and resilient environment. In this seminar, I will discuss my work on the development and application of innovative national and CUHK satellite remote sensing methods with deep learning analytics for monitoring large-scale landslides and studying their interactions with environmental factors. Two important scientific issues will be specifically addressed. For one thing, I will discuss how to accurately monitor slope deformations and intelligently mine their spatiotemporal patterns in various geological, hydrological, and built environments through multi-source big data analytics. For another, I will focus on exploring the interactions between slides and environmental factors and identifying risk indicators for early warning. I will highlight how my research advances fundamental scientific knowledge of large-scale landslide dynamics and their relationship with specific environmental factors and how it strongly supports the United Nations Sustainable Development Goals.

# Ir CHU, Kei-hong Edward

*Senior Geotechnical Engineer, Geotechnical Engineering Office,*
*Civil Engineering and Development Department*

## Biography

Ir CHU, Edward is a Senior Geotechnical Engineer of the Geotechnical Engineering Office (GEO), Civil Engineering and Development Department of the HKSAR Government, specialising in rainfall analysis, rainfall-landslide correlation and groundwater response to rainfall using machine learning, data analytics and numerical simulations. He has been working on a, few technical studies on extreme rainfall and climate change impacts in Hong Kong and groundwater response to rainfall on slopes using data-driven and numerical modelling approaches. He is responsible for developing the cloud-based Internet-of-things (IoT) monitoring systems, including the GEO Raingauge System and Smart Barrier System, to support the operation of GEO's emergency services dealing with landslide danger during heavy rainstorms. He currently manages the GEO's Landslip Warning System, focusing on applying machine learning and data analytics in landslide prediction and integrating machine learning algorithms with IoT-derived rainfall data from the GEO Raingauge System to enable dynamic spatio-temporal landslide forecasting during severe rainstorms, thereby supporting the operation of the Landslip Warning System.

## Presentation Title

AI-empowered Landslip Warning System in Hong Kong

## Abstract

Hong Kong's mountainous terrain, thick weathering profiles, and subtropical climate trigger frequent landslides, posing significant risks to urban infrastructure and public safety. The Geotechnical Engineering Office (GEO) under the Civil Engineering and Development Department operates a territory-wide Landslip Warning System to issue timely alerts to the public and facilitate government emergency responses during severe rainstorms. Since establishing the world's first territory-wide early warning system for landslide disasters in Hong Kong in 1977, the GEO has continuously enhanced the landslide prediction model for the Landslip Warning System. The current landslide prediction model is a statistical model correlating rolling 24-hour rainfall with landslide frequency for four common types of man-made slopes. Leveraging Hong Kong's comprehensive landslide-related datasets, including rainfall records, man-made slope inventories, and landslide reports from 1996 to 2023, the GEO has applied machine learning (ML) and big data analytics, together with integrating domain knowledge of geotechnical and geological engineering, to re-examine the relationship between rainfall and reported landslides on man-made slopes.

This approach identifies and quantifies critical slope and rainfall attributes contributing to reported landslides on man-made slopes, prioritising their relative significance for enhanced predictive accuracy. A ML model incorporating relevant attributes has been developed to predict the number of reported landslides on man-made slopes of a rainstorm event in Hong Kong. The ML model demonstrates superior accuracy and reliability and enables real-time spatio-temporal prediction of reported landslides during rainstorms, presenting a significant advancement in the capability of landslide risk assessment during heavy rainfall. The GEO Raingauge System, which supports the operation of the Landslip Warning System, is being revamped to integrate this ML model for real-time spatio-temporal landslide prediction during rainstorm events.

# Afternoon Session

## Session 2: Data-driven Innovations for Enhancing Excellence and Resillience in Geotechnical Applications

*Session Chair*

### Ir Dr LEE, Siew Wei
*Chairman of the Geotechnical Division,*
*The Hong Kong Institution of Engineers*

Ir Dr LEE Siew Wei is an Executive Director (Geotechnical) of AECOM Hong Kong. He obtained PhD in geotechnical engineering from the Cambridge University. He is a professional civil/geotechnical engineer with 25 years of experience in soft ground and hard rock. He is the Chairman of the Hong Kong Institution of Engineers, Geotechnical Division in Session 2024/25, and was the Chairman of the Association of Geotechnical & Geo-environmental Specialists (HK) in Sessions 2017 & 2018.

# Keynote Speech

## Dr CHAN, Pak-wai, JP
*Director of the Hong Kong Observatory,*
*Hong Kong Observatory*

Dr CHAN, Pak-wai has been working in the Hong Kong Observatory (HKO) for more than 30 years, with research and operational efforts in the Hong Kong International Airport on meteorological instrumentation, low-level windshear and turbulence alerting, and high-resolution numerical weather prediction. Dr CHAN is the developer of the world-first LIDAR windshear alerting system for the airport. He also introduced a dropsonde measurement system for the northern part of the South China Sea to improve monitoring capabilities of tropical cyclones.

Dr CHAN is committed to promoting the application of artificial intelligence in meteorological research and weather forecasting, and enhancing forecasting capacities of severe weather. He also serves as editorial board member of many renowned scientific journals.

Dr CHAN has been involved actively in the work of the World Meteorological Organization (WMO) and International Civil Aviation Organization (ICAO) over the years. He is currently co-Vice-President of the Commission for Observation, Infrastructure and Information Systems of WMO, making him the first Asian to take up a leadership position in the Commission. Dr CHAN is also the Chairperson of the Meteorology Sub-Group of Asia Pacific Region of ICAO to facilitate the implementation of aeronautical meteorological services in the region.

### Presentation Title

Application of Artificial Intelligence in Weather Forecasting
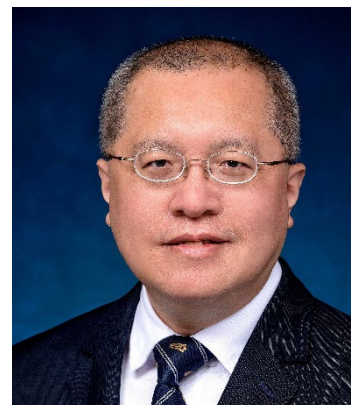
# Keynote Speech

## Mr YANG, Tao

*Deputy Director of the Science and Technology Innovation Center, Sichuan Geological Environment Survey and Research Center*

Mr YANG, Tao holds a master's degree in engineering and is a senior engineer. Currently, he serves as the deputy director of the Science and Technology Innovation Center of the Geology and Environment Center.

He has successively presided over and participated in one sub - project of the National Key R & D Program, and more than 10 science and technology plan projects at the provincial - ministerial and department - bureau levels. He has published 13 academic papers, obtained 20 authorized invention patents, participated in the compilation of one monograph, two codes, and one technical guide.

He has won one second - class award for Sichuan Provincial Geological Science and Technology Progress and four science and technology achievement awards at the department - bureau level. In December 2021, he won the first place in the individual competition of the First Sichuan - Chongqing Geological Hazard Investigation Labor and Skills Competition (Sichuan Division). In 2022, he was awarded the "Sichuan May 1st Labor Medal".

### Presentation Title

Disaster Evolution Mechanisms and Critical Prevention Technologies for High-Position Extra-Large Complex Toppling Deformation Masses in Southwest China

# Dr LIU, Zhongqiang
*Senior Specialist, Norwegian Geotechnical Institute, Norway*

## Biography

Dr LIU, Zhongqiang is Principal Scientist at Norwegian Geotechnical Institute (NGI), Oslo, Norway, with expertise in risk and hazard assessment for geohazards, machine learning in geotechnics. His major fields of work are related to geohazards, assessment of uncertainties, statistical and machine learning methods, risk and reliability analysis, and offshore foundation engineering. He initiated and is now Chair of Technical Committee 309 of ISSMGE: "Machine Learning and Big Data in Geotechnics". He is Chair-Elect of "Geotechnical Safety Network (GEOSNet)" since 2022. Dr Liu is Guest lecturer at Norwegian University of Science and Technology (NTNU), at University of Oslo (UiO), and at Oslo Metropolitan University (OsloMet). He is Technical Lead of Research Group – GeoRisk at NGI. His research has earned several international recognitions, including the Best Paper Award of Journal Georisk in 2015, the OTC ASCE Best Paper Award in 2019, the GEOSNet Young Researcher Award in 2019 and the Best Paper Award of JZUSA in 2023.

## Presentation Title

Machine Learning for Landslide Dynamics Modelling

## Abstract

Due to climate change, more snowmelt and more intense rainfall have been observed over the years. In 2023, extreme rainfall event Hans triggered devastating debris flow disasters caused by shallow landslides in eastern Norway. There was severe disruption to transport routes, and around 4000 people were evacuated. Therefore, there is a growing demand for improvement of methods used during hazard zone mapping of regions prone to debris flow disasters. In this study, we propose a machine learning emulator coupled with numerical modelling, to quantify the regions affected by debris flow, offering an effective predictive tool for similar future events.

# Mr CHIU, Yik-kan Kian

*Geotechnical Engineer, Geotechnical Engineering Office,*
*Civil Engineering and Development Department*

## Biography

Mr CHIU, Kian has more than 14 years' experience in civil and geotechnical engineering. Mr. Chiu has been participated in a number of mega infrastructure projects in Hong Kong, including Central - Wan Chai Bypass and Island Eastern Corridor Link, and Hong Kong Boundary Crossing Facilities, before joining the Geotechnical Engineering Office in 2016. He is currently the Geotechnical Engineer in the Mainland West Division providing geotechnical control over public and private projects, and managing a regional geological study for the development of the Northern Metropolis, including the planning and construction of trial piles with the use of GGBS and full-scale pile loading tests.

## Presentation Title

Trial Piles in Northern Metropolis

## Abstract

Under the Northern Metropolis Action Agenda which outlines the development blueprint of the Northern Metropolis (NM), there will be extensive developments in the northern and north-western parts of the New Territories, leading to a pressing need to enhance the time- and cost-effectiveness of foundation design and construction practice. The Geotechnical Engineering Office (GEO) recently initiated a large-scale pile loading test programme, not only with bi-directional loading tests on instrumented piles to collect extensive field data on end-bearing capacity and rock socket shaft resistance of various types of meta-sedimentary (MS) rocks which is commonly found in the NM, but also to apply new construction materials including low-carbon Ground Granulated Blast furnace Slag (GGBS) concrete and high-strength S690 steel in pile foundation works. Due to extensive folding, faulting and weathering, MS rocks in the NM are found to be highly variable in nature. However, there is a general lack of geotechnical information for those MS rocks mainly because of minimal urban development in the region so far, rendering the current design guidelines of deep foundations on MS rocks err on the relatively conservative side. As there will be a surge of development works within the region in the coming few decades, the GEO carried out a series of bi-directional loading tests to explore room for enhancing the prevailing foundation design guidelines for MS rocks, thereby facilitating material and cost saving of the associated foundation works. As part of the study, some trial piles are strategically designed to investigate the constructability and performance of using eco-friendly GGBS and high-strength S690 steel section in piling works. The study outcome would facilitate the wider application of these new and green materials for the benefit of advancing sustainable and cost-effective geotechnical solutions. This presentation will include the initiatives and the findings of the trial piling works. The preliminary results of the completed bi-directional loading tests on instrumented piles will be discussed. The key observations made during the construction operation and monitoring regarding the application of GGBS and S690 steel used in the trial piles will also be presented.

# Dr GOODWIN, Saoirse

*Engineer, Ove Arup & Partners Hong Kong Limited*

## Biography

Saoirse obtained her PhD from HKUST in 2018, and has worked in a variety of research, teaching and industry positions since graduating. Her academic research mostly specializes in the development and application of Computational Fluid Dynamics (CFD), the Finite Element Method (FEM) and the Discrete Element Method (DEM) for avalanche and landslide mitigation. In industry, she has used LS-DYNA to execute coupled FEM-CFD modelling of landslides and boulders interacting with both rigid and flexible net barriers, including back analyses of several landslide events which occurred in September 2023. Saoirse has also developed software for processing large datasets of Ground Investigation (GI) data into usable geotechnical parameters, hence designing the foundations for offshore windfarms. She is interested in other applications of new technologies, including using machine learning and Large Language Models, for augmenting engineering design processes.

## Presentation Title

Objective Processing and Analysis of Large-scale, Multi-layer GI Datasets: Development of an Interactive Tool for Producing Site-wide Design Geotechnical Parameters

## Abstract

Credible Ground Investigation (GI) data is important for developing efficient foundation designs. An emerging challenge is the ability to process large quantities of GI data in a consistent and justifiable way, considering multiple sources of data, which goes well beyond the limits of scalability of traditional spreadsheet-based approaches. Furthermore, there is a global trend towards incorporating statistical confidence bounds for geotechnical parameters, rather than relying solely on "engineering judgement". This trend is evident in offshore geostatistics design guidelines by DNV and upcoming versions of Eurocode, and requires a rigorous approach to developing geotechnical parameters. A further important consideration is the need to work from single datasources, to enable iterative design processes across the lifespan of projects. A key requirement is to enable changes in upstream data (e.g. adjustments to the geologists' assessment of the stratigraphy) to be propagated into downstream data (i.e. processed geotechnical parameters, and hence foundation design). To this end, we are continually developing the Soil Parameter Statistical Analyser (SOPSA), which is an innovative tool designed to streamline and enhance geotechnical analyses. SOPSA integrates analyses into a cohesive user interface, including: (i) deriving geotechnical outputs from raw source data, using customisable relationships (e.g., SPT to friction angle, CPT to elastic modulus); (ii) interactively applying filters to datasets (e.g., removing transition zones in CPT data); (iii) interactively removing statistical outliers from datasets; and (iv) computing and adjusting rigorous statistical fits to geodata, including confidence bounds, to produce design tables of geotechnical parameters. SOPSA performs these operations simultaneously on a per-layer, per-borehole basis. The interactive components of SOPSA – allowing the effects of adjusting certain processing parameters in real time – are essential for allowing engineers to obtain a developed understanding of their datasets. This functionality has been used for enabling seamless iterative design on detailed designs of offshore windfarms. SOPSA also includes machine-learning-augmented data-fitting functions, which are currently implemented for classifying the stratigraphy based on CPT data, with other extensions to this type of functionality in development.

# Ir LEUNG, Keith

*Associate Director, AECOM Asia Company Limited*

## Biography

Ir LEUNG, Keith is a dedicated geotechnical engineer with over 15 years of experience in geotechnical practices and the application of innovative technologies. Throughout his career, Keith has contributed to numerous large-scale infrastructure projects across Hong Kong, China, and Singapore, focusing on improving efficiency, accuracy, and sustainability in geotechnical engineering.

Currently an Associate Director at AECOM, Keith works closely with multidisciplinary teams to integrate digital tools such as Building Information Modeling (BIM), data analytics, and automation into geotechnical workflows. His efforts have supported the delivery of practical and effective solutions that address complex engineering challenges while aligning with project goals. With additional certifications in project management and digital technologies, he continues to explore ways to bridge geotechnical engineering with modern innovation.

## Presentation Title

Utilizing Geophysical Survey Techniques to Interpret Rockhead Profiles in Urban Development

## Abstract

Geophysical survey techniques provide a non-invasive and efficient method for subsurface soil structure mapping, utilising ambient ground vibrations to deliver valuable geotechnical insights. These methods are particularly beneficial in urban environments where access is restricted, offering cost-effective and environmentally friendly solutions for site investigations.

This presentation will focus on the application of geophysical surveys in one of the Northern Metropolis development projects, where site access was limited by private land ownership. Specifically, the technique was employed to interpret the rockhead profile by integrating shear-wave velocity data with borehole information. This approach provided a holistic understanding of the rockhead profile, enabling more informed planning and reducing the risks associated with unforeseen ground conditions during deep excavation.

The use of geophysical surveys in this project highlights their potential as a complementary tool to traditional borehole investigations. With minimal disruption to the surrounding community, this technique offers an efficient and sustainable way to enhance subsurface characterization.

# Professor LEUNG, Y. F. Andy

*Associate Professor, Department of Civil and Environmental Engineering, The Hong Kong Polytechnic University*

## Biography

Dr LEUNG, Y. F. Andy is currently Associate Head (Partnership) and Associate Professor at the Department of Civil and Environmental Engineering, The Hong Kong Polytechnic University, and the Immediate Past President of the Hong Kong Geotechnical Society. He graduated from The University of Hong Kong (BEng) and University of California, Berkeley (MS), before he obtained PhD degree at the University of Cambridge. His research interests include soil-structure interaction, reliability of geotechnical and structural systems, probabilistic analysis approaches and novel geotechnical instrumentation technologies. He has been a member of various technical committees (TC) of the International Society for Soil Mechanics and Geotechnical Engineering (ISSMGE), including TC 212 Deep Foundations, TC 304 Engineering Practice of Risk Assessment and Management and TC 309 Machine Learning and Big Data. He is also a member of the Future of Machine Learning in Geotechnics (FOMLIG) Council.

## Presentation Title

Augmenting the Role of Soil Test Database in Efficient Reliability-based Design of Ultimate and Serviceability Limit States

## Abstract

Extensive datasets of triaxial test results of local soil specimens are available in an online repository system maintained by the Civil Engineering and Development Department. While the data were collected from various projects across Hong Kong, the ground investigation field works and laboratory test procedures were consistent with local guidelines stipulated in the Geoguide and Geospec, and thus provide a valuable source of standardized test data. This presentation introduces the database with over 3,000 sets of triaxial test results, which enables the derivation of probability density functions of Mohr-Coulomb shear strength ($c'$– $\phi'$) parameters for various soil types in Hong Kong. These serve as useful prior knowledge for reliability-based design. For example, reliability-based design of slopes can be efficiently performed using design charts derived from the regional distributions of $c'$ and $\phi'$. Where limited site-specific data are available at a site, they can be assimilated with the regional distribution through the Bayesian approach, with the aim of reducing the statistical uncertainty due to the small sample size. Apart from the assessment of ultimate limit state, the regional triaxial test database is also valuable in the assessment of serviceability limit state of geotechnical systems. As a demonstration of such potentials, the stress path data from 97 sets of multi-stage consolidated-undrained triaxial compression tests on completely decomposed granite (CDG) specimens are digitised from scanned reports using optical character recognition tools. The multi-stage tests provide information on multiple stress paths for each CDG specimen which, when combined with the appropriate soil constitutive model, can be used for calibration of the maximum shear modulus and critical state parameters, which are essential for analyses of soil deformation. This presentation shows that by utilising geotechnical data in various scales, a data-centric platform can be established to promote data-driven geotechnical design optimisation for both ultimate and serviceability limit states.

# Professor WANG, Yu

*Professor, Department of Civil and Environmental Engineering,*
*The Hong Kong University of Science and Technology*

## Biography

Dr WANG, Yu is a professor of geotechnical engineering at the Hong Kong University of Science and Technology. He is a Registered Professional Engineer (Civil) in Hong Kong and an elected Fellow of American Society of Civil Engineers (ASCE). His recent research efforts have focused on machine learning in geotechnical and geological engineering, geotechnical site characterization, geotechnical uncertainty, reliability and risk, geo-hazards (e.g., landslides and earthquakes), and geothermal energy. His research has earned several prestigious international/national awards, including the 2023 Thomas A. Middlebrooks Award from ASCE, the 2022 R.M. Quigley Award (Honourable Mention) from Canadian Geotechnical Society, the 2020 Best Paper Award from the ASCE-ASME Journal of Risk and Uncertainty in Engineering Systems, Part A: Civil Engineering, the 2020 Higher Education Outstanding Scientific Research Output Awards (the First-class Natural Science Award) from the Ministry of Education, China, the First-class Natural Science Award from the Hubei Provincial Government in 2017, the Highly Cited Research Award from the international journal of Engineering Geology in 2017, and the GEOSNet Young Researcher Award from the Geotechnical Safety Network (GEOSNet) in 2015. He has authored/co-authored over 180 journal papers and two books in English. He served as president of ASCE Hong Kong Section in 2012-2013 and serves in editorial boards of several top journals in geotechnical engineering or risk and uncertainty analysis (e.g., Associate Editor for the ASCE Journal of Geotechnical and Geoenvironmental Engineering).

## Presentation Title

Generative AI for 3D Subsurface Geological Modelling using Limited Site-specific Data and Prior Geological Knowledge

## Abstract

Delineation of subsurface stratigraphy is an essential task in geotechnical site characterization. A three-dimensional (3D) subsurface geological model that precisely depicts stratigraphic relationships in a specific site can greatly benefit subsequent geotechnical analysis and designs. However, only a limited number of boreholes is usually available from a specific site in practice. It is therefore challenging to properly construct complex stratigraphic relationships in a 3D space based on sparse measurements from limited boreholes. To tackle this challenge, a generative machine learning method called multi-scale generative adversarial networks (MS-GAN) was developed for construction of 3D subsurface geological models from limited boreholes and a 3D training image representing prior geological knowledge. MS-GAN automatically learns multi-scale 3D stratigraphic patterns extracted from the 3D training image and generates 3D geological models conditioned on limited borehole data in an iterative manner. The method is demonstrated and validated through a case study in Hong Kong. The results show that MS-GAN can effectively integrate limited borehole logs with geophysical data from an adjacent site to generate 3D subsurface geological models with high accuracy and quantified uncertainty.