ISHMII

The Monitor

Newsletter of the International Society of Structural Health Monitoring of Intelligent Infrastructure

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Message from the Editor, Douglas Thomson, Ph.D., P.Eng.

Dear Members of ISHMII Community,

I am happy that a second issue of the Monitor is being published in 2019. Professor Xia and the Associate Editors have been doing an outstanding job soliciting exciting and interesting articles for the latest issue. I would like to remind members that if they have work they would like to bring to the attention of the ISHMII community they should submit an article to the next issue of the Monitor.

Another publication that will be of interest to the ISHMII community is a recent publication by the Transportation Research Board (TRB). In June 2019 the TRB published a circular on Structural Monitoring (E-C246). The report contains some thoughts that will be of interest to the ISHMII community. One observation was that although SHM has been a research topic for many years, there are few published reports of SHM being used to support decision-making. The point made by the authors being that SHM data will only be a value if it will help owners make decisions about how to manage their structures. They also mention some thoughts on the use of the idea of health in the context of SHM. I think their thoughts are worth quoting. “While most engineers agree on the definition of a structure, the word “health” has many different connotations. To counter that problem, many practitioners have stopped using the word “health” and simply referred to this technology as structural monitoring (SM) to avoid confusion. This document utilizes that terminology.” I think the ISHMII community should also consider the thinking behind the use of this terminology. The report contains sections on the value of structural monitoring and the complementary value of structural monitoring to visual inspection. I think this is a valuable resource for anyone working with infrastructure owners.

Also coming up in the next few months are some conferences. Interestingly, both have a strong emphasis on the translation of research into practise. In early August is ISHMII’s biannual conference. The 9th International Conference on Structural Health Monitoring of Intelligent Infrastructure “Transferring Research into Practice” SHMII-9, St. Louis, MO from August 4-7, 2019. I hope you will all join us in St. Louis.

https://shmii-9.mst.edu

In September is the The 12th International Workshop on Structural Health Monitoring

September 10-12, 2019, Stanford, California, USA. The theme of IWSHM 2019 is “Enabling Intelligent Life-cycle Health Management for Industry Internet of Things (IIOT)”. I draw your attention to a session entitled “Higher Level Inspection by Instrumenting Bridges - Implementing SHM into the Codes” that will be chaired by myself and Professor Mufti. It will be centered around the idea of bringing SHM into the codes through enhanced levels of inspection. In this approach SHM will be used to augment already existing sections in the code.

https://web.stanford.edu/group/sacl/workshop/IWSHM2019/

There are many exciting developments in civil structural (health) monitoring. We will be bringing more of these to you in the coming year in the Monitor.

Council (continued)

Prof. Gian Paolo Cimellaro, Politecnico di Torino (Italy)

Prof. Paolo Clemente, ENEA (Italy)

Prof. Álvaro Cunha, University of Porto (Portugal)

Prof. Nicholas de Battista, University of Cambridge, CSIC & Epsimon Ltd. (UK)

Prof. Alessandro De Stefano, Politecnico di Torino (Italy)

Dr. Mohammed ElShafie, University of Cambridge (UK)

Prof. Dan M. Frangopol, Lehigh University (USA)

Prof. Branko Glisic, Princeton University (USA)

Dr. Mustafa Gul, University of Alberta (Canada)

Dr. Wolfgang Habel, Federal Institute for Materials Research and Testing (BAM) (Germany)

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Prof. Ying Lei, Xiamen University (China)

Prof. Hong-Nan Li, Dalian University of Technology (China)

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Prof. Werner Lienhart, Graz University of Technology (Austria)

Prof. Dr. Maria Pina Limongelli, Politecnico di Milano (PoliMI), (Italy)

Dr. Ali Maher, Rutgers University (USA)

Dr. Saeed Mahini, Griffith University (Australia)

Dr. Alexis Mendez, MCH Engineering, LLC (USA)

Prof. Yasunori Miyamori, Kitami Institute of Technology (Japan)

Prof. Masoud Motavalli, EMPA – Swiss Federal Laboratories for Materials Testing & Research (Switzerland)

Dr. Aftab Mufti, Founding President, Director, SIMTReC, University of Manitoba (Canada)

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Prof. Didem Ozevin, University of Illinois at Chicago College of Engineering (USA)

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AWARDS AND RECOGNITION

Frangopol awarded 2019 George W. Housner *Structural Control and Monitoring Medal*

ASCE honor recognizes impact of pioneering work in integrating structural health monitoring in life- cycle engineering of civil, marine infrastructure systems

George W. Houser is widely considered the father of seismic engineering, which ushered in safer, more cost-effective construction in earthquake-prone areas.

So it's fitting that a medal bearing his name would be bestowed on a researcher who's played a similarly foundational role in ensuring the reliability of modern civil infrastructure systems.

Dan M. Frangopol, the inaugural Fazlur R. Khan Endowed Chair of Structural Engineering and Architecture at Lehigh University, has been awarded the 2019 George W. Housner Structural Control and Monitoring Medal in recognition of his groundbreaking work and leadership in the field of life-cycle engineering.

The Engineering Mechanics Institute (EMI) of the American Society of Civil Engineers (ASCE) selected Frangopol for the honor, citing his "pioneering contributions to the integration of structural health monitoring and control in reliability-based life-cycle assessment, design and optimization of civil and marine infrastructure," according to ASCE Executive Director Thomas W. Smith III.

Life-cycle engineering employs complex, computationally intense analyses to determine the long-term value and risk associated with infrastructure investments.

More than two decades ago, research by Frangopol and his team launched this novel way to define success in the design and assessment of infrastructure systems. His contributions— using probabilistic modeling and analysis, as well as advanced computer simulation—have fostered a global shift in policies and practices in building infrastructure components for long-term risk, resilience, and sustainability, rather than just initial cost and performance.

Since his early seminal work, Frangopol has made continuous and significant contributions to advancing the integration of structural health monitoring and life-cycle engineering for ever-involving, interrelated infrastructure systems in multi-hazard environments. His contributions provided a viable approach to solving the challenge of sustainable development and sprouted widespread effort in developing life-cycle management strategies of structures. According to ASCE, his work "has not only saved time and money, but very likely also saved lives."

His team's recent work—which includes developing a first-of-its-kind comprehensive risk assessment framework that integrates the most common failure modes for bridges exposed to flooding, hurricanes, tsunamis, and other extreme water-related events—continues to advance the scope and capabilities of life-cycle analysis.

"This award is yet another indication of Dan's role as an authority in structural systems reliability and calls attention to impact of life-cycle analysis on how we design and maintain infrastructure systems," says Panos Diplas, P.C. Rossin Professor and chair of civil and environmental engineering at Lehigh.

The George W. Housner Structural Control and Monitoring Medal is presented to an individual whose outstanding research has made a lasting mark in the broad area of structural control and health monitoring. Housner was a professor at the California Institute of Technology and his research profoundly influenced structural control and monitoring of civil infrastructure systems worldwide.

Formal presentation of the medal will take place during the ASCE-EMI 2019 Conference, held June 18-21, 2019, in Pasadena, CA.

Story by Katie Kackenmeister, assistant director of communications, P.C. Rossin College of Engineering and Applied Science

Council (continued)

Prof. Bin Shi, Nanjing University (China)

Prof. Ian Smith, Swiss Federal Institute of Technology (Switzerland)

Dr. S. Paul Sumitro, SmartSensys LLC (USA)

Prof. Susan E. Taylor, Queen's University Belfast (UK)

Dr. Douglas Thomson, University of Manitoba (Canada)

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Prof. You-lin Xu, The Hong Kong Polytechnic University (China)

Prof. Ting-Hua Yi, Dalian University of Technology (China)

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Dr. Zhou Zhi, Harbin Institute of Technology (China)

Dr. Jing Zhou, Dalian University of Technology (China)

Dr. Daniele Zonta, University of Strathclyde (UK)

Yozo Fujino Distinguished Professor, Institute of Advanced Sciences, Yokohama National University Emeritus Professor, The University of Tokyo **receives the Japan Acedemy Prize for "Vibration and its Control in Large Civil Structures"**

Outline of the work: Dr. Yozo Fujino's area of expertise is in vibration control in large civil structures, with a special focus on enhancing the performance of long-span bridges under various types of dynamic action, such as wind and earthquake loading. His countless research and applied contributions have been celebrated both nationally and internationally.

In the structural dynamics field, Dr. Fujino was the first person to identify the lateral vibration of pedestrian cable-stayed bridges caused by the synchronization of human walking, through a detailed vision analysis of video motion. This was in late 1980s, long before the well-known vibration problems of London's Millennium Bridge occurred in 2000. He pioneered the formulation of pedestrian-induced synchronization problems on pedestrian bridges, and served as an advisor to mitigate the vibration problems of Millennium Bridge. He also made significant academic contributions in modeling nonlinear vibrations in the stay cables of cable-stayed bridges. Furthermore, he pioneered the development of a design formula of dampers to suppress stay cable vibrations, which is now in widespread use in the design of cable-stayed bridges.

In the field of structural control, Dr. Fujino has been an international leader in the modeling and application of passive and active structural control systems since the 1990s. His innovative studies on tuned mass dampers (TMD), multiple tuned mass dampers (MTMD), and tuned liquid dampers (TLD) represent seminal work in the field, as is evident from their being widely cited and commercially adopted. He has made fundamental contributions to the development of design formulas for the application of TMD and MTMD on bridges and buildings, which has accelerated their adoption in practice. He also pioneered the development of the TLD, including the development of their operational principles and optimization of their deployment in the design and construction of large structural systems. In addition, he is involved in the modeling and application of seismic isolation systems for bridges, with a particular contribution to the modeling of laminated rubber bearings for seismic isolation. Furthermore, he has confirmed the seismic performance of isolation systems on bridges during the 1995 Great Hanshin-Awaji Earthquake and other earthquakes. These studies have led to the establishment of structural control as an exciting new high-tech area in the field of civil engineering.

Dr. Fujino has also made innovative contributions in the area of structural monitoring to understand the vibration behavior of large-scale civil structures. He pioneered the installation of dense sensor arrays for monitoring the ambient vibration behavior of the Hakucho Bridge (Hokkaido, Japan) under wind action, successfully extracting self-excited aerodynamic forces from measurement data. This work is the very first to 22 prove the validity of wind tunnel testing of bridge girders quantitatively, significantly impacting the entire field of wind engineering and bridge aerodynamics. He also made lasting contributions to the seismic monitoring of long-span bridges, with the Yokohama Bay Bridge as a main example. Using seismic monitoring data, he successfully identified the response characteristics of long-span, cable-stayed bridges and unwanted structural behaviors, and utilized the monitoring results to advise a seismic retrofit program of the major bridges in the metropolitan Tokyo area, ensuring their safe operation in future seismic events.

Dr. Fujino's scholarly contributions have been recognized nationally and internationally by numerous awarding bodies. He was awarded Medal with Purple Ribbon (2007) and the Hoko Award (2015). He has also received numerous international awards, such as the Raymond C. Reese Research Prize (2007), R. H. Scanlan Medal (2011), and George Winter Medal (2015) from the American Society of Civil Engineers (ASCE), and the Outstanding Paper Award (2014) and an honorary membership (2016) from the International Association for Bridge and Structural Engineering (IABSE). He was involved as an editor of Encyclopedia of Structural Health Monitoring in 2009, to which notable worldwide scholars in the research and development of monitoring technologies have contributed their works.

Within the professional bridge engineering community, Dr. Fujino is widely regarded as a visionary international leader. He served as vice president of the IABSE from 2005 to 2013 and the president of the International Association for Structural Control and Monitoring (IASCM) in 2008. Given his stature, Dr. Fujino has also served on the technical review committees for many signature bridges, such as the Akashi Kaikyo Bridges (Hyogo, Japan), the Tatara Bridge (Hiroshima and Ehime, Japan), and the Tokyo Rainbow Bridge in Japan. He has served as technical advisor on the Stonecutters Bridge in Hong Kong, on the design of an active control system used for the new Heathrow Airport Control Tower, and as the advisory committee chairman of the Padma Bridge in Bangladesh, among many others.