70th Anniversary 2019
Japanese Geotechnical Society

SIMSG ISSMGE

7th Asia-Pacific Conference on Unsaturated Soils

August 23 – 25, 2019
Nagoya Congress Center, Nagoya, JAPAN

Edited by
Iwai H.
Yoshikawa T.
Kim B.
Zhang F.

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Preface

Following the success of the last conference held in Guilin, China, in 2015, the Japanese Geotechnical Society (JGS) is honored to host, on this great tradition of conference series, the 7th Asia-Pacific Conference on Unsaturated Soils (AP-UNSAT2019) in Nagoya City, the geographical center of Japan.

The main purpose of the conference series related to unsaturated soils, which was firstly held in Singapore in 2000, is to enhance attention and interests of the researchers and the engineers who specialize both in theoretical and practical applications to the mechanics for unsaturated soils in Asian Pacific region. Under the continuous support of the Technical Committee on Unsaturated Soils (TC106) of the International Society of Soil Mechanics and Geotechnical Engineering (ISSMGE), the 2nd to 5th conferences were held in 2003 in Osaka, Japan; 2007 in Nanjing, China; 2009 in Newcastle, Australia, and 2012 in Pattaya, Thailand respectively. The conference series has provided a forum for the researchers and the engineers within and beyond the existing region of unsaturated soils to present and access the latest developments and to exchange their ideas on the subjects such as heave/desiccation shrinkage, collapse, rainfall-induced slope instability, contaminant transport, carbon dioxide capture storage (CCS), geological repository of high level radioactive waste (HLRW), and well-documented case histories from the region. The organizing committee of AP-UNSAT2019 hope that all events during the conference may provide an easy-access bridge between the theoretical researches and the practical applications related to unsaturated soils. In particular, young researchers and engineers dealing with unsaturated soils are warmly encouraged to exchange their viewpoints during the conference.

Thanks to the precious supports from all the participants, we have received 228 abstracts at first and then received 161 paper submissions (102 full papers and 59 two-page extended abstracts) and 9 keynote papers from 23 countries. Due to the hard working of the organizing committee, the preparing works went smoothly and we really hope that all the participants could enjoy the conference, and also, the beauty of Nagoya.

Feng ZHANG, *Professor of Nagoya Institute of Technology*

Yuji KOHGO, *Professor of Tokyo University of Agriculture and Technology*

Yuji TAKESHITA, *Professor of Okayama University*

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Prof. Yuji KOHGO, *Tokyo University of Agriculture and Technology*

Prof. Yuji TAKESHITA, *Okayama University*

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Sayuri Kimoto	*Kyoto University*
Takeshi Kodaka	*Meijo University*
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Kazuhide Sawada	*Gifu University*
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Toshiyasu Unno	*Utsunomiya University*
Shotaro Yamada	*Tohoku University*
Hiroshi Yokawa	*Chubu University*
Takahiro Yoshikawa	*Nagoya University*

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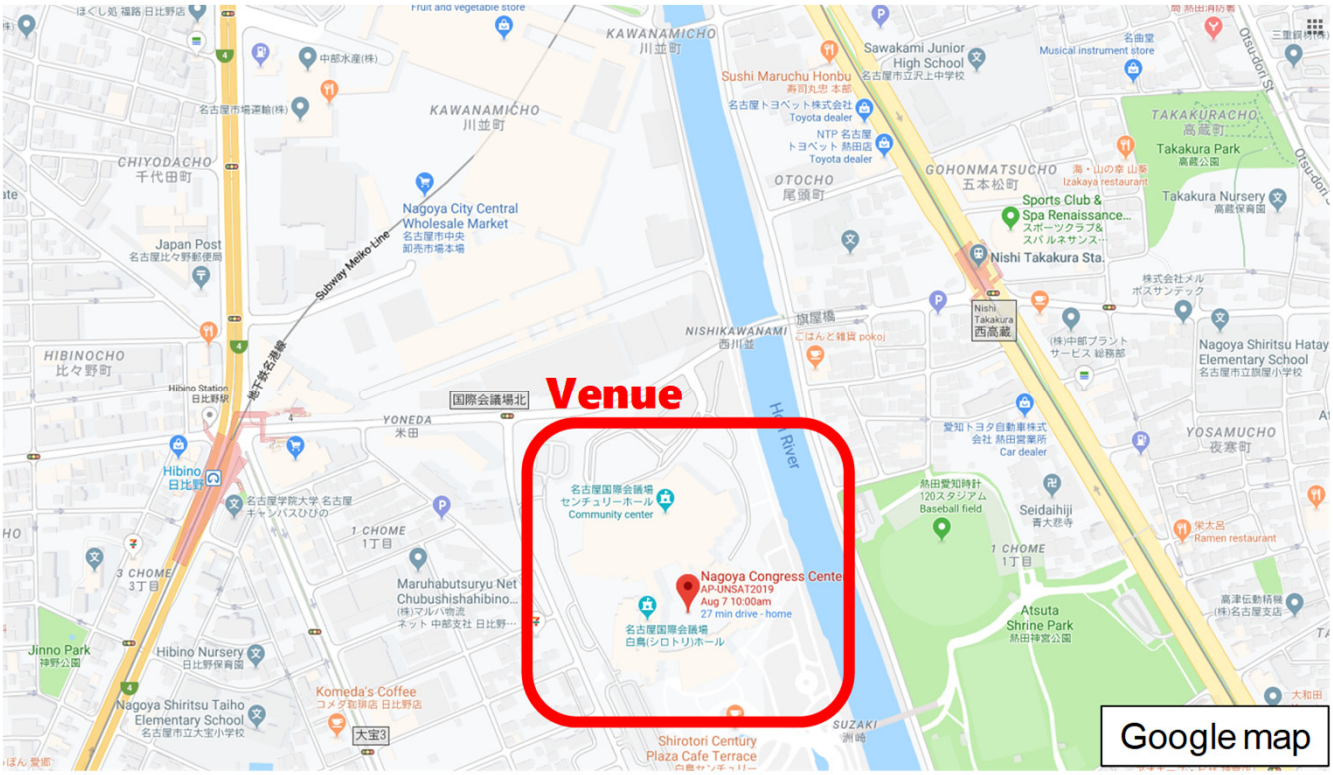
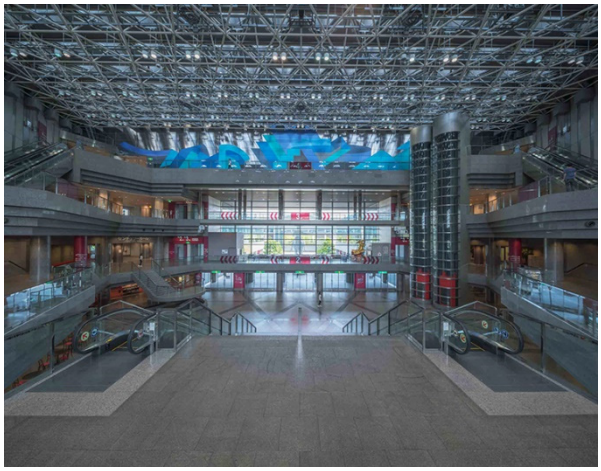
K. K. Muraleetharan	*USA*		
M. Sanchez	*USA*		

Conference Venue

Adress:

Nagoya Congress Center, 1-1-1 Atsuta Nishimachi, Atsuta-ku,
456-0036 Nagoya, Aichi, Japan





Access

Access to NAGOYA

International Flights

Nagoya is connected nationally and internationally by major airlines through Central Japan International Airport, "Centrair", the closest airport to the conference venue (airport code: NGO). There are 262 weekly flights from 28 international destinations, including frequent connections to the major airports in Asia. It also provides delegates from Europe and America with smooth access via other cities in Asia.

City/Country	Time	Frequency
Seoul, KOREA	2.0h	6 Daily
Shanghai, CHINA	2.5h	7 Daily
Beijing, CHINA	3.0h	2 Daily
Taipei, TAIWAN, CHINA	3.0h	3 Daily + 5/wk
Manila, PHILIPPINES	4.0h	1 Daily + 6/wk
Hong Kong, CHINA	4.5h	2 Daily + 3/wk
Bangkok, THAILAND	6.0h	1 Daily + 3/wk
SINGAPORE Helsinki,	7.0h	Daily
FINLAND Detroit,	10.0h	Daily
USA Frankfurt,	11.5h	6/wk
GERMANY	12.0h	5/wk

*Information about domestic transit is available in the "Domestic Flights and Railway" section below.

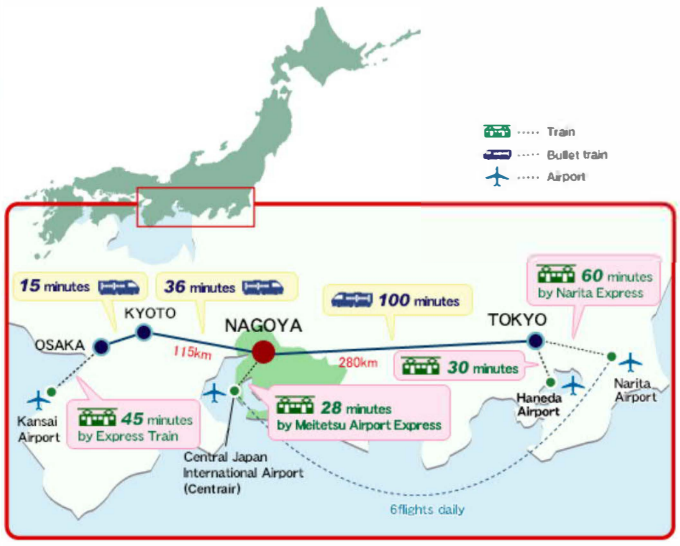
Access to Nagoya via Domestic Flights and Train

Plane

It is convenient for overseas participants to transit via Narita International Airport in Tokyo since there are 6 flights to Central Japan International Airport (Centrair) every day.

Train

Nagoya Station is the hub of a railway network comprising JR, private railways and subway lines. Nagoya is reached from Tokyo in around 100 minutes and Osaka or Kyoto within 1 hour by JR bullet trains (Nozomi Shinkansen).




至東京
TO TOKYO
名古屋高速16号
一宮
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至大阪
TO OSAKA
至岐阜
TO GIFU
地下鉄鶴舞線
SUBWAY TSURUMAI LINE
浅間町
SENGEN-CHO
T 05
名古屋城
NAGOYA CASTLE
M 08
名城公園
MEIJO KOEN
41
至県営名古屋空港
TO NAGOYA AIRPORT
黒川
KUROKAWA
M 09
至砂田橋 TO SUNADABASHI
至瀬戸 TO SETO
至大阪 TO OSAKA
名鉄瀬戸線
MEITETSU SETO LINE
ひがしおおて
HIGASHIOTE
市役所
SHIYAKUSHO
(CITY HALL)
M 07
亀島
KAMEJIMA
至高畑
TO TAKABATA
H 07
至大阪
TO OSAKA
地下鉄桜通線
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国際センター
KOKUSAI CENTER
桜通
高岳
TAKAOKA
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名古屋
NAGOYA
丸の内
MARUNOUCHI
久屋大通
HISAYA-ODORI
地下鉄東山線
SUBWAY HIGASHIYAMA LINE
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H 10
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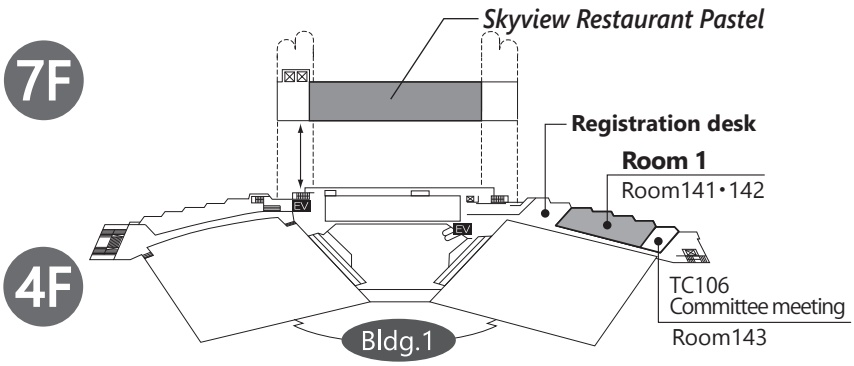
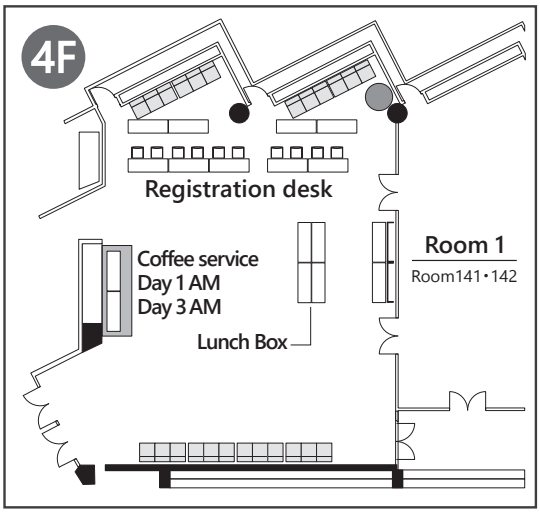
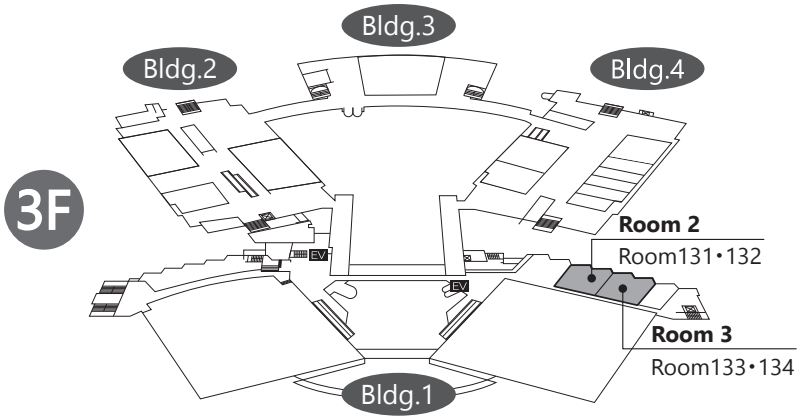
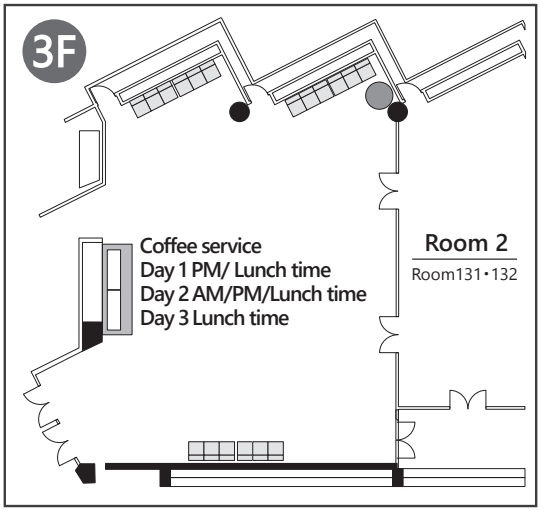
至藤ヶ丘
TO FUJIGAOKA
T 07
H 09
伏見
FUSHIMI
至中村
区役所
TO NAKAMURA
KUYAKUSHO
広小路通
東名高速道路
名古屋
I.C.
TOMEI EXPRESSWAY
近鉄名古屋線
KINTETSU
NAGOYA LINE
江川線
大津通
名古屋空港線
至中津川
TO NAKATSUGAWA
至四日市
TO YOKKAICHI
矢場町
YABA-CHO
M 04
若宮大通
JR 関西本線
JR KANSAI LINE
AN 02
ささしまライブ
SASASHIMA RAIBU
あおなみ線
AONAMI LINE
大須観音
OSUKANNON
T 08
上前津
KAMIMAEZU
T 09
M 03
T 10
鶴舞
TSURUMAI
至豊田
TO TOYOTA
JR東海道新幹線 JR TOKAIDO SHINKANSEN
19
伏見通
堀川
HORIKAWA RIVER
東別院
HIGASHI
BETSUEN
M 02
JR中央本線 JR CHUO LINE
名鉄名古屋本線
MEITETSU NAGOYA LINE
E 01
M 01
金山
KANAYAMA
至東京
TO TOKYO
JR 東海道本線・JR 中央線
JR TOKAIDO・JR CHUO LINE
日比野
HIBINO
E 02
M 28
西高蔵
NISHI TAKAKURA
名古屋国際会議場
NAGOYA CONGRESS CENTER
地下鉄名城線
SUBWAY MEIJO LINE
熱田
ATSUTA
地下鉄名港線
SUBWAY MEIKO LINE
神宮西
JINGU NISHI
M 27
白鳥庭園
SHIROTORI
GARDEN
熱田神宮
ATSUTA JINGU
(ATSUTA SHRINE)
神宮前
JINGUMAE
1
M 26
M 25
至新瑞橋
TO ARATAMA-BASHI
堀田
HORITA
247
伝馬町
TEMMA-CHO
名鉄名古屋本線
MEITETSU NAGOYA LINE
至名古屋港
TO NAGOYAKO(NAGOYA PORT)
名鉄空港線
MEITETSU KUKO LINE
至中部国際空港
TO CENTRAL JAPAN INT'L AIRPORT
至豊橋
TO TOYOHASHI
至豊橋
TO TOYOHASHI

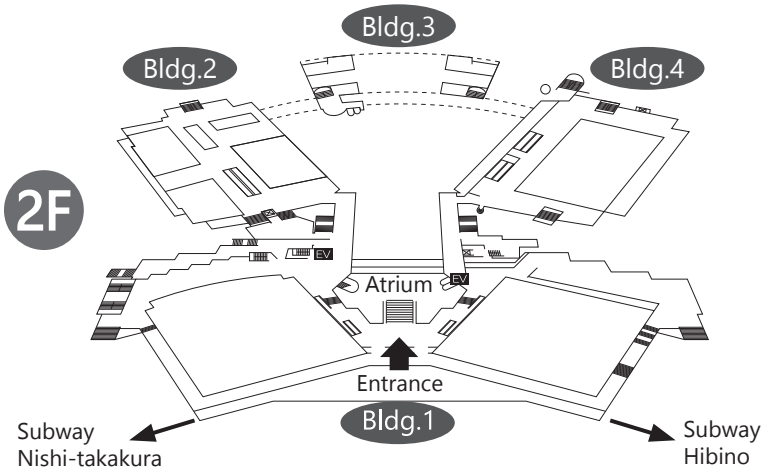
AP-UNSAT2019 Floor Plan





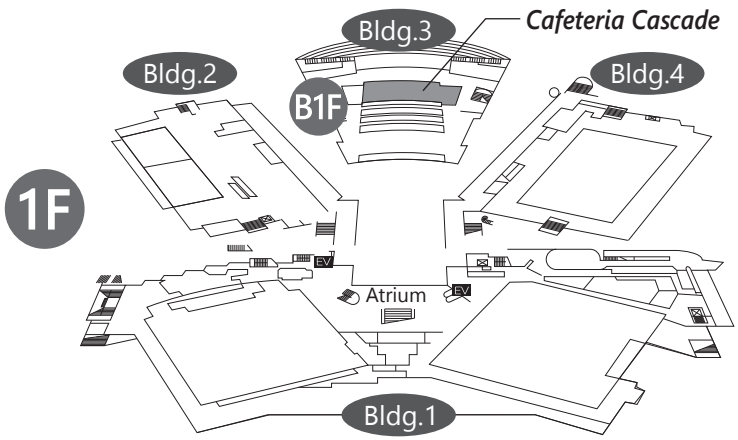






Day 1 Conference Reception

Skyview Restaurant Pastel
7F, Bldg.1



Day 2 Conference Dinner

Cafeteria Cascade
B1F, Bldg.3

APUNSAT-2019 in Nagoya, Aug. 23~Aug. 25

	Thur., 22	Fri., 23	Sat., 24	Sun., 25	Mon., 26
8:00		08:00 - 17:00 Registration - Entrance Hall of 4F, Bldg.1	08:00 - 17:00 Registration - Entrance Hall of 4F, Bldg.1	08:00 - 12:00 Registration - Entrance Hall of 4F, Bldg.	8:00-18:00 Technical tour
9:00		**08:40 - 09:10** Opening Remarks and Photo (Plenary session room, 4F, Bldg.1)	**08:10 - 08:50** Second Asia-Pacific Distinguished Lecture on Unsaturated Soils Prof. Daichao Sheng Plenary session room (4F, Bldg.1)	**09:00 - 09:40** Keynote Lecture 8-Prof.Tatsuya Ishikawa Plenary session room (4F, Bldg.1)	
10:00		**09:10 - 09:50** Keynote Lecture 1-Prof. Yuji Takeshita Plenary session room (4F, Bldg.1)	**09:00 - 09:40** Keynote Lecture 5-Prof.Weimin Ye Plenary session room (4F, Bldg.1)	**09:40 - 10:20** Keynote Lecture 9-Prof. Ryosuke Uzuoka Plenary session room (4F, Bldg.1)	
11:00		**09:50 - 10:30** Keynote Lecture 2- Prof. Yu-Jun Cui Plenary session room (4F, Bldg.1)	**09:40 - 10:20** Keynote Lecture 6-Dr. Leong Eng Choon Plenary session room (4F, Bldg.1)	**10:20 - 10:40** Coffee Break - Entrance Hall of 3F, Bldg.1	
12:00		**10:30 - 10:50** Coffee Break - Entrance Hall of 4F, Bldg.1	**10:20 - 10:40** Coffee Break - Entrance Hall of 3F, Bldg.1	**10:40- 12:00** Parallel Session 4 (room131 & 132, room133 & 134, 3F, Bldg.1; 4F, Bldg.1)	
13:00		**10:50- 12:10** Parallel Session 1 (room131 & 132, room133 & 134, 3F, Bldg.1; 4F, Bldg.1)	**10:40- 12:00** Parallel Session 4 (room131 & 132, room133 & 134, 3F, Bldg.1; 4F, Bldg.1)	**12:00 - 13:00** Lunch -Japanese Lunch Box	
14:00		**12:10 - 13:10** Lunch - Japanese Lunch Box	**12:00 - 13:00** Lunch -Japanese Lunch Box	**13:00 - 14:20** Parallel Session 9 (room131 & 132, room133 & 134, 3F, Bldg.1)	
15:00	15:00 - 18:00 Registration - Entrance Hall of 4F, Bldg.1	**13:10 - 13:50** Keynote Lecture 3-Prof. Seong-Wan Park Plenary session room (4F, Bldg.1)	**13:00 - 13:40** Keynote Lecture 7-Dr. Xiong Zhang Plenary session room (4F, Bldg.1)	**14:30 - 15:50** Parallel Session 10 (room131 & 132, room133 & 134, 3F, Bldg.1)	
16:00		**13:50 - 14:30** Keynote Lecture 4-Dr. Jubert Abdres Pineda Plenary session room (4F, Bldg.1)	**13:50 – 14:50** Parallel Session 5 (room131 & 132, room133 & 134, 3F, Bldg.1; 4F, Bldg.1)	**16:00 - 16:20** Closing Ceremony (room131 & 132, 3F, Bldg.1)	
17:00		**14:40 - 16:00** Parallel Session 2 (room131 & 132, room133 & 134, 3F, Bldg.1; 4F, Bldg.1)	**15:00 - 16:20** Parallel Session 6 (room131 & 132, room133 & 134, 3F, Bldg.1; 4F, Bldg.1)		
18:00		**16:00 - 16:20** Coffee Break - Entrance Hall of 3F, Bldg.1	**16:20 - 16:40** Coffee Break - Entrance Hall of 3F, Bldg.1		
19:00 ~		**16:20 - 17:40** Parallel Session 3 (room131 & 132, room133 & 134, 3F, Bldg.1; 4F, Bldg.1)	**16:40 - 18:00** Parallel Session 7 (room131 & 132, room133 & 134, 3F, Bldg.1; 4F, Bldg.1)		
		17:50 - 19:40 Conference Reception - Skyview Restaurant Pastel (7F, Bldg.1)	**18:15 - 20:00** Conference Dinner - Cafeteria Cascade (B1, Bldg.3)		

DAY-1, Aug.23 (Friday)

Time	Plenary session room (4F, Bldg.1) 160名	Room 131 & 132 (3F, Bldg.1) 80名	Room 133 & 134 (3F, Bldg.1) 80名
08:40 - 09:10	Opening Remarks and Photo	**Prof. Feng Zhang, Prof. Jun Otani, Prof. David Toll, Prof. Eun Chul Shin**	
09:10 - 09:50	**Keynote Lecture 1** **Prof. Yuji Takeshita**	**Chairperson: Prof. Y. Kohgo**	
09:50 - 10:30	**Keynote Lecture 2** **Prof. Yu-Jun Cui**	**Chairperson: 10. Prof. H. Komine**	
10:30 - 10:50	Coffee Break (Entrance Hall of 4F, Bldg.1)		
10:50 - 12:10	Parallel Session 1-1 **<A-3> Stress-strain behavior (1)** **Chairperson: Prof. Zhenyu YIN**	Parallel Session 1-2 **<B-2> Laboartory and field measurements** **Chairperson: Prof. Hirofumi TOYOTA**	Parallel Session 1-3 **<A-4> Volume change and desiccation cracks** **Chairperson: Prof. Yonggui CHEN**
12:10 - 13:10	Lunch - Japanese Lunch Box		
13:10 - 13:50	**Keynote Lecture 3** **Prof. Seong-Wan Park**	**Chairperson: Prof. T. Nishimura**	
13:50 - 14:30	**Keynote Lecture 4** **Dr. Jubert Abdres Pineda**	**Chairperson: Dr. A. Russell**	
14:40 - 16:00	Parallel Session 2-1 **<A-3> Stress-strain behavior (2)** **Chairperson: Dr. Annan ZHOU**	Parallel Session 2-2 **<D-1> Slope stability (1)** **Chairperson: Prof. Xianfeng LIU**	Parallel Session 2-3 **<E-3> Expansive soil (1)** **Chairperson: Prof. Toshio SUGII**
16:00 - 16:20	Coffee Break (Entrance Hall of 3F, Bldg.1)		
16:20 - 17:40	Parallel Session 3-1 **<A-3> Stress-strain behavior (3)** **Chairperson: Prof. Yi DONG**	Parallel Session 3-2 **<D-1> Slope stability (2)** **Chairperson: Prof. Yanjun DU**	Parallel Session 3-3 **<E-3> Expansive soil (2)** **Chairperson: Prof. Liming HU**
17:50 - 19:40	Conference Reception (Skyview Restaurant Pastel of 7F, Bldg.1), **Speech by Prof. Yuji KOHGO**		

DAY-2, Aug.24 (Saturday)

Time	Plenary session room (4F, Bldg.1) 160名	Room 131 & 132 (3F, Bldg.1) 80名	Room 133 & 134 (3F, Bldg.1) 80名
08:10 - 08:50	**Second Asia-Pacific Distinguished Lecture on Unsaturated Soils** **Prof. Daichao Sheng**	**Chairperson: Prof. D. Toll**	
09:00 - 09:40	**Keynote Lecture 5** **Prof. Weimin Ye**	**Chairperson: Prof. H. Rahardjo**	
09:40 - 10:20	**Keynote Lecture 6** **Dr. Leong Eng Choon**	**Chairperson: Prof. A. Iizuka**	
10:20 - 10:40	Coffee Break (Entrance Hall of 3F, Bldg.1)		
10:40- 12:00	Parallel Session 4-1 **<A-2> Water-retention and hydraulic behavior (1)** **Chairperson: Dr. Takaki MATSUMARU**	Parallel Session 4-2 **<B-1> Advanced and new testing equipment (1)** **Chairperson: Prof. Guanlin, YE**	Parallel Session 4-3 **TC215 Special Session** **Chairperson: Prof. A. (Malek) BOUAZZA**
12:00 - 13:00	Lunch -Japanese Lunch Box		
13:00 - 13:40	**Keynote Lecture 7** **Dr. Xiong Zhang**	**Chairperson: Prof. W. L. Zou**	
13:50 – 14:50	Parallel Session 5-1 **<A-2> Water-retention and hydraulic behavior (2)** **Chairperson: Prof. Chaosheng TANG**	Parallel Session 5-2 **<B-1> Advanced and new testing equipment (2)** **Chairperson: Prof. Maosong HUANG**	Parallel Session 5-3 **<E-1> Geo-environment (1)** **Chairperson: Dr. Kazunori FUJISAWA**
15:00 - 16:20	Parallel Session 6-1 **<A-2> Water-retention and hydraulic behavior (3)** **Chairperson: Dr. Tomohiro MORI**	Parallel Session 6-2 **<C-1> Constitutive modelling** **Chairperson: Prof. Huaiping FENG**	Parallel Session 6-3 **<E-1> Geo-environment (2)** **Chairperson: Dr. Giancarlo FLORES**
16:20 - 16:40	Coffee Break (Entrance Hall of 3F, Bldg.1)		
16:40 - 18:00	Parallel Session 7-1 **<A-2> Water-retention and hydraulic behavior (4)** **Chairperson: Prof. Guoqing CAI**	Parallel Session 7-2 **<C-2> Numerical modelling and analysis (1)** **Chairperson: Dr. Sayuri KIMOTO**	Parallel Session 7-3 **<D-2> Hazards** **Chairperson: Prof. Takeshi KODAKA**
18:15 - 20:00	Conference Dinner (Cafeteria Cascade of B1, Bldg.3) **Speech by Prof. Yuji Takeshita & Prof. Kenich Maeda**		

DAY-3, Aug.25 (Sunday)

Time	Plenary session room (4F, Bldg.1) 160名	Room 131 & 132 (3F, Bldg.1) 80名	Room 133 & 134 (3F, Bldg.1) 80名
09:00 - 09:40	**Keynote Lecture 8** **Prof. Tatsuya Ishikawa**	**Chairperson: Prof. C. F. Wei**	
09:40 - 10:20	**Keynote Lecture 9** **Prof. Ryosuke Uzuoka**	**Chairperson: Prof. N. Yasufuku**	
10:20 - 10:40	Coffee Break (Entrance Hall of 4F, Bldg.1)		
10:40 - 12:00	Parallel Session 8-1 **<A-5> Cyclic/dynamic behavior** **Chairperson: Dr. Toshiyasu UNNO**	Parallel Session 8-2 **<C-2> Numerical modelling and analysis (2)** **Chairperson: Dr. Kentaro NAKAI**	Parallel Session 8-3 **<E-2> Frozen soil** **Chairperson: Prof. Sheng ZHANG**
12:00 - 13:30	Lunch -Japanese Lunch Box		
13:00 - 14:20		Parallel Session 9-2 **<C-2> Numerical modelling and analysis (3)** **Chairperson: Dr. Mamoru KIKUMOTO**	Parallel Session 9-3 **<A-1> Microstructure (1)** **Chairperson: Dr. Kazunari SAKO**
14:30 - 15:50		Parallel Session 10-2 **<C-2> Numerical modelling and analysis (4)** **Chairperson: Dr. Yosuke HIGO**	Parallel Session 10-3 **<A-1> Microstructure (2)** **Chairperson: Dr. Shoji KATO**
16:00 - 16:20	Closing Ceremony (Room 131 & 132, 3F, Bldg.1) **Speech by Prof. Atsushi Iizuka**		

Keynote Lecture

Day 1 – August 23 Friday

Keynote Lecture 1

Aug.23 (Fri), 09:10 – 09:50, Plenary session room (4F, Bldg.1)

Chair: Prof. Y. Kohgo

v07.001

"Field techniques for measuring soil hydraulic properties in unsaturated soils"

Professor, Yuji Takeshita (*Okayama University, Japan*)

Keynote Lecture 2

Aug.23 (Fri), 09:50 – 10:30, Plenary session room (4F, Bldg.1)

Chair: Prof. H. Komine

EA01

"Soil-atmosphere interaction in embankments"

Professor, Yu-Jun Cui (*Ecole des Ponts ParisTech, France*)

Keynote Lecture 3

Aug.23 (Fri), 13:10 – 13:50, Plenary session room (4F, Bldg.1)

Chair: Prof. T. Nishimura

EA02

"Effect of stress and suction on resilient modulus of compacted unbound materials"

Professor, Seong-Wan Park (*Dankook University, Korea*)

Keynote Lecture 4

Aug.23 (Fri), 13:50 – 14:30, Plenary session room (4F, Bldg.1)

Chair: Dr. A. Russel

v07.002

"Environmental degradation of clayey rocks"

Dr. Jubert Abdres Pineda (*The University of Newcastle, Australia*)

Keynote Lectures

Day 2 – August 24 Saturday

Second Asia-Pacific Distinguished Lecture on Unsaturated Soils

Aug.24 (Sat), 08:10 – 08:50, Plenary session room (4F, Bldg.1)

Chair: Prof. D. Toll

EA03

"Unusual geotechnical problems in high-speed railway embankments in cold climates"

Professor, Daichao Sheng (*The University of Newcastle, Australia*)

Keynote Lecture 5

Aug.24 (Sat), 09:00 – 09:40, Plenary session room (4F, Bldg.1)

Chair: Prof. H. Rahardio

EA04

"Volume change behavior of highly compacted GMZ bentonite tested under chemo-hydro-mechanical conditions"

Professor, Wei-min Ye (*Tongji University, China*)

Keynote Lecture 6

Aug.24 (Sat), 09:40 – 10:20, Plenary session room (4F, Bldg.1)

Chair: Prof. A. Iizuka

v07.003

"Soil-Water Characteristic Curves – Determination, etimation and aplication"

Dr. Leong Eng Choon (*Nanyang Technology University, Singapore*)

Keynote Lecture 7

Aug.24 (Sat), 13:00 – 13:40, Plenary session room (4F, Bldg.1)

Chair: Prof. W.L. Zou

v07.004

"A photogrammetry-based method to measure the total and localized volume changes of unsaturated soil specimens during triaxial testing"

Dr. Xiong Zhang (*Missouri University, USA*)

Keynote Lectures

Day 3 – August 25 Sunday

Keynote Lecture 8

Aug.25 (Sun), 09:00 – 09:40, Plenary session room (4F, Bldg.1)

Chair: Prof. C.F. Wei

EA05

"Unsaturated soil mechanics for disaster prevention and maintenance of traffic infrastructure in snowy cold region"

Professor, Tatsuya Ishikawa (*Hokkaido University, Japan*)

Keynote Lecture 9

Aug.25 (Sun), 09:40 – 10:20, Plenary session room (4F, Bldg.1)

Chair: Prof. N. Yasufuku

v07.005

"Three-phase coupled seismic analyses of unsaturated/saturated grounds"

Professor, Ryosuke Uzuoka (*Kyoto University, Japan*)

Parallel Session

Day 1 – August 23 Friday

Parallel 1-1: <A-3> Stress-strain behavior (1)
Aug.23 (Fri), 10:50 - 12:10, Plenary session room (4F, Bldg.1)
Chair: Prof. Zhenyu YIN

v07.006

Effect of suction stress on strength characteristics of a compacted silty soil under low confining pressure
Shoji Kato, Tara Nidhi Lohani, Byeong-Su Kim, Seong-Wan Park

v07.007

Predicting the shear strength of unsaturated soils
Y. Gao, D.A. Sun, A.N. Zhou, J. Li

v07.008

An improved equation for unsaturated shear strength behavior of soils
Hossain Md Sayem, Ling-wei Kong, Yong Wang

v07.009

Peak and Critical State Conditions for Unsaturated Sand
Bestun J. Shwan

v07.010

Experimental investigation on two stress variables proposed by Fredlund from deformation, strength and moisture change under triaxial state of stress
Long Zhang, Zhenghan Chen

EA06

Effect of drying and wetting processes on the shear strength behavior of unsaturated clayey soil
Pan Chen, Changfu Wei, Haifeng Lu, Jie Liu

Parallel 1-2: <B-2> Laboratory and field measurements
Aug.23 (Fri), 10:50 - 12:10, Room 131 & 132 (3F, Bldg.1)
Chair: Prof. Hirofumi TOYOTA

v07.011

Experimental study of moisture evaporation process with different soil characteristics
Ni An, Chao-Sheng Tang, Shi-Kang Xu, Xue-Peng Gong, Bin Shi, Hilary I. Inyang

EA07

Experimental verification of the continuous pressurization method on SWCC
Hyun Su Park, Byeong-Su Kim, Shoji Kato, Seong-Wan Park

EA08

Evaluation of capillary barrier system under lateral non-flow condition of sand layer
Byeong-Su Kim, Yuji Takeshita, Seong-Wan Park, Shoji Kato

EA09

Swelling-shrinkage deformation of an expansive soil foundation under high speed railway embankment loads: a case study
Gaofeng Pan, Xianfeng Liu, Guanlu Jiang, Danxi Sun, Chala Ayele Tesema, Yan Feng

EA10

An experimental investigation of internal erosion around defective pipe in saturated-unsaturated soil
Dongmei Zhang, Weiwei Du, Chengpeng Gao

v07.012

Measurement of field-hydraulic soil properties using suction infiltrometer for soil-based pavement
T. Sugii, H. Yokawa, M. Ishii

Parallel 1-3: Volume change and desiccation cracks
Aug.23 (Fri), 10:50 - 12:10, Room 133 & 134 (3F, Bldg.1)
Chair: Prof. Yonggui CHEN

v07.013

Desiccation cracking behavior of soils
Hao Zeng, Chao-Sheng Tang, Qing Cheng, Luan Lin, Jin-Jian Xu

v07.014

Study of evolution law of cracking for swelling mudstone of Sichuan central Redbeds in hydration process
CHEN Shanxiong, ZHOU Zhe, YU Fei, DAI Zhangjun, LI Jian

EA11

Influence of crack on soil resistance and measurement of crack depth
Liang Chen, Jianjian He, Shufa Yan

EA12

Consequence of drying and wetting cycles on fracturing and electrical properties of soft soil
H. F. Zhao, Y. D. Chen

EA13

Experimental study on gas flow through a compacted cracked clay
Zhongkui. Chen, Rui. Chen, Charles W. W. Ng

EA14

Effect of biochar on desiccation cracking characteristics of a clayey soil
Kai Gu, Jinwen Li, Bingshu Zhang, Chaosheng Tang, Bin Shi

Parallel 2-1: <A-3> Stress-strain behavior (2)
Aug.23 (Fri), 14:40 - 16:00, Plenary session room (4F, Bldg.1)
Chair: Dr. Annan ZHOU

v07.015

Effects of inherent anisotropy on G0 of unsaturated sand
B. N. Le, H. Toyota, S. Takada

v07.016

Suction stress via thermo-servo/constant-water content ring shear testing
Ujwalkumar D. Patil, Laureano R. Hoyos, Jairo E. Yepes, Anand J. Puppala, Surya S. C. Congress

v07.017

Influence of degree of saturation on strength and consolidation properties of unsaturated soil and its centrifuge modelling
Bhavita S. Dave, Chandresh H. Solanki, Atul K. Desai

v07.018

Effects of plastic reinforcement on unsaturated soil and its centrifuge modeling for an embankment
Bhavita S. Dave, Mihretab Madamo Lafebo, Chandresh H. Solanki, Atul K. Desai

v07.019

Study on Unsaturated Mechanical Properties of Lignin-Lime Improved Silt
Zhang Yanmei, Liu Jincheng, Zhang Xiaofeng, Cheng Feifei

v07.020

Role of hydromechanical properties of plant roots on unsaturated soil shear strength
Anthony K. Leung, David Boldrin, Ali A. Karimzadeh, Anthony G. Bengough

Parallel 2-2: <D-1> Slope stability (1)
Aug.23 (Fri), 14:40 - 16:00, Room 131 & 132 (3F, Bldg.1)
Chair: Prof. Xianfeng LIU

EA15

Infinite unsaturated soil slopes stability with tensile strength cut-off
LI Meng-zi, CAI Guo-qing, ZHAO Cheng-gang, YANG Bei-bei

v07.021

Incorporating suction in to stability charts for unsaturated soil slopes
Thanh Vo, Adrian R. Russell

v07.022

The role of wetting-induced expansion of unsaturated soils in potential shallow landslides
Shun-chao Qi, Jia-wen Zhou, Xing-Guo Yang, Gang Fan, Gongda Lu, Sai Vanapalli

v07.023

The effect of slope orientation on the stability of cut slopes in swelling rocks and soils: case studies from Nanyang and Yanbian, China
Zhixiong Zeng, Lingwei Kong, Xianwei Zhang, Cheng Chen

EA16

Strength characteristics test of expansive soil with interlayer and slope stability analysis
Zhangjun DAI, Shanxiong CHEN, Jian LI, Guofang Xu

v07.024

Study on the mechanism of loess landslide induced by chlorine salt in Heifangtai terran
Juan Wang, Wei Liu, Wenwu Chen, Peng Liu, Bobo Jia, He Xu

Parallel 2-3: <E-3> Expansive soil (1)
Aug.23 (Fri), 14:40 - 16:00, Room 133 & 134 (3F, Bldg.1)
Chair: Prof. Toshio SUGII

v07.025

SWCC of crushed bentonite under high suction ranges
Seiichi Narushima, Yasunori Arai, Yuki Sakoda, Tomoyoshi Nishimura

EA17

Investigation of experimental methods to derive soil water characteristic curve for the compacted bentonite buffer
Seok Yoon, Jae Owan Lee, Geon Young Kim

v07.026

Chemical influence on water retention behaviour of compacted bentonite
Bing Qin, Yang Lu, Zheng-han Chen

v07.027

Application of the Kita-Sako model to soil-water characteristic curves of bentonite/sand mixture
Kazunari Sako, Shin Sato, Motoki Moriiwa, Masaaki Fukaya, Syuichi Yamamoto, Shinichi Ito, Ryosuke Kitamura

EA18

Laboratory investigation on gas permeability of compacted GMZ bentonite under coupled effects of confining pressure and water content
Jiang F. Liu, Hong Y. Ni, Xu. Chen, Yang G. Wang, Jian, Liu

v07.028

Quick identification of expansive soil in the field based on PIV technique
Yu-Zhou Hou, Guo-Wei Li, Jian-Tao Wu, Wei Chen

Parallel 3-1: <A-3> Stress-strain behavior (3)
Aug.23 (Fri), 16:20 - 17:40, Plenary session room (4F, Bldg.1)
Chair: Prof. Yi DONG

v07.029

Determination of resistance parameters of compacted tropical soils in the state of Rio de Janeiro
Ramos, V. L. F. S., Mahler, C. F., Mainier, F. B., Januzzi, G. M. F.

v07.030

Laboratory tensile strength testing of clay soils using direct measurement
Wilson Pembele, Yilin Gui, Ross Stirling

v07.031

Change of pore-water pressure on creep behavior of an unsaturated silty soil
Tomoyoshi Nishimura, Nanako Tamura

v07.032

Collapse behaviour of compacted loess: role of the stress level on soil microstructure
Miaomiao Ge, Jubert A. Pineda, Daichao Sheng, Glen Burton, Ning Li

v07.033

Prediction of shrinkage behavior of soft soil using ramp loading consolidation theory
Yuan Zhang, Katayoon Tehrani, Alexander Scheuermann, Ling Li

EA19

Analysis of compressibility of red clay considering structural strength
Gu Jianxiao, Wang Yong, Liu Fabiao, Lyu Haibo

Parallel 3-2: <D-1> Slope stability (2)
Aug.23 (Fri), 16:20 - 17:40, Room 131 & 132 (3F, Bldg.1)
Chair: Prof. Yanjun DU

v07.034

The mechanism of long-time displacement in a colluvium slope underlain by mudstone
Chia-Cheng Fan, Jun-Bin Luo, Ruey-Zen Chang

v07.035

Performance of filter gabion with pipe as a simple countermeasure against slope failures due to torrential rainfalls
May Than Thar Cho, Anusron Chueasamat, Hirotaka Saito, Yuji Kohgo

EA20

Investigation on unsaturated slope stability influenced by rainfall and fluctuation of reservoir water level with varied rainfall infiltration rates
X. Xiong, Z.M. Shi, Y.L. Xiong, F. Zhang

v07.036

A study of critical rainfall and landslide occurrence
Saurabh Gupta, Eng-Choon Leong

EA21

Models for estimating earthquake-induced sliding displacement of slopes considering pulse-like ground motions
Yingbin Zhang, Jing Liu

Parallel 3-3: <E-3> Expansive soil (2)
Aug.23 (Fri), 16:20 - 17:40, Room 133 & 134 (3F, Bldg.1)
Chair: Prof. Liming HU

v07.037

Investigation on swelling behaviors of GMZ bentonite pellet mixtures
Z. Zhang, W.M. Ye, Q. Wang

v07.038

Volume change behavior of saturated compacted GMZ bentonite and slurry during cyclic loading-unloading processes
Wang Yang, Ye Wei-Min, Wang Qiong, Chen Bao, Chen Yong-Gui

EA22

Effect of residual lateral stress on the swelling pressure of compacted bentonite/claystone mixture
Qiong Wang, Yu-jun Cui, Weimin Ye, Wei Su

v07.039

Evaluation of the relationship between swelling pressures determined by consolidation-swell test and constant volume test
Zin Moe Htut, Mohammed Azhar M.M, Kuo Chieh Chao

v07.040

Osmotic consolidation of expansive soil
S. Bulolo, E.C. Leong

v07.041

Role of cohesive energy density in swelling behavior of expansive clays – a molecular-level simulation approach
Sahel N. Abduljauwad, Habib-ur-Rehman Ahmed

Parallel Session

Day 2 – August 24 Saturday

Parallel 4-1: <A-2> Water-retention and hydraulic behavior (1)
Aug.24 (Sat), 10:40 - 12:00, Plenary session room (4F, Bldg.1)
Chair: Dr. Takaki MATSUMARU

v07.042

A simple device to measure soil water retention curve
Lin Li

v07.043

Pore water pressure profile development through soil water characteristics curve determination utiliz-ing the continuous pressurization method
M. Hatakeyama, S. Kyono, N. Yasufuku, R. Ishikura, A. Alowaisy

v07.044

A new logarithmic dielectric constant model of soils
Hongjian Liao, Huan Dong, Chunming Ning, Junyu Sun

v07.045

A simple method of estimating soil-water characteristic curve using point pedotransfer functions
L. Zou, E.C. Leong

v07.046

A simple and practical method for predicting soil water characteristic curve based on grading parameters
ZHANG ran Jun, WANG cui Xin, LIN hui Ye, JIANG Tong

EA23

Difference of SWRC and SWRC from MIP test of silty soil
Wen-Jing Sun, Yu-Jun Cui, De-an Sun

Parallel 4-2: <B-1> Advanced and new testing equipment (1)
Aug.24 (Sat), 10:40 - 12:00, Room 131 & 132 (3F, Bldg.1)
Chair: Prof. Guanlin YE

v07.047

Matric suction and Stiffness measurement on fine content soils at low stress state
Laxmi Prasad Suwal, Reiko Kuwano

EA24

Study on relationship between dielectric constant and water content of lateritic clays and mixing models
Yunshan XU, Haibo LU, Zhaotian ZENG, De'an Sun

EA25

Developing a flow pump apparatus for soil-water characteristics curve measurement
Louis Ge, Wen-Chieh Cheng, Chih-Wei Lu

v07.048

A system to measure permeability of unsaturated soils using local pin-type sensors in triaxial apparatus
Jaylord U. Tan Tian, Junichi Koseki, Hailong Wang, Hiroyuki Kyokawa, Takeshi Sato

EA26

Measurement and modelling triaxial stress-dependent water permeability of collapse loess
D. F. Zhang, C. L. Chen, H. Chen

EA27

Pore structure changes in water-saturated sandstone during freezing and thawing by NMR
Jiuhui Cheng, Linlin Wang

Parallel 4-3: TC215 Special Session
Aug.24 (Sat), 10:40 - 12:00, Room 133 & 134 (3F, Bldg.1)
Chair: Prof. A. (Malek) BOUAZZA

v07.049

Understanding water migration behavior of unsaturated bentonites for HLW-disposal project
Hideo Komine

v07.050

Experimental study of the effect on one-dimension erosion of compacted bentonite
Li Xiao-yue

v07.051

Gas breakthrough tests on saturated GMZ01 bentonite using RCP technique with consideration of dry density effect
Lin-Yong Cui, Wei-Min Ye, Qiong Wang, Yong-Gui Chen, Bao Chen

v07.052

Simulation of swelling pressure evolution during infiltration in a bentonite block-pellet laboratory scale test
Ayman A. Abed, Wojciech T. Sołowski

EA28

Effects of repeated drainage and imbibition on the contamination behavior of a LNAPL and on its S-p relation
Giancarlo Flores, Yutaro Matsuda, Yoshiyuki Yamanaka, Atsushi Takai, Takeshi Katsumi

v07.053

Geomechanical studies in urban solid waste
Mahler, C. F., Ramos, V. L. F. S., Mainier, F. B.

Parallel 5-1: <A-2> Water-retention and hydraulic behavior (2)
Aug.24 (Sat), 13:50 - 14:50, Plenary session room (4F, Bldg.1)
Chair: Prof. Chaosheng TANG

EA29

Water retention curve of loess under cyclic wetting-drying
Q.Y. Mu, Y.J. Dang, C.Y. Qian, H.J. Liao

v07.054

Particle size effects on the water retention properties of colluvial sediments
Rodrigo Osses, Jubert A. Pineda, Carlos Ovalle, Sandra Linero, Stephen Fityus

v07.055

Comparison of air entry values from soil water retention and volumetric shrinkage characteristic curves
K. Tehrani, Y. Zhang, A. Scheuermann, D.J. Williams

EA30

Dependency of Poisson's ratio on water content for unsaturated soils
Y. Dong

Parallel 5-2: <B-1> Advanced and new testing equipment (2)
Aug.24 (Sat), 13:50 - 14:50, Room 131 & 132 (3F, Bldg.1)
Chair: Prof. Maosong HUANG

v07.056

Large scale model test on a single pile in expansive soil upon infiltration
Yunlong Liu, Sai K. Vanapalli

v07.057

Incorporating suction in to the interpretation of plate load tests on unsaturated soils
Yi Tang, Thanh Vo, Hossein A. Taiebat, Adrian R. Russell

EA31

Resistivity test technology of triaxial soil sample based on vdP method
Feng Huai-ping, Ma De-liang, Wu Zhong-xue, Tian Li-da, Liu Meng-yao

EA32

A photogrammetric method for 3D displacement measurement of geogrids during the tensile test
Xiaolong Xia, Xiong Zhang, Zhaozheng Yin

Parallel 5-3: <E-1> Geo-environment (1)
Aug.24 (Sat), 13:50 - 14:50, Room 133 & 134 (3F, Bldg.1)
Chair: Dr. Kazunori FUJISAWA

EA33

The Salt Expansion of an unsaturated silty clay
Lihong Chen, Jiankun Liu, Xu Li

EA34

Thermal and saline effect on mineral-water interactions in compacted clays
Huihui Tian, Changfu Wei

EA35

Experimental study on the microstructure evolution of gas hydrate-bearing sediment
Peng Wu, Yongchen Song, Weiguo Liu, Yanghui Li

v07.058

Variance-based determination of dominant model parameters for sand migration in homogenous gas hydrate-bearing reservoir
Shun Uchida, Yongkoo Seol

Parallel 6-1: <A-2> Water-retention and hydraulic behavior (3)

Aug.24 (Sat), 15:00 - 16:20, Plenary session room (4F, Bldg.1)
Chair: Dr. Tomohiro MORI

v07.059

Rapid concurrent measurement of the soil water characteristics curve and the hydraulic conductivity function utilizing the continuous pressurization method
Adel M. Alowaisy, Noriyuki Yasufuku, Ryohei Ishikura, Masanori. Hatakeyama, Shuu. Kyono

v07.060

Effect of grain-size distribution on hydraulic anisotropy of unsaturated soils
H. Rahardjo, A. Satyanaga

v07.061

The role of pore-size distribution function on the estimation of engineering properties of unsaturated soil
Q. Zhai, H. Rahardjo, A. Satyanaga, GL Dai, XL Zhao

v07.062

Relative hydraulic conductivity inferred from pore size distribution of unsaturated soils
Y. F. Xu

v07.063

Hydraulic conductivity functions of quasi-saturated fine-grained soils
K. V. Bicalho, D. Znidarcic, H-Y. Ko

v07.064

Permeability of saturated and unsaturated iron ore fines
H. Wang, J. Koseki, T. Nishimura

Parallel 6-2: <C-1> Constitutive modelling

Aug.24 (Sat), 15:00 - 16:20, Room 131 & 132 (3F, Bldg.1)
Chair: Prof. Huaiping FENG

EA36

Bounding surface model for unsaturated soil coupling hydraulic hysteresis and mechanical loading
Ran Yuan, Yi He, Nian Hu

EA37

Modelling of unsaturated decomposed granite subjected to finite deformation
X. Xiong, Y.L. Xiong, T. Tsunemoto, S. Okino, X.Y. Qiu, Y. Kurimoto, F. Zhang

v07.065

Constitutive modelling hydro-mechanical behavior of unsaturated loess with a loss of structure
Qiuyu Wang, Jiangu Qian, Shiyuan Li

EA38

A constitutive model of unsaturated soils with considering the effect of intergranular physicochemical forces
T.T. Ma, C.F. Wei, C.Q. Yao

EA39

An anisotropic critical state constitutive model for turbidite hydrate-bearing sediments
M.Zhou, K.Soga, K.Yamamoto, H.Huang

EA40

Effect of occluded gas on the constitutive modeling of unsaturated soils
Yan Liu, Li Zhang

Parallel 6-3: <E-1> Geo-environment (2)
Aug.24 (Sat), 15:00 - 16:20, Room 133 & 134 (3F, Bldg.1)
Chair: Dr. Giancarlo FLORES

EA41

Gas permeability of landfill soil cover modified by biochar
Abraham C.F. Chiu, H.X. Guo

EA42

Distinct stress-dilatancy behaviour of fine-grained sediment containing large bio-gas bubbles
Jianfeng Zhang, Yi Hong, Lizhong Wang, Zhuanzhuan Zhang

v07.066

Investigation into mechanical behaviour of loess-wheat straw mixtures
Wen-Chieh Cheng, Xin Jin, Arul Arulrajah, Annan Zhou

v07.067

Determination of resistance parameters of contaminated tropical soils in the state of Rio de Janeiro
Ramos, V. L. F. S., Mahler, C. F., Mainier, F. B., Januzzi, G. M. F.

v07.068

Study of the gravimetric characterisation and heating value of urban solid waste
Mahler, C. F., Ramos, V. L. F. S., Mainier, F. B.

EA43

Time-dependent performance of new hydroxyapatite-based binder stabilized contaminated soil: preliminary field test site assessment
Yan-Jun Du, Ya-Song Feng, Wei-Yi Xia , Shi-Ji Zhou, Zhi-Bin Liu

Parallel 7-1: <A-2> Water-retention and hydraulic behavior (4)
Aug.24 (Sat), 16:40 - 18:00, Plenary session room (4F, Bldg.1)
Chair: Prof. Guoqing CAI

v07.069

Water retention characteristics of granular and powder bentonites
W.Y. Tong, M. Wijaya, E.C. Leong

v07.070

Influence of the organic matter content on the soil water retention characteristics of a reconstituted kaolinitic clay
Carlos R. Reina-Leal, Cesar S. Ramírez, Julio E. Colmenares

v07.071

Some laboratory scale tests on an australian coal tailings sample
Sihe Liao, Partha Narayan Mishra, Alexander Scheuermann

EA44

Adsorbed water density in unsaturated clays
Y. Dong

EA45

Micro- and macro-scopic investigations on wheat-induced change of soil water retention curve of a compacted loam
R. Chen, J. W. Huang, Y. Xu, Z. K. Chen, J. Liu

EA46

Soil-water retention behavior and microstructure evolution of red clay in full suction range
Guoqing Cai, Annan Zhou, Yi Liu, Chengang Zhao

Parallel 7-2: <C-2> Numerical modelling and analysis (1)
Aug.24 (Sat), 16:40 - 18:00, Room 131 & 132 (3F, Bldg.1)
Chair: Dr. Sayuri KIMOTO

v07.072

Nonlinear analysis of unsaturated soils using a meshfree method
Omid Ghaffaripour, Golnaz A. Esgandani, Arman Khoshghalb

EA47

Simple model for predicting the volumetric compression of unsaturated compacted clays
Zhong Han, Wei-lie Zou, Xie-qun Wang

v07.073

A new explicit analytical solution to axisymmetric consolidation of vertical drain in unsaturated soils
Aifang Qin, Tianyi Li, De'an Sun

EA48

Semi-analytical solutions of two-dimensional plane strain consolidation in unsaturated soils considering the sand cushion
Lei Wang, Yongfu Xu, Xiaohe Xia, De'an Sun

v07.074

Modeling of the maximum and minimum void ratios for binary-sized granular materials
W. M. Ye, Z. R. Liu, Y. J. Cui, Z. Zhang, Q. Wang

EA49

A Mathematical Model for Tortuosity of Soil with Considering Particles Arrangement
Han Yan, Jidong Teng, Sheng Zhang, Daichao Sheng

Parallel 7-3: <D-2> Hazards
Aug.24 (Sat), 16:40 - 18:00, Room 133 & 134 (3F, Bldg.1)
Chair: Prof. Takeshi KODAKA

v07.075

Comparison of the bearing capacity of an unsaturated soil obtained from the experiments, a semi-empirical model, and numerical simulations
Won Taek Oh, Sai K. Vanapalli

EA50

Analysis of negative skin friction resistance characteristic influence parameter of pile foundation under flooding condition
Ye Shuai-hua

v07.076

Analysis of soil subsidence due to change in groundwater level in unsaturated soils
S. M. Reza Imam, Reza Mohammadi, Danial Ghafarian

v07.077

Erosion resistance test of soil cement application for surface erosion protection
Sokline Pheng, Kinuko Hibi, Toshikazu Hori, Yuji Kohgo

v07.078

Conditions of the cavity formation and sinkholes in the practical ground
Mari Sato, Yoshinori Uno, Ryota Ito

v07.079

Field measurement about water content in embankment covered by slope protection work
T. Matsumaru, T. Sato

Parallel Session

Day 3 – August 25 Sunday

Parallel 8-1: <A-5> Cyclic/dynamic behavior
Aug.25 (Sun), 10:40 - 12:00, Plenary session room (4F, Bldg.1)
Chair: Dr. Toshiyasu UNNO

v07.080

Numerical simulation of undrained cyclic behavior for desaturated silica sands
Kengo Kato, Koichi Nagao, Naoaki Suemasa

v07.081

Drained shear behavior of an unsaturated soil during cyclic triaxial loadings
Tun Tun Win, Tomotaka Sato, Yuji Kohgo

v07.082

Response of shallow foundation under coupled cyclic loading for unsaturated sand at large number of cycles
Binod K., Frank W.

v07.083

Dynamic centrifuge model tests on embankment with different upstream conditions
Gautham Adapa, Yuki Takada, Kyohei Ueda, Ryosuke Uzuoka

Parallel 8-2: <C-2> Numerical modelling and analysis (2)
Aug.25 (Sun), 10:40 - 12:00, Room 131 & 132 (3F, Bldg.1)
Chair: Dr. Kentaro NAKAI

v07.084

A fully coupled flow-deformation model for cyclic elasto-plastic analysis of multiphase porous media
B. Shahbodagh, G.A. Esgandani, N. Khalili

v07.085

Unsaturated behavior of an earthfill dam during coupled initial impoundment and a prolonged rainfall
Vilayvong K., Kazunori Fujisawa, Akira Murakami

v07.086

Rainfall-induced failure on unsaturated fill and highly weathered schist slopes
Phichet Morya, Supavat Kongpanickul, Kuo Chieh Chao, Rustam Ishenaliev

v07.087

Numerical analysis on the stability of highway embankment reinforced with spiral bladed drain pipe reinforcements
Kiyonobu Kasama, Yasutaka Ito, Zentaro Furukawa, Tomohiro Hamasaki, Kenji Matsuka

v07.088

Influences of rainfall infiltration and hysteresis SWCC of unsaturated soil on settlement of shallow foundations
Sangseom Jeong, Yongmin Kim, Hyundo Park

EA51

Large deformation analysis of soil slope with anti-slide piles base on a three dimensional and parallelized soil-structure-coupled SPH model
Weijie Zhang, Zhanbin Wang

Parallel 8-3: <E-2> Frozen soil
Aug.25 (Sun), 10:40 - 12:00, Room 133 & 134 (3F, Bldg.1)
Chair: Prof. Sheng ZHANG

v07.089

Testing method for resilient properties of unsaturated unbound granular materials subjected to freeze-thaw action
Tianshu Lin, Tatsuya Ishikawa, Tetsuya Tokoro

EA52

The frozen behavior of an unsaturated silty clay
Xu Li, Jiankun Liu, Zhenya Liu

EA53

Effect of confining pressure path on strength and deformation of frozen silty sand
Shujuan Zhang, Zhizhong Sun, Zhi Wen

v07.090

Measurement of unfrozen water in unsaturated soil with pulse NMR
T.Tokoro, T. Ishikawa

EA54

An interpretation of soil freezing characteristic curve of unsaturated freezing soils
Jidong Teng, Yu Zhong, Sheng Zhang, Daichao Sheng

EA55

Thaw subsidence properties of artificial frozen ground and prevention of differential foundation settlement
Yao Zhishu, Song Haiqing, Cai Haibing, Wang Xiaojian

Parallel 9-2: <C-2> Numerical modelling and analysis (3)
Aug.25 (Sun), 13:00 - 14:20, Room 131 & 132 (3F, Bldg.1)
Chair: Dr. Mamoru KIKUMOTO

v07.091

A fully coupled flow-deformation model for time-dependent analysis of unsaturated soils
Thi Ngoc Mac, Babak Shahbodagh, Nasser Khalili

EA56

Soil-water-air coupled elasto-plastic finite deformation simulation of unsaturated silt triaxial test using void ratio-dependent soil water retention model
Takahiro Yoshikawa, Toshihiro Noda

EA57

Discrete element modeling for shear behaviour of a compacted silty soil at low stress states
Hyunbin Kim, Hyunsu Park, Seong-Wan Park

EA58

Numerical simulation on the hydro-mechanical response of high-speed railway embankment under rainfall based on a unified constitutive model for unsaturated soils
Yi Xie, Lulu Zhang, Yonglin Xiong, Guanlin Ye

EA59

An analytical study on expansion of liquefaction damage during aftershock induced by groundwater-level rise due to main shock
Toshihiro Noda, Takahiro Yoshikawa

v07.092

Mechanism of dissipation of excess flow pressures in unsaturated granular soils subjected to seismic excitations
Javad Ghorbani, David Airey

Parallel 9-3: <A-1> Microstructure (1)
Aug.25 (Sun), 13:00 - 14:20, Room 133 & 134 (3F, Bldg.1)
Chair: Dr. Kazunari SAKO

EA60

A revised pore morphology method for modeling the experimental observations of air-water distribution in porous media
Xin Liu, Annan Zhou, Jie Li, Shijin Feng

v07.093

Study on calculation method of pore size distribution formed between soil particles under the closest packing
Tomohiro Mori, Makoto Akiyama, Toru Tsuchikura

v07.094

Investigations on microstructure characteristics of porous pavement based on X-ray CT scanning
Tom Törzs, Jürgen Grabe, Guoyang Lu, Markus Oeser

v07.095

Microscopic investigation of the hydro-mechanical behavior of unsaturated granular media with X-ray CT
Marius Milatz, Jürgen Grabe

v07.096

Distribution changes of grain contacts and menisci in shear band during triaxial compression test for unsaturated sand
Ryunosuke Kido, Yosuke Higo

Parallel 10-2: <C-2> Numerical modelling and analysis (4)
Aug.25 (Sun), 16:20 - 17:40, Room 131 & 132 (3F, Bldg.1)
Chair: Dr. Yosuke HIGO

v07.097

Numerical modeling the uplift bearing capacity of transmission line tower foundation on expansive soil
Xilin Lü, Kunye Zhou, Maosong Huang, Zheng Su

v07.098

An analytical study on the boundary size effect of calibration chamber studies
Y. Cheng, H.W. Yang, D.A. Sun

v07.099

Long- and short-term pore water pressure variations in sandy river dike interpreted with 1- and 2-phase seepage flow analysis
Sho Nishiie, Satoshi Nishimura, Nobutaka Yamazoe

v07.100

Numerical simulation of seepage failure by upward flow considering internal erosion
S. Kimoto, T. Akaki, H. Kodama

EA61

A coupled thermal-hydraulic-mechanical model for frost heave
Jianhua Yin, Xiong Zhang

v07.101

Numerical analysis of in-situ water content and temperature variations due to effects of grass
Binh T. Nguyen, Tatsuya Ishikawa, Takumi Murakami

Parallel 10-3: <A-1> Microstructure (2)
Aug.25 (Sun), 16:20 - 17:40, Room 133 & 134 (3F, Bldg.1)
Chair: Dr. Shoji KATO

v07.102

Osmotic effects on the microstructure of Ashfield shale
Ke Ou, Jubert A. Pineda, Xianfeng Liu, Daichao Sheng, Antonio Gens

EA62

Two-dimensional capillary rise panel of granular media
Shaokai. Nie, Bate, Bate, Yunmin, Chen

v07.103

Molecular dynamics simulation of water molecules absorption by different cations based Montmorillonite
Honghua Zhao, Cong Liu, Shuqi Jiang, Yuanyuan Ge

v07.104

Influence of pore water salinity on the compressibility of Maryland clay
Shengyang Yuan, Xianfeng Liu, Olivier Buzzi

v07.105

Macroscopic and microscopic study of unsaturated shear strength behaviour of type-F fly ash
Naman Kantesaria, Kanika Gupta, Ajanta Sachan

EA63

Aggregate size effect on the mineralogical composition and microstructure of lime-treated soil
Yejiao Wang, Myriam Duc, Yujun Cui, Anh Minh Tang, Nadia Benahmed

Abstract of Keynote Speech

Keynote Lecture 1, Aug. 23rd (Fri), 09:10 ~ 09:50

"Field techniques for measuring soil hydraulic properties in unsaturated soils"

Professor, Yuji Takeshita
Okayama University, Japan

ABSTRACT:

It is well established that filed or in-situ measurements of the soil hydraulic properties are essential to practical and accurate prediction of water movement in unsaturated soils such as natural slope, embankment, landfill and agricultural field. The soil hydraulic properties consist of the saturated hydraulic conductivity, the unsaturated hydraulic conductivity and the soil water characteristic curve defined as a relationship between water content and matric potential (the suction of a soil).

The hydraulic conductivity of unsaturated soils should be measured in the field. Because air bubbles are usually entrapped in porous media when they are saturated by infiltrating water, the saturated hydraulic conductivity measured in unsaturated soil is lower than the truly saturated hydraulic conductivity measured by laboratory experiments and is often referred to as a field-saturated hydraulic conductivity. Field methods for determining the field-saturated hydraulic conductivity of unsaturated soils include constant head infiltration and/or gravity drainage events for near-surface application. For measuring the soil water characteristic curves, it is often difficult to interpret in-situ measurements unless carefully controlled boundary conditions are applied. As a results, the soil water characteristic curves are most generally measured in the laboratory experiments using well-controlled initial and boundary conditions. Whereas laboratory experiments have the advantage of being easy, quick and precise, a major disadvantage is that they lead to soil properties that are often non-representative of field conditions.

Since analyses of the soil hydraulic functions are ultimately directed toward field-scale processes, determination of in-situ properties is more relevant than data obtained from laboratory analyses. This keynote speech will review the current status of field experimental techniques of measuring the soil hydraulic properties in the near surface of unsaturated sandy soils and illustrate their utility for determining key parameters affecting seepage flow in the unsaturated soils. A few areas in need of further investigation will be outlined.

Keynote Lecture 2, Aug. 23rd (Fri), 09:50 ~ 10:30

"Soil-atmosphere interaction in embankments"

Professor, Yu-Jun Cui

Ecole des Ponts ParisTech, France

Dr. Yu-Jun Cui was Panel Member of Géotechnique for three years. He is now Associate Editor of Canadian Geotechnical Journal, Vice Chief Editor of Journal of Rock Mechanics and Geotechnical Engineering, Panel Member of Géotechnique Letters. He is also editorial board members of several other Journals. He was selected by TC106 and delivered the first European Distinguished lecture on unsaturated soils in 2016.

ABSTRACT:

The stability of earth constructions depends strongly on the climatic conditions. In dry seasons, excessive water evaporation can lead to surface cracking, modifying the hydro-mechanical behaviour of soils and thus compromising the constructions' stability. In wet seasons, significant water infiltration leads to reduction of suction and thus decrease of the mechanical performance of constructions. The drying/wetting cycles that the constructions undergo constantly can only come to enhance the detrimental effects. These points have widely investigated in the laboratory, but rarely addressed in the field. In this lecture, two cases studies are firstly presented, one is an experimental embankment with two compacted silty soils and another is an experimental embankment with lime/cement treated silty/clayey soils. Emphasis is put on the atmospheric conditions changes and the subsequent changes in suction and water content in the embankments. A numerical tool is also developed, allowing the soil hydro-mechanical behaviour to be analysed through consideration of atmosphere interaction. This numerical tool is based on an appropriate water evaporation model on one hand, and on a coupled thermal and hydraulic fluids flows on other hand. It is successfully applied to the analyses of the hydro-mechanical behaviour of two embankments in terms of changes of suction and water content, showing that it is possible to analyse the earth constructions' behaviour based on the recent knowledge developed in unsaturated soil mechanics, provided that appropriate water evaporation model is adopted.

Keynote Lecture 3, Aug. 23rd (Fri), 13:10 ~ 13:50

"Effect of stress and suction on resilient modulus of compacted unbound materials"

Professor, Seong-Wan Park

Dankook University, Korea

- Professor, Dankook University (2003–Present)
- Member of ISSMGE (TC106) and core member (ISSMGE TC202)
- Editor-in-Chief, Journal of Korean Geotechnical Society (2015-2017)
- Senior Editor, KSCE Journal of Civil Engineering(2016-Present)
- Senior Researcher, Korea Institute of Construction Technology (2000-2003)

ABSTRACT:

Over the last several decades there has been a significant shift from the use of empirical approaches towards the use of mechanistic models and unsaturated soil mechanics to characterize and predict the behavior of transportation infrastructure and geomaterials. Particularly, resilient modulus is an important mechanical parameter for the study of the behavior of unbound materials under cyclic and traffic loadings. Some studies have indicated that soil suction has an effect on resilient modulus of unbound materials and that there is a non-linear response of this feature for geomaterials during the loading process. Nevertheless, an assessment that couples the dependency of resilient modulus on stress and suction is still lacking. This study addresses this through a detailed analysis of resilient modulus under moisture conditions using suction stress concept on unsaturated soils. Results show a non-linear variation of resilient modulus with stress and that suction stress has a significant influence on it. The model proposed to couple the effect of moisture and stress on resilient modulus presents better prediction performance of compacted unbound materials.

Keynote Lecture 4, Aug. 23rd (Fri), 13:50 ~ 14:30

"Environmental degradation of clayey rocks"

Senior Lecturer, Jubert Abdres Pineda
The University of Newcastle, Australia

Dr. Jubert Pineda received a Bachelor Degree in Civil Engineering from the Santo Tomas University (Bogotá, Colombia). He obtained a Master Degree in Geotechnical Engineering from the National University of Colombia and a PhD Degree in Geotechnical Engineering from the Technical University of Catalonia (UPC, Barcelona) in 2012. At present he works as Senior Lecturer at the Priority Research Centre for Geotechnical Science and Engineering (PR-CGSE) in the University of Newcastle Australia.

Dr. Jubert Pineda has been involved in several research and consulting projects associated with unsaturated soils, stability of dams founded on clayey rocks as well as high-quality sampling and testing of soft soils. His current research interests include mechanics of soft soils, unsaturated soils, mechanics of hard soils-soft rocks and more recently Geo-Engineering problems related to Energy and Sustainability.

ABSTRACT:

Clayey rocks are common in many countries, and are frequently present in civil engineering projects. A recurrent observation in these materials is their transitional nature, which emerges mainly when they are excavated and exposed to weathering processes as those caused by cyclic variations in relative humidity (RH) or suction. Marls, shales, claystones, mudstones, siltstones and very stiff clays are examples of materials that undergo these changes. Despite intrinsic geological differences, clayey rocks show two similar characteristics: (i) a behaviour intermediate between rock and soil; and (ii) a high 'degradation' potential ability to change their mechanical properties, transforming the clayey rock into a soil. This transition is especially relevant when the rock is exposed to unloading and environmental effects, which may leads to stability problems or unexpected deformation of geotechnical infrastructure.

Rock degradation has commonly been related to increase in water content due to cyclic variations in relative humidity. Such cyclic behaviour is accompanied by irreversible volume changes, reduction in rock strength and rock stiffness as well as increase in rock permeability. Tracking of the variations in mechanical properties is fundamental for proper understanding of the rock degradation phenomena.

In this presentation, the mechanisms leading to the degradation of clayey rocks when exposed to environmental effects are evaluated. The main aspects controlling the degradation of clayey rocks are studied in this presentation: (i) the number of applied RH cycles, N, (ii) their amplitude, ΔRH, (iii) the influence of the stress level ($p\text{-}u_a$), (iv) the effect of the fluid used to induce rock saturation (liquid water or vapour) and (v) the chemistry of the pore fluid. Particular emphasis is given to the consequences of the relative humidity cycling on rock microstructure. The development and implementation of non-conventional experimental techniques for inducing and tracking rock degradation, at micro and 'macro' scales, is described. An experimentally-based framework of behaviour is presented which may be used in practice for the evaluation of the degradation potential of clayey rocks.

Second Asia-Pacific Distinguished Lecture on Unsaturated Soils
Aug. 24th (Sat), 08:10 ~ 08:50

"Unusual geotechnical problems in high-speed railway embankments in cold climates"

Professor: Daichao Sheng

University of Technology Sydney, Australia

Professor Daichao Sheng is a Distinguished Professor and Head of School of Civil and Environmental Engineering at University of Technology Sydney (UTS) in Australia. He also holds a conjoint Distinguished Professorship at the National Engineering Laboratory for High-Speed Railway Construction, Central South University in China.

Prof Sheng received a BSc degree on Engineering Geology and Hydrogeology from Lanzhou University in China, an Engineering Licentiate degree and a Doctor of Engineering degree from Lulea University in Sweden.

Prof Sheng's research interests include computational geomechanics, unsaturated soils, cold region geotechnics and environmental geotechnics. He has published widely in these areas. He has a total citation of ~3500 and an H-index of 34, according to Web of Science. He was awarded the RM Quigley Award by the Canadian Geotechnical Society, the John Booker Medal by the International Association of Computer Methods and Advances in Geomechanics (IACMAG), the EH Davis Lecturer by the Australian Geomechanics Society. He is currently one of the 2 Editors for the Canadian Geotechnical Journal and serves in the editorial boards of Computers and Geotechnics, Acta Geotechnica.

Prof Sheng has held a number of senior positions. He was the Co-Director of the Priority Research Centre for Geotechnical Science and Engineering at the University of Newcastle. He also serves as a Technical Executive in Geotechnics of WSP Australia Partial Limited, a leading consulting companies in the world.

Keynote Lecture 5, Aug. 24th (Sat), 09:00 ~ 09:40

"Volume change behavior of highly compacted GMZ bentonite under chemo-hydro-mechanical conditions"

Professor: Weimin Ye

Tongji University, China

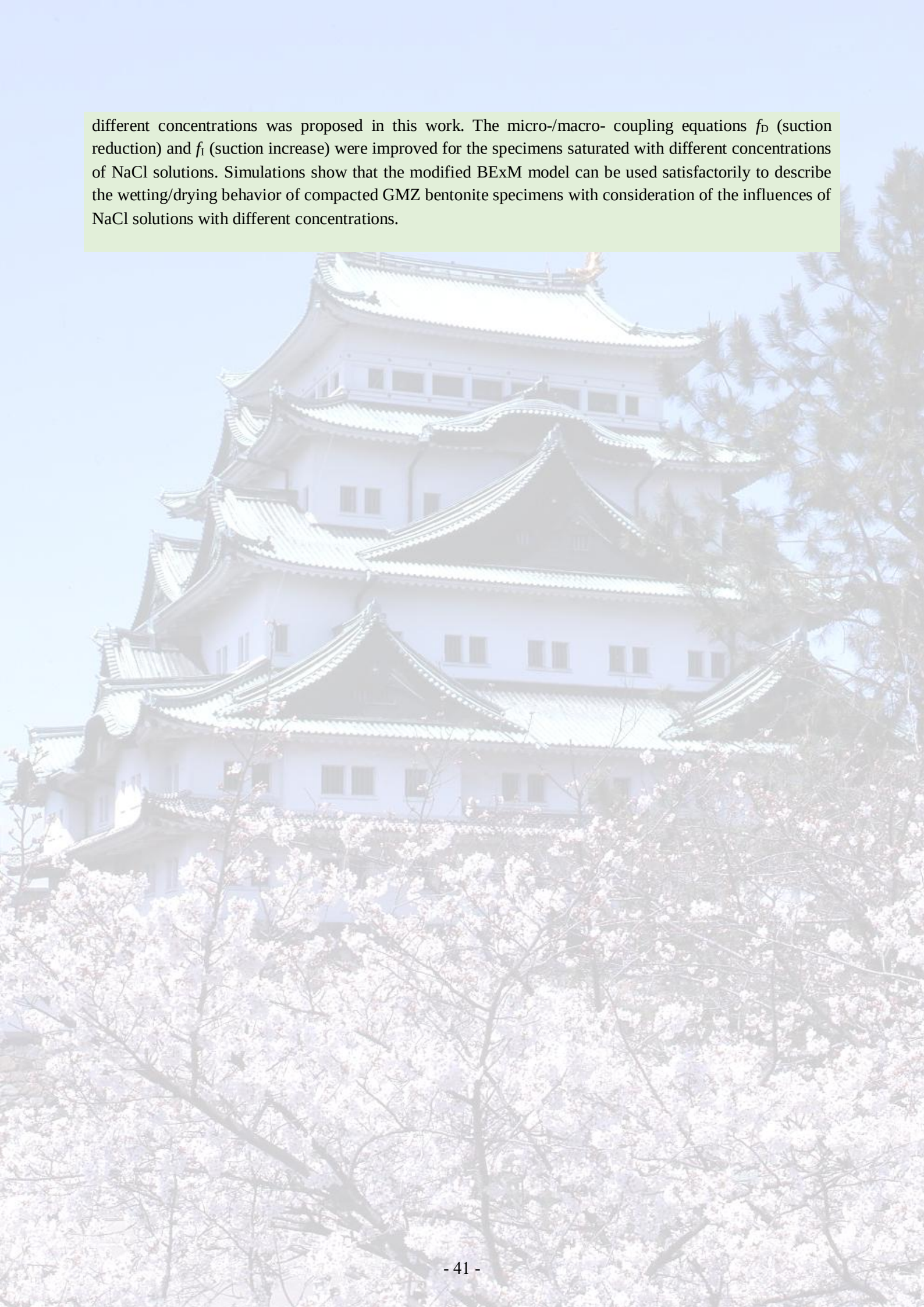
Dr. Weimin YE is a Professor of geological/geoenvironmental engineering in School of Civil Engineering at Tongji University in Shanghai. He earned his PhD in Structure Engineering from Tongji University, with specialization in excavation and geo-environmental protection. Dr. YE's area of expertise is geological/geoenvironmental engineering with particular emphasis in Unsaturated Soil Engineering. He is conducting research in compacted bentonite for using as buffer materials in deep geological repository for disposal of high level radioactive waste in China. In this direction, he is exploring the engineering properties of GMZ bentonite under Chemo-thermo-hydro-mechanical coupling conditions. He has more than 200 publications including more than 80 international journal papers and got 5 awards from the local government for contributions to research.

ABSTRACT:

Due to its low hydraulic conductivity, high swelling capacity and good adsorption properties, the Gaomiaozi (GMZ) bentonite has been selected as potential buffer/backfill materials for construction of artificial barriers in the deep geological repository for disposal of high-level nuclear waste (HLW) in China. During the long-term operation of a repository, the compacted bentonite will inevitably experience wetting or drying processes with hydration or dehydration of groundwater with different concentrations. Furthermore, these processes will take place in the repository with a limited space and certain geo-stresses generated by the upper geological formations.

In this work, compacted GMZ bentonite with an initial dry density of 1.70 g/cm^3 was hydrated with distilled water and NaCl solutions. For a given suction, the measured void ratio of specimen saturated with distilled water is slightly larger than those of the specimens saturated with salt solutions after the drying equilibrium is reached. The degree of saturation of compacted GMZ bentonite specimen increases as the salt concentration increases under the same total suction. A modified soil water retention curve (SWRC) equation was proposed to account for the effect of void ratio and salt solutions on the drying behavior of the specimens. Verifications reveal that the proposed equation can satisfactorily describe the SWRCs of compacted GMZ bentonite saturated with different concentrations of salt solutions. In the meantime, volume change behavior of highly compacted GMZ bentonite was studied under coupling chemo-hydro-mechanical conditions. Using a modified oedometer, cyclic wetting and drying tests were conducted on compacted GMZ bentonite with infiltration of NaCl solutions under different constant vertical stresses. Specimens were infiltrated with different concentrations of NaCl solutions during the wetting tests and a suction-control method was used in the drying tests. Results show that the swelling strain on wetting and the shrinkage strain on drying decrease with the increase of the vertical stresses or the concentration of NaCl solutions. Plastic deformations mainly occurred in the first wetting and drying cycle and decreased with the increase of the vertical stresses. However, the accumulated plastic deformation increased with increasing concentration of NaCl solutions, which could be attributed to the effects of osmotic consolidation. Based on the test results, a modified Barcelona Expansive Model (BExM) model with consideration of the influences of NaCl solutions with

different concentrations was proposed in this work. The micro-/macro- coupling equations f_D (suction reduction) and f_I (suction increase) were improved for the specimens saturated with different concentrations of NaCl solutions. Simulations show that the modified BExM model can be used satisfactorily to describe the wetting/drying behavior of compacted GMZ bentonite specimens with consideration of the influences of NaCl solutions with different concentrations.



Keynote Lecture 6, Aug. 24th (Sat), 09:40 ~ 10:20

"Soil-Water Characteristic Curves – Determination, Estimation and Application"

Associate Professor, Eng Choon Leong
Nanyang Technological University, Singapore

Dr. Leong Eng Choon is currently an Associate Professor at Nanyang Technological University, Singapore. He has over 30 years of teaching experience in geotechnical engineering and is an active researcher in unsaturated soils and soil dynamics. He has published more than 320 journal and conference papers. He is currently an editorial board member of several journals and is an active reviewer for many journals. He has won several awards, notably the Excellence in Reviewing for the Geomechanics for Energy and the Environment journal in 2018, the Koh Boon Hwee Mentor award in 2013, and the ASTM best paper award in 2006. He is also active in the national standardization programmes in SPRING, Singapore. He is the lead author and co-author of the books entitled "Guide to Research Projects for Engineering Students - Planning, Writing, Presenting" and "Mechanics of Residual Soils, 2nd Edition", respectively.

ABSTRACT:

The soil-water characteristic curve (SWCC) or water retention curve is a relationship between water content in a soil and suction. The SWCC was first plotted by Edgar Buckingham, a soil physicist, in 1907 for six soils ranging in texture from sand to clay. It was adopted for use in unsaturated soil mechanics by the geotechnical engineering community. The SWCC is now almost treated as the index property of unsaturated soils. It has been used as a proxy for permeability and shear strength of unsaturated soil. Most soils have a sigmoidal SWCC, otherwise known as a unimodal SWCC as opposed to a bimodal SWCC which has been found for some soils. Although determining the SWCC is easier than determining permeability or shear strength for unsaturated soil, the test is still time-consuming and it is not easy to determine the entire SWCC. Incomplete or insufficient SWCC data may lead to an incorrect SWCC and hence inaccurate determination of permeability and shear strength. Progress has been made to expedite the experimental determination of SWCC as well as estimating the SWCC from basic soil properties using pedotransfer functions. In addition, SWCC has been represented using volumetric water content, gravimetric water content or degree of saturation. Different representations may have dire consequences on its application. Determining the SWCC using volumetric water content or degree of saturation presents challenges in estimating the instantaneous volume during the experiment. In this paper, the current state-of-the-art in determining, representing and estimating SWCC and its applications are described and critically examined.

Keynote Lecture 7, Aug. 24th (Sat), 13:00 ~ 13:40

"A Photogrammetry-Based Method to Measure the Total and Localized Volume Changes of Unsaturated Soil Specimens during Triaxial Testing"

Associate Professor: Xiong Zhang
Missouri University, USA

Dr. Xiong Zhang is an associate professor in the Department of Civil, Architectural and Environmental Engineering at the Missouri University of Science and Technology (Missouri S&T). His research focuses on development of advanced laboratory techniques to rapidly characterize geomaterials, constitutive modeling coupled hydro-mechanical behavior of unsaturated soils, numerical modeling of climate-soil-structure interaction, slope stability analysis, soil stabilization and ground improvement, and frozen ground engineering. He was one of the two speakers of ASCE Geo-Institute (GI) Unsaturated Soils Committee Webinar on "Introduction to Constitutive Modeling of Unsaturated Soils."

Dr. Zhang is currently serving as an Editorial Board Member of Canadian Geotechnical Journal. He also serves as a vice chair of ASCE GI Shallow Foundation Committee and committee member of several nationwide technical committees such as ASCE GI Committee on Design of Residential Structures on Expansive Soil Standards, ASCE GI Pavement Committee, TRB AFP60 Committee on Engineering Behavior of Unsaturated Soils, and TRB AFS20 Committee on Soil and Rock Instrumentation.

ABSTRACT:

Triaxial tests have been widely used to evaluate the soil behavior. In the past few decades, many methods have been developed to measure the volume changes of unsaturated soil specimens during triaxial testing. Literature review indicates that until now measuring the volume changes of unsaturated soil specimens during triaxial testing remains a major challenge for researchers.

In this study, a noncontact method is developed to measure the total and local volume changes of unsaturated soil specimens using a conventional triaxial test apparatus for saturated soils. The method is simple and cost-effective, requiring only a commercially available digital camera to take images of an unsaturated soil specimen during triaxial testing from which accurate 3D model of the soil specimen is reconstructed. In this proposed method, the photogrammetric technique is utilized to determine the orientations of the camera where the images are taken to an accuracy to 3-5 microns, multiple optical ray tracings are employed to correct the refraction at the air-acrylic cell and acrylic cell-water interfaces, and a least–square optimization technique is applied to estimate the coordinates of any point on the specimen surface. Validation tests indicated that the accuracy for the point measurements is less than 76 microns in the water and less than 0.25% for total volume measurements. Methods are also developed to calculate the total volume and localized strains based upon the 3D discrete measurement points on the specimen surface.

This method was awarded the "2016 International Innovation Award in Unsaturated Soil Mechanics" by TC106 within the International Society for Soil Mechanics and Geotechnical Engineering.

Keynote Lecture 8, Aug. 25th (Sun), 09:00 ~ 09:40

"Unsaturated Soil Mechanics for Disaster Prevention and Maintenance of Traffic Infrastructure in Snowy Cold Region"

Professor, Tatsuya Ishikawa

Hokkaido University, Japan

- Ø 1987-1989 Graduate School of Engineering, Kyoto University
- Ø 1999 granted Dr. Eng. from Kyoto University
- Ø 2002-2013 Professor in Hokkaido University
- Ø 2002-213 Secretary of ISSMGE TC 202 (Transportation Geotechnics)

ABSTRACT:

In snowy cold regions, the 0 °C isotherm may penetrate deep into soil ground, thereby causing some geotechnical problems specific to cold regions such as the swelling of pavement surface due to frost heave, the cracking in asphalt-mixture layer due to freeze-thaw, and the slope failures at cut slope and embankment in snow-melting period. Such phenomena are thought to accelerate deterioration of traffic infrastructures and losing of the functions. The primary cause is deemed to be the increase in degree of saturation due to snowmelt and/or ice lens melting in addition to the change in deformation-strength and water retention-permeability characteristics of soils resulting from freeze-thawing. Hence, it is indispensable to examine the influence of rapid increase in water content during thawing periods as well as the freeze-thawing of pore fluid on the hydro-mechanical behaviour of unsaturated soil ground for establishing a precise prediction method of natural disasters and a rational design method of transportation infrastructures in snowy cold regions.

This keynote lecture reviews and summarizes previous researches related to the unsaturated soil mechanics for the disaster prevention and maintenance of traffic infrastructures in snowy cold region from the viewpoints of experimental and analytical studies. To this end, this keynote lecture presents two case studies, namely "slope stability problem" and "pavement rutting problem" in thawing periods. In both problems, this keynote lecture first discusses the mechanical behaviour of the soil slope during freezing and thawing based on the results of the long-term field measurement of soil slope in Hokkaido and full-scale and small-scale model tests of soil slopes and pavement subjected to freeze-thaw actions. Next, it discusses the change in the physical properties, the water retention-permeability characteristics, and the deformation-strength characteristics of geomaterials caused by freeze-thaw actions based on the results of various types of laboratory element tests under saturated and unsaturated conditions. Last, it discusses the applicability of numerical simulations, which can consider the interactions among thermal analysis, seepage analysis, and deformation analysis, to the failure mechanism analysis of soil slopes and the deformation analysis of pavement in snowy cold regions from the viewpoint of the variation in water content due to snow and ice lens melt and the change in material properties due to freeze-thaw. Finally, this keynote lecture discusses the contributions of unsaturated soil mechanics to the disaster prevention and maintenance of traffic infrastructures in snowy cold region in terms of the mechanism of the slope failures and pavement rutting, and its influencing factors by comparing the phenomena in temperate regions with those in snowy cold regions.

Keynote Lecture 9, Aug. 25th (Sun), 09:40 ~ 10:20

"Three-phase coupled seismic analyses of unsaturated/saturated grounds"

Professor, Ryosuke Uzuoka

Kyoto University, Japan

Ø	2017.4-present	Professor, Kyoto University
Ø	2010.4-2017.3	Professor, Tokushima University
Ø	2004.3-2010.3	Associate Professor, Tohoku University
Ø	2001.8-2004.3	Assistant Professor, Tohoku University
Ø	1999.1-2001.8	Researcher, Earthquake Disaster Mitigation Research Center, RIKEN
Ø	1990.4-1998.12	Research Engineer, Hazama Corporation

ABSTRACT:

Some Asian countries share a similar natural environment and face the same threats from natural disasters such as earthquake, typhoon, heavy rainfall, flood, and landslide. What makes a bad situation even worst is that these natural disasters very often did not come alone, which is known as combined disasters. For example, a heavy rain and an earthquake likely occur sequentially in a relatively short period. A three-phase coupled analysis will be a promising tool to discuss dynamic behaviors of unsaturated/saturated grounds such as slopes and embankments during combined disasters. The author reviews recent developments on three-phase coupled seismic analyses. The equations governing the dynamic deformation of unsaturated soil were derived based on porous media theory and constitutive models. The effect of pore air pressure on cyclic behavior of unsaturated sandy soil is discussed through the simulations with three-phase and simplified two-phase analyses. The validity of three-phase coupled analyses is shown through simulations of seismic behaviors of slopes and embankments.

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