Congress Info

Organized by

(http://www.i-asem.org/)

Introduction

Title: The 2021 World Congress on Advances in Structural Engineering and Mechanics (ASEM21)

The 2021 World Congress on Advances in Nano, Bio, Robotics and Energy (ANBRE21)

Organized by: Int'l Association of Structural Engineering & Mechanics (IASEM)
Korea Advanced Institute of Science & Technology (KAIST)
Korean Tunneling and Underground Space Association (KTA)
Seoul National University Department of Architecture & Architectural Engineering (SNU DAAE)

In association with Techno-Press Journals (**www.techno-press.org (http://www.techno-press.org)**)

Sponsored by: Korea Federation of Science and Technology Societies
Korea Tourism Organization

""The 2021 World Congress on Advances in Structural Engineering and Mechanics (ASEM21)" and "The 2021 World Congress on Advances in Nano, Bio, Robotics and Energy (ANBRE21)" will be jointly organized by combining eleven International Conferences at GECE of Seoul National University, Korea on August 24~26, 2021

Techno-Press
(http://www.techno-press.org/)

Korean Tunnelling and Underground Space Association
(http://www.tunnel.or.kr/)

(https://architecture.snu.ac.kr/snu-architecture/about//)

KAIST
(https://www.kaist.ac.kr/kr/)

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KOFST
(http://www.kofst.or.kr/)

KOREA TOURISM ORGANIZATION
(http://kto.visitkorea.or.kr/eng.kto)

As the ASEM21/ANBRE21 Congress will be organized by combining international conferences of different but beneficially interactive topics to meet the demands from participants for more variety in the up-to-date topics. Eleven international conferences are organized under the umbrella of the joint ASEM21/ANBRE21 Congress. The participants will have an excellent opportunity to learn new ideas from other Conferences of different topics. Thus the Congress will be a premier international forum that brings together academics and practicing engineers to exchange frontier research results in the fusion technologies in the topics of Structural Engineering, Mechanics, Nano, Bio, Robotics, and Energy Research. You are cordially invited to participate in this interesting event.

The ASEM21/ANBRE21 Congress consist of the following twelve **2021 International Conferences on**:

- **Innovative Structural Engineering & Mechanics (ISEM)** (1999, 2002, 2004, 2008, 2011, 2013, 2015, 2017, 2019, 2021)-(*Title Changed Slightly)
- **Steel & Composite Structures (ICSCS)** (2001, 2004, 2007, 2010, 2011, 2013, 2015, 2017, 2019, 2021)
- **Computational Technologies in Concrete Structures (ICTCS)** (2009, 2011, 2013, 2015, 2017, 2019, 2021)
- **Smart Structures and Systems (ICSSS)** (2011, 2013, 2015, 2017, 2019, 2021)
- **Earthquakes and Structures (ICEAS)** (2011, 2013, 2015, 2017, 2019, 2021)
- **Tunnels and Underground Spaces (ICTUS)** (2017, 2019, 2021)
- **Advances in Nano Research (ICANR)** (2013, 2015, 2017, 2019, 2021)
- **Advances in Biomaterials and Biomechanics in Bioengineering (ICBME)** (2013, 2015, 2017, 2019, 2021)

- **Advances in Robotics Research (ICARR)** (2013, 2015, 2017, 2019, 2021)
- **Advances in Energy Research (ICER)** (2013, 2015, 2017, 2019, 2021)
- **Composite Materials and Engineering (ICCME)** (2019, 2021)

P.O. Box 33, Yuseong, Daejeon 34186, Korea Tel: +82 70-4231-7007
Email: info@asem21.org / info@anbre21.org

Congress Info

Organized by

IASEM CONFERENCES

(http://www.i-asem.org/)

Organization of Congress

Congress Chair: Chang-Koon Choi (KAIST)
Congress Co-Chair: Thomas Kang (Seoul Nat'l Univ)
Secretary General: Hyo-Gyoung Kwak (KAIST)

Local Organizing Committee

Chair: Chang-Koon Choi (KAIST)
Co-Chair: Phill-Seung Lee (KAIST)

Members:

Gye-Chun Cho (KAIST)
Jin-Keun Kim (KAIST)
Jong-Ho Shin (Konkuk Univ.)
Jeong-Tae Kim (Pukyong Nat'l Univ.)
Thomas Kang (Seoul Nat'l Univ.)
Jihyang Kweon (Konkuk Univ.)
Chang-Sik Ha (Pusan Nat'l Univ.)

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Members:

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Hong-Nan Li (Dalian Univ. of Tech.)
Erasmo Carrera (Politecnico di Torino)
Yaojun Ge (Tongji Univ.)
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Techno-Press
(http://www.techno-press.org/)

Korean Tunnelling and Underground Space Association
(http://www.tunnel.or.kr/)

UAAE
(https://architecture.snu.ac.kr/snu-architecture/about//)

KAIST
(https://www.kaist.ac.kr/kr/)

Walid Tizani (Univ. of Nottingham)

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KOREA TOURISM ORGANIZATION
(http://kto.visitkorea.or.kr/eng.kto)

P.O. Box 33, Yuseong, Daejeon 34186, Korea Tel: +82 70-4231-7007
Email: info@asem21.org / info@anbre21.org

Final Program

ASEM21

The 2021 World Congress on Advances in Structural Engineering and Mechanics (ASEM21)

and

ANBRE21

The 2021 World Congress on Advances in Nano, Bio, Robotics, and Energy (ANBRE21)

GECE, Seoul National University
23~26 August 2021

Organized by: Int'l Association of Structural Eng.& Mechanics (IASEM)
Seoul National University (SNU)
Korean Tunnelling and Underground Space Association (KTA)
Korea Advanced Inst. of Science & Technology (KAIST)

In Cooperation with: Techno-Press Journals

Sponsored by: Korea Federation of Science and Technology Societies
Korea National Tourism Corporation
Institute of Engineering Research, Seoul Naional University

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ASEM21 and ANBRE21

Global Education Center for Engineers, Seoul, Korea

23~26 August 2021

CHAIRMAN'S WELCOME

I am happy to have this opportunity to welcome you all here for the Joint Congress of ASEM21/ANBRE21.

The preparation for the Congress was by no means easy or ordinary, as the unpredictable COVID-19 hard hit all over the world. Instead of giving up our longstanding Congress, my colleageues and I stood high and tried to find ways to circumvent the unprecedented obstacles we had to face.

We have adopted the concept of Hybrid Conference since last year, in which the speakers may present their works either on-site or on-line from their preferred locations and audience may also choose their ways of attendance. I would like specially to acknowledge that it was only possible with the support and cooperation of Global Education Center for Engineers (GECE) of Seoul National University and its director Prof. Thomas Kang, who is also the co-chairman of ASEM21/ANBRE21.

I hope the Congress will be a unique opportunity not only to exchange the recent developments in scientific research, but also to meet the old friends and make new ones, either on-line or off-line.

I would like to extend my appreciation to all the participating authors for their valuable time and efforts to make contribution to this Congress. Special thanks are due to the invited mini symposium organizers for their hard work and keynote lecturers for their valuable contribution to this Congress, not forgetting many individual participants.

Finally, I would like to extend my special appreciation to my colleagues who worked hard to make this Congress a successful one. They are the Congress secretaries, members of the organizing committee, session chairmen and the international advisory committee members of ASEM21/ANBRE21 for their time and efforts to prepare the Congress. I understand that the task this time must have been unusual and therefore very difficult. Thank you.

Seoul, Korea
August 2021

Chang-Koon Choi
Chairman, ASEM21/ANBRE21

WELCOME REMARKS

It is my extreme pleasure to welcome you to the opening session of the Joint Congress of ASEM21/ANBRE21.

Due to global COVID-19 pandemic impacts, hybrid conferences have become common. However to keep items moving smoothly, additional technical expertise and preparedness is required. For this hybrid conference: speakers may present their work either here on-site or on-line from a preferred location. In addition, the audience may choose their method of attendance.

Full High Definition (FHD) cameras located in each session room of the Global Education Center for Engineers (GECE) at Seoul National University provide on-line participants with the benefit afforded by those in attendance and the on-site atmosphere created. High-quality video broadcast, optimized noise canceling sound system and stable 1 gigabit internet within the GECE give on-line participants the sense of actually being there.

One of the many advantages of this ASEM21/ANBRE21 Joint Congress is that it combines multiple international conferences into one single event. It paves a road for discussion on a variety of issues and recent developments. We are proud that this premier international forum offers an opportunity for academicians and practicing engineers to exchange findings and approaches in the fields of structural engineering and mechanics along with nano, bio, robotics and energy technology.

Again, I would like to welcome you to this Joint Congress. Your contribution to it whether in the form of presentation, article, participation, or vigorous discussion is much appreciated and lends itself to creation of a great atmosphere.

I also would like to extend my gratitude to those who worked so hard to make this Joint Congress possible, including: Prof. CK Choi (the Congress chair) and secretaries; the organizing and international advisory committees of ASEM21/ANBRE21, and all the session chairs and speakers.

Without their efforts and warm hearts, these conferences would not be possible.

Having said such, I am honored to announce that this Joint Congress has now officially begun.

Seoul, Korea
August 2021

Thomas Kang
Co-Chair, ASEM21/ANBRE21

CONGRESS ORGANIZATION (ASEM21/ANBRE21)

CONGRESS ORGANIZATION

Congress Chairs
Chang-Koon Choi (KAIST)
Thomas Kang (Seoul Nat'l Univ.)

Secretary General
Hyo-Gyoung Kwak (KAIST)

International Advisory Committee
Brian Uy (Univ. of NSW)
Dennis Lam (Univ. of Bradford)
B.F. Spencer, Jr (Univ. of Illinois)
Keh-Chyuan Tsai (Nat'l Taiwan Univ.)
Stephen Foster (Univ. of NSW)
Andrzej Winnicki (Cracow Univ.)
Shih-Chi Liu (Southeast Univ.)
Fabio Casciati (Zhejiang Univ.)
Alexandros - Dimitrios G. Tsonos (Aristotle Univ. of Thessaloniki)
Miguel Cerrolaza (Polytechnic Univ. of Catalonia)
Kytai Truong Nguyen (The Univ. of Texas at Arlington)
Karl Kingsley (Univ. of Nevada)
Chao Zhang (Northwestern Polytech. Univ.)

Local Organizing Committee
Chair: Chang-Koon Choi (KAIST)
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Members
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Jeong Yong Lee (KAIST)
Joon-Shik Moon (Kyungpook Nat'l Univ)
Hyun Myung (KAIST)
Seunghwa Ryu (KAIST)
Jong-Ho Shin (Konkuk Univ)

CONGRESSS INFORMATION

Official Language: English

Secretariat:

Until August 22, 2021
Secretariat, ASEM21/ANBRE21
P.O. Box 33, Yuseong, Daejeon 34186, Korea
Tel: (+82-70) 4231-7007, Fax: (+82-2) 736-6801
E-mail: info@asem21.org / info@anbre21.org

August 23 - 26, 2021
Office: GECE #519

PARTICIPATING INT'L CONFERENCES

The 2021 International Conference on:

Structural Engineering and Mechanics (ISEM21)
(Co-chairs: Chang-Koon Choi, Phill-Seung Lee)
Steel and Composite Structures (ICSCS21)
(Co-chairs: Brian Uy, Dennis Lam)
Computers and Concrete (ICTCS21)
(Chairman: Hyo-Gyoung Kwak)
Smart Structures and Systems (ICSSS21)
(Co-chairs: Chung-Bang Yun, B.F. Spencer, Jr)
Earthquakes and Structures (ICEAS21)
(Co-chairs: Keh-Chyuan Tsai, Thomas Kang)
Geomechanics and Engineering (ICTUS21)
(Chairman: Joon-Shik Moon)
Advances in Nano Research (ICANR21)
(Chairman: Chang-Koon Choi)
Advances in Biomaterials and Biomechanics in Bioengineering (ICBME21)
(Chairman: Chang-Koon Choi)
Advances in Robotics Research (ICARR21)
(Chairman: Hyun Myung)
Advances in Energy Research (ICER21)
(Chairman: Chang-Koon Choi)
Composite Materials and Engineering (ICCME21)
(Chairman: Gun-Jin Yun)

GENERAL INFORMATION

REGISTRATION

Registration fees for on-line conferences participants will be US$300 for video & poster sessions and US$400 for live Zoom sesseion. For on-site conference participants, the registration fee is US$600.

Registration as on-site:

The fee will cover a copy of congress proceedings, admission to technical sessions (online & offline), lunches and coffee services during session breaks.

Registration as on-line:

The fee will cover access to congress proceedings and admission to all live zoom sessions.

Registration Fees

On-site Participant : US$600 / US$650 (on-site)
Zoom Participant : US$400
Video, Poster Participant : US$300

On-Site Registration: Place and Hours

Mon	Aug.23:	5th Fl. Lobby	14:00 -16:00
Tue	Aug.24:	5th Fl. Lobby	9:00 -16:00
Wed	Aug.25:	5th Fl. Lobby	9:00 -16:00
Thur	Aug.26:	5th Fl. Lobby	9:00 -11:00

PAYMENT & REMITTANCE

Payment for registration fee should be in the form of:

- **Bank Transfer**

-Bank Account No.: 1081-400-427598
-Account Holder: Gukje Gujo Assoc.
-SWIFT No.: HVBKKRSE
-Bank Address:
Woori Bank, Daejeon KAIST Branch. 373-1 Guseong-dong, Yuseong-gu, Daejeon, South Korea
* The banker's fee for remittance must be born by the sender.

- **Credit Card**

VISA or Master Card is acceptable.

Confirmation & Receipt

Upon paying your registration fees and receiving confirmation, please retain the confirmation letter and/or receipt to avoid any contingencies and present them at the registration desk if so requested.

Cancellation & Refund

If the cancellation in writing is received by August 6th, 2021; or the submitted paper is not accepted for presentation, the paid registration fee is fully refunded. After that date, a processing fee of 20% will be deducted. No refunds will be given from August 16th, 2021. For the onsite-registered participants who are not able to attend the conference, a set of proceedings will be sent by mail.

PUBLICATIONS

Congress Proceedings

The full texts of papers (4~20 pages) will be published in the IASEM Online Proceedings and given to the participants in the form of an usb flash drive.

ASEM21:
http://www.i-asem.org/asem21_publication.html
ANBRE21:
http://www.i-asem.org/anrbe21_publication.html

Only the papers of pre-registered authors will be included in the congress proceedings.

Journal Version Papers

As the congress is held in association with the Techno-Press Journals, authors are encouraged to submit their Journal version papers (normally 12-24 journal pages (single column)) to the relevant Techno-Press journals before or after the congress. The journal version papers should be prepared in accordance with the "Instruction to Prepare Manuscript of Techno-Press Journals". (http://www.techno-press.org/papers/instruction.php)
Submitted papers will undergo peer review process and accepted papers will appear in the journal of author's choice.

Techno-Press Journals (www.techno-press.com)
- Structural Eng. & Mechanics (SEM)
- Wind & Structures (WAS)
- Steel & Composite Structures (SCS)
- Computers & Concrete (CAC)
- Smart Structures & Systems (SSS)
- Geomechanics & Engineering (GAE)
- Membrane Water Treatment (MWT)
- Earthquakes & Structures (EAS)
- Ocean Systems Engineering (OSE)
- Advances in Materials Research (AMR)
- Advances in Environmental Research (AER)
- Coupled Systems Mechanics (CSM)
- Advances in Automotive Engineering (AAE)
- Advances in Computational Design (ACD)
- Advances in Concrete Construction (ACC)
- Advances in Energy Research (ERI)
- Advances in Nano Research (ANR)
- Advances in Robotic Research (ARR)
- Advances in Aircraft & Spacecraft Science (AAS)
- Biomaterials & Biomechanics in Bioeng. (BME)
- Structural Monitoring & Maintenance (SMM)
- Metaheuristic Computing and Applications (MCA)
- Advances in Architectural Engineering (AEI)
- Composite Materials and Engineering (CME)

GENERAL INFORMATION

VENUE & ACCOMMODATION

City of Seoul

Seoul, the capital city of Korea has become a hub of international convention industry with its long historic and cultural heritage, excellent infrastructure and central location in East Asia. It is a huge metropolis where modern skyscrapers, high-tech subways and pop culture meet Buddhist temples, palaces and street markets. Notable attractions include futuristic Dongdaemun Design Plaza, a convention hall with curving architecture and a rooftop park; Gyeongbokgung Palace, which once had more than 7,000 rooms; and Jogyesa Temple, site of ancient locust and pine trees.

GECE Convention

ASEM21/ANBRE21 Congress will be held at GECE Convention in Seoul National University.

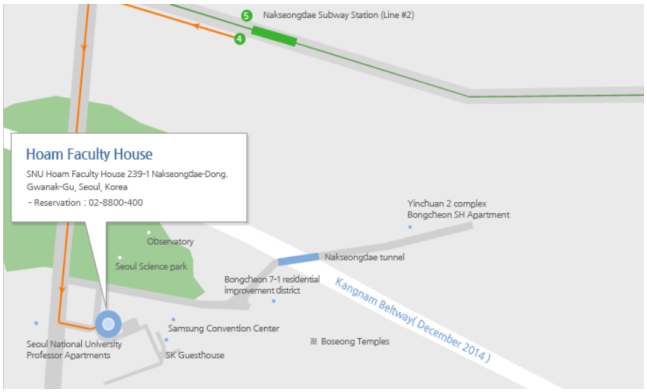
The Ministry of Education of South Korea designated Global Education Center for Engineering (GECE) in 2009 to nurture engineering talents and develop engineering education to the higher level. GECE since has been providing the world-class global engineering education program in association with domestic and foreign partner universities. It has established international education and research networks with its state of the art equipments for video lectures, training creative and promising global engineers. (http://gece.snu.ac.kr/gecexe/index.php)

GECE Convention is a professional convention facility in Seoul National University that has the capacity of holding over 1,000 people with the latest facilities and equipments. All conference rooms are equipped with audio and video systems, including beam projectors, screens, free WiFi, and both wired & wireless microphones to hold various on-line, off-line and hybrid Conferences.

Accommodation

The affiliated hotel of ASEM21/ANBRE21 is Hoam Faculty House in Seoul National University, which is conveniently located near the Congress venue

■ **Hoam Faculty House**
Tel: +82-2-880-0400



ASEM21/ANBRE21 Program at a Glance

**Time is based on KST / GMT+9*

AUGUST 24 TUESDAY	AUGUST 25 WEDNESDAY	AUGUST 26 THURSDAY
11:00-13:00 **Registration** **13:00 - 13:10 Opening Ceremony** **T0:** Opening Remarks (Thomas Kang)		
13:10 - 13:40 Keynote Lectures Ⅰ **T1A:** Topology optimization-based bone microstructure reconstruction from CT scan data (In Gwun Jang, Korea) **T1B:** Global factor method for safe non-linear analyses (Giorgio Monti, Italy)	**09:30 - 10: 00 Keynote Lectures Ⅲ** **W1A:** Latest developments in shield TBM selections & design for mechanized tunnelling (Jeremy Lee, Singapore) **W1B:** Performance-based seismic assessment of slab column frames (Mary Beth Hueste, USA)	**09:30 - 10:00 Keynote Lectures Ⅴ** **H1A:** Machine learning-based structural health monitoring (Hui Li, China) **H1B:** Review of ASCE-41 acceptance criteria for performance-based assessment of existing steel frame buildings (Sashi Kunnath, USA)
13:40 - 14:10 Keynote Lectures Ⅱ **T2A:** Machine learning based design of composite structures (Seunghwa Ryu, Korea) **T2B:** Applications, behaviour and design of high performance steel and composite structures (Brian Uy, Australia)	**10:00 - 10:30 Keynote Lectures Ⅳ** **W2A:** Recent developments towards Autonomous Tunneling and Mining Machinery (Thomas Peinsitt, Austria) **W2B:** Seismic resistance of precast and prefabricated structures with pure dry (Thomas Kang, Korea)	**10:00 - 10:30 Keynote Lectures Ⅵ** **H2A:** Autonomous robot navigation technologies for smart cities (Hyun Myung, Korea) **H2B:** On the application of deep learning in the finite element method (Phill-Seung Lee, Korea) **H2C:** Research and application of TBM safe, efficient and intelligent tunneling technology (Pengyu Li, China)
14:10 - 14:20 Break Time	**10:30 - 10:50 Break Time**	**10:30 - 10: 40 Break Time**
14:20 - 16:00 Session T3 **T3A:** New Technology in Seismic Resistant Design of Structures **T3B:** Seismic and Sustainable Behavior of Novel Materials and Structures **T3C:** Machine Learning Based Design of Materials and Structures **T3D:** Poster Session	**10:50 - 12:20 Session W3** **W3A**: Structural and Hydraulic Interaction in Underground Structures **W3B:** Dynamic Effects on Structures Including Seismic I **W3C:** Behaviour and design of high-performance steel and composite structures **W3D:** Recent Advances in Intelligent Robots, Sensors and Systems	**10:40 - 12:10 Session H3** **H3A:** Smart Technologies for Civil Infrastructure in Industry 4.0 **H3B:** Innovative Structural Design and Analysis for Buildings and Infrastructures

ASEM21/ANBRE21 Program at a Glance

**Time is based on KST / GMT+9*

AUGUST 24 TUESDAY	AUGUST 25 WEDNESDAY	AUGUST 26 THURSDAY
16:00 - 16:10 Break Time	**12:20 - 13:20 Lunch**	
16:10 - 18:30 Session T4 **T4A:** Innovative Cementitious Composites for Improved Sustainability and Resilience in Civil Engineering **T4B:** AI-infused topology optimization and its application **T4D:** Poster Session	**13:20 - 14:50 Session W4** **W4A**: Developments in Underground Space Technologies **W4B:** Dynamic Effects on Structures Including Seismic II **W4C:** Advanced applications of structural analysis I **W4D:** Poster Session	
	14:50 – 15:00 Break Time	
	15:00 - 16:30 Session W5 **W5A**: Improvements in Conventional Tunneling & Tunneling and Underground Works in Extreme Conditions **W5B:** Dynamic Effects on Structures Including Seismic III **W5C:** Advanced applications of structural analysis II **W5D:** Advances in Smart Construction Technologies	

Video/Poster Sessions	
Video Sessions	All pre-recorded video presentations and posters will be available on ASEM21/ANBRE21 Proceedings throughout the conference period (8/24-8/26).
Poster Q&A (Zoom)	**8/24 (Tue) 14:00 - 18:30 (KST/GMT+9)** **8/25 (Wed) 13:00 - 15:00 (KST/GMT+9)** Please refer to the Poster Session Schedule for your designated Q&A time slots.

ASEM21/ANBRE21 Program at a Glance

Participation in live Zoom sessions

1) All on-site and on-line participants may access live sessions through Zoom.
2) Please indicate your name and paper ID to participate. [Ex. SM1234_1234 (name*)]
3) Presenters will be given the co-host authority during their presentation.

Zoom IDs & Passwords	
Session A (Tue-Thr)	ID: 808 231 7007 PW: 0208
Session B (Tue-Thr)	ID: 704 231 7007 PW: 0208
Session C (Tue-Thr)	ID: 606 231 7007 PW: 0208
Session D (Tue-Thr)	ID: 505 231 7007 PW: 0208

All Poster/Video presentations will be uploaded to the online proceeding of ASEM21/ANBRE21.

ASEM21 Online Proceedings: http://www.i-asem.org/asem21_publication.html

ANBRE21 Online Proceedings: http://www.i-asem.org/anbre21_publication.html

TECHNICAL PROGRAM

** All participants may access live sessions through Zoom. Please indicate your name and paper ID to participate.*

REGISTRATION
11:00 – 13:00
GECE Foyer 5th Floor

* *

OPENING CEREMONY

(T0 13:00 – 13:10) **8/24 Tue**

Opening Remarks *Room B #516*
(Zoom ID: 704 231 7007 PW: 0208)

Thomas Kang, Co-Chairman, ASEM21/ANBRE21

KEYNOTE LECTURES (I & II)

(T1 13:10 – 13:40) **8/24 Tue**
(T2 13:40 – 14:10)

SESSION T1A 13:10-13:40 *Room A, #515*
Chairman: Phill-Seung Lee (Zoom ID: 808 231 7007 PW: 0208)
Topology optimization-based bone microstructure reconstruction from CT scan data;
In Gwun Jang (Korea)

SESSION T1B 13:10-13:40 *Room B, #516*
Chairman: Thomas Kang (Zoom ID: 704 231 7007 PW: 0208)
Global factor method for safe non-linear analyses; Giorgio Monti (Italy)

SESSION T2A 13:40-14:10 *Room A, #515*
Chairman: Phill-Seung Lee (Zoom ID: 808 231 7007 PW: 0208)
Machine learning based design of composite structures; Seunghwa Ryu (Korea)

SESSION T2B 13:40-14:10 *Room B, #516*
Chairman: Thomas Kang (Zoom ID: 704 231 7007 PW: 0208)
Applications, behaviour and design of high performance steel and composite structures;
Brian Uy (Australia)

KEYNOTE LECTURES (III & IV)

(W1 09:30 – 10:00) **8/25 Wed**
(W2 10:00 – 10:30)

SESSION W1A 09:30-10:00 *Room A, #515*
Chairman: Jun-Sik Moon (Zoom ID: 808 231 7007 PW: 0208)
Latest developments in shield TBM selections & design for mechanized tunneling;
Jeremy Lee (Singapore)

SESSION W1B 09:30-10:00 *Room B, #516*
Chairman: Thomas Kang (Zoom ID: 704 231 7007 PW: 0208)
Performance-based seismic assessment of slab-column frames; Mary Beth Hueste (USA)

SESSION W2A 10:00-10:30 *Room A, #515*
Chairman: Hangseok Choi (Zoom ID: 808 231 7007 PW: 0208)
Recent developments towards Autonomous Tunneling and Mining Machinery;
Thomas Peinsitt (Austria)

TECHNICAL PROGRAM

SESSION W2B	10:00-10:30	*Room B, #516*
Chairman: Deuckhang Lee		(Zoom ID: 704 231 7007 PW: 0208)
Seismic resistance of precast and prefabricated structures with pure dry; Thomas Kang (Korea)		
KEYNOTE LECTURES (V & VI)		
(H1 09:30 – 10:00) **(H2 10:00 – 10:30)**		**8/26 Thur**
SESSION H1A	09:30-10:00	*Room A, #515*
Chairman: Jangwoon Baek		(Zoom ID: 808 231 7007 PW: 0208)
Machine learning-based structural health monitoring; Hui Li (China)		
SESSION H1B	09:30-10:00	*Room B, #516*
Chairman: Thomas Kang		(Zoom ID: 704 231 7007 PW: 0208)
Review of ASCE-41 acceptance criteria for performance-based assessment of existing steel frame buildings; Sashi Kunnath (USA)		
SESSION H2A	10:00-10:30	*Room A, #515*
Chairman: Jangwoon Baek		(Zoom ID: 808 231 7007 PW: 0208)
Autonomous robot navigation technologies for smart cities; Hyun Myung (Korea)		
SESSION H2B	10:00-10:30	*Room B, #516*
Chairman: Hyeon-Jong Hwang		(Zoom ID: 704 231 7007 PW: 0208)
On the application of deep learning in the finite element method; Phill-Seung Lee (Korea)		
SESSION H2C	10:00-10:30	*(Pre-recorded Video)*
Chairman: Hamidreza Alinejad		
Research and Application of TBM Safe, Efficient and Intelligent Tunneling Technology; Pengyu Li (China)		

TECHNICAL PROGRAM

Structural Engineering and Mechanics

Session T3C	**14:20-16:00**	**Zoom C: 606 231 7007**
Session Title: Machine Learning Based Design of Materials and Structures (Mini Symposium)		
Chairman: Seunghwa Ryu		
Zoom ID: 606 231 7007 PW: 0208		**8/24 Tue**
ATHENA: A software suite for Wireframe Scaffold DNA Origami(invited)**;** Abhishek Dewangan, Minh-Chien Trinh, Hyungmin Jun* (SM2147_7149)		Zoom
Optimal Designs of Body-Centered Truss Structures using Machine Learning and Additive Manufacturing(invited); Sangryun Lee*, Zhizhou Zhang, Grace Gu (SM2147_7115)		Zoom
Deep Learning Framework for Material Design Space Exploration using Active Transfer Learning; Yongtae Kim*, Youngsoo Kim, Charles Yang, Kundo Park, Grace X Gu, Seunghwa Ryu (SM2147_7147)		Zoom
Materials by Design: Using Deep Generative Model(invited)**;** Bor-Yann Tseng, Chi-Hua Yu* (SM2147_7135)		Zoom
In silico investigation of cellular composites inspired by Liquidambar formosana(invited)**;** Yuan Chiang, Shu-Wei Chang* (SM2147_7125)		Zoom
Bayesian-Optimization-Guided Coarse-Grained Molecular Dynamics for Polymer Electrolyte Design(invited)**;** Yanming Wang*, Tian Xie, Arthur France-Lanord, Arthur Berkley, Jeremiah A. Johnson, Yang Shao-Horn, Jeffrey C. Grossman (SM2147_7124)		Zoom

Session T4B	**16:10-18:30**	**Room B: #516**
Session Title: AI-infused topology optimization and its application (Mini Symposium)		
Chairman: Namwoo Kang		
Zoom ID: 704 231 7007 PW: 0208		**8/24 Tue**
Patchwise bone microstructure reconstruction; Bong Ju Chun*, Sang Min Sin, In Gwun Jang (SM2144_7133)		Zoom
Machine Learning-based Topology Optimization: A Review; Seungyeon Shin*, Dongju Shin, Minyoung Kim, Hanyoung Ryu, Namwoo Kang (SM2144_7130)		Zoom
How to Trade off Aesthetics and Performance in Generative Design?; Dongju Shin*, Soyoung Yoo, Sunghee Lee, Minyoung Kim, Kwang Hyeon Hwang, Jong Ho Park, Namwoo Kang (SM2144_7129)		Zoom
Matlab code for topology optimization in arbitrary 3D domains; Yonghwa Ji*, Dongjin Kim, Jaewook Lee (SM2144_7150)		Zoom
Physics informed neural network for topology optimization; Dongjin Kim*, Jaewook Lee (SM2144_7119)		Zoom
Integrated framework for efficient topology optimization using the convolutional LSTM network; Younghwan Joo*, Yonggyun Yu, In Gwun Jang (SM2144_7111)		Zoom

Session W4C	**13:20-14:50**	**Zoom C: 606 231 7007**
Session Title: Advanced applications of structural analysis I		
Chairman: Phill-Seung Lee		
Zoom ID: 606 231 7007 PW: 0208		**8/25 Wed**
Fire rating of anchor channels and channel bolts; Christoph Mahrenholtz, Kaipei Tian* (SM1138_6799)		Zoom
Comparative analysis of deployable and reconfigurable rigid-bar linkage systems; Niki Georgiou*, Marios C. Phocas (SM1138_6790)		Zoom
On flow laws and constitutive relations in non-smooth elastoplasticity; Fabio De Angelis*, Simona De Cicco (SM1131_6938)		Zoom

TECHNICAL PROGRAM

A finite element analysis of a laboratory drilling equipment; Aurelian Iamandei*, Razvan Ripeanu, Lavinia Stanciu, Ioan Popa, Serban Vasilescu (SM1109_6807)	Zoom
Numerical studies for stress loss on NiTi arch-wire in long term during orthodontic treatment; Heesun Kim*, Yeonju Chun, Heeju Son, Jaesun Kwon (SM1101_6951)	Zoom

Session W5C **15:00-16:30** **Zoom C: 606 231 7007**

Session Title: Advanced applications of structural analysis Ⅱ

Chairman: Phill-Seung Lee

Zoom ID: 606 231 7007 PW: 0208 **8/25 Wed**

Shape adaptation of a hybrid bending-active gridshell through cables activation; Ioanna Anastasiadou*, Marios C. Phocas (SM1104_6798)	Zoom
Stress concentration effects in chiral Cosserat elastic plates; Simona De Cicco*, Fabio De Angelis (SM1124_6940)	Zoom
Shear strength prediction of concentric and eccentric reinforced concrete beam-column joints; Ho Fai Wong*, Ying Liu, Wai Yin Poon, Hoi Hin Mo, Tsz Kin Fung (SM1123_6898)	Zoom
Structural dynamics and hole transfer in B-DNA: combining MD, RT-TDDFT and TB; Marilena Mantela, Andreas Morphis, Konstantinos Lambropoulos, Constantinos Simserides*, Rosa Di Felice (BM1602_6986)	Zoom
Simulation of the Griffith's crack using own method of predicting the crack propagation; Jakub Gontarz*, Jerzy Podgórski (CC1215_7058)	Zoom
Hole Transfer in Open Cumulenic and Polyynic Carbyne Chains; Constantinos Simserides*, Andreas Morphis, Konstantinos Lambropoulos (BM1663_6889)	Zoom

Structural Engineering and Mechanics

(Pre-recorded session)

A case study of slope failure in central Trinidad due to water pipe leakage; KYUNG HO PARK*, Neil Beeraspat (SM1134_6794)	Video
Non-matching mesh treatment in hydro-elastic analysis of floating structures; Moonsu Park*, Phill-Seung Lee (SM2133_7084)	Video
Generalisation for thunderstorm downburst wind design spectra; JING SONG*, Pedro Martinez-Vazquez, Konstantinos A. Skalomenos (SM1129_7056)	Video
A density correction method for smoothed particle hydrodynamics; Hyun-Duk Seo*, Hyung-Jun Park, Phill-Seung Lee (SM2133_7142)	Video
Optimization of annular cavity dimensions in the circular jet burner to the enhancement of flame stability; Abhishek Dewangan*, Hyungmin Jun (SM2133_7154)	Video
Elastic properties of lattice-like 2D materials using continuum mechanics; Minh-Chien Trinh*, Hyungmin Jun (SM2133_7155)	Video
Design optimization of two-way post-tensioned concrete slab using simulated annealing algorithm; Adisorn Owatsiriwong, Pison Udomworarat, Kyung Ho Park* (SM1121_6793)	Video
2D RC frame cost optimization using plastic hinge; Hyo-Gyoung Kwak, Seonghun KIM* (SM1121_6881)	Video
Development of Modified p-y Curves to Characterize the Lateral Resistance of Helical Piles; Hyeong-Joo Kim, Hyeong-Soo Kim, Tae-Woong Park*, Peter Rey Dinoy, Jun-Young Kim, James Vincent Reyes (SM1113_6936)	Video

TECHNICAL PROGRAM

Dynamic response of tidal turbine blade under impact load; Ilias Gavriilidis*, Yuner Huang (SM1106_6883)	Video
Structural Behavior of the Underground Silo Structure for LILW Disposal Facilities; SUN-HOON KIM*, Kwang-Jin Kim (SM111_7107)	Video
Aeroelastic characteristics of wind turbine with various cross-sectional shape of tower; Yong Chul Kim* (SM1137_6886)	Video
Growing rule in tapered trees under self-weight loading; Tohya Kanahama*, Takanori Fujimura, Motohiro Sato (SM1131_6960)	Video
Structural Reliability Analysis of SFRP-Reinforced Bridge Columns Exposed to Blast Load; Christopher Eamon*, Ahmad Alsendi (SM1102_7106)	Video
Analysis of axially loaded helical piles in sand using HPCap program; Hyeong-Joo Kim, Peter Rey Dinoy*, James Vincent Reyes, Hyeong-Soo Kim, Jun-Young Kim, Tae-Woong Park (SM1126_6937)	Poster

Steel and Composite Structures

Session W3C **10:50-12:20** **Zoom C: 606 231 7007**
Session Title: Behaviour and design of high-performance steel and composite structures (Mini Symposium)
Chairmen: Dongxu Li, Sina Kazemzadeh Azad
Zoom ID: 606 231 7007 PW: 0208 **8/25 Wed**

Cyclic behaviour and modelling of stainless-clad bimetallic steels with various clad ratios; Xinpei Liu*, Huiyong Ban, Juncheng Zhu, Brian Uy (SC2171_6989)	Zoom
Behaviour and design of stainless steel shear connectors in composite beam; Yifan Zhou*, Brian Uy, Jia Wang, Dongxu Li, Xinpei Liu (SC2171_6984)	Zoom
A numerical study on shear response of concrete-filled stainless steel tubes; Sina Kazemzadeh Azad*, Brian Uy (SC2171_6981)	Zoom
Behaviour and design of bolted endplate joints between composite walls and steel beams; Dongxu Li*, Brian Uy, Jun Mo, Huu-Tai Thai, Hau Tran (SC2171_6978)	Zoom
Progressive collapse analysis of stainless steel composite frames with beam-to-column endplate; Jia Wang*, Brian Uy, Dongxu Li, Yuchen Song (SC2171_6985)	Zoom
Ultimate behaviour and rotation capacity of stainless steel end-plate connections; Yuchen Song*, Brian Uy, Dongxu Li, Jia Wang (SC2171_6979)	Zoom

Steel and Composite Structures
(Pre-recorded session)

Numerical estimation for strengthening length of circular RC columns using outer steel tube; Ju-young Hwang*, Hyo-Gyoung Kwak (SC1160_6926)	Video
Analysis approach for composite steel plate shear walls (CSPSW) reinforced with CFRP; Cigdem Avci-Karatas*, Ali Ghamari (SC1156_6801)	Video
Shear strength of ferritic stainless steel channels with web openings; Amir M. Yousefi*, Bijan Samali, Yang Yu (SC1153_7067)	Video
Design of ferritic stainless steel channels with web openings under shear loads; Amir M. Yousefi*, Bijan Samali, Yang Yu (SC1152_7068)	Video

TECHNICAL PROGRAM

Post-fire structural behaviour of high-strength steel flexural members; Jesse Heikkila*, Yuner Huang (SC1153_6975)	Video
Bi-objective optimization of functionally graded beams in a thermal environment; Chih-Ping Wu*, Kuan-Wei Li (SC1151_6797)	Poster

Computational Technologies in Concrete Structures

(Pre-recorded session)

Effect of carbonation curing on the thermal evolution of hydrates in cementitious materials: An overview; Seonhyeok Kim*, Joonho Seo, H.K. Lee (CC1229_6959)	Video
Equivalent static transformation of wave inertia force for FE analysis of SFT; Gyu-Jin Kim*, Hyo-Gyoung Kwak (CC1229_6931)	Video
Temperature profile predicting model for mass concrete; Dong Jin Jeong*, Jae Hong Kim (CC1228_6919)	Video
Blast Analysis of RC Frames using Moment-Curvature Relationship; SeokJun Ju*, Hyo-Gyoung Kwak (CC1222_6882)	Video
A study on the effects of fiber reinforcement on a concrete material model; MinJoo Lee*, Hyo-Gyoung Kwak (CC1214_7128)	Video
Effect of high temperatures on local bond–slip behavior between rebars and UHPC; Chao-Wei Tang* (CC1206_6784)	Video
Matric suction effect of cement based materials on the shape stability of 3D printed concrete; Jin Hyun Lee*, Jae Hong Kim (CC1208_6903)	Video

Smart Structures and Systems

Session W5D **15:00 – 16:30** **Zoom D: 505 231 7007**
Session Title: Advances in Smart Construction Technologies (Mini Symposium)
Chairmen: Sung-Han Sim, Yuanfeng Duan
Zoom ID: 505 231 7007 PW: 0208 **8/25 Wed**

Condition monitoring of asphalt pavement using ground penetrating radar; Junhwa Lee*, Jinwoong Choi, Shin Yooseong, Sung-Han Sim (SS2325_7158)	Zoom
Optimal Framework for Multi-type Concrete Damage Inspection using Mask R-CNN; Soojin Cho*c, Byunghyun Kim (SS2325_7139)	Zoom
Cable damage detection using magnetostrictive transducer-based guided wave method; Xiaodong Sui*, Yuanfeng Duan, Chungbang Yun, Zhifeng Tang (SS2325_7165)	Zoom
Long-Term bearing displacement estimation model using ANN and Bayesian optimization; Ali Turab Asad*, Sung-Han Sim (SS2325_7164)	Zoom
Nontarget-based displacement measurement using LiDAR combined with camera; Sahyeon Lee*, Sung-Han Sim (SS2325_7157)	Zoom
Crack Detection Method for Civil Infrastructures using Unmanned Aerial Vehicles and Feature Pyramid Networks; Wei Ding*, Ke Yu, Jun Li, Jiangpeng Shu (SS2325_7161)	Poster

TECHNICAL PROGRAM

Session H3A	**10:40-12:10**	**Zoom A:808 231 7007**
Smart Technologies for Civil Infrastructure in Industry 4.0 (Mini Symposium)		
Chairmen: Jongwoong Park, Hyung-Jo Jung		
Zoom ID: 808 231 7007 PW: 0208		**8/26 Thr**

Feasibility study of Liquid Column Hollow Ball Damper for Vibration Control of structures; Mati Ullah Shah*, Muhammad Usman (SS2322_7030)	Zoom
A study on the quality enhancement and evaluation of UAV image with Generative Adversarial Network (GAN) Jin-Hwan Lee*, Hyung-Jo Jung (SS1318_6895)	Zoom
Performance improvement of an MRE-based isolator using a multi-layered electromagnetic system; Yongmon Hwnag, Junghoon Lee, Youjin Kim*, Hyung-Jo Jung	Video
Development of cloud-based bridge monitoring system; Jongbin Won*, Junyoung Park, Junsik Shin, Jong-Woong Park (SS2322_7083)	Zoom
Cloud-Database Integrated Low Power Strain Visualization System for Condition Assessment of Civil Structures; Jong-Woong Parkc, Suleman Khan*(SS2322_7082)	Zoom
A novel seismic resilient system for RC continuous bridge with SMA rebars and friction dampers; Nanyi Jian*, Nailiang Xiang, Tetsuya Nonaka (SS1314_6804)	Zoom

Smart Structures and Systems

(Pre-recorded session)

Density evaluation of PU foam covered with a soft layer using a highly nonlinear solitary; Guenil Kim*, Donghee Kim, Eunho Kim (SS1318_6910)	Video
Effect of Plastic Deformation on the Martensitic Transformations in TiNi Alloy; Margarita Evard*, Fedor S. Belyaev, Aleksandr E. Volkov (SS1314_6972)	Video
Assigned Pixel Label-Based Crack Identification in Steel Structures via Encoder-Decoder Network; Quoc Bao Ta*, Ngoc Loi Dang, Quang Quang Pham, Hyeon Dong Kam, Jeong Tae Kim (SS1318_7134)	Video
Digital prediction model of temperature-induced deflection for cable-stayed bridges based on learning of response-only data; Manya Wang*, Youliang Ding, Hanwei Zhao	Video
Vision-based concrete crack detection and classification for condition assessment; Robin Eunju Kim, Eunbyul Koh* (SS1318_6988)	Video
Impedance-based Damage Monitoring in Prestressed Concrete Anchorage via Smart Rebar-Aggregate; Quang Quang Pham*, Ngoc Loi Dang, Quoc Bao Ta, Hyeon Dong Kam, Jeong Tae Kim (SS1318_7132)	Video

TECHNICAL PROGRAM

Earthquakes and Structures

Session T3A **14:20-16:00** **Room A: #515**
Session Title: New Technology in Seismic Resistant Design of Structures (Mini Symposium)
Chairmen: Deuckhang Lee, Donghyuk Jung
Zoom ID: 808 231 7007 PW: 0208 **8/24 Tue**

Cyclic tests of two spans RC frame with wing-type masonry infill walls; Kwang-Won Jo* Hong-Gun Park (ES2372_7121)	onsite
Deep Learning based Automatic Peak Peaking Method for Structural Modal Analysis; Hyungchul Yoon*, Jaehyung Park, Jongwon Jung (ES2372_7022)	onsite
Seismic Safety Evaluation of Base Isolation Devices for Broadcasting and Communications Facilities; Donghyuk Jung, Saebyeok Jeong*, Young-Deuk Seo, Hyoung-Suk Choi (ES2372_7015)	onsite
Seismic performance of precast shear walls with different vertical connection trategies; Wei Zhang*, Deuckhang Lee, Won-Jun Lee (ES2372_7000)	onsite
Effects of diaphragm flexibility on the seismic design acceleration of precast concrete diaphragms; Dichuan Zhang, Robert B. Fleischman, Deuckhang Lee* (ES2372_6991)	Zoom
Review of traditional wooden structure development in Asian countries; Hafshah Salamah*, Thomas Kang (ES2372_6870)	onsite
Cyclic Loading Tests of Precast Frames Strengthened by Post-Tensioning; Jae Hyun Kim*, Seung-Ho Choi, Sun-Jin Han, Hoseong Jeong, Seok-In Lee, Kang Su Kim (ES2372_7027)	Video
Analytical Hybrid Simulation of Precast Concrete Beam Column Connection; Jin-Ha Hwang*, Deuck Hang Lee, Kang Su Kim, Oh-Sung Kwon (ES2372_7025)	Video

Session T3B **14:20-16:00** **Room B: #516**
Session Title: Seismic and Sustainable Behavior of Novel Materials and Structures (Mini Symposium)
Chairmen: Woosuk Kim, Sanghee Kim
Zoom ID: 704 231 7007 PW: 0208 **8/24 Tue**

Non-linear finite analysis of T-type fastening seismic retrofit for RC columns; Do-Yeon Kim*, Il-Young Jang, Seong-Kyum Kim, Hee-Jun Yang (ES2373_6969)	Zoom
Structural safety of flat plate joint reinforced with metal lath bands; Han Suk Sung*, Thomas Kang (ES2373_6857)	onsite
Numerical analysis of dry-stack stone masonry walls subjected to lateral monotonic load; Fahimeh Yavartanoo*, Thomas Kang (ES2373_6927)	onsite
Comparison on fire performance of unbonded post-tensioned one-way slabs depending on tendon types; Siyoung Park*, Thomas Kang (ES2373_6853)	onsite
Reinforcing Materials for Concrete at Cold Temperatures; William Riddell*, Douglas Cleary, Gilson Lomboy, Shahriar Abubakri, Danielle Kennedy, Benjamin Watts (SC1165_7100)	Zoom
FEM simulation of bent wood-CFRP beams; Bartosz Kawecki*, Jerzy Podgórski (SC1156_6934)	Zoom
Performance of cross-linked plastics as aggregates for cement composites through gamma-ray irradiation; Hyeonwook Cheon*, Heonseok Lee, Jamshid Ruziev, Woosuk Kim (ES2373_6929)	Video
Dynamic seismic performance of curtain wall fasteners with displacement absorption; Heonseok Lee*, Myunghwan Oh, Woosuk Kim (ES2373_6927)	Video

TECHNICAL PROGRAM

Concrete Compressive Strength Prediction Using Machine Learning Algorithnm; Keun-Hyeok Yang, Sanghee kim, Jun Ryeol Park* (ES2373_6845)	Video
Seismic performance of masonry wall retrofitted by truss system under In-plane cyclic loading; Hye-Ji Lee*, Seung-Hyeon Hwang, Sanghee Kim, Keun-Hyeok Yang (ES2373_6844)	Video

Session T4A **16:10-18:30** **Room A: #515**
Session Title: Innovative Cementitious Composites for Improved Sustainability and Resilience in Civil Engineering (Mini Symposium)
Chairmen: Klaus Holschemacher, P.L Ng, Deuckhang Lee
Zoom ID: 808 231 7007 PW: 0208 **8/24 Tue**

Investigation on reduction of conventional rebars in UHPFRC nuclear containment structures; Seung Heon Lee*, Thomas Kang (ES2371_6855)	Onsite
Reliability of Shear Strength of Recycled Aggregate Concrete Beams; Meirzhan Yerzhanov, Hyunjin Ju*, Deuckhang Lee, Kang Su Kim (ES2371_7016)	Zoom
Bond mechanism of reinforcing bar in SFRC considering random distributions of aggregates and steel fibers; Wei Zhang*, Deuckhang Lee, Chang-Joon Lee, P. L. Ng (ES2371_6999)	Zoom
Evaluation of self-healing performance in concrete using nonlinear resonance spectroscopy; Hajin Choi*, Ryulri Kim (ES2371_6819)	Onsite
A study on relation between reduced strength and aerodynamic force for inelastic wind design; Hamidreza Alinejad*, Thomas Kang (ES2374_6854)	Onsite
Corrosion in tensile reinforcement and its influence on shear performance of RC members; Sunjin Han*, Deuckhang Lee, Kang Su Kim (ES2371_6994)	Video
Fiber-reinforced alkali-activated cement concrete; Biruk Hailu Tekle*, Ludwig Hertwig, Klaus Holschemacher (ES2371_7071)	Video
Rapid geometrical inspection system for precast bridge slabs using laser scanning; Min-Koo Kim, Fangxin Li*, Jaemin Kim, Sung-Han Sim (ES2371_7077)	Video
Incorporating high volume fly ash and silica fume to improve the mechanical properties of ECC; Yu Zhu, Zhaocai Zhang, P.L. Ng*, Deuckhang Lee (ES2371_7061)	Video
Analytical technique of moment-curvature response of steel fibre-reinforced concrete beams; Gintaris Kaklauskas, P.L. Ng*, Aleksandr Sokolov, Ashkan Shakeri (ES2371_7055)	Video

Session W3B **10:50-12:20** **Room B: #516**
Session Title: Dynamic Effects on Structures Including Seismic Ⅰ (Mini Symposium)
Chairmen: Thomas Kang, Hyeonyeop Shin
Zoom ID: 704 231 7007 PW: 0208 **8/25 Wed**

Proper orthogonal decomposition analysis of wind-induced pressure coefficients with computational fluid dynamics; Min Kyu Kim*, Thomas Kang (ES2374_7091)	Onsite
Cyclic test for shear capacity of cylindrical wall; Hyeon-Keun Yang*, Hong-Gun Park (ES2374_6825)	Zoom
An experimental study on the dynamic shear properties of conjugated isolation systems; Gia Toai Truong*, Seung-Jae Lee, Kyoung-Kyu Choi, Seon Woo Baek, Chang-Soo Kim (ES1351_6820)	Zoom
Prediction of wind pressure coefficients on high-rise building façade using LSTM RNN model for sensor reduction; Sang Min Lee*, Thomas Kang (ES2374_6865)	Onsite
Analytical assessment of two-way out-of-plane bending performance of URM walls; Huan He*, Sander J. H. Meijers (ES1352_6906)	Zoom

TECHNICAL PROGRAM

Evaluation of the Slab Effect of Coupled Wall on Structures of Wall Type Apartment Building; Myung Ho Jeon*, Hong Gun Park, Jong Hoon Kwon, Sung Hyun Kim (ES2374_6846)	Onsite

Session W4B	**13:20-14:50**	**Room B: #516**
Session Title: Dynamic Effects on Structures Including Seismic Ⅱ (Mini Symposium)		
Chairmen: Thomas Kang, Seung Yong Jeong		
Zoom ID: 704 231 7007 PW: 0208		**8/25 Wed**
Drop-weight impact tests of prestressed concrete panels; Seong Ryong Ahn*, Thomas Kang (ES2374_6868)		Onsite
Effect of floor response spectrum generation methods on secondary system fragility; Yousang Lee*, Hong-gun Park, Ju-Hyung Kim (ES2374_6833)		Onsite
Comparison of base isolation systems for reinforced concrete structures with irregularity in plan; Donato Cancellara (ES1351_7094)		Zoom
Seismic vulnerability assessment of freestanding contents using floor response spectrum; Khine Thazin Phyu Kyaw*, Sung-Hyun Jang, Youn-In Chung, Min-Ho Chey (ES1352_6829)		Zoom
Cyclic wind and seismic loading tests of reinforced concrete coupling beams with different amount of transverse reinforcements; Tse-An Chou*, Seung Heon Lee, Thomas Kang (ES2374_6861)		Onsite
Behavior of Wall Boundary Elements under Cyclic Axial Loading; Mok-In Park*, Hong-Gun Park, Ji-Hun Park, Su-Min Kang, Sung-Hyun Kim (ES2374_6858)		Onsite

Session W5B	**15:00-17:00**	**Room B: #516**
Session Title: Dynamic Effects on Structures Including Seismic Ⅲ (Mini Symposium)		
Chairmen: Thomas Kang, Byeonguk Ahn		
Zoom ID: 704 231 7007 PW: 0208		**8/25 Wed**
Study on the ground characteristics of irregularly distributed ground through centrifuge tests; Jin-Young Park*, Hong-Gun Park, Dong-Kwan Kim (ES2374_6826)		Onsite
Experimental Investigation on Flexure Shear Test for Slit Porcelain Panel Cladding with Kerf Connection; Yo-Han Ju*, Su-Min Kang, Jang-Woon Baek, Hee-Do Kim, Hong-Gun Park (ES1368_7126)		Onsite
Dynamic analysis of reinforced concrete structures with hybrid base isolation systems subject to bi-directional ground motions; Donato Cancellara* (ES1351_7095)		Zoom
Comparison of wind pressure on building from CFD analysis and wind tunnel test using dynamic mode decomposition; Han-Sol Lee*, Thomas Kang (ES2374_6859)		Onsite
Correlation of directional wind loads on high-rise buildings with square-shaped plan; Seung Yong Jeong*, Thomas Kang (ES2374_6850)		Onsite
An analytical study on the performance-based wind design considering the corner modification; Byeonguk Ahn*, Hamidreza Alinejad, Thomas Kang (ES2374_6849)		Onsite
Cyclic Loading Test for T-Shaped Coupled Wall Coupled by Slab; JongHoon Kwon*, HongGun Park, Myung Ho Jeon (ES1352_7112)		Onsite
A study on the impact behavior of shear unbonded post tensioned concrete beams under drop weight impact using non-linear finite element modeling methods; Andrew Nghiem*, Thomas Kang (ES2374_6867)		Onsite

TECHNICAL PROGRAM

Session H3B **10:40-12:10** **Room B: #516**
Session Title: Innovative Structural Design and Analysis for Buildings and Infrastructures (Mini Symposium)
Chairmen: Hyeon-Jong Hwang, Jangwoon Baek
Zoom ID: 704 231 7007 PW: 0208 **8/26 Thu**

System for real-time monitoring and controlling of elongation of post-tensioning tendons; Su Hyun Park*, Thomas Kang (ES2375_6866)	Onsite
Shear strength of PC-CIP composite beams with Fixed Ends; Chul-Goo Kim*, Joo-Hyun Jin, Hong-Gun Park (ES2375_6871)	Zoom
Study on shrinkage prediction models and crack formation in post-tensioned slabs; Gabriela Martinez Lara*, Thomas Kang (ES2375_6862)	Onsite
Structural Behavior of Precast Concrete Moment Frames Subject to Progressive Collapse; Fei-Fan Feng*, Hyeon-Jong Hwangc, Wei-Jian Yi (ES2375_6814)	Zoom
Shear behavior of unbonded post-tensioned beam with greased sheathed-strand tendon; Hyeongyeop Shin*, Thomas Kang (ES2375_6851)	Onsite
Bond strength recovery of lap splices in pre-damaged RC beams retrofitted with CFRP; Cheng Wu*, Hyeon-Jong Hwang, Gao Ma (ES2375_6803)	Zoom
Seismic capacity and demand of dimension stone panel cladding with dowel pin connection; Jang-Woon Baek*, Su-Min Kang, Hong-Gun Park (ES2375_6848)	Zoom

Earthquakes and Structures
(Pre-recorded session)

Research on long term variation of natural frequency of KiK-net network site based on frequency domain identification method; Lejun Wei*, Yinfeng Dong, Man Zhang, Hui Tian (ES1357_7059)	Video
Prediction of permanent drift demands for steel framed-buildings under near-fault pulse-like ground motions; Jorge Ruiz-García*, José M. Ramos-Cruz (ES1360_7109)	Video
Seismic performance of nonconforming Mexican school buildings under maishock-aftershock sequences; Jorge Ruiz-García*, Roberto N. Olvera (ES1360_7110)	Video
Amplitude ratios of three-component ground motions; Hui Tian*, Yinfeng Dong, Dong Li, Man Zhang (ES1353_7060)	Poster
Baseline correction method based on Variational Mode Decomposition (VMD); Dong Li*, Yinfeng Dong, Hui Tian, Xu Huang (ES1353_7051)	Poster
Study on the methods to estimate site natural frequency; Man Zhang*, Yinfeng Dong, Hui Tian and Lejun Wei (ES1354_7062)	Poster

TECHNICAL PROGRAM

Tunnels and Underground Spaces

Session W3A	**10:50-12:20**	**Room A: #515**
Session Title: Structural and Hydraulic Interaction in Underground Structures		
Chairman: Ki-Il Song		
Zoom ID: 808 231 7007 PW: 0208		**8/25 Wed**
Experimental Study on Compressive Behavior of PVA Cementitious Composites with CNTs; Dongmin Lee, Seong-Cheol Lee*, Sung-Won Yoo (TS1402_6896)		Zoom
Challenges of EPB TBM in Pressurized Mixed Ground Conditions under Hangang River; Young-Jin Shin*, Sung-Wook Kang, Jae-Won Lee, Dae-Young Kim (TS1403_6918)		Zoom
Dynamic characteristics of submerged floating tunnel affected by shore connection; Joohyun Park*, Seok-Jun Kang, Gye-Chun Cho (TS1405_6957)		Zoom
Research on the development of xanthan gum and clay mixture ground improvement materials; Dong-Yeup Park*, Yeong-Man Kwon, Gye-Chun Cho (TS1404_6946)		Zoom
Numerical Study on Dynamic Response of Submerged Floating Tunnel Depending on Shore Connection; Seok-Jun Kang*, Joohyun Park, Gye-Chun Cho (TS1404_6948)		Zoom
EPB Shield behavior prediction using machine learning regression methods; Wen-Chieh Cheng*[c], Xue-Dong Bai (TS2409_6806)		Zoom

Session W4A	**13:20-14:50**	**Room A: #515**
Session Title: Developments in Underground Space Technologies		
Chairman: Seongwon Hong		
Zoom ID: 808 231 7007 PW: 0208		**8/25 Wed**
Estimation of rock cutting performance of an actuated undercutting mechanism; Yudhidya Wicaksana*, Hoyoung Jeong, Sehun Kim, Seokwon Jeon (TS1401_6970)		Zoom
Case study on cutter head jamming in slurry shield TBM tunneling in highly fractured rock; Ju-Young Oh*, Sang-Do Lee, Ho-Myung Lee, Seok-Woo Nam, Sun-Jae Lee (TS1401_6912)		Zoom
Surface settlement prediction of stacked twin TBM tunnels by various machine-learning techniques; Dongku Kim*, Khanh Pham, Ju-Young Oh, Hangseok Choi (TS1401_7009)		Zoom
Estimation of forces exerted on TBM cutting tools with coupled DEM-FDM numerical analysis; Hyobum Lee*, Junho Kwak, Hangseok Choi (TS1401_7010)		Zoom
Numerical Evaluation of Surface Settlement Induced by Improper Muck Control of EPB Shield TBM; Jun-Beom An*, Gye-Chun Cho **(**TS1401_6914)		Zoom
Application actuality and experimental research on prefabricated corrugated steel utility tunnel (PCSUT); Hongbo Che*, Liyuan Tong (TS1404_6974)		Zoom

Session W5A	**15:00-16:30**	**Room A: #515**
Session Title: Improvements in Conventional Tunneling &Tunneling and Underground Works in Extreme Conditions		
Chairman: Jongwon Jung		
Zoom ID: :808 231 7007 PW: 0208		**8/25 Wed**
Reduction of the uncertainties in the tunnel support definition from geotechnical characterization by means of directional core drilling; Rafael Rodríguez*, Valentín Fernández, Patricia Fernández (TS1402_6837)		Zoom
A study on the digital image-based uniaxial rock strength prediction using Deep Learning and implications for tunnel excavation; Melvin B. Diaz*, Gyung Won Lee, Sang Seob Kim, Joo Yeon Kim, Sang In Lee, Kwang Yeom Kim (TS1404_7042)		Zoom

TECHNICAL PROGRAM

Numerical analysis of abrasive waterjet rock drilling according to the standoff distance; Hyun-Joong Hwang*, Yohan Cha, Tae-Min Oh, Gye-Chun Cho (TS1402_6947)	Zoom
A Study on the Crack Detection Performance for Learning Structure using Super-Resolution; Jin Kim*, Seungbo Shim, Gye-Chun Cho (TS1406_6949)	Zoom
Development of FE model for simulating electrical resistivity survey to predict mixed ground ahead of a tunnel face; Minkyu Kang*, Soojin Kim, JunHo Lee, Hangseok Choi (TS1401_7017)	Zoom
Successful Application of TBM Mechanized Technologies on Goseong Green Power Plant Project; Jerome Ruben Duhme, Thorsten Tatzki*, Jeremy Lee, Jun Won Eom (TS1401_6923)	Zoom
Influence of the cutter disc wearing in the advancing rate and the lineal cost in a tunnel excavated with TBM; Rafael Rodríguez*, Antonio Tosal, Andrés Suárez, María B. Díaz (TS1403_6838)	Zoom

Tunnels and Underground Spaces

(Pre-recorded session)

Assessment of Abrasive Impact Frequency depending on the Traverse Rate in Waterjet Rock Cutting; Yohan Cha*, Ji-Won Kim, Jin-Seop Kim, Seok Yoon, Gye-Chun Cho (TS1404_7127)	Video
Application of the punch shear test to measure adfreeze bond strength of frozen soil-structure interface; Sangyeong Park*, Chaemin Hwang, Hangseok Choi, Youngjin Son, Tae Young Ko (TS1405_7035)	Video
Estimation of Cerchar Abrasivity Index using machine learning based regression; No-Sang Kwak, Tae Young Ko* (TS1401_6952)	Video
Risk assessment criteria by freeze-thaw characteristics of tunnel concrete lining: theoretical analysis and experimental verification; Jai-Wook An*, Joon-Shik Moon, Hong-Kyoon Kim, Jong-Gun Lee, Tim Lattner (TS1406_6879)	Video
A study on Assessment Model of the Performance level for Tunnel in use; Hong-Kyoon Kim*, Jai-Wook An, Joon-Shik Moon, E.Spratberry Michael (TS1406_6877)	Video
A Heaving Phenomenon on Invert Concrete lining in Mountain Tunnels; Shintaro Mochida*, Hisashi Hayashi, Yasuyuki Okazaki, Masato Shinji (TS1404_6907)	Video
An overcome of far-distance limitation on tunnel CCTV-based accident detection in AI deep-learning frameworks; Kyu Beom Lee*, Hyu Soung Shin (TS1404_6913)	Video
Changes in the Engineering Properties of Slag-Cement Bentonite; Taeyeon Kim*, BongJik Lee, Seongwon Hong (TS1404_6995)	Video
Behavior of convex corner in deep cut & cover tunneling; KyuTae Nam, JaeHo Jeong, SeungHyun Kim, KangHyun Kim*, JongHo Shin (TS1403_6955)	Video
A preliminary study on the simulation of a curved TBM excavation; Byungkwan Park*, Soon-Wook Choi, Chulho Lee, Tae-Ho Kang, Seungchul Do, Woon-Yong Lee, Soo-Ho Chang (TS1401_6941)	Video
The Fundamental Study on Penetration Behavior of Biopolymer Solution for Ground reinforcement; Jae Eun Ryou*, Jongwon Jung (TS1406_6887)	Poster
A study on the characteristics of grout materials for the Tunnel Face Penetration Grouting Method; Soo-Kwon Ham, Beom-Ju Kim, Seok-Won Lee* (TS1401_6928)	Poster
Evaluation of seismic behavior of deep underground building structures by numerical analysis; Sun-Yong Kwon, Mintaek Yoo*, Seongwon Hong (TS1405_6982)	Poster

TECHNICAL PROGRAM

Accuracy validation of pin-on-disk type abrasion testing machine for pick cutters; Chang-Heon Song, Joo-Young Oh, Jung-Woo Cho*, Dae-ji Kim, Mun-Gyu Kim, Hoon Kang (TS1401_7018)	Poster
Feasibility analysis of rock cutting-splitting method by scaled model tests; Sang-Min Lee, Dae-ji Kim, Chang-Heon Song, Joo-Young Oh, Jung-Woo Cho*, Mun- Gyu Kim, Sang-Hwa Yu (TS1401_7019)	Poster
Optimization of HJC material parameters of rock splitting mechanism by dynamics simulation; Hoyoung Jeong*, Chang-Heon Song, Sang-Min Lee, Joo-Young Oh, Mun-Gyu Kim, Jung-Woo Cho, Sang-Hwa Yu (TS1401_7020)	Poster
Characteristics of cutting behavior of a pick cutter in hard rock; Hoyoung Jeong*, Jung-Woo Cho, Sang Min Lee (TS1403_7028)	Poster
Reliability analysis of tunnel face stability considering seepage and strength increase with depth; Jun Kyung Park* (TS1404_7036)	Poster
Experimental Study on Anchor Force Derivation of Non-Open Cut Tunnel Concrete Modular Roof Method; Hyuk Sang Jung, Jin Hwan Kim*, Hwan Hee Yoon, Myung Sagong, Hyoung Hoon Lee (TS1402_7102)	Poster
Prediction of Disc Cutter Wear using Shield TBM Excavation Data; Yunhee Kim*, Jiyeon Hong, Jaewoo Shin, Bumjoo Kim (TS1401_6961)	Poster
The Fundamental Study on Penetration Behavior of Biopolymer Solution for Ground reinforcement; Jae Eun Ryou*, Jongwon Jung (TS1406_6887)	Poster
Face stability analysis of a shallow tunnel using coupled Eulerian-Lagrangian technique; Kwangwoo Lee*, Hyunsung Lim, Hyunki Kim, Junyoung Ko (TS1402_6930)	Poster

TECHNICAL PROGRAM

Biomaterials & Biomechanics in Bioengineering

Session W5C **15:00-16:30** **Zoom C: 606 231 7007**
Session Title: Advanced applications of structural analysis Ⅱ
Chairman: Phill-Seung Lee
Zoom ID: 606 231 7007 PW: 0208 **8/25 Wed**

Structural dynamics and hole transfer in B-DNA: combining MD, RT-TDDFT and TB; Marilena Mantela, Andreas Morphis, Konstantinos Lambropoulos, Constantinos Simserides*, Rosa Di Felice (BM1602_6986)	Zoom
Hole Transfer in Open Cumulenic and Polyynic Carbyne Chains; Constantinos Simserides*, Andreas Morphis, Konstantinos Lambropoulos (BM1663_6889)	Zoom

Advances in Robotics Research

Session W3D **10:50 - 12:20** **Zoom D: 505 231 7007**
Session Title: Recent Advances in Intelligent Robots, Sensors and Systems (Mini Symposium)
Chairmen: Hyun Myung, Anwar Bin P.P Abdul Majeed
Zoom ID: 505 231 7007 PW: 0208 **8/25 Wed**

Data-Driven Control Design with LMIs and Dynamic Programming; Donghwan Lee* (RR2730_6987)	Zoom
Solving Geometric Constraints for Relative Position Estimation using UWB Sensors in Multi-Robot System; Junho Choi*, Eungchang Lee, Sungjae Shin, Hyun Myung (RR2730_6983)	Zoom
The Classification of Wafer Defects: A Support Vector Machine with different ResNet transfer learning models evaluation; Anwar P.P. Abdul Majeed* (RR2730_6997)	Zoom
Development of an Exoskeleton based on Twisted String Actuator to Prevent Back Injuries; Hyeonseok Seong*, Shubhranil Sengupta, Donghyeon Lee, Jee-Hwan Ryu (RR2730_6996)	Zoom
Interaction control of under-actuated UAV capable of exerting downward force; Jinyeong Jeong*, Min Jun Kim (RR2730_7011)	Poster
Extrinsic Calibration of LiDAR and Camera using Multiple Traffic Signs; Wonho Song*, Changki Sung, Euigon Jung, Minho Oh, Hyun Myung (RR2730_7072)	Poster

Advances in Energy Research

A Study on Application of Membrane Distillation for Recovery of VFA and Water Reuse; Bo-Ra Shin*, Min-Kyung Kim, Hee-Jin Jang, Seo-Yeon Park, Ji-Soo Lim, Jin-Woo Cho (ER1759_6935)	Poster

TECHNICAL PROGRAM

Composite Materials and Engineering

Laboratory mechanical properties evaluation of the PP modified bituminous material and asphalt with different mixing method; Ho-Fai Wong, Tsz Chun Chan* Tak Yiu Hung, Kai Chiu Zhu (CM1785_6905)	Poster
Laboratory performance comparison of the PP modified bitumen with different additives; Ho-Fai Wong, Tsz Chun Chan*, Tak Yiu Hung, Kai Chiu Zhu (CM1789_6899)	Poster
High-fidelity Reconstruction Algorithm for Modeling of Sheet Molding Compound (SMC) Composites; Hyoung Jun Lim*, Hoil Choi, Sang-Jae Yoon, Sang Won Lim, Chi-Hoon Choi, Gun Jin Yun (CM1781_7171)	Poster
Development of Multi-scale homogenization method for viscoelastic composites of carbon black filled rubber; Jiwon Jung, Hangil You, and Gun-jin Yun	Poster
Characteristics of compressive strength according to the content of fine aggregate replacement beads; Jung Yun Kim*, Young Sook Roh (CM1781_7131)	Poster

TECHNICAL PROGRAM

Poster Q&A Session

*Poster session participants are required to share their posters at the designated time via Zoom.
*Please upload your posters on Zoom sessions at the given time to proceed with Q&A with other participants during the session.
*You may participate in other live sessions with your paper ID.

Zoom D: 505 231 7007 PW: 0208 **8/24(Tue)14:00-18:30 (KST/GMT+9)**

Characteristics of compressive strength according to the content of fine aggregate replacement beads; Jung Yun Kim*, Young Sook Roh	**14:20-14:35**
Interaction control of under-actuated UAV capable of exerting downward force; Jinyeong Jeong*, Min Jun Kim	**14:35-14:50**
Face stability analysis of a shallow tunnel using coupled Eulerian-Lagrangian technique; Kwangwoo Lee*, Hyunsung Lim, Hyunki Kim, Junyoung Ko	**14:50-15:05**
Amplitude ratios of three-component ground motions; Hui Tian*, Yinfeng Dong, Dong Li, Man Zhang	**15:05-15:20**
A Study on Application of Membrane Distillation for Recovery of VFA and Water Reuse; Bo-Ra Shin*, Min-Kyung Kim, Hee-Jin Jang, Seo-Yeon Park, Ji-Soo Lim, Jin-Woo Cho	**15:20-15:35**
Bi-objective optimization of functionally graded beams in a thermal environment; Chih-Ping Wu*, Kuan-Wei Li	**15:35-15:50**
Analysis of axially loaded helical piles in sand using HPCap program; Hyeong-Joo Kim, Peter Rey Dinoy*, James Vincent Reyes, Hyeong-Soo Kim, Jun-Young Kim, Tae-Woong Park	**15:50-16:05**
Break Time	
The Fundamental Study on Penetration Behavior of Biopolymer Solution for Ground reinforcement; Jae Eun Ryou*, Jongwon Jung	**16:15-16:30**
Characteristics of cutting behavior of a pick cutter in hard rock; Hoyoung Jeong*, Jung-Woo Cho, Sang Min Lee	**16:30-16:45**
Optimization of HJC material parameters of rock splitting mechanism by dynamics simulation; Hoyoung Jeong*, Chang-Heon Song, Sang-Min Lee, Joo-Young Oh, Mun-Gyu Kim, Jung-Woo Cho, Sang-Hwa Yu	**16:45-17:00**
Accuracy validation of pin-on-disk type abrasion testing machine for pick cutters; Chang-Heon Song, Joo-Young Oh, Jung-Woo Cho*, Dae-ji Kim, Mun-Gyu Kim, Hoon Kan	**17:00-17:15**
Characteristics of grout materials for the face grouting in mechanized tunnelling; Soo-Kwon Ham, Beom-Ju Kim, Seok-Won Lee*	**17:15-17:30**
Feasibility analysis of rock cutting-splitting method by scaled model tests; Sang-Min Lee, Dae-ji Kim, Chang-Heon Song, Joo-Young Oh, Jung-Woo Cho*, Mun-Gyu Kim, Sang-Hwa Yu	**17:30-17:45**
Experimental Study on Anchor Force Derivation of Non-Open Cut Tunnel Concrete Modular Roof Method; Hyuk Sang Jung, Jin Hwan Kim*, Hwan Hee Yoon, Myung Sagong, Hyoung Hoon Lee	**17:45-18:00**
Laboratory mechanical properties evaluation of the PP modified bituminous material and asphalt with different mixing method; Ho-Fai Wong, Tsz Chun Chan* Tak Yiu Hung, Kai Chiu Zhu (CM1785_6905)	**18:00-18:15**
Characteristics of compressive strength according to the content of fine aggregate replacement beads; Jung Yun Kim*, Young Sook Roh (CM1781_7131)	**18:15-18:30**
Research on long term variation of natural frequency of KiK-net network site based on frequency domain identification method; Lejun Wei*, Yinfeng Dong, Man Zhang, Hui Tian (ES1357_7059)	**18:30-18:45**

TECHNICAL PROGRAM

Poster Q&A Session

*Poster session participants are required to share their posters at the designated time via Zoom.
*Please upload your posters on Zoom sessions at the given time to proceed with Q&A with other participants during the session.
*You may participate in other live sessions with your paper ID.

Zoom ID: 505 231 7007 PW: 0208 **8/25(Wed)13:00-15:00 (KST/GMT+9)**

Evaluation of seismic behavior of deep underground building structures by numerical analysis; Sun-Yong Kwon, Mintaek Yoo*, Seongwon Hong (TS1405_6982)	**13:20-13:35**
Prediction of Disc Cutter Wear using Shield TBM Excavation Data; Yunhee Kim*, Jiyeon Hong, Jaewoo Shin, Bumjoo Kim (TS1401_6961)	**13:35-13:50**
Reliability analysis of tunnel face stability considering seepage and strength increase with depth; Jun Kyung Park* (TS1404_7036)	**13:50-14:15**
Extrinsic Calibration of LiDAR and Camera using Multiple Traffic Signs; Wonho Song*, Changki Sung, Euigon Jung, Minho Oh, Hyun Myung (RR2730_7072)	**14:15-14:30**
Laboratory performance comparison of the PP modified bitumen with different additives; Ho-Fai Wong, Tsz Chun Chan*, Tak Yiu Hung, Kai Chiu Zhu (CM1789_6899)	**14:30-14:45**

The 2021 World Congress on Advances in Structural Engineering & Mechanics

Proceedings

KEYNOTE PAPERS

Topology optimization-based bone microstructure reconstruction from CT scan data

In Gwun Jang (Korea)

(publication_conf/asem21/Keynote/Full Paper/Full Paper_In Gwun Jang.pdf)

Global factor method for safe non-linear analyses

Giorgio Monti (Italy)

(publication_conf/asem21/Keynote/Abstract/Monti.pdf)

Machine learning based design of composite structures

Seung Hwa Ryu (Korea)

(publication_conf/asem21/Keynote/Abstract/Seunghwa Ryu.pdf)

Applications, behaviour and design of high performance steel and composite structures

Brian Uy (Australia)

(publication_conf/asem21/Keynote/Abstract/BrianUy_Keynote Abstract.pdf)

Latest developments in shield TBM selections & design for mechanized tunnelling

Jeremy Lee (Korea)
(publication_conf/asem21/Keynote/Full Paper/Jeremy Lee_Keynote Paper ICTUS 2021.pdf)

Performance-based seismic assessment of slab-column frames
Mary Beth Hueste (USA)
(publication_conf/asem21/Keynote/Full Paper/F_Hueste ICEAS21.pdf)

Recent developments towards Autonomous Tunneling and Mining Machinery
Thomas Peinsitt (Austria)
(publication_conf/asem21/Keynote/Abstract/Abstract SKR conference_Sandvik.pdf)

Seismic resistance of precast and prefabricated structures with pure dry connections
Thomas Kang (Korea)
(publication_conf/asem21/Keynote/Abstract/Thomas Kang.pdf)

Machine learning-based structural health monitoring
Hui Li (China)
(publication_conf/asem21/Keynote/Abstract/Hui Li.pdf)

Review of ASCE-41 acceptance criteria for performance-based assessment of existing steel frame buildings
Sashi Kunnath (USA)
(publication_conf/asem21/Keynote/Abstract/Kunnath.pdf)

On the application of deep learning in the finite element method
Phill-Seung Lee (Korea)
(publication_conf/asem21/Keynote/Abstract/Phil-Seung Lee.pdf)

Research and application of TBM safe, efficient and intelligent tunneling technology
Pengyu Li (China)
(publication_conf/asem21/Keynote/Full Paper/LI Peng-yu_Keynote Paper.pdf)

Participating International Conferences

The 2021 Int. Conf. on Innovative Structural Engineering and Mechanics (ISEM21)

The 2021 Int. Conf. on Steel and Composite Structures (ICSCS21)

The 2021 Int. Conf. on Computational Technologies in Concrete Structures (ICTCS21)

The 2021 Int. Conf. on Smart Structures and Systems (ICSSS21)

The 2021 Int. Conf. on Earthquakes and Structures (ICEAS21)

The 2021 Int. Conf. on Tunnels and Underground Spaces (ICTUS21)

The 2021 International Conference on Innovative Structural Engineering and Mechanics (ISEM21)

SESSION T3C
Machine Learning Based Design of Materials and Structures (Mini Symposium)

Chairman: Seunghwa Ryu

ATHENA: A software suite for Wireframe Scaffold DNA Origami

*Abhishek Dewangan, Minh-Chien Trinh, Hyungmin Jun**

Optimal Designs of Body-Centered Truss Structures using Machine Learning and Additive Manufacturing

Sangryun Lee, Zhizhou Zhang, Grace Gu*

(publication_conf/asem21/1.SM/1. T3C/2. SM2147_7115A.pdf)

Deep Learning Framework for Material Design Space Exploration using Active Transfer Learning

Yongtae Kim, Youngsoo Kim, Charles Yang, Kundo Park, Grace X Gu, Seunghwa Ryu*

(publication_conf/asem21/1.SM/1. T3C/3. SM2147_7147A.pdf)

Materials by Design: Using Deep Generative Model

*Bor-Yann Tseng, Chi-Hua Yu**

(publication_conf/asem21/1.SM/1. T3C/4. SM2147_7135A.pdf)

In silico investigation of cellular composites inspired by Liquidambar formosana

Yuan Chiang, Shu-Wei Chang (SM2147_7125)*

(publication_conf/asem21/1.SM/1. T3C/5. SM2147_7125A.pdf)

Bayesian-Optimization-Guided Coarse-Grained Molecular Dynamics for Polymer Electrolyte Design

Yanming Wang, Tian Xie, Arthur France-Lanord, Arthur Berkley, Jeremiah A. Johnson, Yang Shao-Horn, Jeffrey C. Grossma*

(publication_conf/asem21/1.SM/1. T3C/6. SM2147_7124A.pdf)

SESSION T4B
AI-infused topology optimization and its application (Mini Symposium)

Chairman: Namwoo Kang

Patchwise bone microstructure reconstruction

Bong Ju Chun, Sang Min Sin, In Gwun Jang*

(publication_conf/asem21/1.SM/2. T4B/1. SM2144_7133.pdf)

Machine Learning-based Topology Optimization: A Review

Seungyeon Shin, Dongju Shin, Minyoung Kim, Hanyoung Ryu, Namwoo Kang*

(publication_conf/asem21/1.SM/2. T4B/2. SM2144_7130.pdf)

How to Trade off Aesthetics and Performance in Generative Design?

Dongju Shin, Soyoung Yoo, Sunghee Lee, Minyoung Kim, Kwang Hyeon Hwang, Jong Ho Park, Namwoo Kang*

(publication_conf/asem21/1.SM/2. T4B/3. SM2144_7129.pdf)

Matlab code for topology optimization in arbitrary 3D domains

Yonghwa Ji,Dongjin Kim, Jaewook Lee*

(publication_conf/asem21/1.SM/2. T4B/4. SM2144_7150A.pdf)

Physics informed neural network for topology optimization

Dongjin Kim+, Jaewook Lee*

(publication_conf/asem21/1.SM/2. T4B/5. SM2144_7119A.pdf)

Integrated framework for efficient topology optimization using the convolutional LSTM network

Younghwan Joo, Yonggyun Yu, In Gwun Jang*

(publication_conf/asem21/1.SM/2. T4B/6. SM2144_7111.pdf)

SESSION W4C
Advanced applications of structural analysis - I

Chairman: Phill-Seung Lee

Fire rating of anchor channels and channel bolts

*Christoph Mahrenholtz, Kaipei Tian**

(publication_conf/asem21/1.SM/3. W4C/1. SM1138_6799.pdf)

Comparative analysis of deployable and reconfigurable rigid-bar linkage systems

Niki Georgiou, Marios C. Phocas*

(publication_conf/asem21/1.SM/3. W4C/2. SM1138_6790.pdf)

On flow laws and constitutive relations in non-smooth elastoplasticity

Fabio De Angelis, Simona De Cicco*

(publication_conf/asem21/1.SM/3. W4C/3. SM1131_6938.pdf)

A finite element analysis of a laboratory drilling equipment

Aurelian Iamandei, Razvan Ripeanu, Lavinia Stanciu, Ioan Popa, Serban Vasilescu*

(publication_conf/asem21/1.SM/3. W4C/4. SM1109_6807.pdf)

Numerical studies for stress loss on NiTi arch-wire in long term during orthodontic treatment

Heesun Kim, Yeonju Chun, Heeju Son, Jaesun Kwon*

(publication_conf/asem21/1.SM/3. W4C/5. SM1101_6951.pdf)

SESSION W5C
Advanced applications of structural analysis II

Chairman: Phill-Seung Lee

Shape adaptation of a hybrid bending-active gridshell through cables activation

Ioanna Anastasiadou, Marios C. Phocas*

(publication_conf/asem21/1.SM/4. W5C/1. SM1104_6798.pdf)

Stress concentration effects in chiral Cosserat elastic plates

Simona De Cicco, Fabio De Angelis*

(publication_conf/asem21/1.SM/4. W5C/2. SM1124_6940.pdf)

Shear strength prediction of concentric and eccentric reinforced concrete beam-column joints

Ho Fai Wong, Ying Liu, Wai Yin Poon, Hoi Hin Mo, Tsz Kin Fung*

(publication_conf/asem21/1.SM/4. W5C/3. SM1123_6898.pdf)

Structural dynamics and hole transfer in B-DNA: combining MD, RT-TDDFT and TB

Marilena Mantela, Andreas Morphis, Konstantinos Lambropoulos, Constantinos Simserides, Rosa Di Felice*

(publication_conf/asem21/1.SM/4. W5C/4. BM1602_6986A.pdf)

Simulation of the Griffith's crack using own method of predicting the crack propagation

Jakub Gontarz, Jerzy Podgorski*

(publication_conf/asem21/1.SM/4. W5C/5. CC1215_7058.pdf)

Hole Transfer in Open Cumulenic and Polyynic Carbyne Chains

Constantinos Simserides, Andreas Morphis, Konstantinos Lambropoulos*

(publication_conf/asem21/1.SM/4. W5C/6. BM1663_6889.pdf)

Structural Engineering and Mechanics (Pre-recorded session)

A case study of slope failure in central Trinidad due to water pipe leakage

Kyung Ho Park, Neil Beeraspat* video

(publication_conf/asem21/1.SM/5. SEM Pre-recorded session/1. SM1134_6794.pdf)

Non-matching mesh treatment in hydro-elastic analysis of floating structures

Moonsu Park, Phill-Seung Lee* video

(publication_conf/asem21/1.SM/5. SEM Pre-recorded session/2. SM2133_7084.pdf)

Generalisation for thunderstorm downburst wind design spectra

Jing Song, Pedro Martinez-Vazquez, Konstantinos A. Skalomenos* video

(publication_conf/asem21/1.SM/5. SEM Pre-recorded session/3. SM1129_7056.pdf)

A density correction method for smoothed particle hydrodynamics

Hyun-Duk Seo, Hyung-Jun Park, Phill-Seung Lee* video

(publication_conf/asem21/1.SM/5. SEM Pre-recorded session/4. SM2133_7142.pdf)

Optimization of annular cavity dimensions in the circular jet burner to the enhancement of flame stability

Abhishek Dewangan, Hyungmin Jun* video

(publication_conf/asem21/1.SM/5. SEM Pre-recorded session/5. SM2133_7154.pdf)

Elastic properties of lattice-like 2D materials using continuum mechanics

Minh-Chien Trinh, Hyungmin Jun* video

(publication_conf/asem21/1.SM/5. SEM Pre-recorded session/6. SM2133_7155.pdf)

Design optimization of two-way post-tensioned concrete slab using simulated annealing algorithm

*Adisorn Owatsiriwong, Pison Udomworarat, Kyung Ho Park** video

(publication_conf/asem21/1.SM/5. SEM Pre-recorded session/7. SM1121_6793.pdf)

2D RC frame cost optimization using plastic hinge

*Hyo-Gyoung Kwak, Seonghun Kim** video

(publication_conf/asem21/1.SM/5. SEM Pre-recorded session/8. SM1121_6881.pdf)

Development of Modified p-y Curves to Characterize the Lateral Resistance of Helical Piles

Hyeong-Joo Kim, Hyeong-Soo Kim, Tae-Woong Park, Peter Rey Dinoy, Jun-Young Kim, James Vincent Reyes* video

(publication_conf/asem21/1.SM/5. SEM Pre-recorded session/9. SM1113_6936.pdf)

Dynamic response of tidal turbine blade under impact load

Ilias Gavriilidis, Yuner Huang*

(publication_conf/asem21/1.SM/5. SEM Pre-recorded session/10. SM1106_6883.pdf)

Structural Behavior of the Underground Silo Structure for LILW Disposal Facilities

Sunhoon Kim, Kwang-Jin Kim* video

(publication_conf/asem21/1.SM/5. SEM Pre-recorded session/11. SM1131_7107.pdf)

Aeroelastic characteristics of wind turbine with various cross-sectional shape of tower

*Yong Chul Kim** video

(publication_conf/asem21/1.SM/5. SEM Pre-recorded session/12. SM1137_6886.pdf)

Growing rule in tapered trees under self-weight loading

Tohya Kanahama, Takanori Fujimura, Motohiro Sato* video

(publication_conf/asem21/1.SM/5. SEM Pre-recorded session/13. SM1131_6960.pdf)

Structural Reliability Analysis of SFRP-Reinforced Bridge Columns Exposed to Blast Load

Christopher Eamon, Ahmad Alsendi* video

(publication_conf/asem21/1.SM/5. SEM Pre-recorded session/14. SM1102_7106.pdf)

Analysis of axially loaded helical piles in sand using HPCap program

Hyeong-Joo Kim, Peter Rey Dinoy, James Vincent Reyes, Hyeong-Soo Kim, Jun-Young Kim, Tae-Woong Park*

(publication_conf/asem21/1.SM/5. SEM Pre-recorded session/15. SM1126_6937.pdf)

The 2021 International Conference on Steel and Composite Structures (ICSCS21)

SESSION W3C
Behaviour and design of high-performance steel and composite structures (Mini Symposium)

Chairman: Dongxu Li and Sina Kazemzadeh Azad

Cyclic behaviour and modelling of stainless-clad bimetallic steels with various clad ratios

Xinpei Liu, Huiyong Ban, Juncheng Zhu, Brian Uy*

(publication_conf/asem21/2.SC/1. W3C/1. SC2171_6989A.pdf)

Behaviour and design of stainless steel shear connectors in composite beam

Yifan Zhou, Brian Uy, Jia Wang, Dongxu Li, Xinpei Liu*

(publication_conf/asem21/2.SC/1. W3C/2. SC2171_6984A.pdf)

Progressive collapse analysis of stainless steel composite frames with beam-to-column endplate

Jia Wang, Brian Uy, Dongxu Li, Yuchen Song*

(publication_conf/asem21/2.SC/1. W3C/5. SC2171_6985A.pdf)

Ultimate behaviour and rotation capacity of stainless steel end-plate connections

Yuchen Song, Brian Uy, Dongxu Li, Jia Wang*

(publication_conf/asem21/2.SC/1. W3C/6. SC2171_6979A.pdf)

Steel and Composite Structures (Pre-recorded session)

Numerical estimation for strengthening length of circular RC columns using outer steel tube

Ju-young Hwang, Hyo-Gyoung Kwak* video

(publication_conf/asem21/2.SC/2. SCS Pre-recorded session/1. SC1160_6926.pdf)

Analysis approach for composite steel plate shear walls (CSPSW) reinforced with CFRP

Cigdem Avci-Karatas, Ali Ghamari* video

(publication_conf/asem21/2.SC/2. SCS Pre-recorded session/2. SC1156_6801.pdf)

Shear strength of ferritic stainless steel channels with web openings

Amir M. Yousefi, Bijan Samali, Yang Yu*

(publication_conf/asem21/2.SC/2. SCS Pre-recorded session/3. SC1153_7067.pdf)

Design of ferritic stainless steel channels with web openings under shear loads

Amir M. Yousefi, Bijan Samali, Yang Yu*

(publication_conf/asem21/2.SC/2. SCS Pre-recorded session/4. SC1152_7068.pdf)

Post-fire structural behaviour of high-strength steel flexural members

Jesse Heikkila, Yuner Huang* video

(publication_conf/asem21/3.CC/2. SCS Pre-recorded session/6. SC1153_6975.pdf)

Bi-objective optimization of functionally graded beams in a thermal environment

Chih-Ping Wu, Kuan-Wei Li* poster

(publication_conf/asem21/2.SC/2. SCS Pre-recorded session/5. SC1151_6797.pdf)

Finite Element Analysis of Steel Deep Beam-to-Column Connections with Web Opening

Sun-hoon Kim, Keunyeong Oh, Chang-hoon Knag, Kangmin Lee* video

(publication_conf/asem21/2.SC/2. SCS Pre-recorded session/7. SC1157_6830.pdf)

The 2021 International Conference on Computational Technologies in Concrete Structures (ICTCS21)

Steel and Composite Structures (Pre-recorded session)

Effect of carbonation curing on the thermal evolution of hydrates in cementitious materials: An overview

Seonhyeok Kim, Joonho Seo, H.K. Lee*

(publication_conf/asem21/3.CC/1. CCS Pre-recorded session/1. CC1229_6959A.pdf)

Equivalent static transformation of wave inertia force for FE analysis of SFT

Gyu-Jin Kim, Hyo-Gyoung Kwak* video

(publication_conf/asem21/3.CC/1. CCS Pre-recorded session/2. CC1229_6931.pdf)

Temperature profile predicting model for mass concrete

Dong Jin Jeong, Jae Hong Kim* video

(publication_conf/asem21/3.CC/1. CCS Pre-recorded session/3. CC1228_6919A.pdf)

Blast Analysis of RC Frames using Moment-Curvature Relationship

SeokJun Ju, Hyo-Gyoung Kwak* video

(publication_conf/asem21/3.CC/1. CCS Pre-recorded session/4. CC1222_6882.pdf)

A study on the effects of fiber reinforcement on a concrete material model

MinJoo Lee, Hyo-Gyoung Kwak* video

(publication_conf/asem21/3.CC/1. CCS Pre-recorded session/5. CC1214_7128.pdf)

Effect of high temperatures on local bond?slip behavior between rebars and UHPC

*Chao-Wei Tang**

(publication_conf/asem21/3.CC/1. CCS Pre-recorded session/6. CC1206_6784.pdf)

Matric suction effect of cement based materials on the shape stability of 3D printed concrete

Jin Hyun Lee, Jae Hong Kim* video

(publication_conf/asem21/3.CC/1. CCS Pre-recorded session/7. CC1208_6903A.pdf)

The 2021 International Conference on Smart Structures and System (ICSSS21)

CONTRIBUTED PAPERS

SESSION W5D
Advances in Smart Construction Technologies

Chairman: Sung-Han Sim, Yuanfeng

Condition monitoring of asphalt pavement using ground penetrating radar

Junhwa Lee, Jinwoong Choi, Shin Yooseong, Sung-Han Sim*

(publication_conf/asem21/4.SS/1. W5D/1. SS2325_7158A.pdf)

Optimal Framework for Multi-type Concrete Damage Inspection using Mask R-CNN

*Soojin Cho*c, Byunghyun Kim*

(publication_conf/asem21/4.SS/1. W5D/2. SS2325_7139A.pdf)

Cable damage detection using magnetostrictive transducer-based guided wave method

Xiaodong Sui, Yuanfeng Duan, Chungbang Yun, Zhifeng Tang*
(publication_conf/asem21/4.SS/1. W5D/3. SS2325_7165A.pdf)

Long-Term bearing displacement estimation model using ANN and Bayesian optimization
Ali Turab Asad, Sung-Han Sim*
(publication_conf/asem21/4.SS/1. W5D/4. SS2325_7164A.pdf)

Nontarget-based displacement measurement using LiDAR combined with camera
Sahyeon Lee, Sung-Han Sim*
(publication_conf/asem21/4.SS/1. W5D/5. SS2325_7157A.pdf)

Crack Detection Method for Civil Infrastructures using Unmanned Aerial Vehicles and Feature Pyramid Networks
Wei Ding, Ke Yu, Jun Li, Jiangpeng Shu*
(publication_conf/asem21/4.SS/1. W5D/6. SS2325_7161A.pdf)

SESSION H3A
Smart Technologies for Civil Infrastructure in Industry 4.0
Chairman: Jongwoong Park, Hyung-Jo Jung

Feasibility study of Liquid Column Hollow Ball Damper for Vibration Control of structures
Mati Ullah Shah, Muhammad Usman*
(publication_conf/asem21/4.SS/2. H3A/1. SS2322_7030.pdf)

A study on the quality enhancement and evaluation of UAV image with Generative Adversarial Network (GAN)
Jin-Hwan Lee, Hyung-Jo Jung*
(publication_conf/asem21/4.SS/2. H3A/2. SS1318_6895.pdf)

Performance improvement of an MRE-based isolator using a multi-layered electromagnetic system
Yongmon Hwnag, Junghoon Lee, Youjin Kim, Hyung-Jo Jung* *video*
(publication_conf/asem21/4.SS/2. H3A/3. SS1315_6892A.pdf)

Development of cloud-based bridge monitoring system

Jongbin Won, Junyoung Park, Junsik Shin, Jong-Woong Park*

(publication_conf/asem21/4.SS/2. H3A/4. SS2322_7083A.pdf)

Cloud-Database Integrated Low Power Strain Visualization System for Condition Assessment of Civil Structures

*Jong-Woong Park, Suleman Khan**

(publication_conf/asem21/4.SS/2. H3A/5. SS2322_7082A.pdf)

A novel seismic resilient system for RC continuous bridge with SMA rebars and friction dampers

Nanyi Jian, Nailiang Xiang, Tetsuya Nonaka*

(publication_conf/asem21/4.SS/2. H3A/6. SS1314_6804.pdf)

Smart Structures and System (Pre-recorded session)

Density evaluation of PU foam covered with a soft layer using a highly nonlinear solitary

Guenil Kim, Donghee Kim, Eunho Kim* video

(publication_conf/asem21/4.SS/3. SSS Pre-recorded session/1. SS1318_6910.pdf)

Effect of Plastic Deformation on the Martensitic Transformations in TiNi Alloy

Margarita Evard, Fedor S. Belyaev, Aleksandr E. Volkov* video

(publication_conf/asem21/4.SS/3. SSS Pre-recorded session/2. SS1314_6972.pdf)

Assigned Pixel Label-Based Crack Identification in Steel Structures via Encoder-Decoder Network

Quoc Bao Ta, Ngoc Loi Dang, Quang Quang Pham, Hyeon Dong Kam, Jeong Tae Kim* video

(publication_conf/asem21/4.SS/3. SSS Pre-recorded session/3. SS1318_7134A.pdf)

Digital prediction model of temperature-induced deflection for cable-stayed bridges based on learning of response-only data

Manya Wang, Youliang Ding, Hanwei Zhao*

(publication_conf/asem21/4.SS/3. SSS Pre-recorded session/4. SS1313_7146.pdf)

Vision-based concrete crack detection and classification for condition assessment

*Eunju Kim, Eunbyul Koh** video

(publication_conf/asem21/4.SS/3. SSS Pre-recorded session/5. SS1318_6988.pdf)

Impedance-based Damage Monitoring in Prestressed Concrete Anchorage via Smart Rebar-Aggregate

Quang Quang Pham, Ngoc Loi Dang, Quoc Bao Ta, Hyeon Dong Kam, Jeong Tae Kim* video

(publication_conf/asem21/4.SS/3. SSS Pre-recorded session/6. SS1318_7132.pdf)

The 2021 International Conference on Earthquakes and Structures (ICEAS21)

CONTRIBUTED PAPERS

SESSION T3A
New Technology in Seismic Resistant Design of Structures (Mini Symposium)

Chairman: Deuckhang Lee and Donghyuk Jung

Cyclic tests of two spans RC frame with wing-type masonry infill walls

Kwang-Won Jo Hong-Gun Park*

(publication_conf/asem21/5.ES/1. T3A/1. ES2372_7121.pdf)

Deep Learning based Automatic Peak Peaking Method for Structural Modal Analysis

Hyungchul Yoon, Jaehyung Park, Jongwon Jung*

(publication_conf/asem21/5.ES/1. T3A/2. ES2372_7022A.pdf)

Seismic Safety Evaluation of Base Isolation Devices for Broadcasting and Communications Facilities

Donghyuk Jung, Saebyeok Jeong, Young-Deuk Seo, Hyoung-Suk Choi* video

(publication_conf/asem21/5.ES/1. T3A/3. ES2372_7015A.pdf)

Seismic performance of precast shear walls with different vertical connection trategies

Wei Zhang, Deuckhang Lee, Won-Jun Lee*

(publication_conf/asem21/5.ES/1. T3A/4. ES2372_7000.pdf)

Effects of diaphragm flexibility on the seismic design acceleration of precast concrete diaphragms

*Dichuan Zhang, Robert B. Fleischman, Deuckhang Lee**

(publication_conf/asem21/5.ES/1. T3A/5. ES2372_6991.pdf)

Review of traditional wooden structure development in Asian countries

Hafshah Salamah, Thomas Kang*

(publication_conf/asem21/5.ES/1. T3A/6. ES2372_6870A.pdf)

Cyclic Loading Tests of Precast Frames Strengthened by Post-Tensioning

Jae Hyun Kim, Seung-Ho Choi, Sun-Jin Han, Hoseong Jeong, Seok-In Lee, Kang Su Kim* video

(publication_conf/asem21/5.ES/1. T3A/7. ES2372_7027.pdf)

Analytical Hybrid Simulation of Precast Concrete Beam Column Connection

Jin-Ha Hwang, Deuck Hang Lee, Kang Su Kim, Oh-Sung Kwon*

(publication_conf/asem21/5.ES/1. T3A/8. ES2372_7025.pdf)

SESSION T3B
Seismic and Sustainable Behavior of Novel Materials and Structures (Mini symposium)

Chairman: Woosuk Kim and Sanghee Kim

Non-linear finite analysis of T-type fastening seismic retrofit for RC columns

Do-Yeon Kim, Il-Young Jang, Seong-Kyum Kim, Hee-Jun Yang*
(publication_conf/asem21/5.ES/2. T3B/1. ES2373_6969.pdf)

Structural safety of flat plate joint reinforced with metal lath bands
Han Suk Sung, Thomas Kang*
(publication_conf/asem21/5.ES/2. T3B/2. ES2373_6857.pdf)

Numerical analysis of dry-stack stone masonry walls subjected to lateral monotonic load
Fahimeh Yavartanoo, Thomas Kang*
(publication_conf/asem21/5.ES/2. T3B/3. ES2373_6860A.pdf)

Comparison on fire performance of unbonded post-tensioned one-way slabs depending on tendon types
Siyoung Park, Thomas Kang*
(publication_conf/asem21/5.ES/2. T3B/4. ES2373_6853.pdf)

Reinforcing Materials for Concrete at Cold Temperatures
William Riddell, Douglas Cleary, Gilson Lomboy, Shahriar Abubakri, Danielle Kennedy, Benjamin Watts*
(publication_conf/asem21/5.ES/2. T3B/5. SC1165_7100.pdf)

FEM simulation of bent wood-CFRP beams
Bartosz Kawecki, Jerzy Podgorski*
(publication_conf/asem21/5.ES/2. T3B/6. SC1156_6934.pdf)

Performance of cross-linked plastics as aggregates for cement composites through gamma-ray irradiation
Hyeonwook Cheon, Heonseok Lee, Jamshid Ruziev, Woosuk Kim* *video*
(publication_conf/asem21/5.ES/2. T3B/7. ES2373_6929A.pdf)

Dynamic seismic performance of curtain wall fasteners with displacement absorption
Heonseok Lee, Myunghwan Oh, Woosuk Kim*
(publication_conf/asem21/5.ES/2. T3B/8. ES2373_6927A.pdf)

Concrete Compressive Strength Prediction Using Machine Learning Algorithnm

*Keun-Hyeok Yang, Sanghee kim, Jun Ryeol Park**

(publication_conf/asem21/5.ES/2. T3B/9. ES2373_6845.pdf)

Seismic performance of masonry wall retrofitted by truss system under In-plane cyclic loading

Hye-Ji Lee, Seung-Hyeon Hwang, Sanghee Kim, Keun-Hyeok Yang*

(publication_conf/asem21/5.ES/2. T3B/10. ES2373_6844.pdf)

SESSION T4A
Innovative Cementitious Composites for Improved Sustainability and Resilience in Civil Engineering (Mini Symposium)

Chairman: Klaus Holschemacher, P.L Ng and Deuckhang Lee

Investigation on reduction of conventional rebars in UHPFRC nuclear containment structures

Seung Heon Lee, Thomas Kang*

(publication_conf/asem21/5.ES/3. T4A/1. ES2371_6855A.pdf)

Reliability of Shear Strength of Recycled Aggregate Concrete Beams

Meirzhan Yerzhanov, Hyunjin Ju, Deuckhang Lee, Kang Su Kim*

(publication_conf/asem21/5.ES/3. T4A/2. ES2371_7016.pdf)

Bond mechanism of reinforcing bar in SFRC considering random distributions of aggregates and steel fibers

Wei Zhang, Deuckhang Lee, Chang-Joon Lee, P. L. Ng*

(publication_conf/asem21/5.ES/3. T4A/3. ES2371_6999.pdf)

Evaluation of self-healing performance in concrete using nonlinear resonance spectroscopy

Hajin Choi, Ryulri Kim*

(publication_conf/asem21/5.ES/3. T4A/4. ES2371_6819A.pdf)

Corrosion in tensile reinforcement and its influence on shear performance of RC members

Sunjin Han, Deuckhang Leec, Kang Su Kim* video
(publication_conf/asem21/5.ES/3. T4A/5. ES2371_6994.pdf)

Fiber-reinforced alkali-activated cement concrete
Biruk Hailu Tekle, Ludwig Hertwig, Klaus Holschemacher* video
(publication_conf/asem21/5.ES/3. T4A/6. ES2371_7071.pdf)

Rapid geometrical inspection system for precast bridge slabs using laser scanning
Min-Koo Kim, Fangxin Li, Jaemin Kim, Sung-Han Sim*
(publication_conf/asem21/5.ES/3. T4A/7. ES2371_7077.pdf)

Incorporating high volume fly ash and silica fume to improve the mechanical properties of ECC
Yu Zhu, Zhaocai Zhang, P.L. Ng, Deuckhang Lee*
(publication_conf/asem21/5.ES/3. T4A/8. ES2371_7061.pdf)

Analytical technique of moment-curvature response of steel fibre-reinforced concrete beams
Gintaris Kaklauskas, P.L. Ng, Aleksandr Sokolov, Ashkan Shakeri*
(publication_conf/asem21/5.ES/3. T4A/9. ES2371_7055.pdf)

SESSION W3B
Dynamic Effects on Structures Including Seismic I (Mini Symposium)
Chairman: Thomas Kang and Hyeonyeop Shin

Proper orthogonal decomposition analysis of wind-induced pressure coefficients with computational fluid dynamics
Min Kyu Kim, Thomas Kang*
(publication_conf/asem21/5.ES/4. W3B/1. ES2374_7091.pdf)

Cyclic test for shear capacity of cylindrical wall
Hyeon-Keun Yang, Hong-Gun Park*

(publication_conf/asem21/5.ES/4. W3B/2. ES2374_6825.pdf)

An experimental study on the dynamic shear properties of conjugated isolation systems

Gia Toai Truong, Seung-Jae Lee, Kyoung-Kyu Choi, Seon Woo Baek, Chang-Soo Kim*

(publication_conf/asem21/5.ES/4. W3B/3. ES1351_6820.pdf)

Prediction of wind pressure coefficients on high-rise building facade using LSTM RNN model for sensor reduction

Sang Min Lee, Thomas Kang*

(publication_conf/asem21/5.ES/4. W3B/4. ES2374_6865A.pdf)

Analytical assessment of two-way out-of-plane bending performance of URM walls

Huan He, Sander J. H. Meijers*

(publication_conf/asem21/5.ES/4. W3B/5. ES1352_6906.pdf)

Evaluation of the Slab Effect of Coupled Wall on Structures of Wall Type Apartment Building

Myung Ho Jeon, Hong Gun Park, Jong Hoon Kwon, Sung Hyun Kim*

(publication_conf/asem21/5.ES/4. W3B/6. ES2374_6846.pdf)

A study on relation between reduced strength and aerodynamic force for inelastic wind design

Hamidreza Alinejad, Thomas Kang*

(publication_conf/asem21/5.ES/4. W3B/7. ES2374_6854.pdf)

SESSION W4B

Dynamic Effects on Structures Including Seismic II (Mini Symposium)

Chairman: Thomas Kang and Seung Yong Jeong

Drop-weight impact tests of prestressed concrete panels

Seong Ryong Ahn, Thomas Kang*

(publication_conf/asem21/5.ES/5. W4B/1. ES2374_6868A.pdf)

Effect of floor response spectrum generation methods on secondary system fragility

Yousang Lee, Hong-gun Park, Ju-Hyung Kim*

(publication_conf/asem21/5.ES/5. W4B/2. ES2374_6833.pdf)

Comparison of base isolation systems for reinforced concrete structures with irregularity in plan

*Donato Cancellara**

(publication_conf/asem21/5.ES/5. W4B/3. ES1351_7094.pdf)

Seismic vulnerability assessment of freestanding contents using floor response spectrum

Khine Thazin Phyu Kyaw, Sung-Hyun Jang, Youn-In Chung, Min-Ho Chey*

(publication_conf/asem21/5.ES/5. W4B/4. ES1352_6829.pdf)

Cyclic wind and seismic loading tests of reinforced concrete coupling beams with different amount of transverse reinforcements

Tse-An Chou, Seung Heon Lee, Thomas Kang*

(publication_conf/asem21/5.ES/5. W4B/5. ES2374_6861A.pdf)

Behavior of Wall Boundary Elements under Cyclic Axial Loading

Mok-In Park, Hong-Gun Park, Ji-Hun Park, Su-Min Kang, Sung-Hyun Kim*

(publication_conf/asem21/5.ES/5. W4B/6. ES2374_6858.pdf)

SESSION W5B
Dynamic Effects on Structures Including Seismic III (Mini Symposium)

Chairman: Thomas Kang and Byeonguk Ahn

Study on the ground characteristics of irregularly distributed ground through centrifuge tests

Jin-Young Park, Hong-Gun Park, Dong-Kwan Kim*

(publication_conf/asem21/5.ES/6. W5B/1. ES2374_6826.pdf)

Experimental Investigation on Flexure Shear Test for Slit Porcelain Panel Cladding with Kerf Connection

Yo-Han Ju, Su-Min Kang, Jang-Woon Baek, Hee-Do Kim, Hong-Gun Park*

(publication_conf/asem21/5.ES/6. W5B/2. ES1368_7126A.pdf)

Dynamic analysis of reinforced concrete structures with hybrid base isolation systems subject to bi-directional ground motions

*Donato Cancellara**

(publication_conf/asem21/5.ES/6. W5B/3. ES1351_7095.pdf)

Comparison of wind pressure on building from CFD analysis and wind tunnel test using dynamic mode decomposition

Han-Sol Lee, Thomas Kang*

(publication_conf/asem21/5.ES/6. W5B/4. ES2374_6859.pdf)

Correlation of directional wind loads on high-rise buildings with square-shaped plan

Seung Yong Jeong, Thomas Kang*

(publication_conf/asem21/5.ES/6. W5B/5. ES2374_6850A.pdf)

An analytical study on the performance-based wind design considering the corner modification

Byeonguk Ahn, Hamidreza Alinejad, Thomas Kang*

(publication_conf/asem21/5.ES/6. W5B/6. ES2374_6849.pdf)

Cyclic Loading Test for T-Shaped Coupled Wall Coupled by Slab

JongHoon Kwon, HongGun Park, Myung Ho Jeon*

(publication_conf/asem21/5.ES/6. W5B/7. ES1352_7112.pdf)

A study on the impact behavior of shear unbonded post tensioned concrete beams under drop weight impact using non-linear finite element modeling methods

Andrew Nghiem, Thomas Kang*

(publication_conf/asem21/5.ES/6. W5B/8. ES2374_6867A.pdf)

SESSION H3B
Innovative Structural Design and Analysis for Buildings and Infrastructures (Mini Symposium)

Chairman: Hyeon-Jong Hwang and Jangwoon Baek

System for real-time monitoring and controlling of elongation of post-tensioning tendons

Su Hyun Park, Thomas Kang*

(publication_conf/asem21/5.ES/7. H3B/1. ES2375_6866.pdf)

Shear strength of PC-CIP composite beams with Fixed Ends

Chul-Goo Kim, Joo-Hyun Jin, Hong-Gun Park*

(publication_conf/asem21/5.ES/7. H3B/2. ES2375_6871.pdf)

Study on shrinkage prediction models and crack formation in post-tensioned slabs

Gabriela Martinez Lara, Thomas Kang*

(publication_conf/asem21/5.ES/7. H3B/3. ES2375_6862A.pdf)

Structural Behavior of Precast Concrete Moment Frames Subject to Progressive Collapse

Fei-Fan Feng, Hyeon-Jong Hwang, Wei-Jian Yi*

(publication_conf/asem21/5.ES/7. H3B/4. ES2375_6814.pdf)

Shear behavior of unbonded post-tensioned beam with greased sheathed-strand tendon

Hyeongyeop Shin, Thomas Kang*

(publication_conf/asem21/5.ES/7. H3B/5. ES2375_6851A.pdf)

Bond strength recovery of lap splices in pre-damaged RC beams retrofitted with CFRP

Cheng Wu, Hyeon-Jong Hwang, Gao Ma*

(publication_conf/asem21/5.ES/7. H3B/6. ES2375_6803.pdf)

Seismic capacity and demand of dimension stone panel cladding with dowel pin connection

Jang-Woon Baek, Su-Min Kang, Hong-Gun Park*

(publication_conf/asem21/5.ES/7. H3B/7. ES2375_6848.pdf)

Earthquakes and Structures (Pre-recorded session)

Research on long term variation of natural frequency of KiK-net network site based on frequency domain identification method

Lejun Wei, Yinfeng Dong, Man Zhang, Hui Tian* *video*

(publication_conf/asem21/5.ES/8. EAS Pre-recorded session/1. ES1357_7059.pdf)

Prediction of permanent drift demands for steel framed-buildings under near-fault pulse-like ground motions

Jorge Ruiz-Garcia, Jose M. Ramos-Cruz*

(publication_conf/asem21/5.ES/8. EAS Pre-recorded session/2. ES1360_7109.pdf)

Seismic performance of nonconforming Mexican school buildings under maishock-aftershock sequences

Jorge Ruiz-Garcia, Roberto N. Olvera* *video*

(publication_conf/asem21/5.ES/8. EAS Pre-recorded session/3. ES1360_7110.pdf)

Amplitude ratios of three-component ground motions

Hui Tian, Yinfeng Dong, Dong Li, Man Zhang*

(publication_conf/asem21/5.ES/8. EAS Pre-recorded session/4. ES1353_7060.pdf)

Baseline correction method based on Variational Mode Decomposition (VMD)

Dong Li, Yinfeng Dong, Hui Tian, Xu Huang* *poster*

(publication_conf/asem21/5.ES/8. EAS Pre-recorded session/5. ES1353_7051.pdf)

Study on the methods to estimate site natural frequency

Man Zhang, Yinfeng Dong, Hui Tian and Lejun Wei* *poster*

(publication_conf/asem21/5.ES/8. EAS Pre-recorded session/6. ES1354_7062.pdf)

SESSION W3A
Structural and Hydraulic Interaction in Underground Structures

Chairman: Ki-Il Song

Experimental Study on Compressive Behavior of PVA Cementitious Composites with CNTs

Dongmin Lee, Seong-Cheol Lee, Sung-Won Yoo*

(publication_conf/asem21/6.TS/1. W3A/1. TS1402_6896.pdf)

Challenges of EPB TBM in Pressurized Mixed Grounds under Hangang River: Effect of Clogging

Young-Jin Shin, Sung-Wook Kang, Jae-Won Lee, Dae-Young Kim*

(publication_conf/asem21/6.TS/1. W3A/2. TS1403_6918.pdf)

Dynamic characteristics of submerged floating tunnel affected by shore connection

Joohyun Park, Seok-Jun Kang, Gye-Chun Cho*

(publication_conf/asem21/6.TS/1. W3A/3. TS1405_6957.pdf)

Research on the development of xanthan gum and clay mixture ground improvement materials

Dong-Yeup Park, Yeong-Man Kwon, Gye-Chun Cho*

(publication_conf/asem21/6.TS/1. W3A/4. TS1404_6946.pdf)

Numerical Study on Dynamic Response of Submerged Floating Tunnel Depending on Shore Connection

Seok-Jun Kang, Joohyun Park, Gye-Chun Cho* video

(publication_conf/asem21/6.TS/1. W3A/5. TS1404_6948.pdf)

EPB Shield behavior prediction using machine learning regression methods

*Wen-Chieh Cheng*c, Xue-Dong Bai*

(publication_conf/asem21/6.TS/1. W3A/6. TS2409_6806.pdf)

SESSION W4A
Developments in Underground Space Technologies
Chairman: Seongwon Hong

Estimation of rock cutting performance of an actuated undercutting mechanism
HYudhidya Wicaksana, Hoyoung Jeong, Sehun Kim, Seokwon Jeon*
(publication_conf/asem21/6.TS/2. W4A/1. TS1401_6970.pdf)

Case study on cutter head jamming in slurry shield TBM tunneling in highly fractured rock
Ju-Young Oh, Sang-Do Lee, Ho-Myung Lee, Seok-Woo Nam, Sun-Jae Lee*
(publication_conf/asem21/6.TS/2. W4A/2. TS1401_6912.pdf)

Surface settlement prediction of stacked twin TBM tunnels by various machine-learning techniques
Dongku Kim, Khanh Pham, Ju-Young Oh, Hangseok Choi* video
(publication_conf/asem21/6.TS/2. W4A/3. TS1401_7009.pdf)

Estimation of forces exerted on TBM cutting tools with coupled DEM-FDM numerical analysis
Hyobum Lee, Junho Kwak, Hangseok Choi* video
(publication_conf/asem21/6.TS/2. W4A/4. TS1401_7010.pdf)

Numerical Evaluation of Surface Settlement Induced by Improper Muck Control of EPB Shield TBM
Jun-Beom An, Gye-Chun Cho*
(publication_conf/asem21/6.TS/2. W4A/5. TS1401_6914.pdf)

Application actuality and experimental research on prefabricated corrugated steel utility tunnel (PCSUT)
Hongbo Che, Liyuan Tong*
(publication_conf/asem21/6.TS/2. W4A/6. TS1404_6974.pdf)

SESSION W5A
Improvements in Conventional Tunneling &Tunneling and Underground Works in Extreme Conditions

Chairman: Jongwon Jung

Reduction of the uncertainties in the tunnel support definition from geotechnical characterization by means of directional core drilling

Rafael Rodriguez, Valentin Fernandez, Patricia Fernandez*

(publication_conf/asem21/6.TS/3. W5A/1. TS1402_6837.pdf)

A study on the digital image-based uniaxial rock strength prediction using Deep Learning and implications for tunnel excavation

Melvin B. Diaz, Gyung Won Lee, Sang Seob Kim, Joo Yeon Kim, Sang In Lee, Kwang Yeom Kim*

(publication_conf/asem21/6.TS/3. W5A/2. TS1404_7042.pdf)

Numerical analysis of abrasive waterjet rock drilling according to the standoff distance

Hyun-Joong Hwang, Yohan Cha, Tae-Min Oh, Gye-Chun Cho* video

(publication_conf/asem21/6.TS/3. W5A/3. TS1402_6947.pdf)

A Study on the Crack Detection Performance for Learning Structure using Super-Resolution

Jin Kim, Seungbo Shim, Gye-Chun Cho*

(publication_conf/asem21/6.TS/3. W5A/4. TS1406_6949.pdf)

Development of FE model for simulating electrical resistivity survey to predict mixed ground ahead of a tunnel face

Minkyu Kang, Soojin Kim, JunHo Lee, Hangseok Choi* video

(publication_conf/asem21/6.TS/3. W5A/5. TS1401_7017.pdf)

Successful Application of TBM Mechanized Technologies on Goseong Green Power Plant Project

Jerome Ruben Duhme, Thorsten Tatzki, Jeremy Lee, Jun Won Eom*

(publication_conf/asem21/6.TS/3. W5A/6. TS1401_6923.pdf)

Influence of the cutter disc wearing in the advancing rate and the lineal cost in a tunnel excavated with TBM)

Rafael Rodriguez, Antonio Tosal, Andres Suarez, Maria B. Diaz*

(publication_conf/asem21/6.TS/3. W5A/7. TS1403_6838.pdf)

Tunnels and Underground Spaces (Pre-recorded session)

Assessment of Abrasive Impact Frequency depending on the Traverse Rate in Waterjet Rock Cutting

Yohan Cha, Ji-Won Kim, Jin-Seop Kim, Seok Yoon, Gye-Chun Cho* video

(publication_conf/asem21/6.TS/4. TUS Pre-recorded session/1. TS1404_7127.pdf)

Application of the punch shear test to measure adfreeze bond strength of frozen soil-structure interface

Sangyeong Park, Chaemin Hwang, Hangseok Choi, Youngjin Son, Tae Young Ko* video

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Estimation of Cerchar Abrasivity Index using machine learning based regression

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Risk assessment criteria by freeze-thaw characteristics of tunnel concrete lining: theoretical analysis and experimental verification

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A preminary study on the simulation of a curved TBM excavation

Byungkwan Park, Soon-Wook Choi, Chulho Lee, Tae-Ho Kang, Seungchul Do, Woon-Yong Lee, Soo-Ho Chang* video
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The Fundamental Study on Penetration Behavior of Biopolymer Solution for Ground reinforcement

Jae Eun Ryou, Jongwon Jung* poster
(publication_conf/asem21/6.TS/4. TUS Pre-recorded session/11. TS1406_6887.pdf)

A study on the characteristics of grout materials for the Tunnel Face Penetration Grouting Method

*Soo-Kwon Ham, Beom-Ju Kim, Seok-Won Lee**
(publication_conf/asem21/6.TS/4. TUS Pre-recorded session/12. TS1401_6928.pdf)

Evaluation of seismic behavior of deep underground building structures by numerical analysis

Sun-Yong Kwon, Mintaek Yoo, Seongwon Hong* poster
(publication_conf/asem21/6.TS/4. TUS Pre-recorded session/13. TS1405_6982.pdf)

Accuracy validation of pin-on-disk type abrasion testing machine for pick cutters

Chang Heon Song, Joo Young Oh, Jung Woo Cho, Dae ji Kim, Mun-Gyu Kim, Hoon Kang* poster

(publication_conf/asem21/6.TS/4. TUS Pre-recorded session/14. TS1401_7018.pdf)

Feasibility analysis of rock cutting-splitting method by scaled model tests

Sang-Min Lee, Dae ji Kim, Chang Heon Song, Joo Young Oh, Jung Woo Cho, Mun- Gyu Kim, Sang-Hwa Yu* poster

(publication_conf/asem21/6.TS/4. TUS Pre-recorded session/15. TS1401_7019.pdf)

Optimization of HJC material parameters of rock splitting mechanism by dynamics simulation

Hoyoung Jeong, Chang-Heon Song, Sang-Min Lee, Joo Young Oh, Mun-Gyu Kim, Jung Woo Cho, Sang-Hwa Yu* poster

(publication_conf/asem21/6.TS/4. TUS Pre-recorded session/16. TS1401_7020.pdf)

Characteristics of cutting behavior of a pick cutter in hard rock

Hoyoung Jeong, Jung-Woo Cho, Sang Min Lee* poster

(publication_conf/asem21/6.TS/4. TUS Pre-recorded session/17. TS1403_7028.pdf)

Reliability analysis of tunnel face stability considering seepage and strength increase with depth

*Jun Kyung Park**

(publication_conf/asem21/6.TS/4. TUS Pre-recorded session/18. TS1404_7036.pdf)

Experimental Study on Anchor Force Derivation of Non-Open Cut Tunnel Concrete Modular Roof Method

Hyuk Sang Jung, Jin Hwan Kim, Hwan Hee Yoon, Myung Sagong, Hyoung Hoon Lee* video

(publication_conf/asem21/6.TS/4. TUS Pre-recorded session/19. TS1402_7102.pdf)

Prediction of Disc Cutter Wear using Shield TBM Excavation Data

Yunhee Kim, Jiyeon Hong, Jaewoo Shin, Bumjoo Kim* poster

(publication_conf/asem21/6.TS/4. TUS Pre-recorded session/20. TS1401_6961.pdf)

A Study on the Crack Detection Performance for Learning Structure using Super-Resolution

Jin Kim, Seungbo Shim, Gye-Chun Cho*

(publication_conf/asem21/8. Poster/TS1406_6887_Poster.pdf)

Face stability analysis of a shallow tunnel using coupled Eulerian-Lagrangian technique

Kwangwoo Lee, Hyunsung Lim, Hyunki Kim, Junyoung Ko* poster

(publication_conf/asem21/6.TS/4. TUS Pre-recorded session/22. TS1402_6930.pdf)

Poster Q&A Session

Characteristics of compressive strength according to the content of fine aggregate replacement beads

Jung Yun Kim, Young Sook Roh*

(publication_conf/asem21/7. Poster Q&A Session/1. CM1781_7131.pdf)

Interaction control of under-actuated UAV capable of exerting downward force

Jinyeong Jeong, Min Jun Kim* poster

(publication_conf/asem21/7. Poster Q&A Session/2. RR2730_7011A.pdf)

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(publication_conf/asem21/7. Poster Q&A Session/3. TS1402_6930A.pdf)

Amplitude ratios of three-component ground motions

Hui Tian, Yinfeng Dong, Dong Li, Man Zhang* poster

(publication_conf/asem21/7. Poster Q&A Session/4. ES1353_7060.pdf)

A Study on Application of Membrane Distillation for Recovery of VFA and Water Reuse

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Bi-objective optimization of functionally graded beams in a thermal environment

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Analysis of axially loaded helical piles in sand using HPCap program

Hyeong-Joo Kim, Peter Rey Dinoy, James Vincent Reyes, Hyeong-Soo Kim, Jun-Young Kim, Tae-Woong Park* poster

(publication_conf/asem21/7. Poster Q&A Session/7. SM1126_6937.pdf)

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Laboratory mechanical properties evaluation of the PP modified bituminous material and asphalt with different mixing method

Ho-Fai Wong, Tsz Chun Chan Tak Yiu Hung, Kai Chiu Zhu*

(publication_conf/asem21/7. Poster Q&A Session/21. CM1789_6899.pdf)

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Extrinsic Calibration of LiDAR and Camera using Multiple Traffic Signs

Wonho Song, Changki Sung, Euigon Jung, Minho Oh, Hyun Myung*

(publication_conf/asem21/7. Poster Q&A Session/19. RR2730_7072.pdf)

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Analysis approach for composite steel plate shear walls (CSPSW) reinforced with CFRP

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ABSTRACT

Steel plate shear walls (SPSWs) have been conducted as a capable system for resisting lateral forces induced on structures by wind and earthquakes. Adding concrete covering is a way of improving the behavior of SSWs. Studies by researchers indicated that, by using the concrete layer, stress is better distributed in the steel plate and the tension field lines are developed in a wider region. The only difference between the traditional system and the composited steel plate shear wall with the concrete system is that, in the latter, there is a gap between the concrete wall and the boundary columns and beams. In the traditional system, there is no gap, and the concrete directly rests against the boundary columns and beams. This seemingly simple modification resulted in a significant improvement in performance as well as an increase in ductility and damage mitigation. Some researchers showed that the carbon fiber-reinforced polymer (CFRP) would enhance the structural behavior of SPSWs. Nevertheless, no simple approach has been presented for composite SPSWs (CSPSWs) reinforced with CFRP. In the present research, the nonlinear behavior of CSPSW is determined and a method of analysis is proposed. The comparison between the findings of this approach and those of the finite element method (FEM) indicates that the proposed method is more accurate and its relevant computations take less time compared to the FEM. This model provides a good understanding of the interactions that might occur among different components of the system. It is also able to predict the overall pushover response, which is used in the nonlinear analysis of CSPSW systems.

1. INTRODUCTION

Composite steel plate shear wall (CSPSW) reinforced with carbon fiber-reinforced polymer (CFRP), a layer of CFRP is placed on both sides of the infill steel plate. Results have shown (Hatami *et al*., 2012) that the CFRP enhances the structural parameters of

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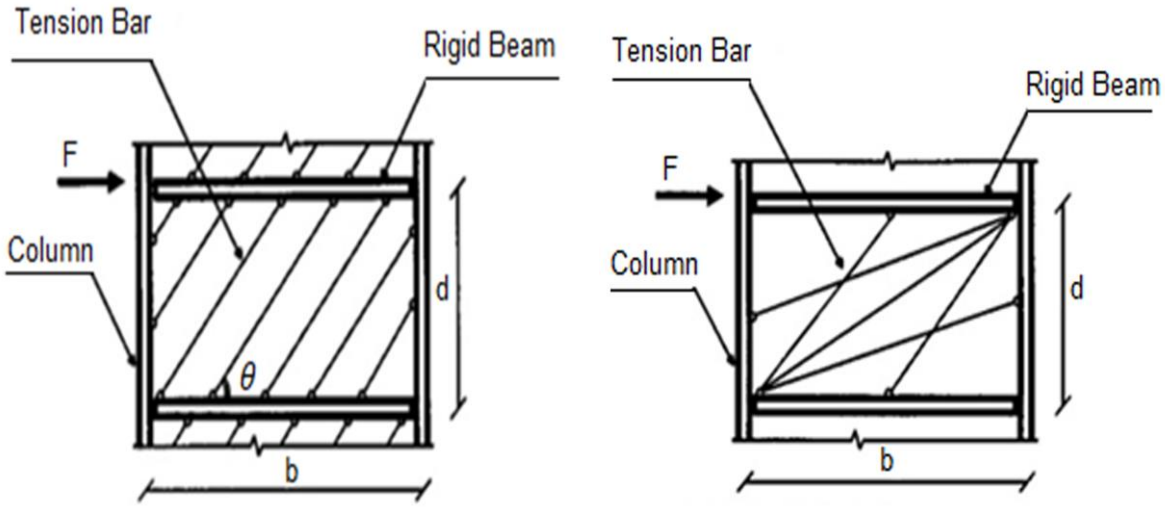
SPSW in the elastic and inelastic zones. In the present study, a method of predicting the nonlinear behavior of CSPSW is presented and its structural characteristics are addressed. Using the linear analysis, a graph is sketched to display the behavior of CSPSW in the inelastic zone.

1.1 Previous works on analysis methods

Several researchers (Timler and Kulak, 1983; Thorburn *et al*., 1983; Driver *et al*., 1998) have studied the behavior of SPSW. Based on the results, the strip model concept represents the SPSW as a series of inclined strip members. Each strip is allocated an area equal to the product of the strip width and the plate thickness. Fig. 1(a) shows the strip model. Since the stripe was developed based on the truss members, it can be used easily via SAP2000 and Etabs software. The models have been suggested by Canadian Steel Design Standard (CAN/CSA-S16-01, 2001). UBC's researchers presented a multi-angle strip model for SPSW using nonlinear analysis. This model is shown in Fig. 1(b) (Rezai, 1999). The researchers indicated that the analysis predictions were close to cyclic test results as well as shake table tests.



a) Strip model used in the Canadian Steel Design Standard (CAN/CSA-S16-01, 2001)

b) Multi-angle strip model proposed by Rezai (1999)

Fig. 1 Strip model representing steel plate walls

Several researchers have used the finite-element formulation with both geometric and material nonlinearities to model the complex wall-frame interactions (Caccese *et al.*, 1993). The results of the finite element analysis (FEA) show a somewhat stiffer load-deformation relationship for SPSWs, compared to the experimental results. In general, this discrepancy can be attributed to either plate imperfection or the residual stresses created by the welding of the steel panel to the frame. Sabouri-Ghomi *et al*. (2005) developed a general method (PFI method) for the analysis and design of SPSWs with different configurations, including walls with or without openings, with thin or thick plates, and with or without stiffeners. The strip model is mostly limited to SPSWs with thin plates. Also, the strip model, although appropriate for the practical analysis of thin plates, is not

directly applicable to other types of plates. Conversely, even though the PFI method is suitable for the analysis of other types of plates, it is not directly applicable to CSPSWs. In this paper, a new method for evaluating the shear capacity and shear stiffness of a given CSPSW is proposed. The obtained results of this approach are compared with those of the finite element method (FEM). The comparison shows that the proposed method produces similar results to the FEA; nevertheless, it is much faster and requires less computation.

2. MODELING

The nonlinear analyses were performed in the ANSYS version 12 finite element package. To achieve sufficient accuracy, all the samples have been chosen by using the SHELL 181 element (an adequate shell element for composite layers) with 6 degrees of freedom (DOF) at every node. Mesh formation has been such that at common points, structural nodes are established and coupled with each other using the capability of the software. In reality, as a result of the fabrication, welding, and assembling processes, the thin infill plates are already in a distorted and buckled shape when being installed. To perform a geometrical and material nonlinear analysis and also to consider imperfections, a technique in the nonlinear FE modeling has been implemented. In doing so, first, an elastic analysis was carried out and after evaluating the buckling modes; the dominant mode was introduced to the software. For evaluating the convergence of the results, two force and moment convergence criteria were employed. The analysis process was performed based on the Full Newton-Raphson approach. The isotropic hardening rule has been utilized for material behavior.

3. VALIDATION of FEM RESULTS

For this meaning, a simple detached infill plate with dimensions 3000x3000x3 mm under pure in-plane shear loading was meshed into various number of elements; and their buckling stresses were compared with Eq. (2) to the classical formula as given in Eq. (1). The results of the FE modelling was compared to verify the numerical modelling.

$$\tau_{cr} = \frac{K_v.\pi^2.E}{12.(1-\vartheta^2)} \tag{1}$$

$$\begin{cases} K_v = 5.34 + \frac{4}{(d/b)^2} & \frac{d}{b} \leq 1 \\ K_v = 4 + \frac{5.34}{(d/b)^2} & \frac{d}{b} > 1 \end{cases} \tag{2}$$

where K_v is the shear buckling coefficient. The coefficient is related to the geometry of the SPSW and boundary condition. The dimensions of the panel, d and b, are shown in Fig. 1. The difference of errors determined by comparing the FE results to the theoretical value for different numbers of incorporated mesh elements has been indicated in Fig. 2. Regarding Fig. 2, mesh with 30x30 elements is selected.

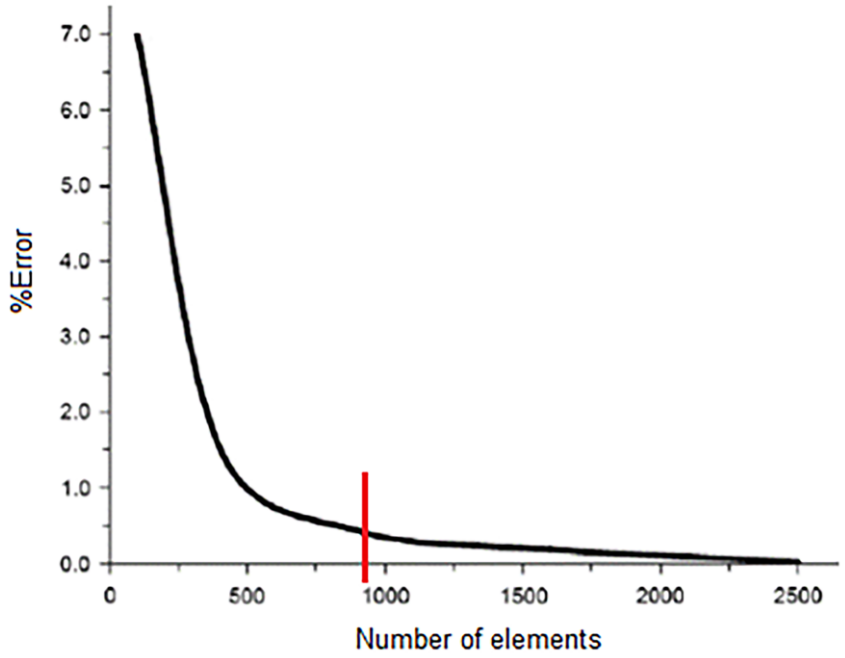


Fig. 2 FE mesh number sensitivity analysis

After measuring the optimum FE meshing, the SPSW was modeled. By comparing the numerical analysis results with the experimental results (Nateghi-Alahi and Khazaei-Poul, 2013), the numerical models were validated for the analyzing and modeling of scaled specimens. Fig. 3 compares the load-displacement curves obtained in the numerical analysis and experimental tests.

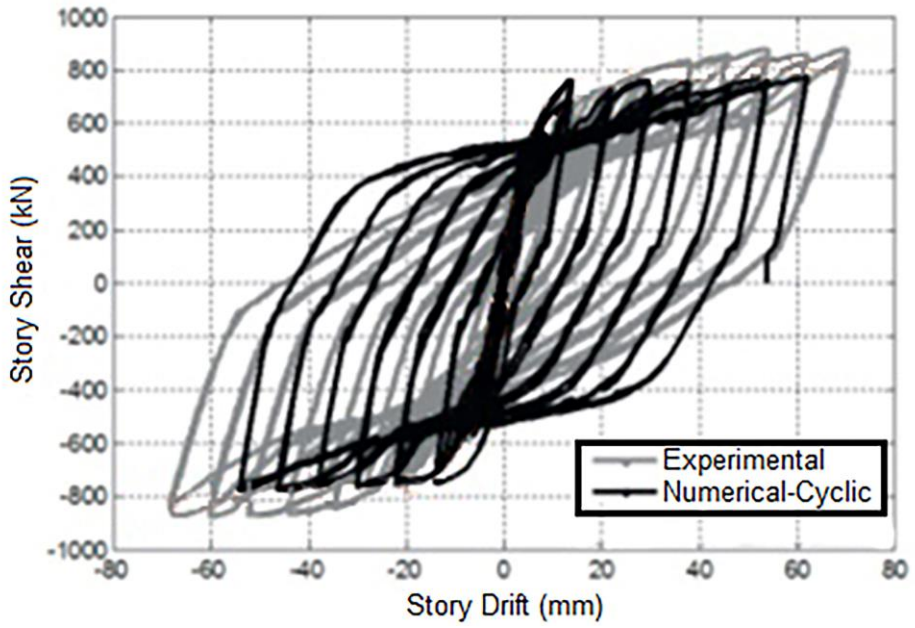


Fig. 3 Comparison of FE modeling with test

4. NUMERICAL MODELS

After verifying the numerical results with the experimental results, for predicting the pushover response of the CSPSW, many numerical specimens are selected (see Table 1) to the accuracy of the presented method. All the specimens are 3 m in height and 7 mm in thickness for the steel plate. Also, 2 mm thick fiber polymers are selected. The CFRP angle in Table 1 is attached to the infill plate illustrated in Fig. 4.

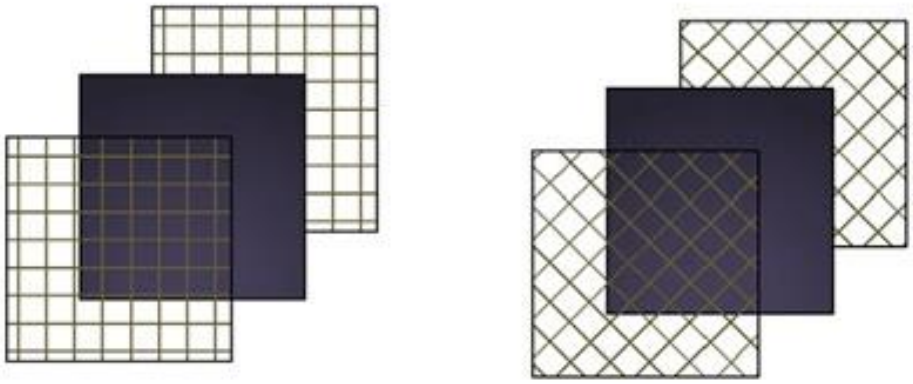


Fig. 4 Fiber angle of CSPSW

Table 1 Properties of FE models

Model name	Type of wall	Fiber Angel (Deg.)	Wall width (mm)
CS-33	CSPSW	Laterally and longitudinally	3000
CS-35	CSPSW	Laterally and longitudinally	5000
CS-36	CSPSW	Laterally and longitudinally	6000
CS-33-30	CSPSW	30	3000
CS-33-45	CSPSW	45	3000
CS-33-60	CSPSW	60	3000
CS-33-90	CSPSW	90	3000
CS-35-30	CSPSW	30	5000
CS-35-45	CSPSW	45	5000
CS-35-60	CSPSW	60	5000
CS-35-90	CSPSW	90	5000
CS-36-30	CSPSW	30	6000
CS-36-45	CSPSW	45	6000
CS-36-60	CSPSW	60	6000
CS-36-90	CSPSW	90	6000

It should be noted that the CFRP layers attached only to two sides of the infill steel plate. On the other hand, the infill steel plate is covered by CFRP layers. The steel members (beam, columns, and infill plate) have been made out of structural steel ST37 with a yield stress of 240 MPa, Elasticity Modulus of 206 GPa. Also, the material properties of CFRP layers have been used as fracture stress of 3800 MPa, and Elasticity Modulus of 240 GPa. The dimensions of beams and columns are selected as in Fig. 5. The specimens are named according to the type of shear wall used, the dimensions, and the fiber angle. So, the first notations refer to the type of shear wall (CS for the composite shear wall), the next two notations refer to the dimensions of the panel (b, d) and the last two notations refer to the angle of fibers.

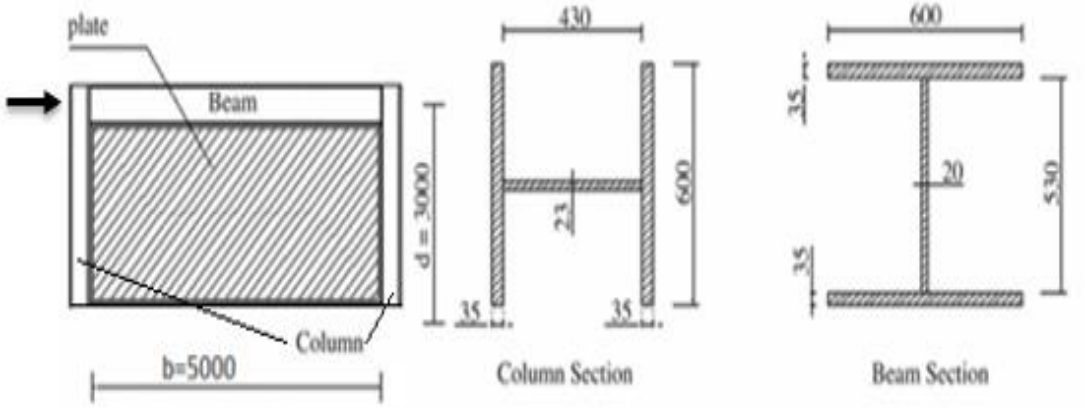


Fig. 5 Geometrical parameters of specimen

5. PROPOSED MODEL for CSPSW ANALYSIS

5.1 Basic assumptions

A typical story of a multi-story structure with a CSPSW can be represented as an isolated panel, for which the following assumptions are made:

- The columns with enough rigidity are used around the infill plates. Due to this assumption, the columns support the infill plate to develop tension field action.
- Regarding Ref. Nateghi-Alahi and Khazaei-Poul (2013), difference between the tension-field intensities in adjacent stories is ignored.
- The effect of stress due to flexural behavior (global bending stresses) on the shear buckling stress of the steel plate is disregarded.
- The principle of superposition applies.
- In the CFRP-CSPSW system, a layer of CFRP increases the number of diagonal tension-field lines.

5.2 Predicting the pushover curve

To determine the pushover curve of the CFRP-CSPSW systems, a simple equation is presented in this section. Eqs. (3)-(13), which are used in this method, have been explained in detail in Figs. 6-7.

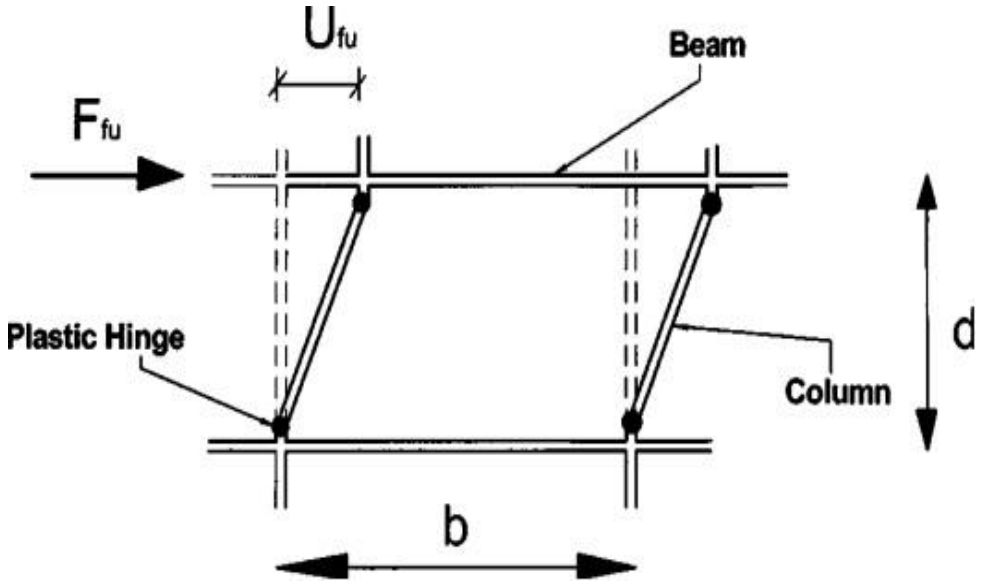


Fig. 6 Frame idealization (Nateghi-Alahi and Khazaei-Poul, 2013)

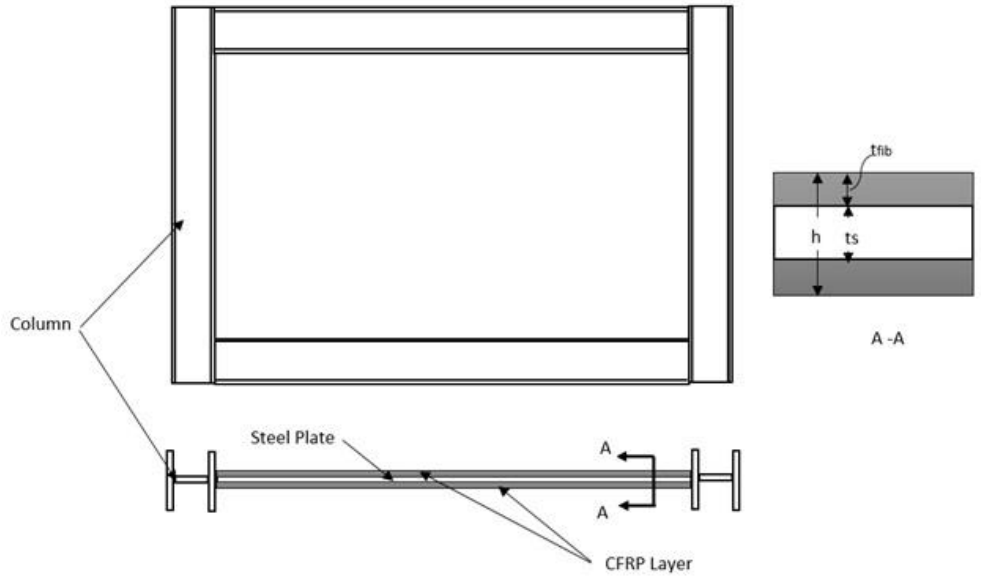


Fig. 7 CFRP-CSPSW

Since it was assumed that the frame around infill plates is moment resistant frame, the beam to column connections are fixed. Point A is shown in Fig. 8, this point is obtained using F_{fu} and U_{fe} from Eqs. (3)-(4), respectively. K_f is computed through Eq.

(5). The slope of line OA in Fig. 8 is the stiffness of the frame, and the load-displacement diagram of the frame is therefore defined. The lateral shear strength, lateral shear displacement, and shear stiffness of the frame are expressed as Hatami *et al*. (2012):

$$F_{fu} = \frac{4.M_{pf}}{d} \tag{3}$$

$$U_{fe} = \frac{M_{pf}.d^2}{6EI_f} \tag{4}$$

$$K_f = \frac{24EI_f}{d^3} \tag{5}$$

Point B is calculated using Eqs. (6)-(10). The shear displacements (in-plane displacements) of the steel plate and CFRP sheet are equal, and this is an idealization of the parallel spring's principle. This principle is used to calculate the shear strength and displacement of the steel sheet covered by the CFRP. Therefore, Eqs. (6)-(10) (Eqs. (6)-(8) have been derived, and Eqs. (9)-(10) are based on PFI method) are derived by combining the PFI method, the parallel springs principle, the numerical results, the classic equations of shells and plates, sandwich panel's behavior and several other experimental factors. Experimental and numerical studies (Rezai, 1999) have shown that the layers of CFRP increase the number of diagonal tension-field lines and intensify the elastic buckling of the steel plate. Therefore, the shear buckling stress and shear strength of the system are affected.

$$\tau_{cr} = \frac{K.\pi^2}{b^2.t} \cdot D \tag{6}$$

$$D = \frac{E_s.{t_s}^3}{12(1-\vartheta^2)} + 1.5(t_{Fib}.h).(2E_1 + \frac{G_{12}}{2}) \tag{7}$$

$$F_{tw} = \tau_{cr}(1 + \sqrt{6.75 + {F_{ys}}/{\tau_{cr}}} \tag{8}$$

$$U_w = \left(\frac{\tau_{cr}}{G_s} + \frac{2F_{tw}}{E_s}\right).d \tag{9}$$

$$F_w = (\tau_{cr} + 0.5F_{tw})b.t \tag{10}$$

The panel has shown in Fig. 8 can be obtained separately for the plate and the surrounding frame, and then by superimposing the two shear load-displacement diagrams can be obtained. Using the von Mises yield criterion, the stress distribution provides a lower bound for the strength of the web plate, knowing that the surrounding frame members are strong enough to sustain the normal boundary forces associated with the tension-field. The values of Points C and D are calculated using Eqs. (11)-(13).

$$F_p = K_f.U_w + F_{wu} \tag{11}$$

$$K = F_p/U_w \tag{12}$$

$$F_c = F_{fu} + F_{wu} \tag{13}$$

Points E and F are also obtained from Fig. 8. In this diagram, the slope of the curve is changed at displacement equal to Δ = 0.005d and Δ = 0.015d.

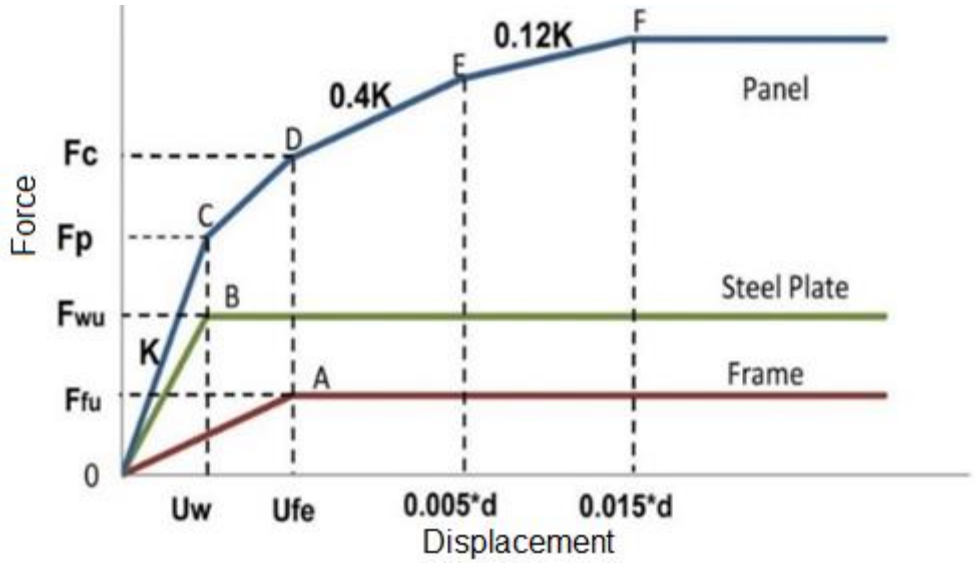


Fig. 8 Load-Displacement diagram

6. RESULTS and DISCUSSION

Fig. 9 shows the results of the proposed method compared with those of the FEM model, showing a good convergence. The proposed method estimates the load-displacement curve (pushover response) of the CFRP-CSPSW. This comparison shows close agreement between the developed method results with FEM results.

To obtain the load-displacement curves using different fiber angles of CFRP, only *K* is modified. The modification of *K* had been defined as follows (Hatami *et al*., 2012):

$$K\theta = \left(\frac{\theta exp4}{10000000} - \frac{\theta exp3}{200000} + 0.001\theta exp2 - 0.0148\theta + 1\right)K \tag{14}$$

Eq. (14) has been derived by fitting the results obtained from the specimens. In this relation, K is calculated from Eq. (12). The results of the FEM (ANSYS program) and the proposed method (Simplified) have been compared in Figs. (10)-(12). The comparison shows a convergence between the results. The main advantage of the proposed method over the FEM is that the proposed method is very simple (does not require any software for ordinary calculations) and is much faster in obtaining the results.

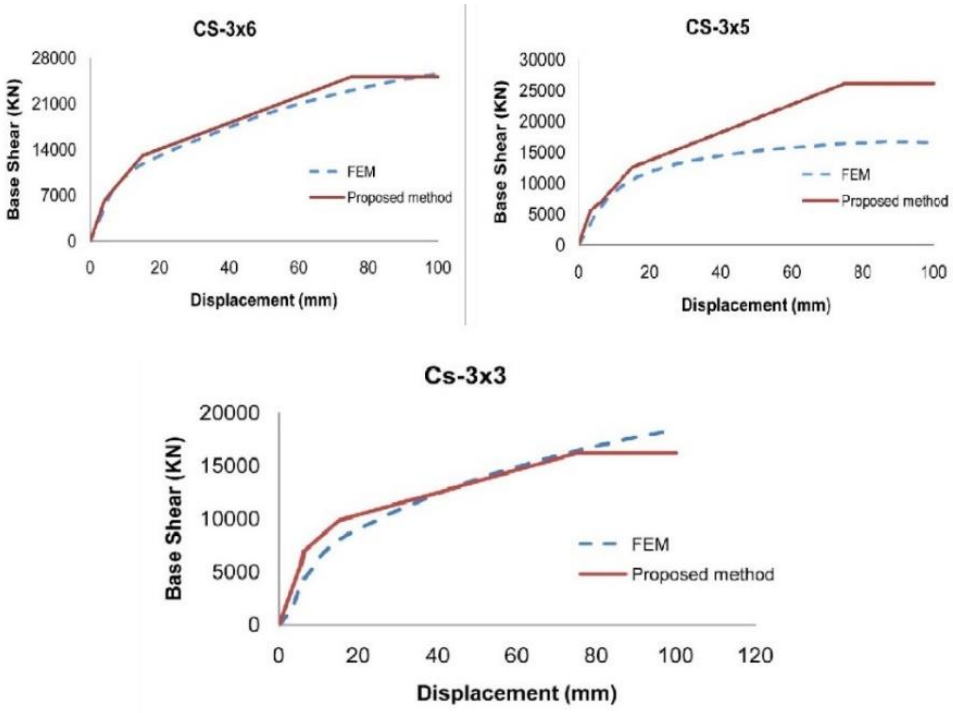


Fig. 9 Comparing the proposed equation results with FE results

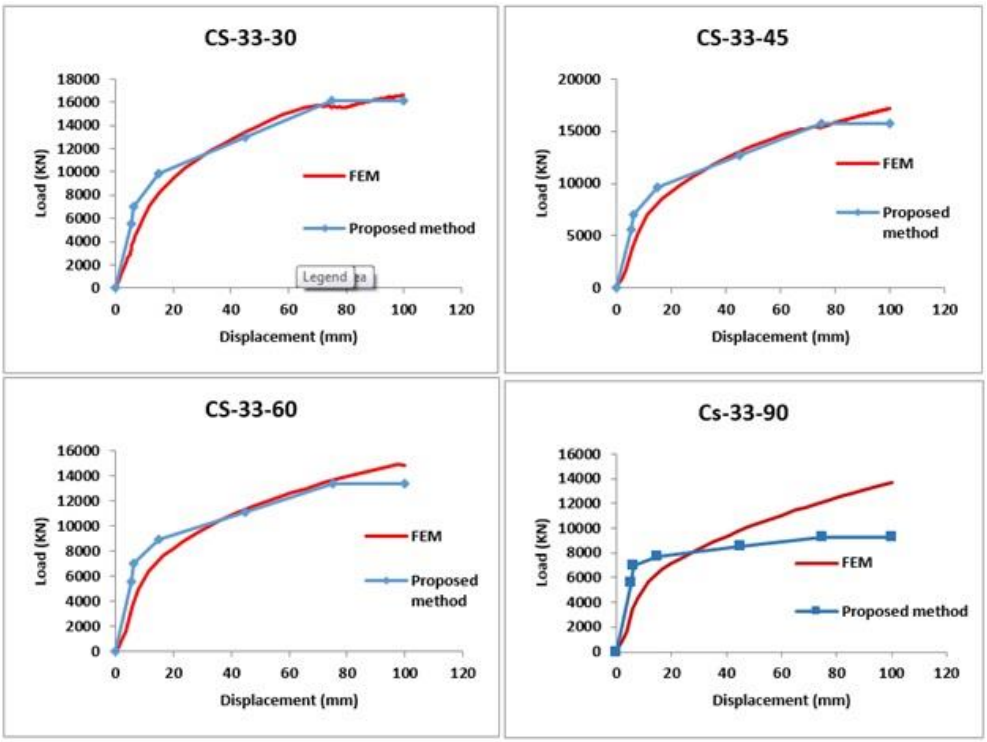


Fig. 10 Comparison of proposed method results with FEM-CS-33-Fiber angle

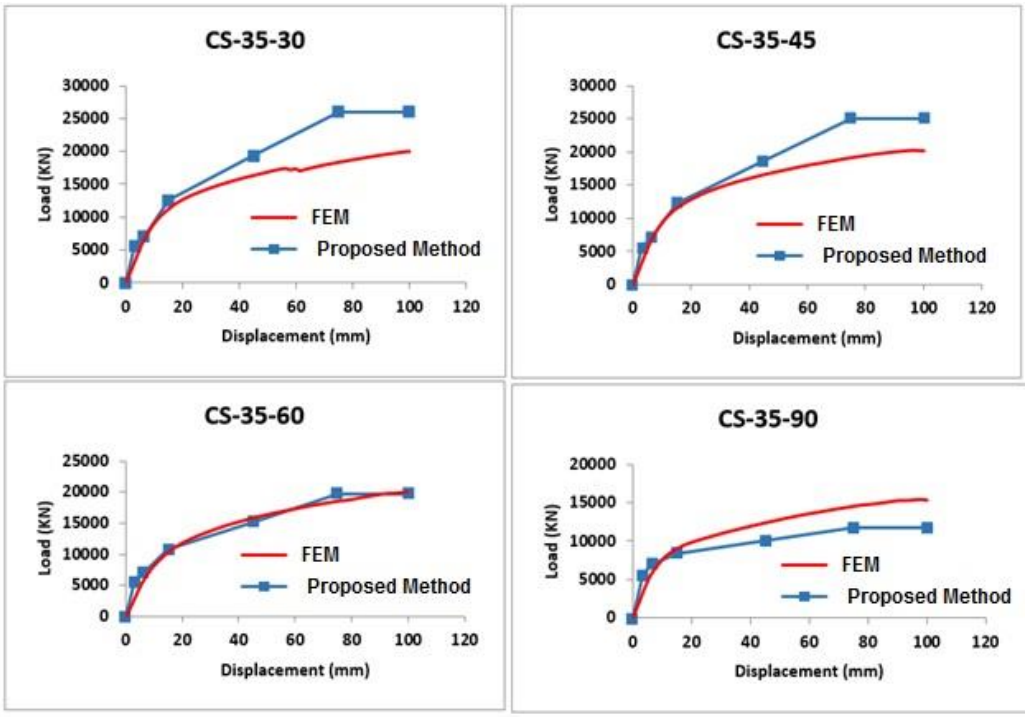


Fig. 11 Comparison of proposed method results with FEM-CS-35-Fiber angle

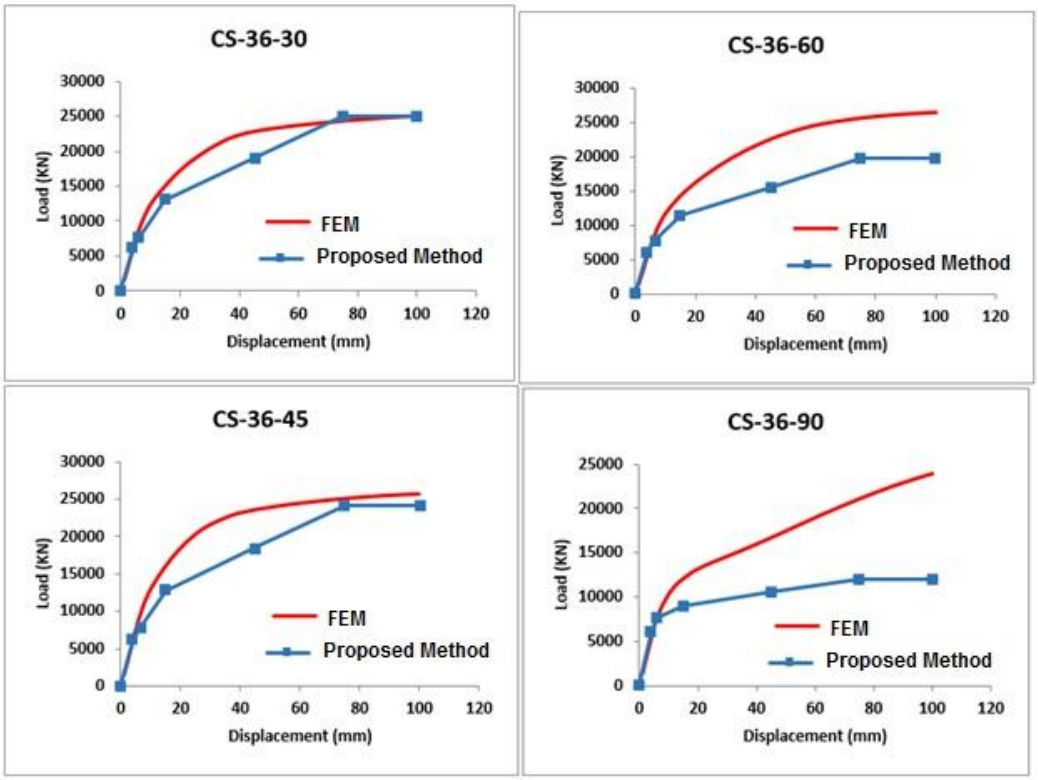


Fig. 12 Comparison of proposed method results with FEM-CS-36-Fiber angle

6. CONCLUSIONS

In the present study, the behavior of SPSW reinforced by fibers was investigated numerically and parametrically. There, summarized findings are presented as follows:

- An analytical model was suggested to determine the behavior of CSPSWs with varying angles of polymer fibers.
- To obtain the load-displacement curves using different angles of CFRP fibers, only the stiffness needs to be modified.
- Finally, some equations have been suggested to calculate the nonlinear behavior of the CSPSW system using the linear analysis approach.

ACKNOWLEDGMENTS

The generated or used data required to reproduce these findings of this study will be made available from the corresponding author upon reasonable request. This research received no external funding. All authors have no conflict of interest to declare the research described in this paper.

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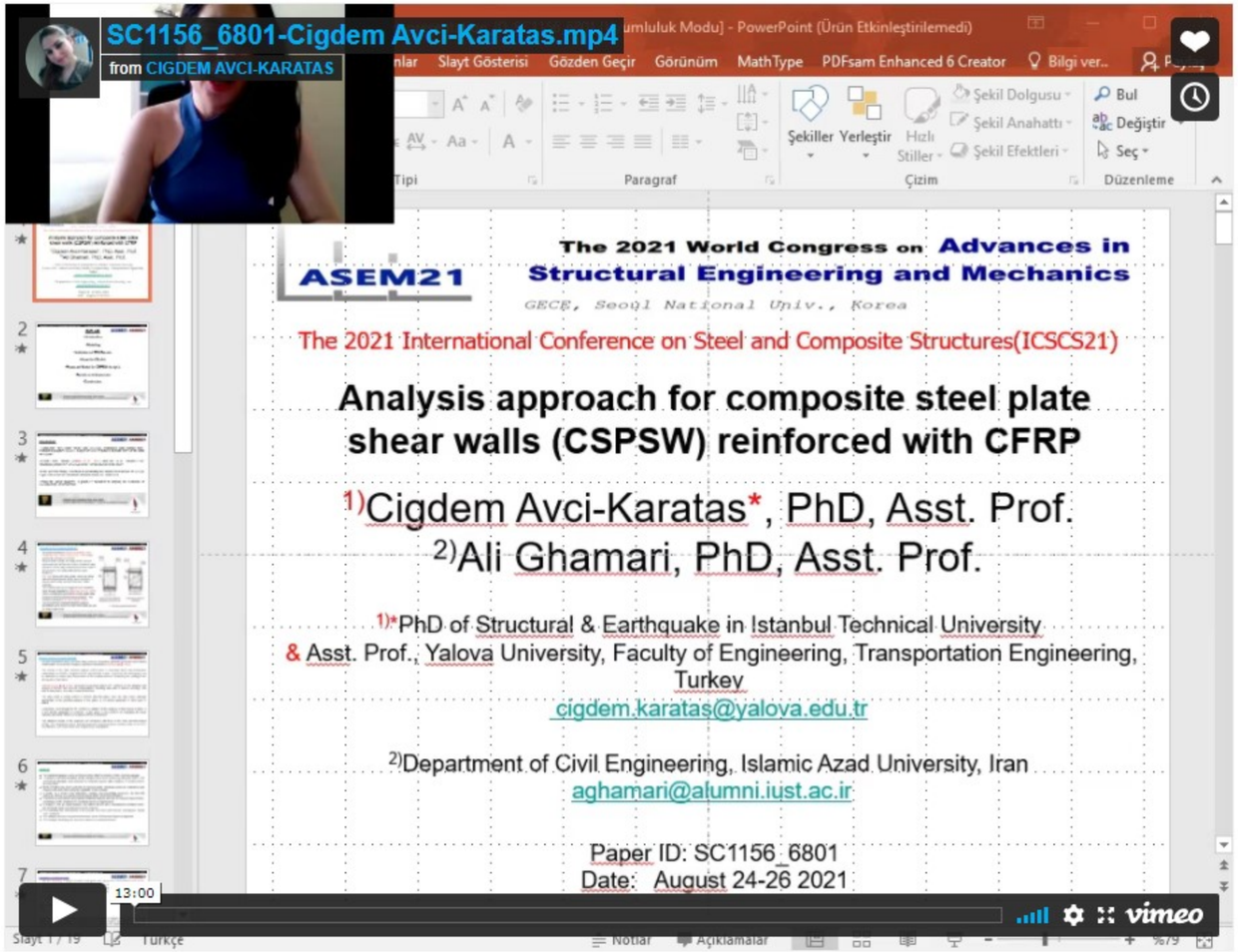

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