



2nd International Symposium on Seismic Performance and Design of Slopes

January 18–22, 2020 | Edinburgh, UK



Hosted by



THE UNIVERSITY of EDINBURGH

Supported by



同濟大學
TONGJI UNIVERSITY



PREFACE

On behalf of the Organizing Committee, welcome to the 2nd International Symposium on Seismic Performance and Design of Slopes (ISSPDS-Edinburgh 2020) that is being held in Edinburgh, UK, 18-22 January 2020. ISSPDS-Edinburgh 2020 is hosted by the University of Edinburgh, UK and supported by Tongji University, China, the International Consortium on Geo-disaster Reduction (ICGdR) and the UNESCO Chair on Geoenvironmental Disaster Reduction.

The International Symposium on Seismic Performance and Design of Slopes is a biennial conference. It began in 2018 at Shanghai, China. The ISSPDS has been a successful platform for bringing together academic scientists, leading engineers, and students all over the world to exchange and share their experiences and research results about seismic performance and design of slopes.

We would like to express our sincere gratitude to numerous individuals and groups for making this conference possible. Organizing Committee are sincerely thanked for their contributions to the organization of the conference. Authors who contributed papers to the proceedings as well as those who presented their papers at the conference are also thanked. Thank you to all our delegates who have come from around the world.

We hope that you have a fruitful ISSPDS-Edinburgh 2020 experience as well as a most pleasant stay in Edinburgh.

Sincerely,

Conference Chair,

Jin Sun, The University of Edinburgh, UK



The University of Edinburgh

Influencing the world since 1583

For more than 400 years the University of Edinburgh has been changing the world. Our staff and students have explored space, won Nobel Prizes and revolutionised surgery. They've published era-defining books, run the country, made life-saving breakthroughs and laid the foundations to solve the mysteries of the universe.

University Facts and Figures

Top 50

We're consistently ranked one of the top 50 universities in the world. We're 18th in the 2019 QS World University Rankings.

4th

We're ranked fourth in the UK for research power, based on the 2014 Research Excellence Framework.

24

We are associated with 24 Nobel Prize winners.

International

We're ranked 13th in the world's most international universities, and have taught students from 82 per cent of the world's

£373m

The amount we won in 2016/17 in competitive research grants.

83%

The amount of our research which is considered world-leading or excellent.

Engineering at Edinburgh

The School of Engineering is one of University's largest Schools, with more than 350 postgraduates, 1,400 undergraduates and over 150 staff. In the 2014 Research Excellence Framework (REF), 94 per cent of our research activity in general engineering was rated 4* world leading or 3* internationally excellent on the overall quality profile. Six specialist research institutes sit within the School:

Multiscale thermofluids

Research in the Institute for Multiscale Thermofluids spans the range of length and time scales from angstroms to metres, and from femtoseconds to minutes. Our work focuses on uncovering and predicting fluid phenomena theoretically, numerically and experimentally; from interfacial dynamics at the nano scale, to blood flows at the millimetre scale and to fluid jets at the centimetre scale. The fluids are gases, liquids, or even supercritical and they can be inert or chemically reacting. Applications of such research include nano-filtering seawater to make it drinkable, nano heat-exchangers to cool high power computer chips, supercritical processing of alternative fuels, and fundamentals of combustion in down-sized engines for electric vehicles.

Bioengineering

The Institute for Bioengineering has interests in biosensing, tissue engineering, biomedical measurement, modelling and applications. We're developing innovative diagnostic, therapeutic and real-time monitoring biomedical devices and technologies. We demonstrated the first ex vivo and in vivo probing of mechanical characteristics of prostate cancer for monitoring disease progression. Our IMPACT (Implantable Microsystems for Personalised Anti-Cancer Therapy) project will use miniature wireless sensors for minute-to-minute monitoring of individual tumours.

Digital communications

The Institute for Digital Communications pioneers new theories and techniques in the fields of signal processing, imaging and communications, technologies that have come to power the global economy. Among recent highlights, Professor Harald Haas' Li-Fi system of lightbulb-based wireless communication was named among the world's top inventions by Time magazine.

Infrastructure and environment

The Institute for Infrastructure and Environment develops better technologies to improve the built and natural environments. It hosts the world-leading Building Research Establishment (BRE) Centre for Fire Safety Engineering and outstanding activities in environmental engineering, bulk materials handling, high-speed rail, non-destructive testing, design, performance, resilience and regulation of structures and systems.

Integrated micro and nano systems

The Institute for Integrated Micro and Nano Systems' research encompasses integrated circuit design, system-on-chip design, microfabrication, micro-electro mechanical systems (MEMS), micro-machining and neural computation. Research themes include materials and structures, optical systems and materials, sensors, smart MEMS technology, and smart wireless devices and systems.

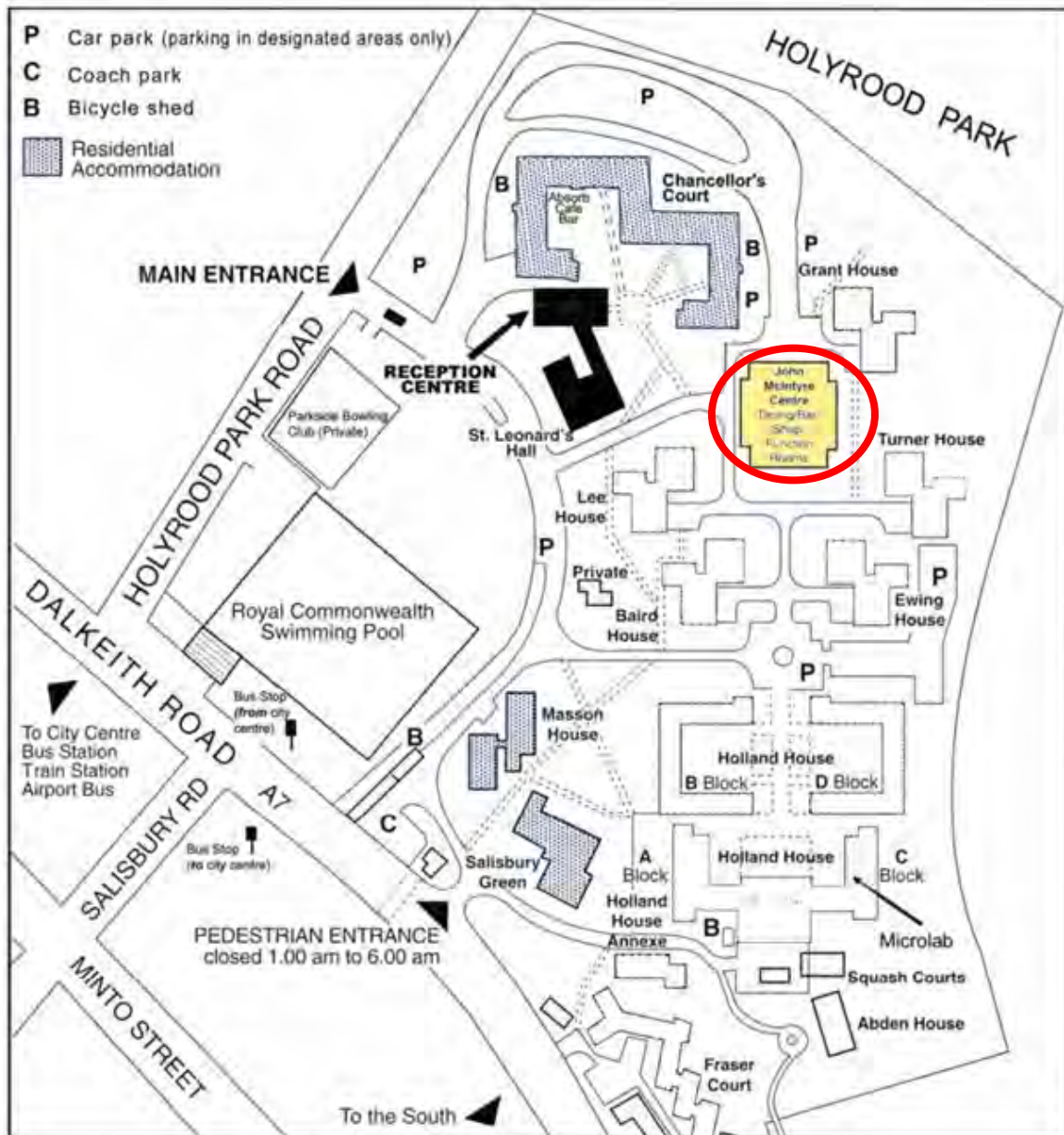
Materials and processes

The Institute for Materials and Processes produces world-class research to advance engineering applications of materials, fluids and processes. We use experimental, computational and theoretical methods to shed light on the underlying engineering science. Our research tackles societal challenges, from reducing CO2 emissions, to sustainable energy, clean water and medical diagnostics and therapeutics. Research themes include carbon capture and separation, multiscale modelling, multiphase flows and transport phenomena, and materials design and characterisation.

Find out more at eng.ed.ac.uk/research

General Information

The conference activities will take place in the John McIntyre Conference Centre. Conference accommodation is located in Masson House and Salisbury Green.





■ Internet access

There is campus wide Wi-Fi access via the Eduroam network. Free access will also be available on the premises of the conference venue for the duration of the conference through the Optify service. To connect to Optify users need to enter an email address and telephone number.

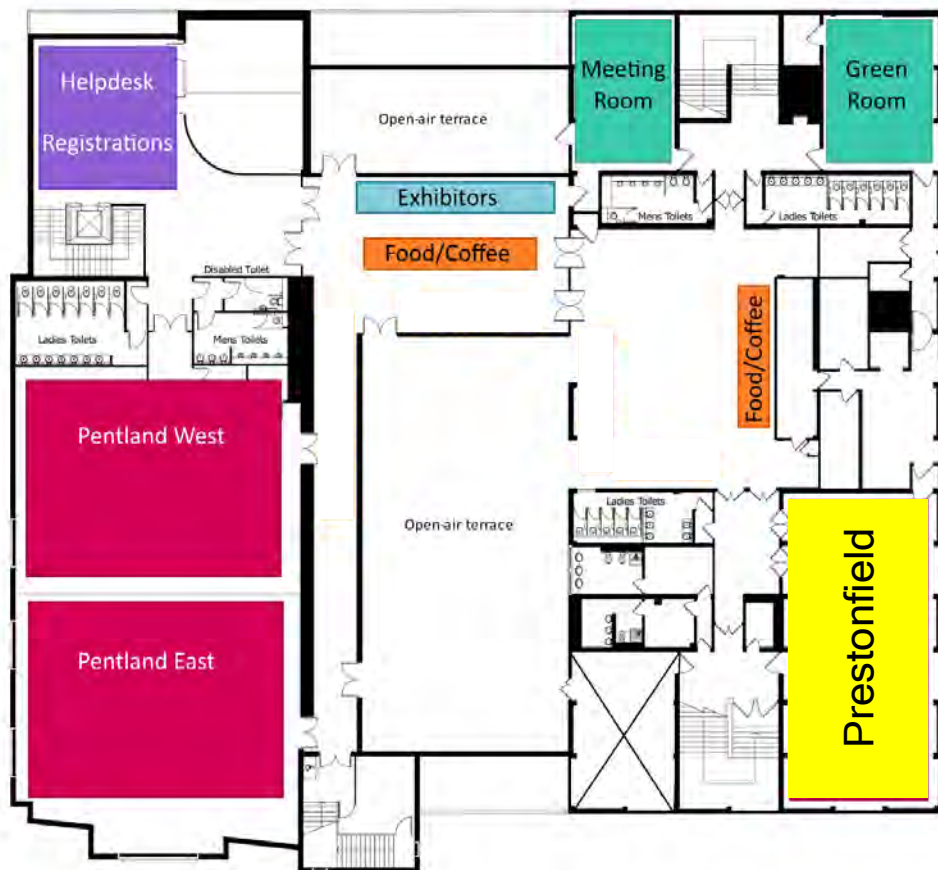
■ **How to reach**

The guideline below is an introduction about the routes leading to John McIntyre Conference Centre.

<p>From Waverley Railway Stations to John McIntyre Conference Centre</p>		<ul style="list-style-type: none"> ● By Taxi (taxi fee: 8 Pound approximately). ● By Bus 14/33/30 to Commonwealth Pool Station, and then walk 5 Min to JMCC. (Bus fee: 1.7 Pound).
<p>From Airports to John McIntyre Conference Centre</p>		<ul style="list-style-type: none"> ● By Taxi (taxi fee: 35 Pound approximately). ● By Airlink Bus 100 to Haymarket Stop first, and then take Bus 2/33 to Commonwealth Pool Station, and then walk 5 Min to JMCC. (Airlink Bus fee: 4.5 Pound, bus fee: 1.7 Pound).

■ **Conference Venue**

All lectures will take place in the Prestonfield Suite.



■ **Presentations: Time and Equipment**

All papers are to be presented and discussed in English which is the official language of the Conference. The time allocation per presenter is:

- 40 minutes per Keynote Lecture (30 min. presentation plus 10 min. discussion)
- 20 minutes per Invited presentation (15 min. presentation plus 5 min. discussion)
- 15 minutes per Regular presentation (12 min. presentation plus 3 min. discussion)

A Windows PC (running PowerPoint) connected to a projector will be present for the presenter to use. PDF's are also acceptable. **All presentations must be provided to the session assistant prior to the beginning of each session.** Please test your presentation before the session starts.

■ **Registration and Information Desk**

All participants are required to check in at the registration and information desk. The staff at the registration desk will be pleased to assist you with all your inquiries.

You can register at the following time slots and places:

- Saturday, 18 January 2020, 14:00~21:00, 3rd Floor, Alexander Graham Bell (AGB) Building, Thomas Bayes Road, Edinburgh EH9 3FG
- Sunday, 19 January 2020, 08:00~11:00, 3rd Floor, Alexander Graham Bell (AGB) Building, Thomas Bayes Road, Edinburgh EH9 3FG
- Sunday, 19 January 2020, 17:00~21:00, Lobby in Salisbury Arms, 58 Dalkeith Rd, Edinburgh EH16 5AD
- Monday, 20 January 2020, 8:00~17:00, John McIntyre Conference Centre, The University of Edinburgh, Pollock Halls, 18 Holyrood Park Rd, Edinburgh EH16 5AY
- Monday, 21 January 2020, 8:00~17:00, John McIntyre Conference Centre, The University of Edinburgh, Pollock Halls, 18 Holyrood Park Rd, Edinburgh EH16 5AY

■ **Badges Policy and Tickets**

Your name badge is your admission to all conference sessions. Please wear your badge at all times while in the conference venue. Tickets are required for lunches, Welcome reception and Banquet. Where tickets are required, please be sure to bring your tickets with you as you will not be admitted without a ticket.

■ **Cell Phone Policy**

To show courtesy to speakers, please turn off your cell phones or set the tone to be silent before entering presentation sessions.

■ **Liability**

The Organizing Committee is not responsible for personal accidents or loss/damage of private properties of the participants. Participants are advised to have insurance if necessary.

■ Contact Information

For general enquiries, please contact the conference secretariat at the registration helpdesk at the entrance to the conference venue. The desk will be staffed at all times during conference hours. Enquires can also be made to the conference secretariat via email at:

ISSPDS.Edinburgh@ed.ac.uk .

Useful numbers

Visit Scotland: 0131 332 2433

Central Taxis: 0131 229 2468

City Cabs: 0131 228 6876

Lothian Buses info: 0131 555 6363

First Edinburgh bus info: 08708 72 72 71

Rail enquiries: 08457 48 49 50



Social Events

■ Welcome Reception (January 19, 2020)

Those who made a regular registration, student registration or accompanying registration will receive a ticket to a welcome reception that will take place from 18:00 to 21:00 on January 19, 2020 at Salisbury Arms, 58 Dalkeith Rd, Edinburgh EH16 5AD. Tickets are required at the entrance.

■ Lunches and Coffee Breaks

Coffee and lunches during the conference period (January 20 to 21, 2020) are included in registration fees. The coffee breaks and lunch will be served in corridors of John McIntyre Conference Centre. Tickets are required at the entrance for the lunches.

■ Dinner (January 20, 2020)

Those who made a regular registration, student registration or accompanying registration will receive a ticket to a dinner that will take place from 18:30 to 20:30 on January 20, 2020 at John McIntyre Conference Centre. Tickets are required at the entrance.

■ Closing Banquet (January 21, 2020)

Those who made a regular registration, student registration or accompanying registration will receive a ticket to a closing banquet that will take place from 18:30 to 21:00 on January 21, 2020 at Playfair Library Hall, located at the University of Edinburgh's Old College, University of Edinburgh, South Bridge, Edinburgh EH8 9YL. Tickets are required at the entrance.



Program Overview

Saturday, 18 January, 2020

14:00~21:00 **Registration of the Committee member** (3rd Floor, Alexander Graham Bell (AGB) Building, Thomas Bayes Road, Edinburgh EH9 3FG)

Sunday, 19 January, 2020

12:00~16:00 **Registration of the Committee member** (3rd Floor, Alexander Graham Bell (AGB) Building, Thomas Bayes Road, Edinburgh EH9 3FG)

15:00~17:00 **Council meeting of the Committee** (3rd Floor, Alexander Graham Bell (AGB) Seminar Room, Thomas Bayes Road, Edinburgh EH9 3FG)

17:00~21:00 **Registration** (Lobby in Salisbury Arms, 58 Dalkeith Rd, Edinburgh EH16 5AD)

18:00~21:00 **Welcome Reception** (Salisbury Arms, 58 Dalkeith Rd, Edinburgh EH16 5AD)

Monday, 20 January, 2020

08:00~17:00 **Registration** (John McIntyre Conference Centre)

08:30~09:00 **Opening Ceremony** (Room Prestonfield, John McIntyre Conference Centre)

09:00~10:20 **Keynote Lectures** (Room Prestonfield, John McIntyre Conference Centre)

10:20~10:50 **Coffee Break** (2nd floor corridor of John McIntyre Conference Centre)

10:50~12:20 **Presentations** (Room Prestonfield, John McIntyre Conference Centre)

12:30~14:00 **Lunch** (2nd floor corridor of John McIntyre Conference Centre)

14:00~15:20 **Keynote Lectures** (Room Prestonfield, John McIntyre Conference Centre)

15:20~15:40 **Coffee Break** (2nd floor corridor of Sino-French Center)

15:40~16:45 **Presentations** (Room Prestonfield, John McIntyre Conference Centre)

16:45~17:00 **Coffee Break** (2nd floor corridor of Sino-French Center)

17:00~17:40 **Presentations** (Room Prestonfield, John McIntyre Conference Centre)

18:30~20:30 **Dinner** (John McIntyre Conference Centre)

Tuesday, 21 January, 2020

08:00~16:00 **Registration** (John McIntyre Conference Centre)

08:30~09:50 **Keynote Lectures** (Room Prestonfield, John McIntyre Conference Centre)

09:50~10:05 **Coffee Break** (2nd floor corridor of John McIntyre Conference Centre)

- 10:05~11:00 **Presentations** (Room Prestonfield, John McIntyre Conference Centre)
11:00~11:15 **Coffee Break** (2nd floor corridor of John McIntyre Conference Centre)
11:15~12:20 **Presentations** (Room Prestonfield, John McIntyre Conference Centre)
12:30~14:00 **Lunch** (2nd floor corridor of John McIntyre Conference Centre)
14:00~15:10 **Presentations** (Room Prestonfield, John McIntyre Conference Centre)
15:10~15:30 **Coffee Break** (2nd floor corridor of Sino-French Center)
15:30~16:55 **Presentations** (Room Prestonfield, John McIntyre Conference Centre)
16:55~17:30 **Closing Ceremony** (Room Prestonfield, John McIntyre Conference Centre)
18:30~21:00 **Closing Banquet** (Playfair Library, 9-16 Chambers Street, EH1 1HT)

Wednesday, 22 January, 2020

- 9:30~16:00 **Field Geological Survey**



Monday, 20 January 2020

8:30~9:00 **Open Ceremony (Chaired by Dr. Jin Sun)**

9:00~10:20 **Keynote Lecture (Chaired by Prof. Xiangjun Pei & Dr. Elisabeth Bowman)**

- **Probabilistic Safety Assessment of Existing Ground-Anchored Slope during Earthquake (40 Mins)**
Prof. Atsushi Yashima Gifu University, Japan
- **Frictional hysteresis in geophysical mass flows (40 Mins)**
Prof. Nico Gray University of Manchester, UK

10:20~10:50 **Coffee Break**

10:50~12:20 **Presentations (Chaired by Prof. Xinli Hu & Prof. Fangpeng Cui)**

10:50~11:15	Simulation-aided optimal design approach for rockfall protection walls (Invited Speaker) <u>Prof. Shuji Moriguchi</u> Tohoku University, Japan
11:15~11:40	Dynamic response of the DGB landslide triggered by the Wenchuan earthquake with a composite hypocenter (Invited Speaker) <u>Prof. Fangpeng Cui</u> China University of Mining and Technology, Beijing
11:40~12:05	Dynamic behavior of piles with different configurations subjected to slope deformation induced by seismic liquefaction (Invited Speaker) <u>Dr. Wuwei Mao</u> Tongji University, China
12:05~12:20	Failure mechanism of slope subjected to seismic effect combined with consequent rainfall <u>Mr. Zhenkun Yang</u> University of Shanghai for Science and Technology, China

12:30~14:00 **Lunch**



Monday, 20 January 2020

14:00~15:20 **Keynote Lecture (Chaired by Prof. Yu Huang & Prof. Nico Gray)**

- **Rapid and long runout landslides triggered by earthquake: motion mechanism and countermeasure (40 Mins)**
Prof. Fawu Wang Shimane University, Japan
- **Experimental study of debris flow (40 Mins)**
Dr. Elisabeth Bowman University of Sheffield, UK

15:20~15:40 **Coffee Break**

15:40~16:45 **Presentations (Chaired by Prof. Fawu Wang & Prof. Lianheng Zhao)**

15:40~16:05	A morphological visualization method for seismic slope stability analysis (Invited Speaker) <u>Prof. Zixin Zhang</u> Tongji University, China
16:05~16:30	Development of a Machine Learning Model for Slope Failure Prediction (Invited Speaker) <u>Dr. Cheng His Hsiao</u> National Taiwan University, China
16:30~16:45	Mechanical characteristics of anchored slide-resistant piles in landslides with weak-hard interbedding strata bedrock <u>Mr. Guihua Wang</u> China University of Geosciences (Wuhan), China

16:45~17:00 **Coffee Break**

17:00~17:40 **Presentations (Chaired by Prof. Chun Liu & Dr. Ming Chang)**

17:00~17:25	Stochastic seismic analysis of geosynthetic-reinforced soil slopes based on probability density evolution method (Invited Speaker) <u>Dr. Ming Peng</u> Tongji University, China
17:25~17:40	Performance-based seismic slope stability evaluation of earth dams using different fragility approaches <u>Dr. Miao Yu</u> China University of Geosciences (Wuhan), China

18:00~20:30 **Dinner**

Tuesday, 21 January 2020

8:30~9:50 **Keynote Lecture (Chaired by Prof. Atsushi Yashima & Prof. Zixin Zhang)**

- **Evolution characteristics of reinforced landslide under long-term water-level fluctuations by physical model test (40 Mins)**
Prof. Xinli Hu China University of Geosciences (Wuhan), China
- **Novel perspective of seismic performance-based evaluation and design for resilient and sustainable slope engineering (40 Mins)**
Prof. Yu Huang Tongji University, China

9:50~10:05 **Coffee Break**

10:05~11:00 **Presentations (Chaired by Prof. Shuji Moriguchi & Dr. Wuwei Mao)**

10:05~10:30	Reynolds Dilatancy Coincides with Two Separate Transport Mechanisms in Sheared Amorphous Packings (Invited Speaker) <u>Prof. Hu Zheng</u> Tongji University, China
10:30~10:45	Study on Resonance Features of a Rock Slope based on Numerical Simulation and Physical Modeling Test <u>Dr. Hanxiang Liu</u> Chengdu University of Technology, China
10:45~11:00	The Research on Long-term Performance Analysis and Optimum Design of Anchored Slope <u>Dr. Min Xiong</u> Tongji University, China

11:00~11:15 **Coffee Break**

11:15~12:20 **Presentations (Prof. Yingbin Zhang & Prof. Bin Ye)**

11:15~11:40	Stability assessment of cohesive slopes subject to seismic action accounting for tension cracks (Invited Speaker) <u>Prof. Stefano Utili</u> Newcastle University, UK
11:40~12:05	Coseismic landslides induced by the 2018 Mw 6.6 Iburi, Japan, Earthquake: spatial distribution, key factors weight, and susceptibility regionalization (Invited Speaker) <u>Dr. Ming Chang</u> Chengdu University of Technology, China
12:05~12:20	Design & practice of seismic shaking table for high-rise structure models <u>Mr. Mohammad Javed Shadan</u> Ryerson University, Canada

12:30~14:00 **Lunch**

Tuesday, 21 January 2020

14:00 ~15:10 **Presentations (Chaired by Prof. Stefano Utili & Prof. Hu Zheng)**

14:00~14:25	Geological space sensing technology of low altitude remote sensing and its application in hybrid reality (Invited Speaker) <u>Prof. Chun Liu</u> Tongji University, China
14:25~14:40	Preliminary study on the mechanism of bedding slope failure triggered by Vehicle vibration <u>Dr. Jian Huang</u> Chengdu University of Technology, China
14:40~14:55	Exploring the seismic responses of the coral slopes on the insular shelf of Xisha Islands in South China Sea by seismic noise recordings <u>Dr. Zhen Guo</u> Tongji University, China
14:55~15:10	Failure Mechanism and Stability Analysis of Soil Slope under Earthquake Quasi-Static Force Based on the Maximum Strength <u>Mr. Kangfu Jiao</u> Central South University, China

15:10~15:30 **Coffee Break**

15:30 ~16:55 **Presentations (Chaired by Dr. Ming Peng & Dr. Miao Yu)**

15:30~15:55	Preliminary study on the effects of near-fault pulse ground motions on permanent displacements of seismic slopes (Invited Speaker) <u>Prof. Yingbin Zhang</u> Southwest Jiaotong University, China
15:55~16:10	Research on the application of corrugated cylinder metal energy dissipation device in rock shed engineering <u>Dr. Dongpo Wang</u> Chengdu University of Technology, China
16:10~16:25	On the initiation and movement mechanisms of a catastrophic landslide triggered by the 2008 Wenchuan (Ms 8.0) earthquake in the epicenter area <u>Dr. Shenghua Cui</u> Chengdu University of Technology, China
16:25~16:40	Numerical performance assessment and centrifuge modeling of slope reinforced by pile-anchor structure under seismic loading <u>Mr. Xi Xu</u> Tongji University, China
16:40~16:55	Effect of vibration on the dynamic behavior of granular flow <u>Dr. Chongqiang Zhu</u> University of Edinburgh, UK

16:55~17:30 **Closing Ceremony** (Chaired by Dr. Jin Sun)

18:30~21:00 **Closing Banquet** (Playfair Library Hall, South Bridge, Edinburgh EH8 9YL)