

ISMLG 2026

5th International Symposium on Machine
Learning & Big Data in Geoscience
(5ISMLG)

**CONFERENCE
BROCHURE**

May 10-13, 2026 Hong Kong, China

TABLE OF CONTENTS

WELCOME TO 5ISMLG	1
ORGANIZATION.....	2
COMMITTEES OF 5ISMLG	2
CONFERENCE OVERVIEW.....	4
GUIDELINES	5
DATE	5
REGISTRATION.....	5
TC309 MEETING.....	5
PRESENTATION.....	5
DINING ARRANGEMENTS	5
VENUE	6
PUBLIC TRANSPORTATION.....	7
KEYNOTE SPEAKERS	8
CONFERENCE PROGRAM	18
FIELD TRIP.....	33
CONTACT	34

WELCOME TO 5ISMLG

The **5th International Symposium on Machine Learning & Big Data in Geoscience (5ISMLG)** will be held during **10-13 May 2026** at **The Hong Kong University of Science and Technology (HKUST)**. ISMLG is the flagship conference series of the **TC309 Machine Learning** under the **International Society for Soil Mechanics and Geotechnical Engineering (ISSMGE)**. It serves as a premier platform for academic researchers, practitioners, and industrial professionals to exchange innovative ideas, explore cutting-edge advancements, and showcase the latest applications of machine learning and big data analytics in geoscience and geoen지니어ing. The 5ISMLG will provide an invaluable opportunity to foster interdisciplinary collaboration, promote pioneering research, and bridge the gap between machine learning methodologies and real-world geoen지니어ing challenges.

The conference covers a wide range of topics, including but not limited to:

- Machine Learning for Geoscience and Geoen지니어ing
- Big Data Analytics for Geoscience and Geoen지니어ing
- Geotechnical/Geological Databases
- Large Language Models (LLMs) for Geoscience and Geoen지니어ing
- Physics-Informed Machine Learning for Geoscience and Geoen지니어ing
- Data-driven Site Characterization
- Machine Learning of Monitoring Data in Geotechnical and Geological Engineering
- Machine Learning and AI for Tunnel and Underground Engineering
- Machine Learning and AI for Risk Assessment and Management of Geohazards (e.g., Landslides, Earthquakes, Floods)
- Machine Learning and AI for Geomechanics
- Machine Learning and AI for Climate Change and Sustainability
- Digital Twins and Smart Geosystems
- AI Ethics, Interpretability, and Trustworthiness in Geoscience and Geoen지니어ing

We are delighted to welcome the geotechnical machine learning community to 5ISMLG at the beautiful campus of HKUST and look forward to seeing you in Hong Kong.

Yu Wang
Chair of 5ISMLG

ORGANIZATION

ORGANIZERS



SUPPORTERS



COMMITTEES OF 5ISMLG

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Kenichi Soga

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Bruno Stuyts	Hui Su	Stephen Suryasentana
Faraz Sadeghi Tehrani	Vikas Thakur	Franz Tschuchnigg
Mehmet Baris Can Ulker	Marco Uzielli	Sigurdur M á Valsson
Paul Vardanega	Thomas Vergote	Gang Wang
Hui Wang	Kuo-Lung Wang	Yu-Hsing Wang
Ze Zhou Wang	Haijia Wen	Jonathan White
Lucy Wu	Stephen Wu	Te Xiao
Zhongxuan Yang	Negin Yousefpour	Xiong (Bill) Yu
Dimitrios Zekkos	Liangtong Zhan	Dongming Zhang
Jie Zhang	Lin Zhang	Lulu Zhang
Pin Zhang	Qianbing Zhang	Wengang Zhang
Jidong Zhao	Tengyuan Zhao	Mingliang Zhou
Honghu Zhu	Tymoteusz Zydrón	

CONFERENCE OVERVIEW

MAY 10, SUNDAY

14:00-20:00 **Registration** (Lecture Theatre A)

MAY 11, MONDAY

08:45-09:00 **Opening Ceremony** (Lecture Theatre A)

09:00-10:45 **Keynote Lectures 1-3** (Lecture Theatre A)

10:45-11:05 **Coffee Break** (Lecture Theatre A)

11:05-12:20	Parallel Session 1 (Lecture Theatre A) SS6	Parallel Session 2 (Room 4503) SS9	Parallel Session 3 (Room 4504) SS10	Parallel Session 4 (Room 4579) SS7
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12:30-14:00 **Lunch & Break** (HKUST China Garden Restaurant)

14:00-15:45 **Keynote Lectures 4-6** (Lecture Theatre A)

15:45-16:05 **Coffee Break** (Lecture Theatre A)

16:05-18:05	Parallel Session 5 (Lecture Theatre A) SS6 & SS4	Parallel Session 6 (Room 4503) SS5 & SS9	Parallel Session 7 (Room 4504) SS10 & SS8	Parallel Session 8 (Room 4579) SS7
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18:30-20:30 **Conference Banquet** (HKUST China Garden Restaurant)

MAY 12, TUESDAY

08:45-10:30 **Keynote Lectures 7-9** (Lecture Theatre A)

10:30-10:50 **Coffee Break** (Lecture Theatre A)

10:50-12:05	Parallel Session 9 (Lecture Theatre A) SS1	Parallel Session 10 (Room 4503) SS5	Parallel Session 11 (Room 4504) SS3	Parallel Session 12 (Room 4579) SS11
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12:15-13:30 **Lunch & Break** (HKUST China Garden Restaurant)

13:30-14:55	Parallel Session 13 (Lecture Theatre A) SS1 & SS2	Parallel Session 14 (Room 4503) SS4	Parallel Session 15 (Room 4504) SS8	Parallel Session 16 (Room 4579) SS11
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14:55-15:10 **Coffee Break** (Lecture Theatre A)

15:10-16:30 **Bright Spark Lectures 1-4** (Lecture Theatre A)

16:30-16:40 **Closing Ceremony** (Lecture Theatre A)

MAY 13, WEDNESDAY

09:00-13:00 **Field Trip to Hong Kong UNESCO Global Geopark**

GUIDELINES

DATE

May 10-13, 2026 (Beijing Time)

REGISTRATION

14:00-20:00, May 10, 2026 (Lecture Theatre A, HKUST)

08:30-18:00, May 11, 2026 (Lecture Theatre A, HKUST)

08:30-16:00, May 12, 2026 (Lecture Theatre A, HKUST)

TC309 MEETING

17:50-18:30, May 11, 2026 (Room 4580, via Lift 27/28)

PRESENTATION

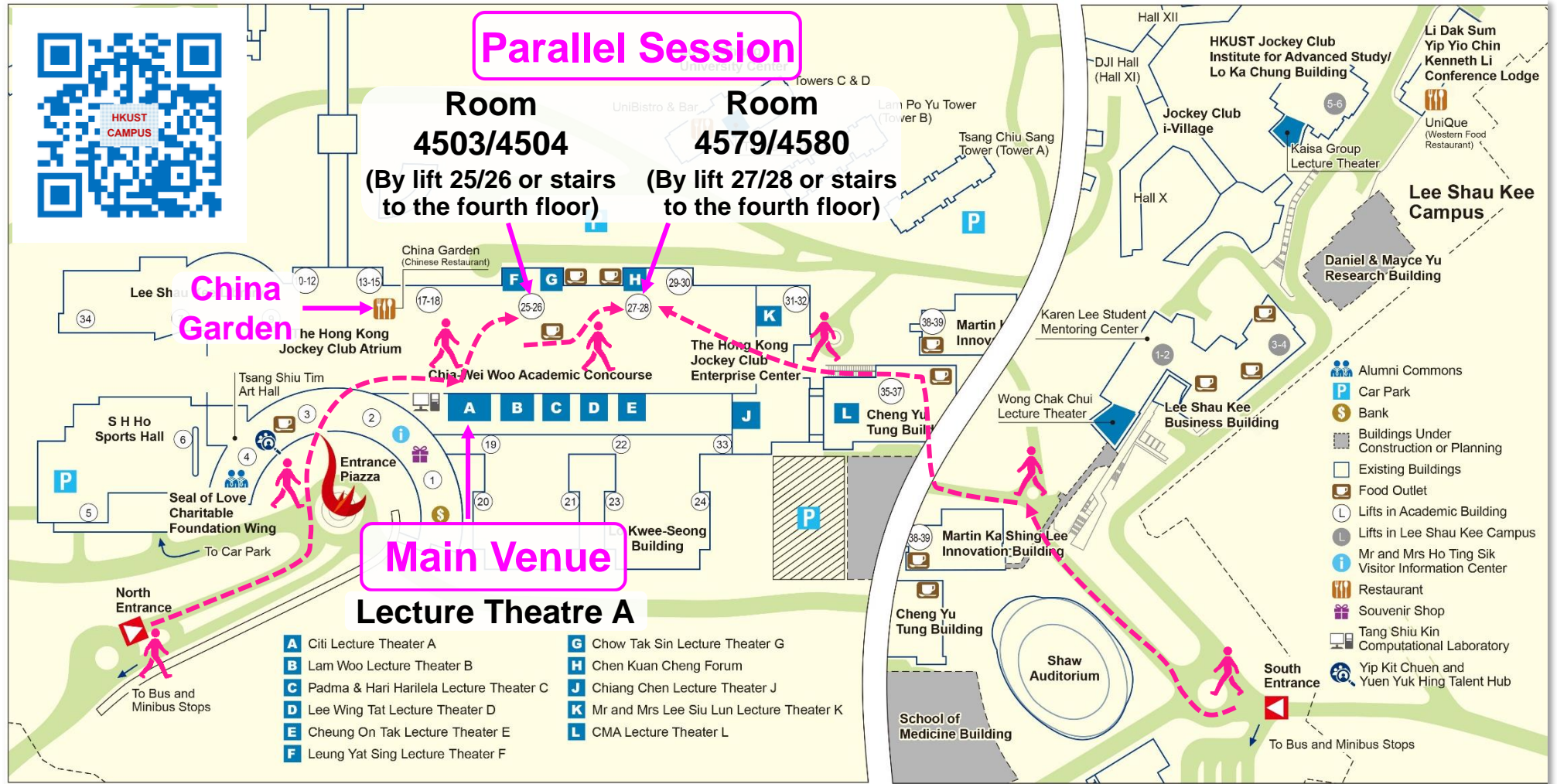
	Keynote Lecture: 35 mins (including Q&A)
Presentation time	Parallel Session: 12 mins (including Q&A) Bright Spark Lecture: 20 mins (including Q&A)
File type	PPT (English)
PPT aspect ratio	16:9
File upload	<ul style="list-style-type: none"> • Please arrive in the session room at least 5 minutes before the session. • Upload the presentation file to the computer in the session room before the session starts.
Remark	<ul style="list-style-type: none"> • Any standard fonts provided by MS Office may be used. If not, please attach the font file(s) with the presentation file. • Please check your presentation file before your presentation to ensure that your file works properly.

DINING ARRANGEMENTS

Date	Lunch		Banquet	
	Time	Location	Time	Location
May 11	12:30-14:00	China Garden Restaurant (G/F)	18:30-20:30	China Garden Restaurant (G/F)
May 12	12:15-13:30	China Garden Restaurant (G/F)	--	--

VENUE

The Hong Kong University of Science and Technology, Clear Water Bay, Kowloon, Hong Kong



PUBLIC TRANSPORTATION



MTR Stations with bus or green minibus service to HKUST 提供往科大巴士或綠色專線小巴服務的港鐵車站
Diamond Hill 鑽石山: 🚌 91, 91M, 91P*
Choi Hung 彩虹: 🚌 91, 91M, 91P* 🚗 11, 11S#
Ngau Tau Kok 牛頭角: 🚗 104
Tiu Keng Leng 調景嶺: 🚌 792M
Hang Hau 坑口: 🚌 91M 🚗 11, 11M, 11S#
Po Lam 寶琳: 🚌 91M 🚗 12, 11S#
Tseung Kwan O 將軍澳: 🚌 792M

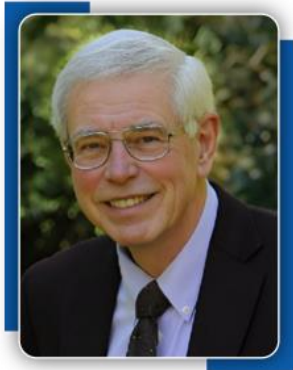
Transportation from airport to HKUST:
For passengers with bulky luggage, taking a taxi to HKUST direct is recommended. Those with simple luggage may take Airport Bus A22 to Lam Tin MTR station or A29 to Po Lam MTR station, and change for taxi to HKUST.

- 🚌 Bus Routes 巴士路線
- 🚗 Green Minibus Routes 綠色專線小巴路線

* Departing from Diamond Hill Station at 07:55 – 08:50 to North Bus Station (HKUST) Monday to Friday (except Public Holidays)
星期一至星期五 (公眾假期除外), 於07:55至08:50由鑽石山鐵路站前往北門巴士站 (香港科技大學)

Departing from Po Lam (Public Transport Interchange) at midnight 12:00 to 05:00 to North Bus Station (HKUST)
午夜12:00至05:00由寶林 (公共交通匯處) 前往北門巴士站 (香港科技大學)

KEYNOTE SPEAKERS



MONDAY, 11 MAY

09:00-09:35

Resilient Infrastructure

Thomas O'Rourke

Thomas R. Briggs Professor of Engineering Emeritus
Cornell University, United States
Member of the US National Academy of Engineering
International Fellow of the UK Royal Academy of Engineering
Member of the Mexican Academy of Engineering

Abstract: The effects of hurricanes with respect to infrastructure resilience are reviewed. The effects of Hurricane Sandy on New York City and subsequent programs to improve the City's infrastructure are described. Special attention is focused on the restoration of the L Line Tunnel, which was flooded by Hurricane Sandy. Professor O'Rourke will describe how a team from Cornell and Columbia Universities was assembled at the request of Governor Andrew Cuomo to help re-engineer the tunnel, and still keep the subway in service. The new approach integrates several advanced technologies, including distributed fiber optics and high-resolution LiDAR, and makes a breakthrough in infrastructure restoration. He will also describe recent advances in earthquake resilience for the regional water supply for Southern California. The agents of change that lead to improved policies and approaches are explored, including the technical, institutional, and social challenges of introducing new technologies and engaging community support.

Biography: Thomas O'Rourke is the Thomas R. Briggs Professor of Engineering Emeritus in the School of Civil and Environmental Engineering at Cornell University. He is a member of the US National Academy of Engineering, Distinguished Member of ASCE, International Fellow of the Royal Academy of Engineering, Member of the Mexican Academy of Engineering, and a Fellow of the American Association for the Advancement of Science. He authored or co-authored over 440 technical publications, received numerous awards for his research, and delivered both Rankine Lecture and Karl Terzaghi Lecture. His research interests cover geotechnical engineering, earthquake engineering, underground construction technologies, engineering for large, geographically distributed systems, and geographic information technologies and database management.

KEYNOTE SPEAKERS



MONDAY, 11 MAY

09:35-10:10

Redefining “Sites” Using Tailored Lego Clustering

Kok-Kwang Phoon

President

Singapore University of Technology and Design, Singapore

Fellow of the Academy of Engineering Singapore

Fellow of the Singapore National Academy of Science

Abstract: One central feature of geotechnical engineering is site uniqueness or site-specificity. However, there is no data-driven method to quantify site uniqueness. The corollary is that it is not possible to identify “similar” sites from big indirect data (BID) (a site database with large geographic coverage) automatically and no method to combine sparse site-specific data with big indirect data to produce a quasi-local transformation model that is less biased compared to a generic model and less imprecise compared to a site-specific model. This “site recognition” challenge is difficult because site-specific data is MUSIC-X-G (Multivariate, Uncertain and Unique, Sparse, Incomplete, and potentially Corrupted with “X” and “G” denoting spatial variability and geologic uncertainty, respectively). The tailored clustering has been shown to be more effective than classical clustering (reference solution) in identifying “similar” sites from big indirect data (BID). There are other data-driven site characterization (DDSC) methods but all of them share a common assumption that a site is identical to a project site. For illustration, why not combine two adjacent project sites as a single “site” for DDSC? Would a “similar” site be even more similar to a target site if only records within one or more depth intervals are extracted? In this lecture, this fundamental question – “what is site?” – is being studied using a large geotechnical site whose 3D subsurface volume that can be sub-divided into unit blocks (“Lego bricks”). It would be shown that “similar” sites, each defined by a different assembly of such Lego bricks, can produce a better quasi-local model. This lecture further explains that a target site itself can be divided into two or more target Lego assemblies. The quasi-local model for each assembly can be distinct. In short, the general question is how to look for similar Lego assemblies in BID to match a particular target Lego assembly, which is a subpart of a target site. “Data-driven site characterization” refers to any site characterization methodology that relies solely on measured data, both site-specific data collected for the current project and existing data of any type collected from past stages of the same project or past projects at the same site, neighboring sites, or beyond. This definition remains valid, but the term “site” should be interpreted as any ground volume without the “project site” qualifier. With this generalization, it is possible to imagine “precision site characterization” when more data are made available in the future.

Biography: Kok-Kwang Phoon is President, Singapore University of Technology and Design (SUTD), as well as Cheng Tsang Man Chair Professor. Concurrently, he is serving as the Deputy Executive Chair (Research) of AI Singapore and a member of the Committee of Government Scientific Advisors. He has also served as the Deputy Chief Scientific Advisor (DCSA) to the National Research Foundation, Prime Minister’s Office, Singapore. He has been elected to serve on the board of the International Council of Academies of Engineering and Technological Sciences (CAETS), 2026-2027. Prof. Phoon is a world leader in the development of reliability and data-centric geotechnics. He was bestowed the ASCE Norman Medal twice in 2005 and 2020, the Humboldt Research Award in 2017, the Harry Poulos Award in 2023, and the Alfredo Ang Award in 2024 among other accolades. Prof. Phoon is the Founding Editor of Georisk and Founding Editor-in-Chief of Geodata and AI.

KEYNOTE SPEAKERS



MONDAY, 11 MAY

10:10-10:45

Building and Implementation of Tunnel Intelligent Agents in Extreme Environments

Hehua Zhu

Distinguished Professor

Tongji University, China

Academician of the Chinese Academy of Engineering

Abstract: Starting from the challenges posed by extreme environments in deep underground engineering, this presentation reveals the time constraints and cognitive limitations associated with the “golden hour” in tunneling. To address the “small data” challenges arising from significant geological variability and sparse monitoring, this presentation emphasizes the necessity of incorporating physics and knowledge of complex systems. A rapid analysis approach that seamlessly integrates physics, knowledge, and data should be developed. On this basis, the presentation clarifies the pathway for transitioning from digital twins to engineering intelligent agents. We propose to develop tunnel intelligent agents equipped with five core capabilities: “self-sensing, self-decision-making, self-control, self-organization, and self-learning.” These technologies have been implemented and validated in projects such as the Ehan High-speed Grand Canyon Tunnel. Finally, the presentation highlights the need to establish an autonomous “machine-environment” collaborative system based on a System of Systems (SOS) architecture. This would enable a paradigm shift from a “human-machine-environment” framework with minimal human assistance to a fully integrated “machine-environment” framework characterized by unmanned operations.

Biography: Hehua Zhu is now Distinguished Professor in Geotechnical Engineering at Tongji University and an Academician of the Chinese Academy of Engineering, and Director of State Key Laboratory of Disaster Reduction in Civil Engineering. He received his Bachelor’s and Master’s Degrees in Mining Engineering from Chongqing University in 1983 and 1986, respectively, and his PhD was awarded in Structural Engineering (Civil Engineering) at Tongji University in 1989. He did his post-doctoral research at the Geo-Research Institute of Osaka and Kyoto University, Japan, from 1993 to 1995. He proposed a generalized 3D Hoek-Brown rock strength criterion together with Prof. Lianyang Zhang, which was also called generalized Zhang-Zhu rock strength criterion (GZZ) recommended as ISRM standard. He was awarded with the Humboldt Research Prize in 2015 and the T.H.H. medal at ICCES’13 in 2013. He created an International journal of Underground Space.

KEYNOTE SPEAKERS



MONDAY, 11 MAY

14:00-14:35

Data-driven and Resilience-based Geotechnical System in Hong Kong

Raymond Cheung

Head of the Geotechnical Engineering Office (GEO)

Civil Engineering and Development Department, Hong Kong, China

Abstract: The Geotechnical Engineering Office (GEO) of the Civil Engineering and Development Department has leveraged the rapid advancement in innovation and technology to establish a data-driven and resilience-based geotechnical system with a view to withstanding the evident adverse impacts of climate change on slope safety and facilitating future development in Hong Kong. This keynote illustrates the advancement of the geotechnical system through mastering the cutting-edge innovation and technology in four projects, highlighting the opportunities and challenges in attempting to strengthen city's resilience against extreme weather and facilitate infrastructure development. These include early landslip warning, construction material testing, ground modelling and digital knowledge services. The GEO's fifth-generation AI-empowered landslip warning system applies multivariate machine-learning models on big data of rainfall, landslide and slope records to achieve significant improvement in forward landslide prediction and support timely issuance of landslip warnings. To facilitate city development, an automated system for concrete cube testing integrating robotics, AI-based image recognition and fracture-pattern classification is developed, which improves the reliability, efficiency and occupational safety of the work process. At a city level, an AI-assisted three-dimensional geological modelling (3DGM), utilizing cutting-edge generative models to infer stratigraphy in areas with limited ground investigation data, has been established. It provides uncertainty-aware ground models for early-stage project planning. Lastly, a pilot large-language-model (LLM) based chatbot using retrieval-augmented generation on geotechnical publications and guidance offers multilingual, citation-backed responses to complex technical enquiries, providing a foundation for long-term AI knowledge services.

Biography: Ir Dr Raymond Cheung has more than thirty-five 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), Technical Committee 205 (Safety and Serviceability) of the International Society for Soil Mechanics and Geotechnical Engineering (ISSMGE) 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.

KEYNOTE SPEAKERS



MONDAY, 11 MAY

14:35-15:10

The HKUST Space Remote Sensing Program

Limin Zhang

Chair Professor and Department Head

The Hong Kong University of Science and Technology, Hong Kong, China

Abstract: Space-aerial-terrestrial monitoring ensures the safe operation of engineering systems, socio-economical systems and the natural environment. The multi-source monitoring data also fuels geoscience machine learning and engineering applications. HKUST leads an ambitious multi-modal satellite sensing program that aims to monitor global land and ocean hazards and environment, advance renewable energy development, and achieve green and sustainable development goals. The major components of the multi-modal satellite program will be introduced in this lecture, including the HKUST-FYBB#1 high-resolution optical satellite, the high-precision CO₂ and methane synergistic observatory payload to be deployed on China Space Station, the Feilian hyperspectral satellite constellation for global wind field measurement, and a space-based data center that will eliminate the downlink bottleneck for remote sensing data and support low-carbon economy.

Biography: Dr. Limin Zhang is Chair Professor and Head of the Department of Civil and Environmental Engineering and Associate Director of State Key Lab of Climate Resilience for Coastal Cities at the Hong Kong University of Science and Technology. His research areas include slopes, dams, foundations, geotechnical risk assessment and management, as well as geoscience sensing. Dr. Zhang is Chair of International Society of Soil Mechanics and Geotechnical Engineering (ISSMGE)'s TC210 on Embankment Dams, Past Chair of ASCE Geo-Institute's Risk Assessment and Management Committee, 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 the recipient of the Chinese National Engineer Award, ASCE Ralph Peck Award, ISSMGE's Lacasse Lecture Award, and Wilson Tang Lecture Award.

KEYNOTE SPEAKERS

MONDAY, 11 MAY

15:10-15:45



The Innovative Development Path of China's Railways (中国铁路创新发展之路)

Jian Zheng (郑健)

Deputy Director of the Expert Academic Committee, China State Railway Group, China (国铁集团专家学术委员会副主任委员, 原总工程师)

Dean of Research Institute of the High-speed Railway and Station-City Integration, Tongji University, China

(同济大学高铁及站城融合研究院院长)

Abstract: This report provides an overview of China's railway development achievements. China has built a fully operational high-speed railway (HSR) network, established a comprehensive heavy-haul railway collection and distribution system, and successfully completed six major speed increases on existing lines. With world-class construction capabilities and continuous breakthroughs in technological innovation, China's railway sector has reached the global forefront in terms of overall technical proficiency and has become a leading force in the international railway industry. The report offers a comprehensive assessment of the impact of China's railways on economic and social development. The rapid expansion of China's railway system—particularly its HSR network—has effectively reduced travel time and distance, continuously improved the integrated transportation system, strengthened the comprehensive economic competitiveness of cities, enhanced travel quality for the public, stimulated the growth of the tertiary industry (e.g., tourism), accelerated the development of rail-based urban clusters and metropolitan areas, and facilitated international cooperation and exchange in the railway sector. These advances have significantly contributed to the establishment of a new development paradigm, brought new benefits to the well-being of the Chinese people, and set a new benchmark for global HSR development. The report also systematically outlines future plans and prospects for China's railways. Through scientifically formulated and successively implemented medium- and long-term railway network plans and five-year railway development plans, China aims to accelerate the construction of a modern and efficient HSR network, improve its extensive conventional-speed railway network, develop a high-efficiency and cost-effective freight logistics network, build a multi-tiered rail network for urban clusters and metropolitan areas, and create a seamlessly integrated comprehensive transportation hub system. In the future, China's railways will become safer, more convenient, greener, more efficient, and more economical—taking the lead in supporting the construction of a modern country.

This keynote lecture will be delivered in Mandarin with English subtitle.

(报告客观总结了中国铁路建设发展成就: 中国高速铁路成网运营, 形成了重载铁路集疏运体系, 成功实施既有线六次大提速, 工程建造水平世界领先, 科技创新不断取得新突破, 中国铁路总体技术水平已迈入世界先进行列, 已成为引领世界铁路发展的重要力量。报告全面评价了中国铁路对经济社会发展的影响, 中国铁路特别是高铁的快速发展, 有效缩短了时空距离, 不断完善了综合交通体系, 进一步提升了城市综合经济竞争力, 改善了百姓出行品质, 推动了旅游业等第三产业发展, 加快了轨道上的城市群和都市圈发展, 促进了铁路国际合作交流, 极大地推动了新发展格局的构建,

给百姓美好生活带来了新福祉，给世界高铁发展树立了新标杆。报告系统谋划了中国铁路未来规划展望，通过科学编制、接续实施中长期铁路网规划和铁路五年发展规划，将加快构建现代高效的高速铁路网，完善覆盖广泛的普速铁路网，打造高效经济的货运物流网，发展城市群都市圈多层次轨道网，打造一体衔接的综合交通枢纽集群，未来铁路将更加安全、便捷、绿色、高效、经济，为建设现代化国家当好先行。)

Biography: Professor ZHENG Jian has served as Deputy President of China Railway Siyuan Survey and Design Group Co., Ltd. (FSDI), President of China Railway Third Survey and Design Institute Group Co., Ltd. (TSDI), Chief Planner of the former Ministry of Railways, President of the Economic Planning and Research Institute of the former Ministry of Railways, Director of the Engineering Appraisal and Design Center of the former Ministry of Railways, Commander-in-Chief of the Railway Passenger Station Construction Headquarters of the former Ministry of Railways, a member of the Party Leadership Group of the National Railway Administration, Chief Engineer of China State Railway Group Co., Ltd. (China Railway), and Technical Chief Advisor of China State Railway Group Co., Ltd. He is currently Deputy Director of the Expert Academic Committee of China State Railway Group Co., Ltd., and Dean of Research Institute of the High-speed Railway and Station-City Integration at Tongji University. Over the past four decades, he has been engaged in railway survey and design, technological innovation, theoretical research, and engineering management. He has fully participated in and helped shape the research, development, and planning of China's high-speed railway technical roadmaps, policies, standards, and network expansion. He is a core architect of the top-level design and macro-level strategy for China's railway technology advancement. He has received two Special Prizes, one First Prize, and three Second Prizes of the National Science and Technology Progress Award, as well as two Gold Prizes of the National Survey and Design Award.

(郑健教授曾任铁四院副院长、铁三院院长，原铁道部总规划师兼经济规划研究院院长、工程鉴定设计中心主任、铁路客站建设总指挥部总指挥长，国家铁路局党组成员，国铁集团总工程师、技术总顾问，现任国铁集团专家学术委员会副主任委员、同济大学高铁及站城融合研究院院长。近四十年来一直从事铁路勘察设计、技术创新、理论研究、工程管理工作，全程参与和推动了我国高铁技术路线、技术政策、技术标准的研究制定和高铁规划建设，是铁路技术发展顶层设计和宏观决策核心成员。曾获得国家科技进步特等奖 2 项、一等奖 1 项、二等奖 3 项、全国勘察设计金奖 2 项。)

KEYNOTE SPEAKERS



TUESDAY, 12 MAY

08:45-09:20

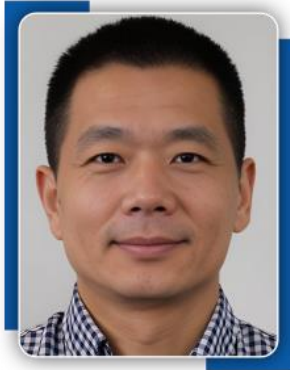
ISSMGE Intelligent Geotechnics Honour Lecture:
**Intelligent Safety Risk Assessment of Tunnel
Engineering Throughout the Whole-Life-Cycle**

Hongwei Huang
Distinguished Professor
Tongji University, China

Abstract: This lecture presents a multi-source information fusion and intelligent algorithm approach for the whole-life-cycle safety risk assessment of tunnel engineering, covering geology, design, construction, operation, and maintenance. At its core, the method leverages sensing technologies, machine learning, and numerical simulation to enable data-driven dynamic assessment and control of safety risks. In geological modeling, a 3D transparent geological model is constructed based on the Markov principle, integrating real-time vision and borehole data. Deep learning is applied to dynamically identify geotechnical parameters, thereby digitizing the geological environment. During the design and construction stages, machine learning methods are used to achieve high-precision predictions of structural parameters, forming a data-driven and machine-learning-based design methodology. In construction, embodied intelligence is introduced: sensors monitor the tunnel boring machine (TBM) attitude and the excavation face in real time, forming a sensing–decision–execution closed loop to dynamically control ground settlement and achieve risk-controllable intelligent tunneling. In the operation and maintenance phase, mobile vision devices automatically identify surface defects (such as cracks, leakage, and spalling) and upload data in real time via wireless network, enabling automatic detection and localization of defects and improving operational efficiency. For safety assessment, multi-source information from the above stages is integrated, and numerical simulation techniques such as the phase-field method are used to simulate defect evolution considering ground–structure interaction, which can quantify safety risk for the tunnel.

Biography: Prof. Hongwei Huang is a Distinguished Professor of Tongji University, China. He is mainly engaged in risk assessment on Geo-structural system, underground infrastructure safety and health monitoring and inspection, etc. Currently, he is the director of Shanghai Institute of Disaster Prevention and Relief, the founding director of International Joint Research Centre for Resilient Infrastructure of Tongji University. And also, he has been the Founding Chair of Engineering Risk and Insurance Research Branch of China Civil Engineering Society since 2009. While serving as core members for international academic committees including GeoSNet, Geo-Institute on Risk Management of ASCE, TC304 of ISSMEGE, WG2 of ITA, etc., Prof. Huang is also the Associate editor of Canadian Geotechnical Journal, ASCE-ASME Journal of Risk and Uncertainty of Engineering System, Editorial Board Members of Tunneling and Underground Space Technology, and Georisk. And with more than 200 journal papers and 6 books published, over 20 keynotes in various prestigious international conferences delivered, Prof. Hongwei Huang has also chaired more than 5 international conferences.

KEYNOTE SPEAKERS



TUESDAY, 12 MAY

09:20-09:55

Data-driven Geotechnical Site Characterization

Jinsong Huang

Professor

The University of Newcastle, Australia

Abstract: Geotechnical design and analysis require engineers to make decisions and judgments about ground conditions under conditions of significant uncertainty and incomplete information. It is estimated that, for a typical project, less than one part in a million of the ground volume is directly investigated. Consequently, information obtained from a limited number of investigation locations must be interpolated and extrapolated to represent a much larger subsurface domain. This keynote will introduce data-driven approaches to geotechnical site characterization, ranging from methods based on random field theory and Bayesian updating to more recent machine-learning techniques. Particular emphasis will be placed on tree-based methods incorporating recently proposed geotechnical distance fields. Compared with conventional tree-based approaches, these geotechnical distance fields incur minimal additional computational cost while delivering substantial improvements in performance for both spatial interpolation and soil stratification problems.

Biography: Jinsong Huang is a Professor at the Priority Research Centre for Geotechnical Science and Engineering within the Discipline of Civil, Surveying and Environmental Engineering at the University of Newcastle. His research focuses on risk assessment in geotechnical engineering and computational geomechanics. He has published more than 250 papers covering topics including slope stability and landslide risk assessment, modelling of spatial variability, stress-integration techniques for elastoplastic constitutive models, contact dynamics of granular media, hydraulic fracturing analysis, and predictive maintenance of railway infrastructure. Professor Huang has received several prestigious awards, including the Regional Contribution Award from the International Association for Computer Methods and Advances in Geomechanics (IACMAG) at its 2014 international conference in Kyoto, the GEOSNet Award from the Geotechnical Safety Network in 2017, and recognition as Australia's Field Leader in Environmental and Geological Engineering by The Australian 2020 Research Magazine. He has been listed among Stanford University's "World's Top 2% Scientists" for single-year impact since 2020 and for career-long impact since 2024. He currently serves as Managing Editor of Georisk and as an editorial board member for the Canadian Geotechnical Journal and Computers and Geotechnics.

KEYNOTE SPEAKERS



TUESDAY, 12 MAY

09:55-10:30

The Role of ML in Geotechnical Practice: Trustworthiness, Explainability, and Accountability

Zhongqiang Liu

Principal Researcher

Norwegian Geotechnical Institute, Norway

Abstract: Machine learning (ML) has the potential to support the analysis of complex soil–structure interactions, improve predictive accuracy and enhance decision-making in geotechnical engineering. However, the integration of ML into geotechnical engineering raises critical concerns regarding trustworthiness, explainability, and accountability, particularly given the high-stakes nature of infrastructure design and construction. This presentation examines the role of ML in geotechnical practice through the lens of these three interrelated dimensions. The importance of uncertainty quantification, model interpretability and ethical implications of ML applications in geotechnical engineering are addressed, and the State-of-Practice is exemplified with several real-life case studies. The necessity of combining domain knowledge with responsible ML practices to ensure reliable, transparent and ethically sound adoption of ML in geotechnical engineering is also highlighted and discussed.

Biography: Dr. Zhongqiang Liu is Principal Researcher at Norwegian Geotechnical Institute (NGI) and Adjunct Professor at Oslo Metropolitan University (OsloMet), Oslo, Norway, with expertise in risk and hazard assessment for geohazards, machine learning in geotechnics. He initiated and is now Chair of Technical Committee 309 of ISSMGE: Machine Learning and Big Data in Geotechnics. He is Chair of “Geotechnical Safety Network (GEOSNet)”. Dr. Liu is Technical Lead of Research Group – Georisk at NGI. Dr. Liu is PI/co-PI of several HEU and RCN projects. His research has earned several international recognitions, including Best Paper Award of Journal Georisk in 2015, OTC ASCE Best Paper Award in 2019, GEOSNet Young Researcher Award in 2019, Best Paper Award of JZUSA in 2023, and Best Paper Award of Engineering Geology in 2025.

CONFERENCE PROGRAM

MAY 11, MONDAY

08:45-09:00 **Opening Ceremony** (Lecture Theatre A)

09:00-10:45 **Keynote Lectures 1-3** (Lecture Theatre A)

10:45-11:05 **Coffee Break** (Lecture Theatre A)

	Parallel Session 1 (Lecture Theatre A)	Parallel Session 2 (Room 4503, Lift 25/26)	Parallel Session 3 (Room 4504, Lift 25/26)	Parallel Session 4 (Room 4579, Lift 27/28)
11:05-12:20	SS6 (6)	SS9 (6)	SS10 (6)	SS7 (6)

12:30-14:00 **Lunch & Break** (HKUST China Garden Restaurant)

14:00-15:45 **Keynote Lectures 4-6** (Lecture Theatre A)

15:45-16:05 **Coffee Break** (Lecture Theatre A)

	Parallel Session 5 (Lecture Theatre A)	Parallel Session 6 (Room 4503, Lift 25/26)	Parallel Session 7 (Room 4504, Lift 25/26)	Parallel Session 8 (Room 4579, Lift 27/28)
16:05-18:05	SS6 (6) & SS4 (4)	SS5 (4) & SS9 (6)	SS10 (3) & SS8 (7)	SS7 (10)

18:30-20:30 **Conference Banquet** (HKUST China Garden Restaurant)

MAY 12, TUESDAY

08:45-10:30 **Keynote Lectures 7-9** (Lecture Theatre A)

10:30-10:50 **Coffee Break** (Lecture Theatre A)

	Parallel Session 9 (Lecture Theatre A)	Parallel Session 10 (Room 4503, Lift 25/26)	Parallel Session 11 (Room 4504, Lift 25/26)	Parallel Session 12 (Room 4579, Lift 27/28)
10:50-12:05	SS1 (6)	SS5 (5)	SS3 (5)	SS11 (6)

12:15-13:30 **Lunch & Break** (HKUST China Garden Restaurant)

	Parallel Session 13 (Lecture Theatre A)	Parallel Session 14 (Room 4503, Lift 25/26)	Parallel Session 15 (Room 4504, Lift 25/26)	Parallel Session 16 (Room 4579, Lift 27/28)
13:30-14:55	SS1 (4) & SS2 (3)	SS4 (7)	SS8 (7)	SS11 (7)

14:55-15:10 **Coffee Break** (Lecture Theatre A)

15:10-16:30 **Bright Spark Lectures 1-4** (Lecture Theatre A)

16:30-16:40 **Closing Ceremony** (Lecture Theatre A)

OPENING CEREMONY, KEYNOTE LECTURES & BANQUET

MAY 11, MONDAY

Opening Ceremony (Lecture Theatre A)

Chair: *Yu Wang* (HKUST)

Welcome Speech

08:45-08:55 *Charles Ng* (Vice President, HKUST; Immediate Past President, International Society for Soil Mechanics and Geotechnical Engineering (ISSMGE))

08:55-09:00 **Group Photo**

Keynote Lectures (Lecture Theatre A)

Chair: *Charles Ng* (HKUST) & *Jianye Ching* (National Taiwan University)

Resilient Infrastructure

09:00-09:35 *Thomas O'Rourke* (Cornell University)

Redefining "Sites" Using Tailored Lego Clustering

09:35-10:10 *Kok-Kwang Phoon* (Singapore University of Technology and Design)

Building and Implementation of Tunnel Intelligent Agents in Extreme Environments

10:10-10:45 *Hehua Zhu* (Tongji University)

10:45-11:05 **Coffee Break** (Lecture Theatre A)

11:05-12:20 **PARALLEL SESSIONS 1-4**

12:30-14:00 **Lunch & Break** (HKUST China Garden Restaurant)

Keynote Lectures (Lecture Theatre A)

Chair: *Tong Qiu* (The University of Utah) & *Gang Wang* (HKUST)

Data-driven and Resilience-based Geotechnical System in Hong Kong

14:00-14:35 *Raymond Cheung* (Geotechnical Engineering Office, Hong Kong SAR Government)

The Role of ML in Geotechnical Practice: Trustworthiness, Explainability, and Accountability

14:35-15:10 *Zhongqiang Liu* (Norwegian Geotechnical Institute)

The Innovative Development Path of China's Railways (中国铁路创新发展之路)

15:10-15:45 *Jian Zheng* (China State Railway Group & Tongji University)
(郑健, 中国国铁集团; 同济大学)

15:45-16:05 **Coffee Break** (Lecture Theatre A)

16:05-18:05 **PARALLEL SESSIONS 5-8**

18:30-20:30 **Conference Banquet** (HKUST China Garden Restaurant)

PARALLEL SESSIONS 1 & 2 (MAY 11, MONDAY)

PARALLEL SESSION 1 VENUE: LECTURE THEATRE A

Chair: *Takayuki Shuku* (Tokyo City University) & *Jianye Ching* (National Taiwan University)

SS6: Databases and Their Use for Data-centric Geotechnics

- 11:05-11:17 **CPT-BH-USCS/8/4182: A global geotechnical database enabling fully coupled Bayesian simulation of soil categories and properties**
Jianye Ching
- 11:17-11:29 **Big data for shield tunneling construction: Assessment, mining, and applications**
Chao Zhang
- 11:29-11:41 **The potential use of the net cone resistance to pile shaft friction estimation in clay**
Ebrahim Ghorbani, Chuangxin Lyu, Zhongqiang Liu
- 11:41-11:53 **Sparse spectrum representation of Gaussian process regression for nonstationary geotechnical spatial variability characterization using limited measurements**
Cong Miao, Yu Wang
- 11:53-12:05 **Data-driven hierarchical Bayesian model-based stacking ensemble learning framework for wall deflection prediction in excavations**
Ari Surya Abdi, Jianye Ching
- 12:05-12:17 **A benchmark dataset for braced excavations in the Guangzhou metro: A case study from the Pearl River Delta, China**
Runhong Zhang

PARALLEL SESSION 2 VENUE: ROOM 4503, LIFT 25/26

Chair: *Yuanqin Tao* (Zhejiang University of Technology) & *Xiangfeng Guo* (South China University of Technology)

SS9: Data-driven Modeling, Risk Assessment, and Intelligent Control in Underground Engineering

- 11:05-11:17 **Efficient durability assessment of jointed rigid pipes under coupled environmental stressors: A machine learning and Bayesian data updating approach**
Sizhuo Zheng, Xiaogang Qin
- 11:17-11:29 **Domain-adversarial learning for long-term TBM thrust prediction**
Shengtai Ge, Shaoliang Zeng, Yuanqin Tao, Honglei Sun
- 11:29-11:41 **Intelligent and autonomous pipeline deposit tracking based on a multi-object tracking framework**
Sihao Yu, Louis Ngai Yuen Wong, Kazaf Yuen Pan Wong
- 11:41-11:53 **Data-driven prediction of time-varying 3D settlement in land reclamation project with complex stratigraphy**
Danni Zhang, Huaming Tian, Yu Wang, Kostas Senetakis
- 11:53-12:05 **A context fusion model for predicting ground deformation in variable-diameter shield tunneling**
Guodong Wu, Chao Zhang
- 12:05-12:17 **Integrated risk assessment framework for slurry shield construction: Combining shield boring parameter prediction with hybrid weighting VIKOR method**
Yajie Wang, Shuilong Shen

PARALLEL SESSIONS 3 & 4 (MAY 11, MONDAY)

PARALLEL SESSION 3

VENUE: ROOM 4504, LIFT 25/26

Chair: *Chao Shi* (Nanyang Technological University) & *Hui Wang* (University of Dayton)

SS10: Digital and Intelligent Geological Modelling for Smart City Applications

- 11:05-11:17 **Data-knowledge fusion based probabilistic tunable large geological model**
Wei Yan, Wanhuan Zhou, Ping Shen
- 11:17-11:29 **Implicit modelling of geological cross-sections from sparse borehole data**
Siyu Lu, Chao Shi
- 11:29-11:41 **Study of contaminant transport with complex boundaries using causality-enhanced physics-informed neural networks**
Jiong Chen, Linshuang Zhao
- 11:41-11:53 **Subtype and transition probability guided machine learning for soil stratification**
Jiawei Xie, Jinsong Huang, Shuihua Jiang
- 11:53-12:05 **Accurate assessment of reservoir slope instability risk: A sequential Bayesian updating framework integrating multi-source sparse data**
Huafu Pei, Na You, Fanhua Meng
- 12:05-12:17 **Online semi-supervised geological prediction for shield tunneling with multi-layer HMRF modeling**
Guangcan Sun, Qiujing Pan

PARALLEL SESSION 4

VENUE: ROOM 4579, LIFT 27/28

Chair: *Zijun Cao* (Southwest Jiaotong University) & *Tengyuan Zhao* (Xi'an Jiaotong University)

SS7: Geotechnical Uncertainty Quantification and Reliability Analysis in the Digital Era: New Paradigms, Methods, and Applications

- 11:05-11:17 **3D and 2D mesostructural relationship of soil-rock mixture based on numerical image techniques**
Pei Zhang, Kai Wang, Xiuli Du
- 11:17-11:29 **Learning three-dimensional auto-correlation function directly from sparse measurement data: A spectral approach**
Yue Hu, Yu Wang, Michael Beer
- 11:29-11:41 **Physics-aware directional importance sampling for efficient geotechnical reliability analysis**
Tao Wang, Jian Ji
- 11:41-11:53 **Graded early warning method for tailings dam stability based on rainfall monitoring and reliability index**
Jiakun Liu, Liang Li, Chao Wang
- 11:53-12:05 **Reliability assessment of offshore wind turbines considering fully coupled aero-hydro-geotech dynamics**
Heng Zhou, Te Xiao
- 12:05-12:17 **Robust design of earthen levees in the face of flood hazards**
Lei Wang, Liang Zhang

PARALLEL SESSION 5 (MAY 11, MONDAY)

PARALLEL SESSION 5

VENUE: LECTURE THEATRE A

Chair: Takayuki Shuku (Tokyo City University) & Yu Otake (Tohoku University)

SS6: Databases and Their Use for Data-centric Geotechnics

- 16:05-16:17 **A high-dimensional spatial embedding and attention network approach for spatial estimation of SPT N -values**
Kazuhiro Oda
- 16:17-16:29 **MRF-based geological modeling using a composite algorithm**
Takayuki Shuku
- 16:29-16:41 **Statistical modeling of multivariate nonlinear and multimodal data using minimum information dependence modeling: Application to Tokyo-CLAY/14/67760**
Tomoka Nakamura, Taiga Saito, Yu Otake
- 16:41-16:53 **Data-centric framework for soil liquefaction assessments addressing region- uniqueness**
Jiun-Shiang Wang, Jianye Ching
- 16:53-17:05 **Latent representation of soil properties: Insights from multi-modal fusion, conversion, and correlation**
Qimeng Guo, Liangtong Zhan, Zhenyu Yin, Yunmin Chen
- 17:05-17:17 **Subsurface modeling for urban ground subsidence: A comparative study in Seoul**
Taek-Kyu Chung, Han-Saem Kim, Suho Cho, Jinhyun Choo, Choong-Ki Chung

SS4: Data-driven Site Characterization

- 17:17-17:29 **ML-based feature analysis of stereo microphone impact echo signals via dimensionality reduction**
Kingsley Asare Boakye, Taeseo Ku, Changho Lee
- 17:29-17:41 **Delineating non-stationary undrained shear strength profiles from extremely sparse measurements using CPT-based prior knowledge**
Zheng Guan, Yu Wang
- 17:41-17:53 **Multi-scale reconstruction of 3D subsurface model using deep learning techniques based on CPT data**
Xiaoqi Zhou, Peixin Shi
- 17:53-18:05 **Three-dimensional modelling of subsurface stratigraphy using boreholes outside the target site**
Borui Lyu, Yu Wang

PARALLEL SESSION 6 (MAY 11, MONDAY)

PARALLEL SESSION 6

VENUE: ROOM 4503, LIFT 25/26

Chair: *Yuanqin Tao (Zhejiang University of Technology) & Tongming Qu (Wuhan University)*

SS5: Probabilistic Site Characterization: Data Fusion, Modelling, and Applications

- 16:05-16:17 **3D coupled stratigraphy and geo-properties modeling based on deep learning model**
Shengkun Wang, Yu Tang, Xueyou Li
- 16:17-16:29 **A diffusion-model-based framework for intelligent generation of geological profiles using sparse borehole data**
Yicheng Wang, Xueyou Li, Zhiyong Yang
- 16:29-16:41 **A data-driven GR-Gibbs framework for probabilistic stratigraphic modeling and uncertainty quantification in complex geological settings**
Yu Tang, Xueyou Li, Shengkun Wang
- 16:41-16:53 **Machine learning of three-dimensional soil stratigraphic modelling by joint sparse representation of cone penetration test (CPT) data**
Juncheng Yao, Yu Wang, Kostas Senetakis

SS9: Data-driven Modeling, Risk Assessment, and Intelligent Control in Underground Engineering

- 16:53-17:05 **Multi-source data-driven cutterhead health prediction**
Wengang Zhang, Weixin Sun
- 17:05-17:17 **Cross-stage servo-force optimization for excavation-induced wall deflections**
Shaoxiang Zeng, Yuanqin Tao, Honglei Sun, Yuanqiang Cai
- 17:17-17:29 **VMD-BiLSTM-based lateral displacement prediction for foundation pit retaining structure via multi-source domain transfer learning**
Jingkang Shi, Maoen Huang
- 17:29-17:41 **Cloud-based intelligent platform for automated and resilient shield tunnel construction**
Weiwei Zhao, Shuilong Shen, Annan Zhou
- 17:41-17:53 **Transformer-based model for excavation-induced deformation prediction considering soil spatial variability**
Sunjuexu Pan, Shaoxiang Zeng, Yuanqin Tao, Honglei Sun
- 17:53-18:05 **Prediction of pipe uplift resistance in sand using coupled Eulerian-Lagrangian model and machine learning technique**
Xinrui Li, Xiaogang Qin

PARALLEL SESSION 7 (MAY 11, MONDAY)

PARALLEL SESSION 7

VENUE: ROOM 4504, LIFT 25/26

Chair: *Chao Shi* (Nanyang Technological University) & *Gengfu He* (National University of Singapore)

SS10: Digital and Intelligent Geological Modelling for Smart City Applications

16:05-16:17 **Prelogging: An AI-powered web application for automated rock core logging and fracture analysis in Hong Kong**

Louis Wong

16:17-16:29 **Developing digital training images from narrative geological knowledge using large language models**

Borui Lyu, Yu Wang

16:29-16:41 **Machine learning of CPT data to determine competent stratum for deep cement mixing in reclamation projects**

Cong Miao, Lawrence Shum, Sunny So, Leo Shu, Siew-Wei Lee, Anthony Wong, Yu Wang

SS8: Knowledge-informed Data-driven Modelling for Geotechnics and Risk Assessment

16:41-16:53 **The influence of geotechnical distance fields (GDFs) on spatial prediction of primary consolidation using artificial neural network**

Raksmey Thea, Kingsley Asare Boakye, Changho Lee

16:53-17:05 **Machine learning empowered reliability analysis of vegetated slopes**

Min Zhong, Shuihua Jiang, Peng Lan

17:05-17:17 **An uncertainty-aware and knowledge-informed inversion framework for spatial-temporal numerical modeling of rockfill dams**

Ke Qin, Xiaosong Tang, Dianqing Li

17:17-17:29 **A geology-informed graph neural network solution for addressing the data sparsity challenge in 3D geological modeling**

Mingyong Liao, Guilin Wang, Haijia Wen

17:29-17:41 **Multimodal learning-based permeability regression in random-field porous media using a 3D CNN**

Xinyue Zhu, Jianfu Shao, Hongzhuo Fan, Yun Jia

17:41-17:53 **Multi-risk prediction and causation analysis of undersea tunnel construction based on IAHP-LightGBM and SHAP**

Le Zhang, Sihan Liu, Hongwei Huang, Liqing Qu, Mingliang Zhou

17:53-18:05 **Research on interpretable machine learning methods for landslide hazard under different rainfall conditions**

Fangyi Yan, Haijia Wen

PARALLEL SESSION 8 (MAY 11, MONDAY)

PARALLEL SESSION 8

VENUE: ROOM 4579, LIFT 27/28

Chair: *Zijun Cao (Southwest Jiaotong University) & Tengyuan Zhao (Xi'an Jiaotong University)*

SS7: Geotechnical Uncertainty Quantification and Reliability Analysis in the Digital Era: New Paradigms, Methods, and Applications

- 16:05-16:17 **Quantifying the effect of uncertain root defects on tree resistance to large-deformation uprooting: A stochastic analysis**
Qi Huang, Yu Wang
- 16:17-16:29 **Interpretable XGBoost surrogates for learning probabilistic seismic demand model parameters and rapid fragility inference of road embankments**
Qiwei Jin, Zhijian Qiu, Yewei Zheng
- 16:29-16:41 **Ground failure mechanism for deep tunnel in sandy cobble strata based on the cohesive zone element**
Feng Guo, Pei Zhang, Xiuli Du
- 16:41-16:53 **Transfer learning-based prediction of spatiotemporally varying settlement at similar ground improvement projects**
Huaming Tian, Yu Wang
- 16:53-17:05 **On likelihood function formulation in Bayesian inference with observational data from progressive slope excavation**
Lianyu Zhang, Zijun Cao
- 17:05-17:17 **Gaussian mixture modeling for multivariate geotechnical parameters**
Qi Wan, Qinxuan Deng, Zijun Cao, Zhao Zhao
- 17:17-17:29 **Hierarchical Bayesian framework for estimating auto-correlation length in data-scarce geotechnical site characterization**
Tengyuan Zhao, Xuejiao Cao
- 17:29-17:41 **Bayesian data integration from multiple sources in probabilistic digital twins for geotechnical applications**
Dafydd Cotoarbă, Antonis Mavritsakis, Timo Schweckendiek, Ian FC Smith, Daniel Straub
- 17:41-17:53 **Stochastic modelling of ground source heat pump performance and malfunction probability with consideration of spatially varying soil properties**
Yuanzhong Yan, Gongsheng Huang, Yu Wang
- 17:53-18:05 **Ground model on seafloor multi-physics coupling with geotechnical characteristics for offshore infrastructure planning**
Han-Saem Kim, Taek-Kyu Chung, Ji-Ho Lee, Suho Cho

KEYNOTE, BRIGHT SPARK LECTURES & CLOSING CEREMONY

MAY 12, TUESDAY

Keynote Lectures (Lecture Theatre A)

Chair: Akihiro Takahashi (Institute of Science Tokyo) & Yu-Hsing Wang (HKUST)

08:45-09:20 **ISSMGE Intelligent Geotechnics Honour Lecture: Intelligent Safety Risk Assessment of Tunnel Engineering Throughout the Whole-Life-Cycle**
Hongwei Huang (Tongji University)

09:20-09:55 **Data-driven Geotechnical Site Characterization**
Jinsong Huang (The University of Newcastle)

09:55-10:30 **The HKUST Space Remote Sensing Program**
Limin Zhang (HKUST)

10:30-10:50 **Coffee Break** (Lecture Theatre A)

10:50-12:05 **PARALLEL SESSIONS 9-12**

12:15-13:30 **Lunch & Break** (HKUST China Garden Restaurant)

13:30-14:55 **PARALLEL SESSIONS 13-16**

14:55-15:10 **Coffee Break** (Lecture Theatre A)

Bright Spark Lectures (Lecture Theatre A)

Chair: Zhongqiang Liu (TC309 Chair) & Zhenyu Yin (Hong Kong Polytechnic University)

15:10-15:30 **From Pixels to Physics: Machine Learning-enabled Spatial Intelligence for Geotechnical Engineering Digital Twins**
Tongming Qu (Wuhan University)

15:30-15:50 **Simultaneous Bayesian Learning of Multi-source Data**
Xin Liu (Wuhan University)

15:50-16:10 **Unlocking the Potential of Data-centric Geotechnics: A Cross-disciplinary Perspective**
Andreas-Nizar Granitzer (Norwegian Geotechnical Institute)

16:10-16:30 **Towards Intelligent Geomechanics: Bridging Physics, Data, and Uncertainty**
Kai-Qi Li (Hong Kong Polytechnic University)

Closing Ceremony (Lecture Theatre A)

Chair: Yu Wang (HKUST)

16:30-16:40 **Concluding Remarks**
Zhongqiang Liu (TC309 Chair)

PARALLEL SESSIONS 9 & 10 (MAY 12, TUESDAY)

PARALLEL SESSION 9 VENUE: LECTURE THEATRE A

Chair: *Te Xiao (Shanghai Jiao Tong University) & Shuai Zhang (Zhejiang University)*

SS1: Advances in Machine Learning for Landslide Hazards

- 10:50-11:02 **An efficient Bayesian updating algorithm for high-dimensional problem involving multiple sets of data**
Taochun Jiang, Xin Liu, Dianqing Li, Yu Wang, Kok-Kwang Phoon
- 11:02-11:14 **Quantifying annual probability of slope failure under varying groundwater levels**
Junjie Wang, Xin Liu, Dianqing Li, Yu Wang, Manyu Wang
- 11:14-11:26 **Machine learning-powered submarine landslide susceptibility evaluation in hydrate-rich regions**
Fengyao Zhao, Lulu Zhang, Te Xiao
- 11:26-11:38 **Slope stability prediction using transfer learning with the data, physics, and math integrated multi-model driven research paradigm**
Yihuai Lou, Jiateng Kong, Yunmin Chen
- 11:38-11:50 **Bayesian probabilistic evaluation of landslide rheological parameters and run-out behavior considering both the lateral and longitudinal morphological characteristics on depositional area**
Mi Tian, Ziqiang Ding, Chao Ma
- 11:50-12:02 **From particles to practice: A multi-scale computational toolkit for next-generation geomechanics**
Shiwei Zhao, Jidong Zhao

PARALLEL SESSION 10 VENUE: ROOM 4503, LIFT 25/26

Chair: *Zheng Guan (Delft University of Technology) & Xiaogang Qin (Sun Yat-sen University)*

SS5: Probabilistic Site Characterization: Data Fusion, Modelling, and Applications

- 10:50-11:02 **Identification of soil parameters in mechanized tunnelling based on physics-informed neural networks**
Zilong Zhang, Qi Zhang, Qiuqing Pan
- 11:02-11:14 **Hierarchical multi-source heterogeneous data fusion framework for tunnel surrounding rock classification**
Yongkai Shen, Zijun Cao
- 11:14-11:26 **Graph convolution network-based stratigraphic modeling using sparse borehole data**
Lai Wang, Qiuqing Pan
- 11:26-11:38 **Automated quantification of London clay spatial variability from offshore wind farm data**
Huayun Pan, Xiangfeng Guo, Yue Hu, Zezhou Wang, Zhichao Shen
- 11:38-11:50 **AKGSS-based method for efficient reliability and sensitive analysis of multiple failure modes**
Yuchao Ding, Zhiyong Yang, Xiaohui Qi
- 11:50-12:02

PARALLEL SESSIONS 11 & 12 (MAY 12, TUESDAY)

PARALLEL SESSION 11

VENUE: ROOM 4504, LIFT 25/26

Chair: *Haijia Wen (Chongqing University) & Weixin Sun (Chongqing University)*

SS3: Machine Learning Applications in Geohazards and Geoen지니어링

- 10:50-11:02 **A physics-informed neural network framework for time-variant seismic resilience assessment of corroding pile-supported wharves**
Yunfan Zhang, Lulu Zhang, Qing Ai
- 11:02-11:14 **Physics-informed deep Ritz phase-field modeling of mixed-mode brittle fracture in rock-like materials**
Rongfei Liu, Zhan Yu, Jianfu Shao
- 11:14-11:26 **Soil-nailed slope optimization design using the mixed particle swarm optimization and whale optimization algorithm**
Juntao Xiao, Liang Li, Shan Xiao
- 11:26-11:38 **Learning constitutive relations of unsaturated clay from images**
Xiangyi Zuo, Chao Zhang
- 11:38-11:50 **DEP-UNet based joint inversion of conductivity and permittivity for ground penetrating radar**
Bohan Zhou, Jing kang Shi
- 11:50-12:02

PARALLEL SESSION 12

VENUE: ROOM 4579, LIFT 27/28

Chair: *Dongming Zhang (Tongji University) & Changtai Zhou (Tongji University)*

SS11: AI for Smart Tunneling Across the Full Life Cycle: From Site Investigation to Resilient Operation

- 10:50-11:02 **Few-shot leakage segmentation in shield tunnel linings via fine-tuning a large vision foundation model**
Zhiyao Tian, Yu Zhao
- 11:02-11:14 **A physics and information dual-driven prediction of earth pressure balance shield chamber pressure**
Sen Wang, Dongming Zhang
- 11:14-11:26 **Real-time prediction of rock mass classifications ahead of tunnel face using Bayesian sequential learning of TBM operational data and geo-data spatial correlation**
Chenhao Zhang, Yu Wang, Xu Li, Kostas Senetakis
- 11:26-11:38 **Integrated geological modeling for tunnel construction using tunnel face observations and borehole data**
Xiaoyong Kou, Qihao Jiang, Dongming Zhang
- 11:38-11:50 **AE-driven machine learning framework in fiber-reinforced concrete**
Neng Wang, Peng Jin, Zili Li
- 11:50-12:02 **Physics-interpretable graph attention network for tunnel segment uplift prediction**
Haoze Wu, Shuilong Shen, Annan Zhou

PARALLEL SESSION 13 (MAY 12, TUESDAY)

PARALLEL SESSION 13

VENUE: LECTURE THEATRE A

Chair: Xin Liu (Wuhan University) & Jian He (HKUST)

SS1: Advances in Machine Learning for Landslide Hazards

- 13:30-13:42 **Physics-aware spatiotemporal super-resolution framework for multiphase flow simulation**
Yangli Zhou, Shuai Zhang
- 13:42-13:54 **Assessment of ice-rock avalanche disaster chains in southeast Tibet: A "probability-energy-magnitude" coupled framework**
Tangzhe Gao, Shuai Zhang
- 13:54-14:06 **Quantitative regional landslide risk nowcasting**
Jian He, Limin Zhang
- 14:06-14:18 **Comparison of machine learning, statistical, and AHP-FAHP models for landslide susceptibility mapping in district Buner, Pakistan**
Oazi Khurshid Ahmad, Muhammad Waseem

SS2: Intelligent Risk Assessment for Geological Disasters

- 14:18-14:30 **Analysis of infiltration mechanisms and stability of ecological slopes under rainfall conditions**
Zhirong Yuan, Shuihua Jiang, Peng Lan
- 14:30-14:42 **Future site-specific rainfall projections through data fusion**
Tianyang Lu, Yu Wang, Kostas Senetakis
- 14:42-14:54 **Deep learning-based assessment of rock deterioration in the hydro-fluctuation belt of the Three Gorges reservoir area**
Haijia Wen, Yingqi Zeng

PARALLEL SESSION 14 (MAY 12, TUESDAY)

PARALLEL SESSION 14

VENUE: ROOM 4503, LIFT 25/26

Chair: *Jiawei Xie (Nanchang University) & Shuihua Jiang (Nanchang University)*

SS4: Data-driven Site Characterization

- 13:30-13:42 **The failure mechanism and hazard assessment of clustered landslides triggered by extreme rainstorms in the southeastern hilly areas**
Zhilu Chang, Jinwu Zhang, Shuihua Jiang
- 13:42-13:54 **A geostatistics-informed neural network for spatial prediction of sparse geotechnical data**
Jiawei Xie, Jinsong Huang, Shuihua Jiang
- 13:54-14:06 **Investigation of dependency structures among CSG material parameters using Tab-PFN, a consideration toward active mix design**
Taiga Shibata, Yu Otake, Yoga Okamoto, Keisuke Tanaka, Mitchitaka Okamoto
- 14:06-14:18 **Real-time reconstruction of unsaturated soil slope infiltration state based on sparse measurements and an adaptive deep operator network**
Peng Lan, Shuihua Jiang, Honghu Jie
- 14:18-14:30 **A data-centric random forest framework for enhancing CPT data quality and spatial modeling**
Wu Hao, Mohd Ashraf Mohamad Ismail, Nirandoal Cheng
- 14:30-14:42 **Physics-informed semi-supervised fusion of sparse borehole and CPT data for probabilistic spatial prediction of interbedded strata**
Zehang Qian, Chao Shi, Siew-Wei Lee
- 14:42-14:54 **Identifying the spatial correlation factor of Markov random field using convolutional neural network from geological profiles**
Pei-Yun Liao, Yu-Chen Lu, Jia-Jyun Dong

PARALLEL SESSION 15 (MAY 12, TUESDAY)

PARALLEL SESSION 15

VENUE: ROOM 4504, LIFT 25/26

Chair: *Gengfu He (National University of Singapore) & Yue Hu (Leibniz Universität Hannover)*

SS8: Knowledge-informed Data-driven Modelling for Geotechnics and Risk Assessment

- 13:30-13:42 **Large language model for deep excavation design**
Shiheng Wu, Shaoxiang Zeng, Yuanqin Tao, Honglei Sun
- 13:42-13:54 **Structuring expert judgment in geotechnical parameter calibration using LLM-based feature extraction**
Yu Otake, Narui Miura, Wu Stephen
- 13:54-14:06 **Multiphysics-informed machine learning of coupled thermal-hydrodynamic-mechanical-chemical responses for gas production in hydrate-bearing marine sediments**
Xindong Zhai, Long Yu, Brian Sheil, Qing Yang
- 14:06-14:18 **Back-analysis of embedded retaining wall using inverse physics-informed neural network**
Nandeesh Babanagar, Brian Sheil
- 14:18-14:30 **Deep generative model for rapid prediction of underground blast-induced ground shock in complex terrains**
Yang Li, Peng Deng, Chao Zhang
- 14:30-14:42 **Fourier-Transformer: A generative model for blast wave propagation in rock**
Bowen Che, Peng Deng, Chao Zhang
- 14:42-14:54 **Data-driven vulnerability assessment of expressway cut slope stability using GIS-based indicators and clustering ensembles**
Suho Cho, Han-Saem Kim, Taek-Kyu Chung, Seung-Woo Kim

PARALLEL SESSION 16 (MAY 12, TUESDAY)

PARALLEL SESSION 16

VENUE: ROOM 4579, LIFT 27/28

Chair: *Dongming Zhang (Tongji University) & Changtai Zhou (Tongji University)*

SS11: AI for Smart Tunneling Across the Full Life Cycle: From Site Investigation to Resilient Operation

- 13:30-13:42 **Hyperspectral imaging combined with deep learning for intelligent rock type classification and strength estimation**
Changsong Wang, Mingliang Zhou, Hongwei Huang
- 13:42-13:54 **RETun: An LLM-based RAG framework with domain-specific embedding fine-tuning for tunneling knowledge question answering**
Du Han, Chao Zhang
- 13:54-14:06 **Enhance visual detection capability of blastholes on tunnel faces in complex environments by using synthetic data**
Chengxin Lin, Lulu Zhang, Qing Ai
- 14:06-14:18 **Application programming interfaces (APIs) and large language models (LLMs) for automation in landslide hazard monitoring**
Kelvin Lo, Ayoub Riman
- 14:18-14:30 **LLM-driven post-hazard questionnaire survey for developing infrastructure resilience models under extreme climate change: Framework and application**
Zhongkai Huang, Haocheng Li, Nianchen Zeng, Dongmei Zhang, Sotirios Argyroudis, Stergios-Aristoteles Mitoulis
- 14:30-14:42 **ECA-enhanced Yolo with SAHI for defect segmentation in shield tunnel linings**
Haoyuan Liang, Shuilong Shen, Annan Zhou
- 14:42-14:54 **A multi-source data processing method for real-time geological identification in shield tunneling**
Xinhao Min, Shuilong Shen, Yanning Wang, Annan Zhou

FIELD TRIP

MAY 13, WEDNESDAY
VENUE: Hong Kong UNESCO Global Geopark

09:00 **Pick-up from HKUST entrance piazza**

09:00-13:00 **Field trip**

Hong Kong UNESCO Global Geopark

The composite image includes two photographs at the top: the left one shows the 'World Geopark' monument with Chinese characters, and the right one shows a dramatic cliff face with vertical rock columns. In the center is a QR code labeled 'FIELD TRIP'. Below these is a large map of the High Island Geo Trail area. The map labels several key locations: 'High Island Reservoir Monument', 'S-shaped Hexagonal Rock Columns and Intrusive Dyke', 'Fault Breccia Belt', 'Biu Tsim Kok Viewing Platform', 'Po Pin Chau Viewing Platform', and 'Cofferdam'. It also shows the 'MacLehose Trail' sections and a 'High Island Geo Trail' with three difficulty levels: 'Biu Tsim Kok Section (1.5 km round trip)', 'Po Pin Chau Section (1.5 km round trip)', and 'High Island Reservoir Monument' (2.8 km round trip). The map includes icons for a minibus stop, a viewing platform, and a trailhead.

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NOTES



Organizers:

The Hong Kong University of Science and Technology (HKUST)

Department of Civil and Environmental Engineering

State Key Laboratory of Climate Resilience for Coastal Cities (SKL-CRCC)

The International Society for Soil Mechanics and Geotechnical Engineering (ISSMGE)

TC309 Machine Learning and Big Data

Supporters:

The Hong Kong Polytechnic University

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The Hong Kong Institution of Engineers-Geotechnical Division

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