9th International Conference on Structural Health Monitoring of Intelligent Infrastructure

TRANSFERRING RESEARCH INTO PRACTICE

2019 ST. LOUIS SHMII-9

August 4–7, 2019

Hyatt Regency St. Louis at The Arch | St. Louis, Missouri USA

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Welcome

Genda Chen
Conference Chair

Sreenivas Alampalli
Conference Co-Chair

Structural Health Monitoring (SHM) represents a vibrant field with limited applications in mainstream practice. In recent years, practical applications have grown due to technological advances in sensing, visualization, and data analytics, coupled with project delivery mechanisms such as accelerated bridge construction and public-private partnerships. Aligning with our conference theme, transferring research into practice, will thus be a critical milestone in driving the SHM community for further advancement of the field. In this process, educators, researchers, industry, owners, and regulators will all have an important role to play.

The 9th International Conference on Structural Health Monitoring of Intelligent Infrastructure (SHMII-9) will be held on August 4-7, 2019, in St. Louis, USA. The Conference covers research and development, technology transfer, and technology demonstration in 47 sessions. It provides a forum for the exchange of ideas, knowledge sharing, and technology-need matchmaking in the global SHM community. It also serves as a unique venue to showcase the technologies and achievements in transportation infrastructure, demonstrate the practical value of SHM research, and raise the public awareness on the need for further SHM research and applications.

The three-day program includes keynote lectures, invited lectures, panel discussion and an onsite field demonstration of the latest sensing, nondestructive evaluation, and robotic technologies, at the Stan Musial Veterans Memorial Bridge. The program also includes a student poster competition to encourage student participation, a short course on fiber optic sensing applications, and a SHM education workshop geared toward fostering incorporation of SHM concepts as part of undergraduate curriculums. The two-volume conference proceedings includes 245 full-length papers submitted to the SHMII-9; each paper was reviewed by distinguished peers in the field.

SHMII-9 represents the 9th official event in the biennial conference series of the International Society for Structural Health Monitoring of Intelligent Infrastructure (ISHMII). The previous eight events were held in 2003 (Tokyo, Japan), 2005 (Shenzhen, China), 2007 (Vancouver, Canada), 2009 (Zurich, Switzerland), 2011 (Cancun, Mexico), 2013 (Hong Kong, China), 2015 (Turin, Italy), and 2017 (Brisbane, Australia).

We wish you a successful conference in the City of St. Louis, the Gateway to the West of USA.

Genda Chen, Ph.D., P.E., F. ASCE, F. SEI, F. ISHMII (Conference Chair)
Professor and Director of INSPIRE University Transportation Center
Missouri University of Science and Technology (Missouri S&T)

Sreenivas Alampalli, Ph.D., P.E., MBA, F. ASCE, F. SEI, F. ISHMII, F. ASNT (Conference Co-Chair), Director of Structure Management Bureau
New York State Department of Transportation (NYSDOT)

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Schedule at a Glance

Monday, August 5, 2019

7:00 AM – 5:00 PM	Registration Desk Open (Grand Coat Room)
7:00 AM – 9:00 AM	Continental Breakfast (Grand D)
8:00 AM – 8:40 AM	**Conference Opening Session** (Grand E) Welcome Remarks
8:40 AM – 9:40 AM	**Plenary Session 1** (Grand E) New I-35W Bridge Instrumentation and Data Interpretation for Engineering Lauren Linderman, PhD, University of Minnesota, USA Benjamin Jilk, P.E., S.E., Minnesota Department of Transportation Bridge Office,USA Bayesian Machine Learning for Structural Health Monitoring of Rail Transit System Yi-Qing Ni, PhD, The Hong Kong Polytechnic University, Hong Kong
9:40 AM – 10:00 AM	Refreshment Break (Grand D)
10:00 AM – 11:40 AM	**Concurrent Sessions 1** (see full conference schedule pages 26-27 for details)
11:40 AM – 1:00 PM	Lunch Buffet (Grand Ballroom F/G/H) Lunch Presentation by Randy Hitt, Missouri Department of Transportation
1:00 PM – 2:40 PM	**Invited Sessions** (see page 25 for conference details)
2:40 PM – 3:15 PM	**Poster Session 1** (see page 30) | Refreshment Break (Grand D)
3:15 PM – 5:15 PM	**Concurrent Sessions 2** (see full conference schedule pages 28-30 for details)

Tuesday, August 6, 2019

7:00 AM – 5:00 PM	Registration Desk Open (Grand Coat Room)
7:00 AM – 9:00 AM	Continental Breakfast (Grand D)
8:00 AM – 8:10 AM	**Conference Opening Session** (Grand E)
8:10 AM – 9:40 AM	**Plenary Session 2** (Grand E) Health Monitoring of Battery Structures for Electrical Vehiclesg Fu-Kuo Chang, PhD, Stanford University, USA Inspection, Recognition and Diagnosis of Structural Health for Tunnel Lining by Artificial Intelligence Hongwei Huang and D.M. Zhang, PhD, Tongji University, China Monitoring for Asset Managements Ian F.C. Smith, PhD, Swiss Federal Institute of Technology, Switzerland
9:40 AM – 10:00 AM	Refreshment Break (Grand D)
10:00 AM – 11:40 AM	**Concurrent Sessions 3** (see full conference schedule pages 32-33 for details)
11:40 AM – 1:00 PM	Break for Lunch - Lunch on your own
1:00 PM – 2:40 PM	**Concurrent Sessions 4** (see full conference schedule pages 34-35 for details)
2:40 PM – 3:15 PM	**Poster Session 2** (see page 30) | Refreshment Break (Grand D)
3:15 PM – 5:15 PM	**Concurrent Sessions 5** (see full conference schedule pages 36-38 for details)
6:30 PM – 9:30 PM	**Awards Banquet sponsored by Jacobs** (Grand E/F/G/H)

Schedule at a Glance

Wednesday, August 7, 2019

7:00 AM – NOON	Registration Desk Open (Grand Coat Room)
7:00 AM– 9:00 AM	Continental Breakfast (Grand D)
8:00 AM – 9:40 AM	**Concurrent Sessions 6** (see full conference schedule pages 40-41 for details)
9:40 AM – 10:00 AM	Refreshment Break (Grand D)
10:00 AM – 11:00 AM	**Plenary Session 3** (Grand E) The Challenges of Introducing Scientific Results into Practice of SHM: Reliability, Validation and Acceptance Aspects Wolfgang R. Habel, PhD, formerly Federal Institute for Materials Research and Testing (BAM), Berlin SHM Role in the Framework of Infrastructure Resilience G.D. Cimellaro and O. Kammouth, PhD, Politecnico di Torino, Italy
11:00 AM – 12:00 PM	Closing Session/Conference Adjourns (Grand E)
2:00 PM – 4:00 PM	**In-Situ Exhibitor Bridge Test Demonstrations** (Stan Musial I-70 Bridge) (details on page 23)
5:00 PM	UTC Business Meeting — invitation only (Grand A/B)

Exhibitors

Stop by and visit with our exhibitors in Grand Ballroom D during breaks

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Sunday, August 4, 2019 — Short Course 8:00 AM - 2:00 PM

Strain-Based Structural Health Monitoring using Fiber Optic Sensors

Branko Glisic, Princeton University, USA

Structural health monitoring (SHM) is a process aimed at providing accurate and in-time information concerning structural health condition and performance. The information obtained from monitoring is generally used to increase safety, plan and design maintenance activities, verify hypotheses, reduce uncertainty, and to widen the knowledge concerning the structure being monitored.

Recent developments in fiber optic sensing (FOS) technologies made it possible to conduct global structural monitoring using long-gauge sensors and integrity monitoring using truly distributed sensors. These sensors combined in appropriate topologies and networks can provide tools for the assessment of a wide range of parameters relevant for structural behavior.

The aim of this course is to transfer the knowledge on SHM and FOS. Targeted groups are those who deal with or can take benefits from SHM: civil engineers, practitioners, consultants, contractors, infrastructure managers, owners, researchers and students.

Covered topics include brief introduction to the SHM, overview of available FOS technologies, and SHM methods based on FOS technologies. These topics are illustrated through numerous examples taken from practice.

Short Course Schedule

8:00 AM – 8:30 AM	Welcome, registration, distribution of material, coffee, refreshments
8:30 AM – 9:05 AM	Introduction to Structural Health Monitoring *Motivation, aims, benefits, SHM process*
9:05 AM – 9:50 AM	Overview of Fiber Optic Sensing Technologies • *Monitoring systems* • *Discrete and distributed strain and temperature sensors* • *Accelerometers, tilt-meters, technical textiles*
9:50 AM – 10:15 AM	Monitoring Projects – Examples from Practice • *New I-35W Minneapolis Bridge, USA (courtesy of Roctest Inc.)* • *Halifax Metro Centre, Canada (courtesy of Roctest Inc.)*
10:15 AM – 10:30 AM	Refreshment Break
10:30 AM – 11:05 AM	Sensors Types and Interpretation of Measurement *Strain analysis; dependence of measurement on gauge-length of sensor*
11:05 AM – 11:40 AM	Sensor Topologies and Global Structural Monitoring *Simple, parallel, crossed, and triangular topology; integrity monitoring*
11:40 AM – 12:15 PM	Global Structural Monitoring —Data Analysis Examples from Practice *High-rise buildings Punggol EC26 (courtesy of Roctest Inc.) and Pinnacle@Duxton (courtesy of HDB)* *Singapore; Semiconductor facility piles testing, Taiwan (courtesy of Roctest Inc.)* *Streicker Bridge, Princeton, USA*
12:15 PM – 12:30 PM	Refreshment Break
12:30 PM – 1:05 PM	Integrity Monitoring — Examples from Practice *Concrete pipeline full scale testing, USA* *Fatigue cracking monitoring of Gota Bridge, Sweden (courtesy of Roctest Inc.)* *Streicker Bridge, Princeton, USA*
1:05 PM – 1:25 PM	Importance of Data Visualization *The Learning Bridge project (Tacony-Palmyra Bridge, NJ)* *Streicker Bridge project (Virtual Tour and Informational Modelling)*
1:25 PM – 2:00 PM	Closing Remarks and Course Survey

Sunday, August 4, 2019 — Workshop
2:30 PM - 5:30 PM

Structural Health Monitoring Education Planning and Implementation

Vijaya (VJ) Gopu, Louisiana State University, USA

You are invited to adopt and introduce a fully developed and self-contained Structural Health Monitoring Education Unit to your undergraduate civil engineering students across two required structural engineering courses: structural analysis and structural design.

To aid you in this process, you are invited to participate in a workshop where you will be provided with —

- A comprehensive Planning and Implementation Guide
- All educational materials needed to implement the unit

The SHM Education Unit is composed of two subunits: **Fundamentals Education** and **Applications Education**.

The content in the subunits is divided into modules, each with specific student learning outcomes written in terms of Bloom's Taxonomy cognitive levels of learning and consistent with ABET a-k accreditation criteria and the ASCE Body of Knowledge. The individual modules are provided online to the students in alternative formats: PowerPoint and eLearning. The education module topics are as follows:

FEM0 Getting Started — What, Why and How
FEM1 Introduction to Structural Health Monitoring
FEM2 Structural Health Monitoring Methodology and Testing Categories
FEM3 Sensor and Data Acquisition Technology
FEM4 Analysis and Interpretation of Sensor Data
SEM1 Planning SHM Projects
SEM2 SHM Systems Design
SAM1 SHM Assignment
SAM2 SHM Demonstration Model

The Unit was designed to eliminate or minimize the planning and implementation barriers, but one of the challenges you will face is designing and fabricating a model to demonstrate the features and operation of a SHM system on a beam or other structure. However, we have some ideas to share with you that will allow you to expose your students to the practice aspects of SHM using resources you likely have in your department. You will probably have great ideas of your own!

Organizing Committee

Conference Chair
Dr. Genda Chen, Professor and Robert W. Abbett Distinguished Chair in Civil Engineering, Missouri University of Science and Technology (USA)

Conference Co-Chair
Dr. Sreenivas Alampalli, Director of Structure Management Bureau, New York State Department of Transportation (USA)

Organizing Committee Members
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Dr. Yi Bao, Assistant Professor, Stevens Institute of Technology (USA)

Randy Hitt, Construction & Materials Liaison Engineer, Missouri Department of Transportation (USA)

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Dr. Hongyan Ma, Assistant Professor of Civil Engineering, Missouri University of Science and Technology (USA)

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Sue Turner, Director of Professional and Continuing Education – Global Learning, Missouri University of Science and Technology (USA)

Michelle Wiginton, Conference Support Specialist, Professional and Continuing Education – Global Learning, Missouri University of Science and Technology (USA)

Dr. Chenglin (Bob) Wu, Assistant Professor of Civil Engineering, Missouri University of Science and Technology (USA)

Dr. Guirong (Grace) Yan, Assistant Professor of Civil Engineering, Missouri University of Science and Technology (USA)

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Dr. Tommy Chan, Professor in Civil Engineering, Queensland University of Technology (Australia)

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Dr. Hoon Sohn, Professor & Director, ICT Bridge Center, Department of Civil and Environmental Engineering, KAIST (South Korea)

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Dr. Zhishen Wu, Professor of Civil Engineering, Ibaraki University (Japan)

Dr. You-lin Xu, Chair Professor in Structural Engineering and Dean of Faculty of Construction and Environment, Hong Kong Polytechnic University (China)

Conference Keynote Speakers

Monday, August 5, 2019
8:40 AM– 9:10 AM

New I-35W Bridge Instrumentation and Data Interpretation for Engineering*

Dr. Lauren Linderman | Ben Jilk, P.E., S.E.

Abstract

The I-35W Saint Anthony Falls Bridge, opened in September 2008, includes instrumentation for long-term monitoring of the structural behavior of the bridge. Data from the over 500 sensors deployed on the structure, including vibrating wire strain gages, fiber-optic strain gages, thermistors, linear potentiometers, and accelerometers, has been collected since the bridge's opening. This large-scale, long-term deployment offers insight on monitoring of bridges and a unique data-set to investigate structural behavior. In this presentation, the monitoring system will be introduced and key results will be reviewed. The original motivation and value of the information for asset management will be discussed from a MnDOT perspective. Of particular interest are the temperature-dependent and long-term time-dependent behavior of the post-tensioned concrete bridge. A data analysis approach that leverages temperature, strain, and displacement sensors distributed throughout the structure to capture the time-dependent behavior will be described. For a structure that sees significant temperature loading and gradients, the temperature captured by the thermistors is essential to capture the temperature-dependent behavior used in evaluating time-dependent deflections and can account for significant strains. The potential impact of these analysis results on concrete bridge design practice and lessons learned for monitoring deployments will be summarized.

Biographies

Dr. Lauren Linderman

Lauren Linderman is an Assistant Professor in the Department of Civil, Environmental, and Geo- Engineering at the University of Minnesota. She earned her Ph.D. in Civil Engineering from the University of Illinois at Urbana-Champaign in 2013. Dr. Linderman's research combines analytical and experimental studies in the area of smart structures for improving the long-term performance of civil infrastructure through both monitoring and vibration mitigation. Within the field of smart structures, the topics of most interest include data acquisition, wireless sensor technology, networked estimation and feedback control, modal analysis, and experimental methods. She received the NSF CAREER in 2018 on sensor selection for reliable monitoring and control of civil systems. She was named Young Engineer of the Year in 2019 by the Minnesota section of ASCE. She serves on the ASCE EMI Technical Committee on Structural Health Monitoring and Control.

Ben Jilk, P.E., S.E.

Ben Jilk is the Complex Analysis and Modeling Design Leader at the Minnesota Department of Transportation Bridge Office. He has been involved with the instrumentation and monitoring of the new I35W bridge from the beginning; starting with work he did as a graduate student at the University of Minnesota and subsequently followed by being technical liaison for research projects while working at MnDOT.

*Denotes Presentation Only

Conference Keynote Speakers

Monday, August 5, 2019
9:10 AM – 9:40 AM

Bayesian Machine Learning for Structural Health Monitoring of Rail Transit System

Dr. Yi-Qing Ni

Abstract

Operational safety is the most important issue for rail transit in view of its mass transportation volume and high running speed. Developing smart rail systems by integrating sensing, communication, computing and information technologies is becoming an urgent need to satisfy the safety and reliability requirements in modern rail industry. Sensory systems have been increasingly implemented on railway infrastructure and rail vehicles for online and on-board monitoring to ensure the operational safety. In addition to innovative sensing technology, there is an urgent need to develop advanced analytic tools which enable data-driven fault diagnosis and prognosis in a real-time or near real-time manner. Probabilistic machine learning (PML) has currently emerged as one of the principal theoretical and practical approaches for designing machines that learn from data acquired through sensing. The PML paradigm, which is capable of describing how to represent and manipulate uncertainty in modelling and prediction, has a central role in massive data analytics. In particular, probabilistic approaches developed in the framework of Bayesian machine learning (BML) provide an efficient means to interpret the heterogeneous monitoring data with different sources of uncertainty. Not only it allows for the consideration of uncertainties inherent in monitoring data in characterization and modelling, it also enables quantification of uncertainties in prediction and forecast. This presentation outlines the applications of key BML methods, such as sparse Bayesian learning, Bayesian compressive sensing, and Gaussian process regression to fault diagnosis and prognosis of railway systems with the use of online and on-board monitoring data. Illustrative examples of using real-world data for data-driven fault diagnosis and prognosis of rail transit system in the BML context are provided.

Biography

Dr. Yi-Qing Ni

Yi-Qing Ni is a Chair Professor of Smart Structures and Rail Transit in the Department of Civil and Environmental Engineering, the Hong Kong Polytechnic University, Hong Kong, and the Director of National Engineering Research Center on Rail Transit Electrification and Automation (The Hong Kong Polytechnic University), Hong Kong. His research areas cover structural health monitoring, smart materials and structures, and monitoring and control in rail engineering. Professor Ni has published more than 180 SCI-cited journal papers with an H-index of 37 in Web of Science Core Collection (an H-index of 49 in Google Scholar), and over 290 international conference papers. He was selected as a Highly Cited Researcher in the Field of Civil Engineering by Shanghai Ranking Consultancy and Elsevier in 2016. He received the 2017 "SHM Person of the Year Award" (selected by the editorial board of "Structural Health Monitoring: An International Journal") during the 11th International Workshop on Structural Health Monitoring held at Stanford University in September 2017. He is a fellow of Hong Kong Institution of Engineers (HKIE), and a council member of International Society for Structural Health Monitoring of Intelligent Infrastructure (ISHMII).

Conference Keynote Speakers

Tuesday, August 6, 2019
8:10 AM – 8:40 AM

Health Monitoring of Battery Structures for Electrical Vehicles*

Dr. Fu-Kuo Chang

Abstract

Due to recent rapid advancements in high-energy storage batteries such as lithium-ion (Li-ion) batteries, electric vehicles are receiving more and more attention in both automotive and aviation industries. However, those high-energy batteries are often susceptible to mechanical intrusion and deformation, along with thermal runaway. Typical battery packs are therefore compounded by layer upon layer of vehicle level mechanical enclosures and protection systems to guard the cells and provide mechanical stability while maintaining intimate contact between the functional components. In addition, there is a lack of reliable prediction methods for battery state of health (SOH) and remaining service life (RSL) which leads to significant conservation in battery energy capacity design. These overhead components significantly reduce both the packing factor and the system-level energy density. For example, in state-of-the-art EVs, the weight and volume of the complete energy storage 'system', including protection systems and enclosures, can be as much as twice those of the cells alone. Additionally, the advantages of high-energy cells are also largely offset by the complexity and cost of the more demanding system-level engineering requirements.

In this presentation, we introduce a new multifunctional energy storage composite (MESC) for the design of battery-power electrical vehicles. MESC is made of high-strength carbon-fiber composites embedded with lithium-ion battery materials and built-in piezoelectric sensors. A novel interlocking fabrication technique is developed to seamlessly integrate lithium-ion batteries in composites without sacrificing the structural integrity of the host while maintaining the energy capacity and electrical performance of the original battery materials. At the same time, the SOH of the integrated batteries can be monitored accurately simultaneously using the built-in sensor networks in the composites. Prototypes of the multifunctional energy-storage composites have been fabricated and demonstrated the feasibility of potentially providing up to 40% weight savings on the combined battery and structural weight of existing commercial electric vehicles.

Biography

Dr. Fu-Kuo Chang

Fu-Kuo Chang is a Professor in the Department of Aeronautics and Astronautics at Stanford University. His primary research interest is in the areas of multi-functional materials and intelligent structures with particular emphases on structural health monitoring, self-sensing diagnostics, intelligent sensor networks, and multifunctional energy storage composites for transportation vehicles as well safety-critical assets. He is a recipient of the SHM Lifetime Achievement Award (2004), SPIE NDE Lifetime Achievement Award (2010), and the PHM lifetime Achievement Award (2018). He is the Editor-in-Chief of Int. J. of Structural Health Monitoring. He is also a Fellow of AIAA and ASME.

*Denotes Presentation Only

Conference Keynote Speakers

Tuesday, August 6, 2019
8:40 AM – 9:10 AM

Inspection, Recognition and Diagnosis of Structural Health for Tunnel Lining by Artificial Intelligence

Dr. Hongwei Huang

Abstract

As one may realize, the fast development of the construction for underground infrastructures urges the badly needs of efficient inspection and monitoring techniques for the infrastructures that are put into operation. The structural health condition may deteriorate over long time period, which threatens the safety of the assets and the publics. During the past two decades, fast mobile inspection systems have been developed over the world from MTI-200a (2018), MIMM-R (2014), TCRACK (2012), GRP-5000 (2012). However, the image data of tunnel defects that are captured by these systems are extremely complex due to the unfavorable environmental conditions and geometrical nonlinearity of tunnel linings. Although the recognition method of cracks based on luminance difference and contrast difference in a local grids and recognition method of leakage based on water leakage infrared radiation have been proposed with certain accuracy, this paper will show that both the efficiency and accuracy have been greatly improved by using the deep learning of AI based image recognition method. Later, a novel diagnosis index named tunnel defect index for the structural defects of tunnel after the recognition is discussed with a field case application. Given the experiences on the inspection, recognition and diagnosis for tunnel lining over two decades, new practical oriented views in future studies are summarized briefly at the end of this paper.

Biography

Dr. Hongwei Huang

Hongwei Huang is a Full Professor and National Yangtze River Scholar Distinguished Professor of Tongji University, China. Currently, Prof. Huang is also the dean of the graduate school of Tongji University, Chair of Risk and Insurance Research Branch of China Civil Engineering Society. Prof. Huang is the Editorial Board Member of several high ranking international academic journals including Tunneling and Underground Space Technology, ASCE-ASME Journal of Risk and Uncertainty of Engineering System, and GeoRisk. He serves as core members for international academic committees including Geotechnical Safety Network (GEOSNet), Geo-Institute on Risk Management of ASCE, TC304 of the International Society for Soil Mechanics and Geotechnical Engineering (ISSMEGE), WG2 of ITA and etc. So far, he has published more than 200 journal papers in Chinese and English and more than 5 books. Based on the above achievements, he has delivered more than 12 keynotes in international conferences and chaired more than 5 international conferences.

Conference Keynote Speakers

Tuesday, August 6, 2019
9:10 AM – 9:40 AM

Monitoring for Asset Management*

Dr. Ian F.C. Smith

Abstract

It is estimated that the annual global expenditure of the architecture, engineering and construction industry attained $10 trillion in 2018. Construction involves the largest use of mined raw materials. To improve sustainability, we need to learn to do more with less. Placing sensors on structures can help. The vast majority of research in structural monitoring is related to defect detection and much work is focused on physical-model-free signal analysis to identify anomalies accurately and in a timely manner. While this work may be useful in areas outside of structural engineering, it provides insufficient support to managers of civil-infrastructure assets. Asset managers need to make million-dollar decisions such as retrofit versus structural replacement and if retrofit, choosing the best strategy. Such decisions require knowledge of the physical behavior of the structure. Engineers use improved physical-principles models to extrapolate into retrofit scenarios to ensure that cost estimates of alternatives are accurate. Fortunately, there is often reserve capacity (beyond safety factors) in structures such as bridges. Therefore, sensing can result in significant savings. This paper describes experience using a data-interpretation strategy that has been specially developed for infrastructure asset management. A summary of results of over twenty cases of full-scale testing confirms that most structures have significant amounts of reserve capacity. This interpretation strategy is thus a useful tool for asset managers and more generally, it has the potential to help develop less conservative design practices in a material-scarce future.

Biography

Dr. Ian F.C. Smith

Ian F.C. Smith is a Professor of Structural Engineering at the Swiss Federal Institute of Technology (EPFL) in Lausanne, Switzerland. He received his PhD from Cambridge University, UK in 1982. His research interests are on intersections of computer science with structures and urban systems. Applications include advanced cyber-physical systems such as biomimetic structures and sensed civil infrastructure.

In 2003, he co-authored the text book Fundamentals of Computer-Aided Engineering (Wiley) and the 2nd Edition, Engineering Informatics: Fundamentals of Computer-Aided Engineering appeared in June 2013. In 2004, he was elected to the Swiss Academy of Engineering Sciences and in 2005, he received the Computing in Civil Engineering Award from the American Society of Civil Engineers (ASCE). Over fifteen years, he was Co-Editor-in-Chief of the Elsevier journal "Advanced Engineering Informatics" and among several current editorial-board memberships, he is Specialty Editor of the ASCE journal "Computing in Civil Engineering".

**Denotes Presentation Only*

Conference Keynote Speakers

Wednesday, August 7, 2019
10:00 AM – 10:30 AM

The Challenges of Introducing Scientific Results Into Practice of SHM: Reliability, Validation and Acceptance Aspects

Dr. Wolfgang R. Habel

Abstract

Many structure components as part of the working infrastructure network have to be monitored for different reasons. Well-designed sensors and corresponding measurement systems are required. Both conventional and new innovative sensor solutions are used; however new solutions developed in scientific institutions have to be introduced into practice and fulfil the expectations of users and/or owners of the structure: established application methodology, optimum long-term performance, knowledge about possible drifts and creep effects, and finally verified information about the measurement uncertainty after many years of work under harsh environmental conditions.
This presentation focuses on essential – but not always considered – aspects when monitoring solutions are required. Appropriate selection of the sensor system that provides the required monitoring characteristic, which includes only those components correctly validated according to standardized procedures that consider all environmental influences etc. are discussed. Throughout this presentation, critical questions related to reliable measurement results are illustrated by means of examples. Also presented are new helpful activities in the international standardization of fiber-optic sensors, which are usefully applicable in SHM systems for civil infrastructure.

Biography

Dr. Wolfgang R. Habel

Wolfgang Habel received the diploma degree in Electrical Engineering in 1972 and his Ph.D. degree in Civil Engineering (Dr.-Ing.) from the Technical University of Berlin. He gathered professional experience as an R&D engineer in the development of superconducting high voltage cables and automated control and sensor units for industrial building production. Since 1985, he has been developing fiber optic sensors to monitor diverse structures. He joined the German Federal Institute for Materials Research and Testing in Berlin in 1997 and was there head of the fiber-optic sensor sector until his retirement in 2014. He was leading numerous projects dealing with monitoring of diverse structures in different fields, was granted with several patents, and published numerous papers and book chapters in the field of fiber-optic sensor technology for SHM. He is still leading development of IEC standards for FOS.

From 2007, he was Vice-President, from 2014 until 2016 President of ISHMII. Since 2015, he is coordinator of a large German joint research monitoring project in high voltage engineering and has been teaching Master students at two universities in Germany in courses “Optics for NDT” and “Sensor-based monitoring”.

Conference Keynote Speakers

Wednesday, August 7, 2019
10:30 AM – 11:00 AM

SHM Role in the Framework of Infrastructure Resilience

Dr. Gian Paolo Cimellaro

Abstract

Upgrading critical infrastructure systems by integrating sensing, communication, computing and information technologies is becoming an urgent need to keep up with increasing natural disasters that put threat on human lives. Sensor-enabled infrastructure systems is destined to empower resilient communities with more intelligence and sustainability, and therefore enhance the operational safety of physical infrastructure. Through online and on-board monitoring, the infrastructure components incorporating appropriate analytic and predictive modelling tool not only provides real-time insight into the operational status of every system and its components, but also enables the trend prediction and timely prognosis of failure before it happens as well as early-stage diagnosis of damage in its incipiency.

The presentation will introduce the Cyber-Resilient Infrastructure framework (CRI) that encourages the incorporation of innovative techniques, such as optical fiber sensors and machine learning, for structural health monitoring of a variety of infrastructure systems. It will cover both basic research as well as practical applications in structural systems. Case studies and application examples will be presented to show the resilience-related advantages gained by incorporating novel techniques in the field of disaster resilience. This presentation concludes with ongoing developments in Europe, particularly for high speed trains.

Biography

Dr. Gian Paolo Cimellaro

Gian Paolo Cimellaro's primary field of investigation is Earthquake Engineering with emphasis on defining Quantification of Resilience of systems. Prof. Cimellaro's interdisciplinary research investigates representations of health system properties and processes, creating quantitative modeling solutions for a better understanding of sustainable use and resilience of systems that often challenges collaborating teams consisting of scientists, social scientists, engineers, lawyers and extension specialists across a wide spectrum of disciplines. His major contribution has been the quantification of the concept of disaster resilience. More information is available at: http://staff.polito.it/gianpaolo.cimellaro/faculty_bio.html

Conference Invited Speakers

Monday, August 5, 2019
1:00 PM – 1:25 PM

Vehicular Tracking Using Machine Learning to Link Loads in Highway Corridors for the Performance Assessment of Connected Highway Bridges

Dr. Jerome Lynch

Abstract

Recent advances in sensing and connectivity technologies have made structural monitoring more accessible and affordable for a broader set of structures including highway bridges. Structural monitoring data from bridges hold great promise for the development of more quantitative approaches to the risk management of critical highway assets. However, a major limitation of most bridge monitoring systems is the absence of a quantitative measurement of the loads being imposed on bridges. As a result, accurately assessing the performance and health of a bridge can be difficult based solely on output-only bridge response measurements. Vehicular loads are commonly measured in highway networks using weigh-in-motion systems (WIMS) but these stations are often located far from the bridge being monitored. In this presentation, recent work on the use of computer vision and machine learning is presented for tracking vehicular loads in highway networks with the aim of linking WIMS measured truck loads in the network to bridge responses collected using structural monitoring systems. A cyber-physical system (CPS) architecture is proposed with bridge monitoring systems, cameras and WIMS stations synchronized with one another using wireless connectivity to a common cloud environment. Cameras are installed at monitored bridges and WIMS stations to continuously track vehicles driving over these assets with convoluted neural network (CNN)-based machine learning algorithms used to automate the extraction and identification of truck loads. This allows trucks to be tracked and truck weights measured by WIMS stations to be assigned to measured bridge responses. The presentation highlights deployment of the system on the northbound I-275 corridor between Newport and Romulus, Michigan that is instrumented with wireless structural monitoring systems on two bridges, one WIMS station and multiple cameras to track truck loads. The presentation focuses on the unique input-output datasets generated and their potential to transform bridge management. The work specifically focuses on the development of data-driven load rating methods that can be used to more accurately assess the capacity of monitored bridges by using measurement data to inform the rating methodology.

Biography

Dr. Jerome Lynch

Jerome Lynch is the Donald Malloure Department Chair of Civil and Environmental Engineering at the University of Michigan; he is also Professor of Civil and Environmental Engineering, and Professor of Electrical Engineering and Computer Science. Dr. Lynch completed his graduate studies at Stanford University where he received his Ph.D. in Civil and Environmental Engineering in 2002, M.S. in Civil and Environmental Engineering in 1998, and M.S. in Electrical Engineering in 2003. Prior to attending Stanford, Dr. Lynch received his B.E. in Civil and Environmental Engineering from the Cooper Union in New York City. His current research interests are in the areas of wireless cyber-physical systems, cyberinfrastructure tools for management of structural monitoring datasets, and nanoengineered thin film sensors for damage detection and structural health monitoring. Dr. Lynch has been awarded the 2005 ONR Young Investigator Award, 2009 NSF CAREER Award, 2009 Presidential Early Career Award for Scientists and Engineers (PECASE), 2012 ASCE EMI Leonardo da Vinci Award and 2014 ASCE Huber Award.

Conference Invited Speakers

Monday, August 5, 2019
1:25 PM – 1:50 PM

UAV-based Autonomous and Instantaneous Bridge Diagnosis*

Dr. Hoon Sohn

Abstract

Unmanned aerial vehicle (UAV) has been widely utilized in various engineering fields. This paper provides an overview of an UAV based bridge inspection project sponsored by Ministry of Land, Infrastructure and Transport in South Korea. This project aims to complement existing bridge inspection practices by integrating UAV, non-destructive testing sensing and big data analytics. The specific objectives of the project consist of (1) development of a UAV hardware platform capable of close-range flight near a bridge and flight-to-attach operation onto the bridge (40 minutes flight time with 4.5 kg of payload under 2 m/sec wind speed); (2) autonomous UAV operation using a vision based SLAM algorithm (under 50 mm location error) for localization and a line-of-sight path control algorithm under gust wind conditions (less than 4m/s); (3) hybrid imaging system combining infrared and vision-based cameras for visualization and quantification of various defects (micro-crack, spalling, bolt loosening and coating thickness variation); (4) automatic generation of 3D BIM model and overlapping with bridge inspection results; and (5) development of UAV-based bridge inspection guideline and regulations. Component level validation tests were performed on concrete and steel bridge structures, and testing of the entire integrated system is underway.

Biography

Dr. Hoon Sohn

Hoon Sohn received his B.S. (1992) and M.S. (1994) degrees from Seoul National University, Seoul Korea and Ph.D. (1999) from Stanford University, California, USA, all in Civil Engineering. He worked at Los Alamos National Laboratory (LANL) from 1999 to 2004 as a Director-funded Postdoctoral Fellow/Technical Staff Member. He was an Assistant Professor in the Civil and Environmental Engineering Department at Carnegie Mellon University for 2004-2006. He is now Professor at KAIST (Korea Advanced Institute of Science and Technology), and the Director of ICT Bridge Research Center sponsored by the Ministry of Land, Infrastructure and Transport in Korea (about 25 Million USD project over 5 years). Over last twenty years, his research interest has been in the areas of structural health monitoring, nondestructive testing, sensing technologies and data analytics. He has published over 170 refereed journal articles, over 350 conference proceedings, and 10 book & book chapters. His developed technologies are licensed and commercialized by private companies, resulting in over 830,000 USD licensing agreements. He is a co-chair of SPIE Annual International Symposium on Smart Structures and Material Systems and Nondestructive Evaluation (2018-2019), and he was selected to SPIE Fellow in 2018. He was also the recipient of SHM Person-of-Year Award at 2011 International workshop on SHM, 2008 Young Scientists Award (150,000 USD cash award) and 2017 Young Engineers Award (50,000 USD cash award), 2017 KAIST Best Research Award, and 2018 Kyung-Am Award (200,000 USD cash award) all in South Korea. His work has been funded by the Boeing Company, Samsung Electronics, Samsung Display, US Air Force Research Laboratory, US Air Force Office of Scientific Research (US AFOSR), US National Science Foundation, National Research Foundation of Korea, Korea Agency for Defense Development, Hyundai & KIA Motors, Hyundai Heavy Industries, Bombardier, POSCO, Daewoo Construction, and Foongsan FNS.

**Denotes Presentation Only*

Conference Invited Speakers

Monday, August 5, 2019
1:50 PM – 2:15 PM

Engineering Practice and Exploration of Bridge Structural Health Monitoring Technology in China

Dr. Yufeng Zhang

Abstract

Structural health monitoring technology is an essential supplement to traditional manual detection methods. The application of structural health monitoring technology for constructing a bridge neural system is helpful for early detection of structural damage and hidden dangers, and to ensure the safety and health of bridges. This paper mainly introduces the application of structural health monitoring technology in China in recent years, especially in long-span cable-supported bridges in Jiangsu Province, China. This article discussed the timely alarm system, cumulative damage trend deduction, manual inspection workload reduction, verification of existing design and guidance of future design of the structural health monitoring technology through specific engineering cases. This paper covered the current technical stage of structural health monitoring technology and main technical bottlenecks, as well as recent technical breakthroughs in areas such as distributed sensing technology and automatic identification of anomalous data.

Biography

Dr. Yufeng Zhang

Yufeng Zhang is a researcher-level senior engineer and the expert enjoying special government allowances of the State Council. He is the director of 'The State Key Laboratory on Safety and Health for in-service Long-span Bridges' and the Chief Engineer in Structural Health Monitoring Division, Testing Institute, JSTI. He specializes in bridge construction control, inspection, health monitoring and structural evaluation. He presided over the design and implementation of the structural health monitoring system for more than 60 bridges, including Sutong Yangtze River Highway Bridge and Ma'anshan Yangtze River Highway Bridge. He has been in charge of construction monitoring projects for more than 50 bridges including Yunnan Jindong Bridge and Kangbashi Bridge. He conducted the detection, test, evaluation, reinforcement and maintenance work for hundreds of bridges including Yang Pu Bridge and Wujiang Bridge. He has obtained the second National Prize for Progress in Science and Technology, the first Prize for Progress in Science and Technology in Jiangsu, Special Science and Technology prize for China Highway and Transportation Society, and several other provincial level prizes.

Conference Invited Speakers

Monday, August 5, 2019
2:15 PM – 2:40 PM

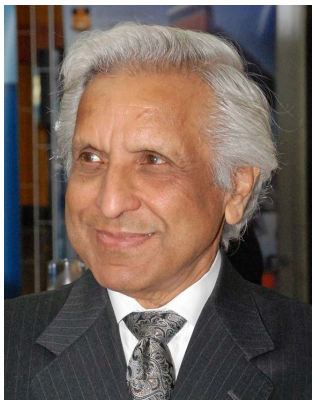
A Case for Adding an Inspection Level Related to SHM for Bridge Evaluation

Dr. Aftab Mufti

Abstract

The Canadian Highway Bridge Design Code uses the concept of a target reliability index for evaluating the load carrying capacity of existing bridges. This index, which is based on risk to human life, is related to three aspects of uncertainties inherent in a bridge: those related to (a) element behaviour, (b) system behavior, and (c) inspection level. It is assumed that all bridge inspections are manual. Citing examples of tests on many instrumented bridges, the paper proposes another level of inspection, which is done with the help of electronic instruments and tests under controlled vehicle loads. The paper proposes simple additions to the clauses of the CHBDC, which can be used to determine the optimum load carrying capacities of existing bridges where structural monitoring information is available.

Biography



Dr. Aftab Mufti

Aftab A. Mufti is an Emeritus Professor of Civil Engineering at the University of Manitoba, Winnipeg, Manitoba, Canada. He is also the former Scientific Director and President of the Innovative Structures with Intelligent Sensing Canada Research Network, a Network of Centres of Excellence. His research interests include FRPs, FOSs, FEM, bridge engineering, Structural Health Monitoring (SHM). At the University of Manitoba he introduced new research area of Civionics Engineering to monitor deteriorating infrastructure. He has authored or co-authored 5 books, plus provided chapters for 2 others, edited 9 books, and written more than 350 technical publications. Dr. Mufti is the recipient of 24 awards. He is the holder of several patents on the steel-free bridge deck concept, of which he is the principal developer. He has been involved in the writing of bridge design codes since 1992, and was the Chair of the Technical Sub-Committee on the Fibre Reinforced Structures of the Canadian Highway Bridge Design Code, published in 2006. He is a fellow of 9 societies. On November 2013 he was elected as a Fellow of the Royal Society of Canada (FRSC) and on July 1, 2010 he was appointed as a Member of the Order of Canada, highest civilian honour bestowed on Canadian citizens, for his contribution to and leadership in the field of civil engineering, notably for researching the use of advanced composite materials and fibre optic sensors in the construction and monitoring of bridges and other infrastructures.

Conference Invited Speakers

Monday, August 5, 2019
1:00 PM – 1:25 PM

Hong Kong Experience in Structural Health Monitoring of Long-Span Cable-Supported Bridges

Dr. You-Lin Xu

Abstract

Many long-span cable-supported bridges emerge worldwide in recent years. The installation of a long-term structural health monitoring (SHM) system to the bridge becomes a necessity to monitor its loading conditions, assess its performance, detect its damage, and guide its maintenance with the utmost goal of ensuring its functionality, safety and sustainability during its life time. However, the structural systems, operation conditions, and environments of long-span cable-supported bridges are very different from those of aircrafts and machines. There are still many challenges in SHM technologies for long-span cable-supported bridges. This presentation takes the Tsing Ma suspension bridge and the Stonecutters cable-stayed bridge in Hong Kong as examples and recapitulates the relevant works done by the author and his colleagues and students in the past twenty years. The SHM systems installed in the two bridges are briefly introduced first. The characterization of highway loading, railway loading, wind characteristics, and temperature effects from the data recorded by the SHM system is then presented. The assessment of bridge performance in terms of identified dynamic characteristics and recorded structural responses is introduced. Toward fatigue damage prognosis and damage detection, SHM-based 4M technologies, which involve multiscale modeling, multi-type sensor placement, multi-level and multi-stage damage detection, is presented. Finally, the SHM-based bridge rating system for bridge maintenance and the SHM-based life-cycle management of the bridge are discussed.

Biography

Dr. You-Lin Xu

You-Lin Xu received his Ph.D. degree from the University of Sydney in 1991. He joined The Hong Kong Polytechnic University in 1995, where he is currently Dean of the Faculty of Construction and Environment. He authored over 270 SCI journal papers and three technical books. He received the CAE Guanghua Engineering Science and Technology Prize in 2018, the IAWE Davenport Medal in 2018, the ASCE Robert H. Scanlan Medal in 2012, the CACM Qian Ling Xi Computational Mechanics Award in 2010, and the Croucher Award in 2006. He has been engaged in the health monitoring projects on the Tsing Ma Bridge and the Stonecutters Bridge. He was Chair of the 6th International Conference on Structural Health Monitoring of Intelligent Infrastructure in 2013. He is a Fellow of the Hong Kong Institution of Engineers, the American Society of Civil Engineers, the Engineering Mechanics Institute of the U.S.A., the Institution of Structural Engineers of the U.K, and the Hong Kong Academy of Engineering Science.

Conference Invited Speakers

Monday, August 5, 2019
1:25 PM – 1:50 PM

Risk and Stock Management of Civil Infrastructure

Dr. Yozo Fujino

Abstract

In this presentation, two aspects of management of civil infrastructure, typically bridges, are discussed; namely risk management and stock management. Firstly, risk management for earthquakes is described with emphasis on lessons from the past earthquakes such as 1989 Loma Prieta Eq., 1994 Northridge Eq., 1995 Kobe Eq. and 2011 Tohoku Eq. It will be shown how the earthquake-induced damage was evolved for the past thirty years. As to stock management, large governmental project (2013-2019) for infrastructure maintenance in Japan is explained. In this presentation, new developments and potential applications of nondestructive evaluations, sensing systems, imaging systems, data analytics, climbing robots, unmanned aerial vehicles (UAV), will be introduced and reviewed.

Biography

Dr. Yozo Fujino

Yozo Fujino was Professor of Civil Engineering, University of Tokyo from 1990 to 2014 and now Distinguished Professor of Institute of Advanced Sciences, Yokohama National Univeristy. His area of expertise comprises dynamics, control and monitoring of bridges and structures, earthquake- and wind-effects on structures. He is also interested in cable-supported long span bridges. He was appointed to be a policy adviser in the Council of Science and Technology, Cabinet Office, Government of Japan in 2014 and was in charge of a 5-years(2014-2019) large research project (approx. 150 M$US) "Infrastructure maintenance, renovation and management". He received many awards; recent ones are Medal with Purple Ribbon from the Emperor of Japan(2007), R.H. Scanlan Medal(2011) and George Winter Medal(2015) both from ASCE, T.Y. Lin Medal(IABMAS, 2012), International Achivement Award JSCE(2013), IABSE Award(2014) and so on. He is a recipient of the 2019 Japan Academy Prize which is the highest honor to academicians in Japan. He is a member of the Engineering Academy of Japan since 2012.

Conference Invited Speakers

Monday, August 5, 2019
1:50 PM – 2:15 PM

Integrating smart inspection and monitoring results through a multi-scale model strategy*

Dr. Jian Zhang

Abstract

The specific objectives of the presentation consist of the following aspects: (a) Smart inspection technology. A wall-climbing UAV system is developed to acquire structure images which are transmitted to a smartphone through a developed wireless data transmission system, and an advanced convolution neural network is employed to image processing and crack detection on a smartphone software. (b) SHM technology. Experimental Study of Thermal Effects of long span bridges are studied by processing the long-term monitoring data, and thermal performance analysis calculating temperature-induced stress is studied, in which the different kinds of thermal loads including uniform temperature, linear/nonlinear temperature gradient and partial constraints in axial/rotation directions are considered. (c) A multi-scale FE model strategy is proposed to integrate the smart inspection and monitoring results for safety evaluation of long span bridges, especially the uncertainty involved in the structural identification and finite analysis stages are considered.

Biography

Dr. Jian Zhang

Jian Zhang is a professor and Vice Dean of School of Civil Engineering, Southeast University, China. He received his PhD from Kyoto University, Japan, and worked at University of California at San Diego and Drexel University, USA. In the area of structural health monitoring, he has published 4 books and over 50 first/corresponding-author SCI journal papers. His research results have been applied on over 20 long span bridges including the Sutong Yangzi-River bridge and the Second Humen bridge. He is the editor board member of the journal of Computer-Aided Civil and Infrastructure Engineering and the Journal of Structural Control and Monitoring. He is serving as the co-chairman of EVACES-8 conference and the ISHMII council member. He was awarded the first prize of Science and Technology Award of Jiangsu Province (twice), the first prize of Science and technology of China Highway Society, and the second prize of National Award for Technological Invention.

**Denotes Presentation Only*

Conference Invited Speakers

Monday, August 5, 2019
2:15 PM – 2:40 PM

Complementary Use of NDE and SHM in Comprehensive Assessment of Causes of Deterioration in Concrete Bridge Decks* *Dr. Nenad Gucunski*

Abstract

Significant advances were made in recent years in NDE technologies' efficiency for detecting and characterizing deterioration in bridge decks, including advances in automation of NDE data collection, analysis, and interpretation. Those advances enable more extensive and more frequently implemented data collection that will lead to more objective description of the current condition and more precise prediction of the progression of deterioration. In addition, a complementary use of multiple NDE technologies may assist in identification of likely causes of deterioration. As such, the NDE data are becoming essential for effective and economical management of bridges, concrete bridge decks in particular. It has also been shown that the bridge deck performance varies widely, even between bridges that are very close in age, and that have similar traffic loads, designs, and climate conditions. This indicates that deterioration processes, since they are a result of multiple inputs and actions, are inherently complex. Therefore, additional influences require examination to provide the most complete answers regarding disparate bridge deck performance. Complemental use of NDE, SHM, and other technologies for local and global assessment of bridges open opportunities for providing those answers. The presentation provides an overview of the benefits stemming multi-NDE technology surveys, especially those employing rapid and automated data collection and analysis. It also explores ways we can gain additional knowledge about the bridge performance through multi-NDE technology surveys, and complemental use of NDE and SHM.

Biography

Dr. Nenad Gucunski

Nenad Gucunski is professor and chairman of Civil and Environmental Engineering, and Director of Infrastructure Condition Monitoring Program at Rutgers' Center for Advanced Infrastructure and Transportation (CAIT). His primary expertise is in nondestructive evaluation (NDE) of transportation infrastructure, problems of dynamic soil-structure interaction, and geophysical methods. Dr. Gucunski published more than 250 publications, primarily on various aspects of development of NDE/NDT technologies, and their application and automation. Dr. Gucunski is an active member of a number of technical committees of several professional societies, and the past chair of the ASCE's Geophysical Engineering Committee. Dr. Gucunski and his team are the recipients of the 2014 ASCE Charles Pankow Award for Innovation for the development of RABIT (Robotics Assisted Bridge Inspection Tool) for bridge decks. Dr. Gucunski received his B.S. degree in civil engineering from University of Zagreb, Croatia, and M.S. and Ph.D. degrees in civil engineering from The University of Michigan.

**Denotes Presentation Only*

August 7, 2019
2:00 PM – 4:00 PM

In-Situ Exhibitor Bridge Test Demonstrations

(Stan Musial I-70 Bridge)

Shuttle departs from Hyatt Regency St. Louis in front of lobby

The Missouri Department of Transportation (MoDOT) is sponsoring in-situ bridge test demonstrations. This is a great opportunity for exhibitors to showcase their products to conference attendees.

The Stan Musial Veterans Memorial Bridge is a bridge across the Mississippi River between St. Clair County, Illinois, and the City of St. Louis, Missouri. Built between April 19, 2010, and February 2014, the bridge opened on February 9, 2014. The main span of the bridge is 1,500 feet (460 m) in length, part of a total span of 2,803 feet. It is 86 feet (26 m) wide. Cables stretch from the bridge deck to the tops of two A-shaped towers, which reach 435 feet (133 m) above I-70. The new bridge's main span is supported by 1,000 miles (1,600 km) of 0.6-inch-diameter (15 mm) stay-cable strand, enough for nearly two round trips from St. Louis to Chicago. Nearly 15,000 tons of structural steel are used, along with 8,600 tons of reinforcing steel. Some 90,600 cubic yards of concrete are in the foundation, deck slab, and towers. At its completion, the bridge was the third-longest cable-stayed bridge in the United States.

The cost of the original design of the bridge and surrounding area was estimated at nearly $1.7 billion. After both state governments decided that they could not bear that cost, they called for a new design of a smaller bridge in 2007 with an estimated cost of $667 million. Of the total, $264 million will go to move I-70 in Illinois, $57 million to move I-70 in Missouri, and $346 million to build the bridge. The Illinois state government plans to spend $313 million; Missouri, $115 million. A federal grant will cover the other $239 million. The final cost was $695 million. the bridge was officially named the Stan Musial Veterans Memorial Bridge, with the signature of President Barack Obama on July 12, 2013.

The spark for the Stan Musial Veterans Memorial Bridge began about 30 years ago. In the early 1990s, it was apparent to regional leaders in the St. Louis area that traffic levels between St. Clair County Illinois and St. Louis City were rising. Although there were several older bridges in the area that carried traffic across the Mississippi River, there was only one interstate bridge into St. Louis City – the Poplar Street Bridge. The Poplar Street Bridge carried three interstates – I-55, I-64 and I-70, from Illinois to St. Louis City – the only U.S. bridge carrying three interstates into a city. With traffic levels reaching well over one hundred and twenty thousand vehicles daily, regional leaders evaluated the situation to determine possible solutions. Their concern was that commerce would move to other states due to morning and evening backups running more than 45 minutes, and a significant safety problem spurred by crashes in the daily backups. One of those solutions was constructing a new interstate river bridge to remove one of the interstates from the Poplar Street Bridge. The ideal solution – an eight-lane interstate bridge just to the north of downtown St. Louis, was too costly, and Illinois and Missouri started several years of discussion on various options.

Ultimately, in February 2008, the two states announced a compromise. The Stan Musial Veterans Memorial Bridge would be constructed in phases. By constructing the project in phases, the states could afford the project while meeting existing needs. The first phase was a four-lane cable stayed river bridge wide enough to be restriped to six lanes in 15 years if traffic levels continued to rise as expected. In 25-30 years, if traffic levels continue to rise and funding was determined, an additional four lane companion bridge would be constructed. That new bridge, south of the existing bridge, would represent the ultimate build-out. However, that compromise had impacts. The new bridge would have connections to the north, but not to the south, as those would be included with the future companion bridge. Until that bridge was constructed, the Stan Musial and the Poplar Street Bridge project would work together, as one big interchange, to bring traffic into the city. Drivers heading north – to the airport and businesses in north city and north county -- would use the Stan Musial bridge. Those heading south – to south city, I-44, the brewery or to Cardinal games – could use the Poplar Street Bridge. Construction on the Stan Musial Bridge started in 2010 and continued for four years – opening to traffic on February 8, 2014.

Conference Schedule — Sunday, August 4, 2019

7:00 AM – 8:00 PM	Registration Desk Open (Grand Coat Room)
8:00 AM – 2:00 PM	**Short Course: Strain-Based Structural Health Monitoring Using Fiber Optic Sensor** Branko Glisic, Princeton University, USA (Grand Ballroom C)
2:00 PM – 6:00 PM	ISHMII Council Meeting (Gateway East)
2:30 PM – 5:30 PM	**SHM Education Planning & Implementation Workshop** Vijaya (VJ) Gopu, Louisiana State University, USA (Grand Ballroom C)
6:00 PM – 8:00 PM	**Opening Reception** (Grand D)
4:00 PM – 8:00 PM	**Exhibit Hall Open** (Grand D)

Conference Schedule — Monday, August 5, 2019

7:00 AM – 5:00 PM	Registration Desk Open (Grand Coat Room)
7:00 AM – 9:00 AM	Continental Breakfast (Grand D)
8:00 AM – 5:00 PM	**Exhibit Hall Open** (Grand D)
8:00 AM – 8:10 AM	Group Photo (Grand E)
8:10 AM – 8:40 AM	**Welcome Remarks** (Grand E)
8:40 AM – 9:40 AM	**Plenary Session 1 Keynote Presentations** | *Moderator: Aftab Mufti*


Ben Jilk


Lauren Linderman

8:40 AM
492 - New I-35W Bridge Instrumentation and Data Interpretation for Engineering
Ben Jilk (Minnesota Department of Transportation, USA)
Lauren Linderman (University of Minnesota, USA)

Abstract/Bios on page 8


Yi-Qing Ni

9:10 AM
485 - Bayesian Machine Learning for Structural Health Monitoring of Rail Transit System
Yi-Qing Ni (The Hong Kong Polytechnic University, Hong Kong)

Abstract/Bio on page 9

9:40 AM – 10:00 AM	Refreshment Break (Grand D)
10:00 AM – 11:40 AM	**Concurrent Sessions 1** (see pages 26-27)
11:40 AM – 12:45 AM	Lunch Buffet (Grand F/G/H)
1:00 PM – 2:40 PM	**Invited Sessions** (see page 25)
1:00 PM – 2:40 PM	**Panel Discussion** (see page 25)
2:40 PM – 3:15 PM	**Poster Session 1** (see page 30) | Refreshment Break
3:15 PM – 5:15 PM	**Concurrent Sessions 2** (see pages 28-29)

Invited Sessions 1:00 PM - 2:40 PM (Monday, August 5)

Presentations are noted by abstract/paper number, which corresponds to the Abstract Book

Invited Presentations – 1
(Grand A)
Moderator: Farhad Ansari


Jerome Lynch

1:00 PM
479 - Vehicular Tracking Using Machine Learning to Link Loads in Highway Corridors for the Performance Assessment of Connected Highway Bridges
Jerome Lynch (University of Michigan, USA)
Abstract/Bio on page 15


Hoon Sohn

1:25 PM
487 - UAV-Based Autonomous and Instantaneous Bridge Diagnosis
Hoon Sohn (Korea Advanced Institute of Science & Technology, Korea)
Abstract/Bio on page 16


Yufeng Zhang

1:50 PM
489 - Engineering Practice and Exploration of Bridge Structural Health Monitoring Technology in China
Yufeng Zhang, Yu Cheng, Yuanshan Xie and Jinhua Yang (State Key Laboratory of Safety and Health of In-service Long-span Bridges, China)
Abstract/Bio on page 17


Aftab Mufti

2:15 PM
481 - A Case for Adding an Inspection Level Related to SHM for Bridge Evaluation by CHBDC
Aftab Mufti, B. Bakht, F. Raeisi, B. Algohi and S. Faraz (University of Manitoba, Canada)
Abstract/Bio on page 18

Invited Presentations – 2
(Grand B)
Moderator: Kenichi Soga


You-Lin Xu

1:00 PM
488 - Hong Kong Experience in Structural Health Monitoring of Long-Span Cable-Supported Bridges
You-Lin Xu (Hong Kong Polytechnic University, Hong Kong)
Abstract/Bio on page 19


Yozo Fujino

1:25 PM
495 - Risk and Stock Management of Civil Infrastructure
Yozo Fujino (Yokohoma National University, Japan)
Abstract/Bio on page 20


Jian Zhang

1:50 PM
490 - Integrating Smart Inspection and Monitoring Results Through a Multi-Scale Model Strategy
Jian Zhang (Jiangsu Key Laboratory of Engineering Mechanics, China)
Abstract/Bio on page 21


Nenad Gucunski

2:15 PM
484 - Complementary Use of NDE and SHM in Comprehensive Assessment of Causes of Deterioration in Concrete Bridge Decks
Nenad Gucunski (Rutgers University, USA)
Abstract/Bio on page 22

Panel Discussion
1:00 PM – 2:40 PM (Monday, August 5)

Technology Transfer: Bridging the Gap Between Research and Practice
(Grand C)
Moderators: Caesar Singh, USDOT & Sreenivas Alampalli, NYSDOT

This panel discussion will focus on the central theme of the conference — bridging the gap between research and practice. A panel of practitioners, researchers, and industry representatives will discuss and interact with audience on this topic in light of recent advancements in technologies (such as remote sensing), project delivery mechanisms, human resource development, mentoring, etc. in the context of Structural Health Monitoring.

Concurrent Sessions 1 — 10:00 AM - 11:40 AM (Monday, August 5)

Presentations are noted by abstract/paper number, which corresponds to the Abstract Book

Structural System Identification and Model Updating 1 (Grand A)

Moderator: Yang Wang

10:00 AM
19 - Environmental Effects on Cepstral Coefficients and Their Removal for Structural Performance Assessment
Eleonora M. Tronci, Raimondo Betti and Maria Q. Feng (Columbia University, USA), Maurizio De Angelis (Sapienza University of Rome, Italy)

10:20 AM
48 - Application of Gaussian Process Metamodel in Structural Finite Element Model Updating Applying Dynamic Measured Data
Hossein Moravej, Tommy Chan and Khac Duy Nguyen (Queensland University of Technology, Australia), Andre Jesus (School of Computing and Engineering, University of West London, United Kingdom)

10:40 AM
133 - SHM-Based Decision Support System for Bridge Scour Management
Andrea Maroni and Enrico Tubaldi (University of Strathclyde, United Kingdom), Dimitry Val (Heriot-Watt University, United Kingdom), Hazel McDonald (Transport Scotland, United Kingdom), Stewart Lothian (Network Rail Scotland Route, United Kingdom), Oliver Riches (ARUP Scotland, United Kingdom), Daniele Zonta and Daniele Zonta (University of Strathclyde, United Kingdom)

11:00 AM
146 - A Non-Convexity Study in Finite Element Model Updating
Yang Wang, Xinjun Dong and Dan Li (Georgia Institute of Technology, USA)

11:20 AM
229 - Identification of Stick-Slip Friction in Single Degree of Freedom System Using the Random Decrement Technique
Karsten Krautwald Vesterholm (University of Southern Denmark, Denmark), Tobias Friis and Rune Brincker (Technical University of Denmark, Denmark), Anders Brandt (University of Southern Denmark, Denmark)

Structural Health Diagnosis and Prognosis 1 (Grand B)

Moderators: Hua-Peng Chen & Ying Lei

10:00 AM
12 - Monitoring of Post Tensioned Bridges in Arid Environments
John Fahd Touma (Engineering Research International, Saudi Arabia), Ali Othman A. Almonbhi (Transport Ministry - Kingdom Of Saudi Arabia, Saudi Arabia)

10:20 AM
33 - A Structural Damage Detection Approach Based on Bidirectional LSTM Neural Network
Ren Li, Qi Zhang, Jianxi Yang, Tong Li,Guiping Wang and Jingpei Dan (Chongqing University, China)

10:40 AM
44 - A Deflection Based Algorithm for Bridge Health Monitoring Using Liquid Level Sensing System
Xijun Ye and Bingcong Chen (Guangzhou University, China)

11:00 AM
88 - Robustness Analysis of a Structural State Identification Method Based on a 1-D Convolutional Neural Network
Youqi Zhang, Yasunori Miyamori, Shuichi Mikami, Takehiko Saito and Toshiyuki Oshima (Kitami Institute of Technology, Japan)

11:20 AM
466 - Quantitative Detection Method for Shield Tunnel Leakage Based on Mask R-CNN
Yadong Xue and Xinyuan Cai (Tongji University, China), Hua Shao (Shanghai Rail Transit Maintenance Support Co., Ltd., China), J. Gao (Tongji University, China)

Innovations in Sensor Technologies 1 (Grand C)

Moderator: Hoon Sohn

10:00 AM
35 - Performance of Parallel Accelerated Oscillator Damper Under Seismic Loading
Yonggang Tan, Zhigang Li and Zhe Zhang (Dalian University of Technology, China)

10:20 AM
454 - Shaping the Future of Structural Health Monitoring with IOT sensors
Damon Parsy (Beanair GmbH, Germany)

10:40 AM
284 - An Innovative Implementation of Visible Light Sensing for Quantifying the Dynamic Response of Bridge Girders
Hisham Abuella, Omid Khandel and Mohamed Soliman (Oklahoma State University, USA)

11:00 AM
126 - Research on Stress Measurement of Un-bonded Steel Strands Under Different Loading Conditions Using LC Oscillation Method
Benniu Zhang, Chong Tu, Xingxing Li, Hongmei Cui and Hang Zhang (Chongqing Jiaotong University, China)

11:20 AM
224 - In-Service Stress Monitoring of Steel Cables and Prestressing Tendons Using EME Sensors
Ru Zhang, Yuanfeng Duan and Yang Zhao (Zhejiang University, China)

SHM-aided Life-cycle Performance Assessment (Mills 1)

Moderators: Ian Smith & Chenglin Wu

10:00 AM
236 - Computational Platform for Probabilistic Multi-Objective Optimum Service Life Management Integrating Inspection and Monitoring
Sunyong Kim (Wonkwang University, Republic of Korea), Dan M. Frangopol (Lehigh University, USA)

10:20 AM
68 - Smart Aggregate-Based Seismic Stress Monitoring of RC Column: Numerical Model Updating
Haibin Zhang (Harbin Institute of Technology (Shenzhen), China), Shuang Hou (South China University of Technology, China), Jinping Ou and Haibin Zhang (Harbin Institute of Technology, China), Genda Chen (Missouri University of Science and Technology, USA)

10:40 AM
457 - Long-Term Monitoring for Insulation and Thermal Crack Prevention on a Concrete Arch Gravity Dam in Cold Region
Bo Chen (Hohai University, China)

11:00 AM
447 - Monitoring Technology Based on Durability of Concrete Structures in Whole Lifetime
Wei-Liang Jin and Jin Xia (Zhejiang University, China), Jiang-Hong Mao (Zhejiang University, China), Jin-Quan Wang (Hangzhou Bay Cross-sea Bridge Development Co., Ltd., China), Jun Zhang and Wei-Jie Fan (Zhejiang University, China), X. Song (Zhejiang University, China)

11:20 AM
212 - Moving Data to Distinguish Spurious Modes in Eigensystem Realization Algorithm
Chunxu Qu, Ting-Hua Yi and Hong-Nan Li (Dalian University of Technology, China)

Concurrent Sessions 1 — 10:00 AM - 11:40 AM (Monday, August 5)

Presentations are noted by abstract/paper number, which corresponds to the Abstract Book

SHM Towards Smart, Resilient and Sustainable Civil Infrastructures 1 (Mills 3)

Moderators: Yuanfeng Duan & Yiquing Ni

10:00 AM
379 - Probabilistic Prediction of Vertical Deflection of Bridges Using Gaussian Process Regression with FE Analysis
Jaebeom Lee (Ulsan National Institute of Science and Technology, Republic of Korea), Kyoung-Chan Lee (Korea Railroad Research Institute, Republic of Korea), Sung-Han Sim, Junhwa Lee, Sangmok Lee and Young-Joo Lee (Ulsan National Institute of Science and Technology, Republic of Korea)

10:20 AM
385 - Long-Term Monitoring of Bridge Displacement Using LiDAR, Computer Vision, and Strain-Based Indirect Estimation
Junhwa Lee, Kyoung-Chan Lee, Young-Joo Lee and Sung-Han Sim (Ulsan National Institute of Science and Technology (UNIST), Republic of Korea)

10:40 AM
387 - Road Condition Evaluation Using Smartphone Based Sensing and Data Assimilation Techniques
Kai Xue, Tomonori Nagayama and Di Su (The University of Tokyo, Japan)

11:00 AM
409 - FreeRTOS-Based Real-Time Wireless Data Acquisition Framework for Structural Health Monitoring
Yuguang Fu, Tu Hoang, Kirill Mechitov and Billie F. Spencer (University of Illinois at Urbana-Champaign, USA)

11:20 AM
411 - Robust and High-Performance Control of Shake Tables
Mir Amirali Najafi and B.F. Spencer Jr. (University of Illinois, USA) (Zhejiang University, China)

Mobile Automated Rovers Fly-by for Bridge Network Resiliency 1 (Mills 5)

Moderator: Miguel Casero Flórez

10:00 AM
57 - Feasibility Study of Extracting Vibration Characteristics in Beams Using Unmanned Aerial Vehicles (UAVs)
Efstathios Stathis Polydorou, Des Robinson, Su Taylor and Patrick McGetrick (Queen's University Belfast, United Kingdom)

10:20 AM
76 - Bridge Health Monitoring Using Accelerometer-Based Bridge Weigh-in-Motion
Daniel McCrum, Muhammad Arslan Khan and Eugene O'Brien (University College Dublin, Ireland)

10:40 AM
78 - Modal Analysis of a Bridge using Short-Duration Accelerations
Miguel Casero, Arturo González and Kun Feng (University College Dublin, Ireland)

11:00 AM
139 - Portable Bridge Weigh-In-Motion (P-B-WIM)
Yahya M. Mohammed, Nasim Uddin, Chengjun Tan and Zhenhua Shi (University of Alabama at Birmingham, USA)

11:20 AM
157 - Deep Learning-Based Crack Detection Using Mask R-CNN Technique
Chengjun Tan, Nasim Uddin and Yahya M. Mohammed (University of Alabama at Bimingham, USA)

Remote Sensing (Mills 6)

Moderators: Caesar Singh & Jenny Liu

10:00 AM
259 - Robust Geometry-Based Surface Defect Detection from Remotely Sensed 3D Data
Richard L. Wood and Mohammad Ebrahim Mohammadi (University of Nebraka-Lincoln, USA)

10:20 AM
180 - Examination of LiDAR Scanning for the Quantitative Structural Assessment of Highway Bridges
Adriana C. Trias, Jie Gong and Franklin L Moon (Rutgers University, USA)

10:40 AM
170 - Satellite Remote Sensing of Two Post-Tensioned Bridges in Virginia
Edward Hoppe (Virginia Department of Transportation, USA), Fabrizio Novali, Alessio Rucci and Alfio Fumagalli (TRE Altamira Inc., Italy), Sara Del Conte, Giacomo Falorni and Nora Toro (TRE Altamira Inc., Canada)

11:00 AM
39 - Multi-Angle Measurement Collection and Analysis Approach of Bridge Dynamic Response Using Smartphones
Rolands Kromanis and Christopher Forbes (Nottingham Trent University, United Kingdom)

11:20 AM
175 - Uneven Settlement Monitoring System for Metro Tunnel
Ming Zhao, Jinfeng Zhang and Sha Chang (Tongji University, China), Guowei Wang (Shanghai Shentong Metro Co., Ltd., China)

Structural Damage and Nonlinear Behavior Identification (Mills 8)

Moderators: Bin Xu & Jia He

10:00 AM
238 - Model Free Structural Nonlinear Restoring Force and Mass Identification Under Unknown Ground Excitations
Jing Li, Bin Xu and Baichuang Deng (Hunan University, China)

10:20 AM
274 - Two-Step Nonparametric Structural Nonlinearity Identification with Limited Acceleration Measurements and Unknown Mass
Bin Xu (Huaqiao University, China), Bai-Chuan Deng (Hunan University, China), Jing Li (Huaqiao University, China)

10:40 AM
346 - Wavelet Based Identification of Time-Varying Structures and Long Term Monitoring of Isolated Structures
Yongfeng Du, Lijie Zhao and Wanrun Li (Institute of Earthquake Protection and Disaster Mitigation, Lanzhou University of Technology, China)

11:00 AM
222 - A KF-Based Joint Estimation of Nonlinear Structural States and Unknown Excitations with Limited Measurements
Jia He and Xiao-Xiong Zhang (Hunan University, China), Bin Xu (Huaqiao University, China)

11:20 AM
446 - Modal Analysis and Damage Identification of Structures with Compressed Sensing*
Zhongdong Duan (Harbin Institute of Technology, Shenzhen, China)

**Denotes Presentation Only*

Concurrent Sessions 2 — 3:15 PM - 5:15 PM (Monday, August 5)

Presentations are noted by abstract/paper number, which corresponds to the Abstract Book

Structural System Identification and Model Updating 2 (Grand A)

Moderator: Yang Wang

3:15 PM
251 - Classification of Damage in Miter Gates Using Hierarchical Clustering to Identify Optimal Sensing
Manuel Vega, Ramin Madarshahian and Michael Todd (University of California San Diego, USA)

3:35 PM
254 - Temperature-Driven Structural Performance Evaluation of the Hurricane Bridge via Multiple Model Approach
Brittany Murphy and Matthew Yarnold (Texas A&M University, USA)

3:55 PM
260 - Model Update Technique Based on Time Domain Response Sensitivity Enhancement Method
Kun Liu (Harbin Institute of Technology, China), Guibo Nie (Institute of Engineering Mechanics, China Earthquake Administration, China)

4:15 PM
329 - Multivariate Statistical Analysis of Operational Frequencies and Damping Ratios of Bridges in Cali-Colombia
Diana Millán, Sebastián Castellanos, José Rafael Tovar, Johannio Marulanda Marulanda and Peter Thomson (Universidad de Valle, Colombia)

4:35 PM
279 - Vibration Test and FE Analysis of Dynamic Characteristics of a PC Beam with Crack and Temperature Change
Yasunori Miyamori, Daichi Ogawa, Keiichi Kamata, Youqi Zhang,Takehiko Saito, Heesup Choi and Toshiyuki Oshima (Kitami Institute of Technology, Japan)

4:55 PM
299 - Evaluation of Finite Element Model Calibration for a Multi-Beam Highway Bridge by Static and Dynamic Test Measurements
Navid Zolghadri and Kirk A. Grimmelsman (Intelligent Infrastructure Systems, USA)

Structural Health Diagnosis and Prognosis 2 (Grand B)

Moderators: Hua-Peng Chen & Ying Lei

3:15 PM
51 - Damage Detection of Arch Suspender Based on Relative Variation of Wavelet Total Energy and Experimental Study
Yiqiang Xiang (Zhejiang University, China), Yakun Jia (Shanghai Municipal Engineering Design Institute Group Co. Ltd., China)

3:35 PM
56 - Fast Wave Tomography: A Semi-Real Time Local Velocity Reconstruction Methodology in Distance Decaying Sensing Network
Avik Kumar DAS and Christopher K.Y. Leung (Hong Kong University of Science and Technology, Hong Kong)

3:55 PM
377 - Acoustic Emission Source Modeling, Classification and Localization in Reinforced Concrete Beams
Paresh Mirgal and Sauvik Banerjee (Indian Institute of Technology Bombay, India)

4:15 PM
371 - Early Detection of Fracture Initiation in Concrete Using Distributed Optical Fiber Strain Sensing
Jinho Park, Tsubasa Sasaki, Benjamin L Worsfold, Ruonan Ou and Kenichi Soga (University of California, Berkeley, USA)

**Denotes Presentation Only*

Structural Health Diagnosis & Prognosis 2 (Grand B), continued...

4:35 PM
321 - Structural Damage Detection Based on Sparse Bayesian Learning and Model Reduction for Long-Span Bridges
Parisa Adadollahi and Jian Li (University of Kansas, USA), Yong Huang (Harbin Institute of Technology, China)

4:55 PM
295 - Results of a Full Scale Destructive Bridge Test and Its Application In Damage Identification
Brwa Hasan Hussein Salihi (Koya University, Iraq), Harry W. Shenton III (University of Delaware, USA), Zheng Wu (Bentley Systems Inc., USA)

Innovations in Sensor Technologies 2 (Grand C)

Moderator: Yi Bao

3:15 PM
108 - Infrastructural Internet-of-Things Using Quasi-Self-Powered Structural Health Monitoring Sensors
Owen Pochettino and Kenji Aono (Washington University in St. Louis, USA), Hassene Hasni and Nizar Lajnef (Michigan State University, USA), Shantanu Chakrabartty (Washington University in St. Louis, USA)

3:35 PM
444 - Development of a Wireless Tilt Sensor using Flex Sensing Technology for Monitoring Slope Movement
Yifan Zhang (Donghua University, China), Chengyu Hong and Fangfang Ren (Shanghai University, China)

3:55 PM
248 - Piezoelectric MEMS Sensor Fusion: Acoustic Emission + Ultrasonics
Hanie Kazari, Minoo Kabir and Didem Ozevin (University of Illinois at Chicago, USA)

4:15 PM
370 - Open Source - Low Cost Wireless Sensor Network for SHM Applications
Carmelo Apostoliti, Gian Paolo Cimellaro and Marco Domaneschi (Politecnico di Torino - DiSEG, Italy)

4:35 PM
242 - Tuning Piezoresistivity of Cement-Based Composites by the Hybrid Blends of Graphene Nanoplatelets (GNPs) and Carbon Nanotubes (CNTs)
Xiaohu Wang, Jin Tao and Qiang Zeng (Zhejiang University, China)

4:55 PM
380 - Deformation Monitoring of Segment Joints in a Shield Tunnel using Optic/Electronic Compositec Sensing Cables*
Tong Jiao and Zhi Zhou (Dalian University of Technology, China)

Concurrent Sessions 2 — 3:15 PM - 5:15 PM (Monday, August 5)

Presentations are noted by abstract/paper number, which corresponds to the Abstract Book

SHM-aided Reliability Analysis and Evaluation of Structures (Mills 1)

Moderator: You-Lin Xu

3:15 PM
26 - The Benefit of Permanent Monitoring for Seismic Emergency Management
Pier Francesco Giordano (Politecnico di Milano, Italy), Simona Miraglia (University of Aalborg, Denmark), Maria Pina Limongelli (Politecnico di Milano, Italy)

3:35 PM
62 - Data Acquisition for Structural Reliability Analysis of Corroded Steel Plate-Girder Bridge
Mayuko Nishio, Jothi Saravanan Thiyagarajan and Fumiya Matsushima (Yokohama National University, Japan)

3:55 PM
96 - How Heuristic Behaviour Can Affect SHM-Based Decision Problems?
Andrea Verzobio (University of Strathclyde, United Kingdom), Denise Bolognani (University of Trento, Italy), John Quigley and Daniele Zonta (University of Strathclyde, United Kingdom)

4:15 PM
153 - Analysis of Long-Term Vibration Frequencies of a Building Over a Period of 28 Years
David Murià-Vila, Baruo Daniel Aldama-Sánchez, Miguel García-Illesca and Gerardo Rodríguez Gutiérrez (Instituto de Ingeniería, UNAM, Mexico)

4:35 PM
165 - Local Condition Assessment and Damage Detection of Gusset-Less Connections Used in a Vertical Lift Truss Bridge
Milad Mehrkash and Erin Santini Bell (University of New Hampshire, USA)

4:55 PM
294 - Health Assessment of Critical Bridge Components Using Monitoring Data in a Reliability Framework: Application to a Railroad Bridge with Fatigue Critical Elements
Katherine A. Flanigan and Jerome P. Lynch (University of Michigan, USA)

SHM Towards Smart, Resilient and Sustainable Civil Infrastructures 2 (Mills 3)

Moderators: Yuanfeng Duan & Yiquing Ni

3:15 PM
414 - Space-Frequency Information Based CNN Method for Damage Detection of Arch Bridges
Y.F. Duan, Q.Y. Chen and C.B. Yun (Zhejiang University, China), H.M. Zhang (Tongji University, China)

3:35 PM
415 - A Fully Autonomous Damping Estimation with SVM-Based Fault Data Treatment Using 1-Year Wireless Monitoring Data
Sunjoong Kim (University of Illinois at Urbana-Champaign, USA), Ho-Kyung Kim (Seoul National University, Republic of Korea), Billie F. Spencer (University of Illinois at Urbana-Champaign, USA)

3:55 PM
416 - Low-Cost Electro-Mechanical Impedance Testing for Civil Structures
Addie Lederman (KPFF Consulting Engineers, USA), Shuo Wang, Fernando Gomez and Bill Spencer (University of Illinois at Urbana-Champaign, USA)

4:15 PM
419 - A Heteroscedastic Gaussian Process Approach for SHM-Based Modelling and Forecasting of High-Speed Rail Track Slab Deformation
Yi-Qing Ni, Qi-Ang Wang and Chao Zhang (The Hong Kong Polytechnic University, Hong Kong)

SHM Towards Smart, Resilient and Sustainable Civil Infrastructures 2 (Mills 3), continued...

4:35 PM
420 - Gaussian Mixture Model for Automated Modal Tracking of the Long-Span Bridge
Jianxiao Mao and Hao Wang (Southeast University, China), Billie F. Spencer, Jr. (University of Illinois at Urbana-Champaign, USA)

4:55 PM
436 - Analysis of Thermal Field Characteristics of Steel Truss Bridge Based on Long-Term Monitoring Data
Qingxin Zhu, Hao Wang, Jianxiao Mao and Wenzhi Zheng (Southeast University, China)

Mobile Automated Rovers Fly-by for Bridge Network Resiliency 2 (Mills 5)

Moderator: Miguel Casero Flórez

3:15 PM
160 - Class-Associative Structural Health Pattern Recognition using Oscillatory Neural Network
Ting Zhang, Mohammad Rafiqul Haider, Nasim Uddin and Iwan D. Alexander (University of Alabama at Birmingham, USA)

3:35 PM
161 - A High-Efficiency Wireless Power Link for Structural Health Monitoring
Ruikuan Lu, Mohammad Rafiqul Haider and Nasim Uddin (University of Alabama at Birmingham, USA)

3:55 PM
200 - Extraction of Bridge Dynamic Characteristics Utilizing Handheld Devices
Ahmed Elhattab (Southern Company, USA), Nasim Uddin (The University of Alabama at Birmingham, USA), Eugene O'Brien (University College Dublin, Ireland)

4:15 PM
220 - A Frequency Synchronized Oscillatory Neural Network Using Two-Stage Ring-Oscillators
Shang-Kai Wei, Mohammad Rafiqul Haider and Nasim Uddin (University of Alabama at Birmingham, USA)

4:35 PM
327 - Design and Simulation of an Efficient Solar-Energy Harvesting Testbed for Remote Sensor Node
Yves L.T. Komnang, Mohammad Rafiqul Haider and Sazia Afreen Eliza (University of Alabama at Birmingham, USA)

4:55 PM
182 - Unmanned Aerial Vehicle (UAV) Enabled Building Information Modeling for Bridge Inspection
Brandon Perry, Yanlin Guo, Rebecca Atadero and John van de Lindt (Colorado State University, USA)

Concurrent Sessions 2 — 3:15 PM - 5:15 PM (Monday, August 5)

Presentations are noted by abstract/paper number, which corresponds to the Abstract Book

Damage Identification under Changing Environment (Mills 6)

Moderators: Dongshen Li & Guirong (Grace) Yan

3:15 PM
86 - Structure Damage Identification with Multi-Scale Dynamic Entropy
Suyan Wang and Shuang Meng (Dalian University of Technology, China), Dongsheng Li (Shantou University, China), Hongnan Li (Dalian University of Technology, China)

3:35 PM
407 - Long-Term Dynamic Monitoring of Offshore Platform for Damage Assessment
Michele Rizzo and Michele Betti (University of Florence, DICeA, Italy), Paolo Castelli (Edison Exploration & Production S.p.A., Italy), Ostilo Spadaccini and Andrea Vignoli (University of Florence, DICeA, Italy)

3:55 PM
355 - Image-Based Crack Identification for Concrete Bridges Using Region-Based Convolutional Neural Network
Jianghua Deng, Ye Lu and Vincent Cheng-Siong Lee (Monash University, Australia)

4:15 PM
118 - Prevention of the Environmental Degradation of Timber Bridges Using Two Epoxy Resin-Inorganic Material Composites
Sameer A. Awad and Christopher M. Fellows (University of New England, Australia), Seyed Saeed Mahini (Griffith University, Australia)

4:35 PM
234 - Thermal Modulation of Nonlinear Acoustic Wave for Microcracking Damage Evaluation in Concrete
Hongbin Sun and Jinying Zhu (University of Nebraska-Lincoln, USA)

4:55 PM
367 - Strain Correlation-Based Novelty Detection of the Cluster of Bridges Considering the Environmental Effects
Jianxin Cao and Yang Liu (Harbin Institute of Technology, China)

Value of SHM Information for Resilient Civil Infrastructure (Mills 8)

Moderators: Gian Paolo Cimellaro & Branko Glisic

3:15 PM
470 - SHM and Decision Maker Risk Aversion*
Antti J. Valkonen and Branko Glisic (Princeton University, USA)

3:35 PM
471 - Analyzing the Academic Landscape of Structural Health Monitoring: 2003-2017*
Kaitlyn Kliewer (LERA Consulting Structural Engineers, USA), Edward Melcer (University of California Santa Cruz, USA), Branko Glisic (Princeton University, USA)

3:55 PM
349 - IdealSensor: On-Site Rescuer Health and Position Monitoring in Emergency Situations
Gian Paolo Cimellaro and Marco Domaneschi (Politecnico di Torino - DISEG, Italy), Carlo Brandolese (Politecnico di Milano, Italy), Matteo Grotto (IBT Systems, Italy)

4:15 PM
333 - A Static Control Method for Grillage Adaptive Beam String Structures Based on Gradient - Genetic Algorithm
Yanbin Shen, Yueyang Wang, Guang Yang and Yaozhi Luo (Zhejiang University, China)

4:35 PM
237 - Stereovision Monitoring of 3D Postures of a Semi-Submersible Floating Foundation Model in Wind and Wave Test
Baohua Shan (Harbin Institute of Technology, China), Yiqing Xiao (Harbin Institute of Technology, China), Chao Li (Harbin Institute of Technology, China), Yang Liu (Harbin Institute of Technology, China), Shengtao Zhou (Harbin Institute of Technology, China), Zhilin Xue (Harbin Institute of Technology, China)

4:55 PM
325 - Wireless Soft Elastomeric Capacitor Sensor Network for Long-Term Fatigue Crack Monitoring of Steel Bridges
Xiangxiong Kong (University of Kansas, USA), Jong-Hyun Jeong (University of Arizona, USA), Parisa Adadollahi (University of Kansas, USA), Yuguang Fu (University of Illinois at Urbana-Champaign, USA), Honkgi Jo (University of Arizona, USA), Caroline Bennett and William Collins (University of Kansas, USA), Simon Laflamme (Iowa State University, USA), Jian Li (University of Kansas, USA)

Student Poster Competition

SHMII-9 will highlight student research as part of the three-day conference program activities. The Student Poster Competition is an opportunity to showcase your research, exchange knowledge and ideas, and engage with representatives from the transportation industry. The student poster competition is sponsored by Sensors journal.

Posters will be available for viewing in the second floor lobby, at the published times:

Poster Session 1:
Monday, August 5
2:40-3:15 pm

Poster Session 2:
Tuesday, August 6
2:40-3:15 pm

The SHMII-9 Student Poster Session Committee members will serve as judges for the poster competition.

First, second, and third place awards will be announced during the closing ceremony on August 7, 2019.

1st Place: $500 USD
2nd Place: $250 USD
3rd Place: $125 USD

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Conference Schedule — Tuesday, August 6, 2019

7:00 AM – 5:00 PM	Registration Desk Open (Grand Coat Room)
7:00 AM – 9:00 AM	Continental Breakfast (Grand D)
8:00 AM – 5:00 PM	**Exhibit Hall Open** (Grand D)
8:00 AM – 8:10 AM	Opening Remarks (Grand E)
8:10 AM – 9:40 AM	**Plenary Session 2 — Keynote Presentations** | *Moderator: Dan Frangopol* (Grand E)


Fu-kuo Chang

8:10 AM
491 - Health Monitoring of Battery Structures for Electrical Vehicles
Fu-Kuo Chang (Stanford University, USA)

Abstract/Bio on page 10


Hongwei Huang

8:40 AM
482 - Inspection, Recognition and Diagnosis of Structural Health for Tunnel Lining by Artificial Intelligence
Hongwei Huang and D.M. Zhang (Tongji University, China))

Abstract/Bio on page 11


Ian F.C. Smith

9:10 AM
486 - Monitoring for Asset Managment
Ian F.C. Smith (Swiss Federal Institute of Technology, Switzerland)

Abstract/Bio on page 12

9:40 AM – 10:00 AM	Refreshment Break (Grand D)
10:00 AM – 11:40 AM	**Concurrent Sessions 3** (see pages 32-33)
11:40 AM – 1:00 PM	**Lunch (on your own)**
1:00 PM – 2:40 PM	**Concurrent Sessions 4** (see pages 34-35)
2:40 PM – 3:15 PM	**Poster Session 2** (see page 30) | Refreshment Break (Grand D)
3:15 PM – 5:15 PM	**Concurrent Sessions 5** (see pages 36-38)
6:30 PM – 9:30 PM	**Awards Banquet sponsored by Jacobs** Aftab Mufti Medal for Life Achievement Aftab Mufti Medal for Best Papers ISHMII Fellows and Honorary Members

Concurrent Sessions 3 — 10:00 AM - 11:40 AM (Tuesday, August 6)

Presentations are noted by abstract/paper number, which corresponds to the Abstract Book

Structural System Identification and Model Updating 3 (Grand A)

Moderator: Yang Wang

10:00 AM
368 - Damage Detection Based on Strain Output Feedback of the Bridges Under Active Excitation
Zheng Zhou and Yang Liu (Harbin Institute of Technology, China)

10:20 AM
402 - Using Approximately Synchronised Accelerometers to Identify Mode Shapes: A Case Study
Wai Kei Ao, David Hester and Connor O'Higgins (Queen's University Belfast, United Kingdom)

10:40 AM
406 - Comparing Applicability of Bayesian Model Updating and Error-Domain Model Falsification Based on Computational and Engineering Considerations
Sai G.S. Pai and Ian F.C. Smith (Swiss Federal Institute of Technology, Switzerland)

11:00 AM
272 - Steel Railway Bridge Response Prediction Using Limited Sensors, Stochastic Filtering, and Structural Modeling
Saeed Eftekhar Azam, Daniel G. Linzell and Ahmed Rageh (University of Nebraska–Lincoln, USA)

11:20 AM
277 - Real Time Hybrid Simulation Based on Vector Form Intrinsic Finite Element and Field Programmable Gate Array
Junjie Tao, Yuanfeng Duan and Yi Fang (Zhejiang University, China), Hongmei Zhang (Tongji University, China), Chung Bang Yun (Zhejiang University, China)

Structural Health Diagnosis and Prognosis 3 (Grand B)

Moderators: Hua-Peng Chen & Ying Lei

10:00 AM
273 - Structural Behavior of the Support of a Railway Bridge That the Footing was Rebuilt
David Antero Cervantes Amaya, Héctor Guerrero Bobadilla, Víctor Cecilio Romoaldo, José Alberto Escobar Sánchez and Roberto Gómez Martínez (National Autonomous University of Mexico, Mexico)

10:20 AM
193 - Investigating of Structural Failure Modes Induced by Tornadoes Through Post-Event Surveys
Ryan Honerkamp and Guirong Yan (Missouri University of Science and Technology, USA)

10:40 AM
159 - Moving-Vehicle-Excited Bridge Impact Test and Related Structural Identification Theory
Liming Zhou (Southeast University, China)

11:00 AM
300 - Structural Health Monitoring in Workflows of Preservation Engineering
Anna C. Blyth, Rebecca Napolitano and Branko Glisic (Princeton University, USA)

11:20 AM
450 - Damage Detection at Web/Flange Junction of Welded I-Section Steel Beam Based on Impact-Optic Technique
Ying Xu and Hongguang Zu (Harbin Institute of Technology, Shenzhen, China)

Evaluation of Bridges Using Sensors, Civionics and SHM 1 (Grand C)

Moderator: Anil Agrawal

10:00 AM
10 - Measurement of the Flow of Force in a Skewed Masonry Arch Bridge Using Fibre Optic Sensing
Sam Cocking and Haris Alexakis (University of Cambridge, United Kingdom), Matthew DeJong (University of California, Berkeley, USA)

10:20 AM
28 - Monitoring on Tendon Force Distribution in Prestressed Concrete Bridge by Brillouin-Based Optical Fiber Sensor
Kazumasa Okubo, Michio Imai and Naoki Sogabe (Kajima Technical Research Institute, Japan), Shinji Nakaue and Masashi Oikawa (Sumitomo Electric Industries, Ltd., Japan), Kazuyoshi Chikiri (Hien Electric Industries, LTD., Japan)

10:40 AM
116 - Effects of Vehicle Mass and Excitation on the Modal Frequencies of Girder Bridges in Structural Health Monitoring
Wen-Hwa Wu, Chien-Chou Chen, Yu-Jie Chen and Gwolong Lai (National Yunlin University of Science & Technology, Taiwan)

11:00 AM
132 - Field Test Load Rating Procedure for Performance-Based Design of Highway Bridges
Renxiang Lu, Johnn Judd and Michael Barker (University of Wyoming, USA)

11:20 AM
206 - Demonstration Smart Timber Bridge – Glulam Timber Bridge on Geosynthetic Reinforced Soil (GRS) Abutments
Travis Hosteng (National Center for Wood Transportation Structures, USA), James Wacker, Christopher Senalik, John Hermanson and Nathan Bechle (USDA Forest Products Laboratory, USA), T. Wipf (Iowa State University, USA)

Monitoring for Safety Evaluation of Existing Conditions 1 (Mills 1)

Moderator: Jian Li

10:00 AM
464 - Research on Piezoelectric Monitoring Method of Working Stress of Concrete Structures
Chengcheng Du, Dujian Zou, Tiejun Liu, Weijie Li and Taotao Li (Harbin Institute of Technology (Shenzhen), China)

10:20 AM
280 - Investigations on Increase and Decrease of Frequencies of a Steel Plate Girder Bridge Due to Artificial Cracks
Chul-Woo Kim, Takuya Mimasu, Yoshinao Goi and Gen Hayashi (Kyoto University, Japan)

10:40 AM
213 - Concrete Deformation Sensors Positioning Optimization for Radioactive Waste Structure Monitoring
Elodie Chapoulade, Aurélie Talon, Alaa Chateauneuf and Pierre Breul (Clermont Auvergne University - Pascal Institute UMR CNRS, France), Guillaume Hermand and Marc Leconte (Andra, France)

11:00 AM
73 - Analytical Study of a Degraded Concrete Bridge for Structural Health Monitoring
Md Niamul Islam (Nagaoka University of Technology, Japan), Kenta Takeda (Nagoya Institute of Technology, Japan), Takeshi Miyashita (Nagaoka University of Technology, Japan), Saiji Fukada (Kanazawa University, Japan), Atsuhiro Takasu (National Institute of Informatics, Japan)

11:20 AM
49 - Study on Health Monitoring Technology of Oil and Gas Pipelines During the Soil Freeze-Thaw Process
Liang Ren, Jiajian Wang, Hongnan Li, Suyan Wang and Baorong Chang (Dalian University of Technology, China)

Concurrent Sessions 3 — 10:00 AM - 11:40 AM (Tuesday, August 6)

Presentations are noted by abstract/paper number, which corresponds to the Abstract Book

SHM Towards Smart, Resilient and Sustainable Civil Infrastructures 3 (Mills 3)

Moderators: Yuanfeng Duan & Yiqing Ni

10:00 AM
437 - BDLM-Based Prediction of Temperature-Induced Strain Response of a Long-Span Cable-Stayed Bridge Using Structural Health Monitoring Data
Hao Wang, Yiming Zhang (Southeast University, China), Huaping Wan (Hong Kong Polytechnic University, China), Jianxiao Mao, Tianyou Tao and Qingxin Zhu (Southeast University, China)

10:20 AM
381 - Design and Application of a Wind Pressure Field Monitoring System Based on Wireless Sensor Network
Yaozhi Luo, Yucheng Wang, Yanbin Shen and Xian Xu

10:40 AM
408 - Reliability-Based Topology Optimization Approach for Protection of Seismically Excited Structures
Fernando Gomez and Billie F. Spencer (University of Illinois at Urbana-Champaign, USA)

11:00 AM
423 - Acceleration-Feedback Control for a Base-Isolation Structure Regarding a Comprehensive Structural Performance Evaluation
Yuting Ouyang and Weixing Shi (Tongji University, China), Billie F. Spencer (University of Illinois Urbana-Champaign, USA), Jiazeng Shan (Tongji University, China)

11:20 AM
427 - Rapid Damage Assessment System of Buildings After Seismic Events Using Artificial Neural Network
Koji Tsuchimoto and Billie F. Spencer (University of Illinois, USA)

Robotic/UAV Platform for Structural Inspection and Preservation (Mills 5)

Moderators: Miguel Casero Flórez & Hung La

10:00 AM
47 - Learning Structural Damage Through Hyperspectral Images
Sameer Aryal, Shimin Tang and Zhi-Qiang Chen (University of Missouri-Kansas City, USA)

10:20 AM
100 - Deep Learning-Based Defect Detection of Bridge Bearings Using Convolutional Neural Networks
Mida Cui, Gang Wu and Huile Li (Southeast University, China)

10:40 AM
149 - Deep Learning with 3D Reality Modeling for Crack Detection and Evaluation
Rony Kalfarisi (Bentley Aystems, USA), Z.Y. Wu (Bentley Systems Inc., USA)

11:00 AM
171 - Condition and Deterioration Assessment of Bridge Elements Using Advanced Digital Imaging Technologies
Y. Edward Zhou, Nicolas D'Amico, Mark R. Guzda and John D. Delp (AECOM, USA)

11:20 AM
177 - Automatic Bolt Loose Detection Based on Digital Image Processing Technology
Linsheng Huo, Yu Liu and Hongnan Li (Dalian University of Technology, China)

Case Studies in Infrastructure 1 (Mills 6)

Moderators: Benjamin Jilk & Guirong Yan

10:00 AM
235 - Embedded H-Gauge with Hybrid-Powered Sensors for Pavement Monitoring
Sri Harsha Kondapalli, Owen Pochettino and Kenji Aono (Washington University in St. Louis, USA), Nizar Lajnef (Michigan State University, USA), Shantanu Chakrabartty (Washington University in St. Louis, USA)

10:20 AM
144 - Monitoring of Construction and Use of a Steel Railway Bridge with One Central Arch
Amelie Outtier, Hans De Backer, B. De Pauw and G. Van Staen (Ghent University, Belgium)

10:40 AM
80 - Determining Dynamic Amplification by Understanding Vehicle-Bridge Interaction
John Braley (Rutgers University, USA)

11:00 AM
344 - Automated Monitoring of Vegetation Interference with Power Lines by Analysis of Point Clouds Combined with Cable Mechanics
Shakhzod Takhirov (University of California, Berkeley, USA), Mukhady Israilov (Joint Research Institute of Russian Academy of Sciences (KNII-RAN), Russian Federation)

11:20 AM
11 - A Pipe Leakage Monitoring Method Using Fiber Bragg Grating Sensors
Mengya Sun, Bin Shi, Hongtao Jiang, Guyu Zhou, Chenxi Feng and Suping Liu (Nanjing University, China)

Getting the Most from Your SHM Dollar (Mills 8)

Moderator: Peter Vanderzee

10:00 AM
461 - Cost Effective Monitoring Programs for Structural Life Extension
Thomas Weinmann (Geocomp, USA)

10:20 AM
462 - Structural Health Monitoring…A Proven Technology that is Essential for Modern Bridge Management
Richard Floyd (WSP USA, USA)

10:40 AM
472 - How a Few Structural Health Monitoring Dollars Saved Million
Sue Tryon (Benham Design, LLC., USA)

11:00 AM
98 - Correlation of Vehicle Load to Displacement of Bridge Structures to Provide Load Rating
Darragh Lydon, Su Taylor, Myra Lydon and Jesus Martinez del Rincon (Queens University Belfast, United Kingdom)

11:20 AM
404 - Joint Structural System and Vehicular Load Identification for Operational Monitoring and Maintenance of Bridges Using a Bayesian Finite Element Model Updating Approach
Farid Ghahari, Hamed Ebrahimian, Ertugrul Taciroglu (University of California, Los Angeles, USA)

**Denotes Presentation Only*

Concurrent Sessions 4 — 1:00 PM – 2:40 PM (Tuesday, August 6)

Presentations are noted by abstract/paper number, which corresponds to the Abstract Book

System Identification Using SHM/NDE 1 (Grand A)
Moderator: Zhi Zhou

1:00 PM
211 - Residual Force Decomposition Method for Nondestructive Damage Identification of Reticulated Shell Structures
Jun Wu, Yongfeng Luo and Xixin Gao (Tongji University, China), Lei Wang (Shanghai Tongen Civil Engineering Technology Consulting Co., China)

1:20 PM
261 - Dynamic Characterization of Seismically-Excited Structures Using Frequency-Domain Stochastic Subspace System Identification
Chia-Ming Chang and Jay-Yu Chou (National Taiwan University, Taiwan)

1:40 PM
281 - Improving Accuracy of Road Profile Identifications of a Real Bridge Utilizing Drive-by Bridge Inspection
Naoya Toshi, Syunsuke Nakajima, Kai-Chun Chang and Chul-Woo Kim (Kyoto University, Japan)

2:00 PM
301 - Finite Element Calibration Approach for Structural Damage Detection and Load Identification
Zheng Yi Wu and P. Yin (Bentley Systems, Inc., USA), W. Elhaddad (University of California, Berkeley, USA)

2:20 PM
24 - A Method for Nonlinear Model Validation and Parameter Calibration of Structure using Restoring Force Surface and Support Vector Machine Method
Xin Wang, Zuo-Cai Wang and Wei-Xin Ren (HeFei University of Technology, China)

INSPIRE UTC Research – Robotic Platform (Grand B)
Moderator: Paul Oh

1:00 PM
130 - An Unmanned Aerial and Traversing Robot as Mobile Platform for Bridge Inspections
Clayton A. Fritsche, Alec M. Reven and Genda Chen (University of Missouri Science and Technology, USA)

1:20 PM
219 - A Genetic Algorithm for Minmax k-Chinese Postman Problem with Applications to Bridge Inspection
Siming Liu, Sushil J. Louis, Hung La and N. Harris (University of Nevada, USA)

1:40 PM
250 - Roller Chain-Like Robot For Steel Bridge Inspection
Son Thanh Nguyen and Hung Manh La (University of Nevada, Reno, USA)

2:00 PM
311 - Visual SHM for Concrete Infrastructure Using Wall-Climbing Robot
Liang Yang, Jizhong Xiao and Yong Chang (The City College of New York, USA), Biao Jiang (Hostos Community College, USA)

2:20 PM
83 - Considerations for Hose Wielding UAV for Civil Infrastructure Cleaning
Blake Hament and Paul Oh (University of Nevada, Las Vegas, USA)

Evaluation of Bridges Using Sensors, Civionics and SHM 2 (Grand C)
Moderator: Brandon Henning

1:00 PM
21 - Review of Methods Used for Outlier Detection in Structural Health Monitoring
Connor O'Higgins, David Hester, Patrick McGetrick, Des Robinson (Queen's University Belfast, United Kingdom), W.K. Ao (Queen's University, United Kingdom)

1:20 PM
58 - Monitoring of the Variation of Neutral Axis in Slab on Girder Bridges
Basheer Algohi, Aftab Mufti, Baidar Bakht, Douglas Thomson and Dagmar Svecova (University of Manitoba, Canada)

1:40 PM
123 - Residual Stresses in an Orthotropic Steel Deck Based on the Hole-Drilling Technique
Hans De Backer, Amelie Outtier, W. Nagy and E. Van Puymbroeck (Ghent University, Belgium)

2:00 PM
166 - System Identification and Seismic Response Monitoring of Two Large-Scale Highway Bridges Using Target-Tracking Digital Image Correlation
Luna Ngeljaratan and Mohamed Moustafa (University of Nevada, Reno, USA)

2:20 PM
64 - Numerical Modeling of Early Age Cracks in Concrete for Long-Term Evaluation of Structure
Vivek Kumar and Branko Glisic (Princeton University, USA)

Monitoring for Safety Evaluation of Existing Conditions 2 (Mills 1)
Moderator: Didem Ozevin

1:00 PM
395 - Damage or Unusual Behavior Detection in In-Service Tunnels: An Overview and Possible Prospects
Marco Domaneschi (Politecnico di Torino - Department of Structural, Geotechnical and Building Engineering (DISEG), Italy), Gian Paolo Cimellaro (Politecnico di Torino - Department of Structural, Geotechnical and Building Engineering (DISEG), Italy), Necati Catbas (University of Central Florida, USA), Daniele Inaudi (Smartec, Switzerland), Giuseppe Carlo Marano (Politecnico di Torino DISEG, Italy)

1:20 PM
243 - Non-Destructive Subsurface Structural Health Monitoring of Transportation Infrastructure
Sally E. Goldin (King Mongkut's University of Technology Thonburi, Thailand), Kurt T. Rudahl (Heurika Geographics Pte. Ltd., Singapore)

1:40 PM
183 - Selection of Explanatory Variables for Effective Deterioration Model Development
Minwoo Chang (Korea Railroad Research Institute, Republic of Korea), Marc Maguire (Utah State University, USA)

2:00 PM
70 - Comparative Study of Crack Detection Techniques Using Digital Image Processing to Monitor Structure Health and Safety
Long Qiao and K.C. Ashok (Missouri Western State University, USA)

2:20 PM
38 - A Novel Smart Wafer Designed for Monitoring Bolt Loosening Based on the Piezoelectric Effect of Piezoceramics*
Shuli Fan, Jialei Chen and Linsheng Huo (Dalian University of Technology, China)

**Denotes Presentation Only*

Concurrent Sessions 4— 1:00 PM – 2:40 PM (Tuesday, August 6)

Presentations are noted by abstract/paper number, which corresponds to the Abstract Book

Damage Diagnosis and Prognosis Using Soft Computing 1 (Mills 3)

Moderators: Ling Yu & Hua-Peng Chen

1:00 PM
162 - Online Structural Damage Detection Based on Online Dictionary Learning
Zepeng Chen and Ling Yu (Jinan University, China)

1:20 PM
208 - Slope Displacement Prediction Using Hybird Soft Computing Algorithms
Hanyong Liu (Research Institute of Highway Ministry of Transport, China), Chengyin Liu (Harbin Institute of Technology, Shenzhen, China)

1:40 PM
258 - Structural Damage Tracking Using Finite Element Model Updating with Improved Swarm Algorithm
Nizar Faisal Alkayem, Maosen Cao and Lixia Pan (Hohai University, China)

2:00 PM
265 - Probabilistic Deterioration Modelling of Fatigue Cracking in Wind Turbine Blades
Hua-Peng Chen (University of Greenwich, United Kingdom), Tian-Li Huang (Central South University, China), Mehrdad B. Mehrabani (University of Greenwich, United Kingdom), C. Zhang (University of Greenwich, United Kingdom)

2:20 PM
271 - Interstory Drift Monitoring of Building Under Earthquake Loading Using MEMS Inclinometers
Shuang Hou (South China Univ. Tech., China), Chuangshuo Zeng (The University of Mississippi, USA)

Case Studies in Infrastructure 2 (Mills 6)

Moderator: Lauren Linderman

1:00 PM
400 - Distributed Strain Monitoring of Reinforced Concrete Foundation Piles During Load Tests
Stefan Breuer, Wieland Hill and Rainer Macherey (NKT Photonics GmbH, Germany), Karolina Komlossy and Arne Kindler (Stump Spezialtiefbau GmbH, Germany), F. Kammann (NKT Photonics GmbH, Germany)

1:20 PM
101 - A Comprehensive Structural Health Monitoring System for the New Champlain Bridge
Mark Treacy (Mageba SA, Switzerland), Gianni Moor (Mageba SA, USA), Borja Bailles (Mageba International, USA), Andrea Paciacconi (Mageba SA, Switzerland)

1:40 PM
16 - Database Management System for Statewide Bridge Monitoring
Thomas Weinmann and Ozan Celik (Geocomp, USA)

2:00 PM
467 - Influence of Adjacent Blasting and Unloading on Existing Tunnel Structure
Yadong Xue, Yongfeng Lai and Xiaozheng Fang (Tongji University, China)

2:20 PM
20 - Wireless Sensing on Deformation of Utility Tunnel: A Case Study in Shanghai
Jingkang Shi, Dongming Zhang and Hongwei Huang (Tongji University, China), Y. Wu (Wisen Innovation Ltd, China)

Data Fusion and Analytics 1 (Mills 5)

Moderator: Hongwei Huang

1:00 PM
6 - A Piecewise Linear Representation of Time Series Considering the Trend Transition Points for Monitoring Data During Construction of Steel Structures
Xixin Gao (Tongen Civil Engineering Technology Consulting Ltd., Shanghai, China), Yongfeng Luo (Tongji University, China), Jun Wu (Tongji University, China), Lei Wang (Tongen Civil Engineering Technology Consulting Ltd., Shanghai,China)

1:20 PM
42 - Learning Disaster-Scenes Using Deep Learning Methods
Shimin Tang, Sameer Aryal and Zhiqiang Chen (University of Missouri-Kansas City, USA)

1:40 PM
239 - Efficient Vision-Based Data Anomaly Detection for Structural Health Monitoring
Yuequan Bao, Zhiyi Tang and Hui Li (Harbin Institute of Technology, China)

2:00 PM
92 - Safety Evaluation of Shield Tunnel Based on Multi-Source Data Fusion
Xin Xie, Hongwei Huang and Dongming Zhang (Tongji University, China), S. Lacasse (Norwegian Geotechnical Institute, Norway)

2:20 PM
97 - Monitoring Temperature Effects on a Historical Timber Building
Juan Wang and Huihui Chen (Beijing Jiaotong University, China), Qingshan Yang (Chongqing University, China), Na Yang (Beijing Jiaotong University, China)

Fiber Optic Sensors for Structural Health Monitoring (Mills 8)

Moderators: Daniele Zonta & Jie Huang

1:00 PM
178 - 5 Years' Experience Using Distributed Fiber Optic Sensing Along Ductile Driven Piles
Christoph M. Monsberger, Madeleine Winkler, Helmut Woschitz and Werner Lienhart (Graz University of Technology, Austria), Martin Hayden (Keller Grundbau GmbH, Austria)

1:20 PM
440 - Implementation of Fiber Optic Acoustic Sensors for Post-Tensioned, Cable Stays, and Suspension Cable Wire Break Monitoring
Terry A. Tamutus, Dustin Carr and Justin L. Stay (Structural Monitoring Solutions, USA), Mike Baez (Luna Innovations, USA)

1:40 PM
448 - Structural Heath Monitoring for Linear Structure Based on Distributed Optical Fibre Sensors and its Application
Jiang-hong Mao (Zhejiang University, China), Wei-liang Jin (Zhejiang University, China), Jun Zhang (Zhejiang University, China), W.J. Fan (Zhejiang University, China), Q. Li (Zhejiang University, China), X.Y. Gao (Zhejiang University, China)

2:00 PM
434 - Optical Fiber Based Large Scale Pavement Structure Performance Monitoring Sensors
Wanqiu Liu (Dalian University of Technology, China)

2:20 PM
145 - Corrosion Localization of Steel Structures Using Fiber Bragg Grating Sensors
Ying Huang, Fodan Deng, Dawei Zhang, Simone Ludwig and Fardad Azarmi (North Dakota State University, USA)

Concurrent Sessions 5 — 3:15 PM – 5:15 PM (Tuesday, August 6)

Presentations are noted by abstract/paper number, which corresponds to the Abstract Book

System Identification Using SHM/NDE 2 (Grand A)
Moderator: Zhongdong Duan

3:15 PM
7 - Modification and Verification of an Ambient-Vabration-Based Approach for Damage Detection of Structures
Amin Moghadam and Hani Melhem (Kansas State University, USA)

3:35 PM
93 - Occupant Tracking Using Model-Based Data Interpretation of Structural Vibrations
Slah Drira, Yves Reuland and Ian F.C. Smith (Swiss Federal Institute of Technology, Switzerland)

3:55 PM
14 - Study on Performance Evaluation of Steel Arch Bridge Based on Long Term Monitoring
Wladimir M. González and Rubén L. Boroschek (University of Chile, Chile)

4:15 PM
114 - Stiffness and Hysteresis Force Identification of a Full-Scale RC Column Using Seismic Acceleration Response Measurements
Muge Kuleli and Tomonori Nagayama (The University of Tokyo, Japan)

4:35 PM
147 - Substructural Identification by Localized Frequency Response Functions of the Remote Sensing System
Brock D. Hedegaard and Brittany Shotwell (University of Wisconsin-Madison, USA)

4:55 PM
163 - Non-Linear Identification of the Seismic Damage in a Masonry Building from Dynamic Response Records
Erica Lenticchia and Gaetano Miraglia (Politecnico di Torino, Italy), Marcello Morgantini (Columbia University, USA), Marica Pecorelli, Cecilia Surace and Rosario Ceravolo (Politecnico di Torino, Italy), Raimondo Betti (Columbia University, USA)

INSPIRE UTC Research – Infrastructure Sensing (Grand B)
Moderator: Yang Wang

3:15 PM
199 - UAV-Based Smart Rock Positioning for Determination of Bridge Scour Depth
Haibin Zhang, Zhaochao Li, Alec Reven, Buddy Scharfenberg, and Genda Chen (Missouri University of Science and Technology, USA), Jinping Ou (Harbin Institute of Technology, China)

3:35 PM
71 - Corrosion Induced Mass Loss Measurement Under Various Strain Levels through Gr/AgNW-based, Fe-C Coated LPFG Sensors
Chuanrui Guo, Liang Fan, Genda Chen (Missouri University of Science and Technology, USA)

3:55 PM
30 - Thermally-Stable Passive Wireless Antenna Sensor for Strain Sensing
Dan Li and Yang Wang (Georgia Institute of Technology, USA)

4:15 PM
25 - Assessing Moisture Content on the Surface of Mortar Samples from Hyperspectral Imaging
Liang Fan, Abdullah Alhaj, Hongyan Ma and Genda Chen (Missouri University of Science and Technology, USA)

INSPIRE UTC Research – Infrastructure Sensing (Grand B), continued...

4:35 PM
124 - Microwave High-Resolution 3D SAR Imaging of Corroded Reinforcing Steel Bars in Concrete Subjected to Accelerated Electrochemical Corrosion
Chao Liu, Stephona Barker, Liang Fan, M.T. Ghasr, Genda Chen and Reza Zoughi (Missouri University of Science and Technology, USA)

4:55 PM
445 - Evaluations of Multiple Non-Destructive Techniques on Top and Bottom Surfaces of a Reinforced Concrete Bridge Deck
Abdullah Alhaj, Hongya Qu, Haibin Zhang, Chen Genda, Neil Anderson and Evgeniy Torgashov (Missouri University of Science and Technology, USA)

Evaluation of Bridges Using Sensors, Civionics and SHM 3 (Grand C)
Moderator: Chenglin Wu

3:15 PM
53 - A Multi-Sensing Monitoring System to Study Deterioration of a Railway Bridge
Haris Alexakis, Andrea Franza (University of Cambridge, United Kingdom), Sinan Acikgoz (University of Oxford, United Kingdom), Matthew DeJong (University of Cambridge, United Kingdom)

3:35 PM
66 - Innovative Strain Based Bridge Weigh in Motion System for Truss Bridges
Ethan MacLeod and Kaveh Arjomandi (University of New Brunswick, Canada), Jared McGinn (New Brunswick Department of Transportation Infrastructure, Canada)

3:55 PM
128 - Structural Health Monitoring (SHM) of Bed Scour in the FlexiArch™ Bridge System
Evdokia Gyftaki, Su E. Taylor, Gerard Hamill and Desmond Robinson (Queen's University, United Kingdom), Brian McFarland (Queen's University, United Kingdom)

4:15 PM
173 - Evaluation of Distribution Factor of Girder Bridges Using Live Load Response
Basheer Algohi (University of Manitoba, Canada), Aftab Mufti (SIMTReC, University of Manitoba, Canada), Evangeline Murison (Manitoba Infrastructure, Canada), Ruth Eden (Manitoba Infrastructure, Canada),Brian Westcott (Intelligent Structures, USA), Douglas Thomson (University of Manitoba, Canada)

4:35 PM
256 - Characterization of Acoustic Emission from Wire Breaks in Post-Tensioning Steel Tendons
Sadegh Mahmoudkhani, Aftab Mufti, Junhui Zhao, Basheer Algohi, Douglas Thomson and Chad Klowak (University of Manitoba, Canada), D. Whitmore, J. Furgal (Vector Corrosion Ltd., Canada)

4:55 PM
285 - Application of Fiber Optic Sensors for Damage Detection and Performance Monitoring of Prestressed Concrete Bridge Girders
Omid Khandel (Oklahoma State University, USA), Mohamed Soliman (Oklahoma State University, USA), Royce W. Floyd (University of Oklahoma, USA), Cameron Murray (University of Arkansas, USA)

Concurrent Sessions 5 — 3:15 PM – 5:15 PM (Tuesday, August 6)

Presentations are noted by abstract/paper number, which corresponds to the Abstract Book

Nondestructive Evaluation (Mills 1)

Moderators: Nenad Gucunski & Glenn Washer

3:15 PM
127 - Detection of Delamination and Corrosion in a Pedestrian Bridge Deck Using Microwave SAR Imaging Approach
Mohammad Tayeb Ghasr, Stephon Barker, Chao Liu, Genda Chen and Reza Zoughi (Missouri University of Science and Technology, USA)

3:35 PM
158 - Detecting Interfacial Debonding of FRP–Concrete Joints Using Active Microwave Thermography
Xingxing Zou (Missouri University of Science and Technology, USA), Seyed Ali Mirala (Missouri University of Science and Technology, USA), Lesley Sneed (Missouri University of Science and Technology, USA), Kristen Donnell, Mohammad Tayeb Ahmad Ghasr (Missouri University of Science and Technology, USA)

3:55 PM
249 - Amplifying Propagating Elastic Waves in Pipe-Like Structures by Metamaterial Lens for the Enhanced Guided Wave Ultrasonics
Serife Tol, Gorkem Okudan and Didem Ozevin (University of Illinois at Chicago, USA)

4:15 PM
449 - Piezomagnetism Based Approach Monitoring the Bond Deterioration Under Static and Cyclic Loading
Jun Zhang (Zhejiang University, China), Wei-liang Jin (Zhejiang University, China), Jiang-hong Mao (Zhejiang University, China), W.J. Fan (Zhejiang University, China), F. Zhang (Zhejiang University, China)

4:35 PM
453 - Rebar Detection Using Ground Penetrating Radar with State-of-the-Art Convolutional Neural Networks
Habib Ahmed and Hung Manh La (University of Nevada, Reno, USA), Nenad Gucunski (Rutgers Universirty, USA)

4:55 PM
459 - Improved Ground Penetrating Radar Data Processing Method for Railroad Ballast Inspection
Jenny Liu and Hanli Wu (Missouri University of Science and Technology, USA)

Damage Diagnosis and Prognosis Using Soft Computing 2 (Mills 3)

Moderators: Ling Yu & Hua-Peng Chen

3:15 PM
296 - Monitoring Based Stochastic Deterioration Modelling of Existing Concrete Structures Using Lifetime Distributions
Hua-Peng Chen (University of Greenwich, United Kingdom)

3:35 PM
343 - Optimal Sensor Placement Based on Response Correlation Analysis Under Multiple Working Conditions
Wei Lu, Qiexin Peng, Jun Teng and Weihua Hu (Harbin Institute of Technology, Shenzhen, China)

3:55 PM
350 - Structural Damage Detection Using Relationship Between Transmissibility Functions and Stiffness Variations
Huanlin Liu (Jinan University, China), Ling Yu (Jinan University, China), L. Yu (Jinan University, Guangzhou, China)

4:15 PM
374 - Ant Lion Optimization for Parameter Identification of Structural Systems
Liu Mei, Jiahui Chen and Haijun Zhou (Shenzhen University, China)

4:35 PM
430 - Bridge Damage Identification via Interaction Forces of the Vehicle-Bridge System Using Vehicle Axle Responses
Jiantao Li and Xinqun Zhu (University of Technology Sydney, Australia)

4:55 PM
119 - Structural Damage Diagnosis Based on Stochastic Subspace Identification and Artificial Neural Network
Chih-Wei Chang, Tzu-Kang Lin, Chia-Ming Chang and Yu-Ching Chen (National Chiao Tung University, Taiwan)

Data Fusion and Analytics 2 (Mills 5)

Moderator: Jian Li

3:15 PM
322 - Drift Estimation of Building Structures Under Non-Stationary Wing Using Sensor Data Fusion
Abdulaziz Almarshad, Jian Li and Andrés Lepage (University of Kansas, USA)

3:35 PM
81 - Dynamic Warning on Abnormity of Cable-Stayed Bridges Using Deflection Measurements
Zi-Yuan Fan, Xiang Xu, Yuan Ren and Qiao Huang (Southeast University, China)

3:55 PM
403 - A Bayesian Probabilistic Approach for Structural Damage Detection
Yuan-Hao Wei (The Hong Kong Polytechnic University, Hong Kong), Yi-Qing Ni (The Hong Kong Polytechnic University, Hong Kong), Qi-Ang Wang (China University of Mining and Technology, China)

Concurrent Sessions 5 — 3:15 PM – 5:15 PM (Tuesday, August 6)

Presentations are noted by abstract/paper number, which corresponds to the Abstract Book

Case Studies in Infrastructure 3 (Mills 6)

Moderator: Guirong (Grace) Yan

3:15 PM
8 - Structural Response of a Tunnel Lining to Water Level Fluctuations of a Tidal River
Hans De Backer, Amelie Outtier, K. Schotte and Ph. Van Bogaert (Ghent University, Belgium)

3:35 PM
443 - Fiber Bragg Grating Based Tilt and Pressure Sensors Fabricated by Fused Deposition Modeling Process
Chengyu Hong (Shanghai University, China), Yifan Zhang (Donghua University, China), Yu Yuan (Shanghai University, China), Yuyao Yang (Shanghai University of Engineering Science, China)

3:55 PM
227 - Managing the Ageing Dutch Highway and Waterway Networks, Asset Information Need and Monitoring Opportunities
Leo Klatter (Ministry of Infrastructure and Water Management, Netherlands), Willy Peelen (TNO, Netherlands)

4:15 PM
15 - Structural Health Monitoring System for the Governor Mario M. Cuomo Bridge
Ozan Celik and Thomas Weinmann (Geocomp, USA)

4:35 PM
176 - In Situ Experimental Study of FFT-Based Bridge Weigh-in-Motion System on a Continuous Box Girder Bridge
Hanli Wu (Missouri University of Science and Technology, USA), Hua Zhao (Hunan University, China), Jenny Liu (Missouri University of Science and Technology, USA)

4:55 PM
468 - Simulation Analysis of a Slope Landslide in Chongqing Based on MPM
Jiaxuan Wang (Hefei University of Technology, China), Yadong Xue (Tongji University, China)

Fiber Optic Sensors and Defect Detection in Composite Structures (Mills 8)

Moderator: Bin Xu

3:15 PM
323 - Detecting Grouting Compactness of Prestressed Duct Using Distributed Fiber Optic Sensors
Xin Feng, Shilin Gong, Tong Zhu and Jing Zhou (Dalian University of Technology, China)

3:35 PM
438 - Optical Fiber Sensor-Based Smart Structures for Civil Engineering*
Zhi Zhou (Dalian University of Technology, China)

3:55 PM
223 - Interface Debonding Detection of Concrete Filled Steel Tubular (CFST) Based on the Acoustic Signal
Gangbing Song (University of Houston, USA), Dongdong Chen and Linsheng Huo (Dalian University of Technology, China)

4:15 PM
266 - Multi-Physics Coupling Numerical Study on Debonding Detection Mechanism for RC Members Using Wave Propagation Measurement
Xinling Fan and Bin Xu (Huaqiao University, China), Hongbing Chen (Hunan University, China), Song Xia (Xi'an Jiaotong University, China)

4:35 PM
23 - Corrosion-Induced Deterioration Assessment at Steel-Concrete Interface Based on Hoop Strains Measured with Distributed Fiber Optic Sensors
Liang Fan and Genda Chen (Missouri University of Science and Technology, USA), Yi Bao (Stevens Institute of Technology, USA)

4:55 PM
202 - Measuring Temperature Distribution in Steel-Concrete Composite Slabs Subjected to Fire Using Brillouin Scattering Based Distributed Fiber Optic Sensors
Yi Bao (Stevens Institute of Technology, USA), Matthew S. Hoehler (National Institute of Standards and Technology, USA), Christopher M. Smith (Berkshire Hathaway Specialty Insurance, USA), Matthew Bundy (National Institute of Standards and Technology, USA), Genda Chen (Missouri University of Science and Technology, USA)

**Denotes Presentation Only*

Conference Schedule — Wednesday, August 7, 2019

7:00 AM – 12:00 PM	Registration Desk Open (Grand Coat Room)
7:00 AM – 9:00 AM	Continental Breakfast (Grand D)
8:00 AM – 12:00 PM	**Exhibit Hall Open** (Grand D)
8:00 AM – 9:40 AM	**Concurrent Sessions 6** (see pages 40-41)
9:40 AM – 10:00 AM	Refreshment Break (Grand D)
10:00 AM – 11:00 AM	**Plenary Session 3 Keynote Presentations** (Grand E) | Moderator: Zhishen Wu


Wolfgang R. Habel

10:00 AM
480 - The Challenges of Introducing Scientific Results into Practice of SHM: Reliability, Validation and Acceptance Aspects
Wolfgang R. Habel (formerly with the Federal Institute for Materials Research and Testing (BAM), Germany)

Abstract/Bio on page 13


G.P. Cimellaro

10:30 AM
483 - SHM Role in the Framework of Infrastructure Resilience
Gian Paolo Cimellaro and O. Kammouth (Politecnico di Torino, Italy)

Abstract/Bio on page 14

11:00 AM – 12:00 PM	**Closing Ceremony** (Grand E) **11:00 AM** **Student Poster Awards** | Jenny Liu **11:15 AM – 11:20 PM** **Closing Remarks** | Genda Chen **11:20 AM – 12:00 PM** **ISHMII General Meeting** | Zhishen Wu
2:00 PM – 4:00 PM	**Stan Musial Veterans Memorial Bridge (MoDOT Bridge Test Demo)** (details page 23)
5:00 PM – 8:00 PM	UTC Business Meeting - Invitation Only (Grand A/B)

Concurrent Sessions 6 — 8:00 AM – 9:40 AM (Wednesday, August 7)

Presentations are noted by abstract/paper number, which corresponds to the Abstract Book

Vibration-Based Monitoring and Assessment (Grand A)

Moderators: Rodrigo Sarlo & Jian Zhang

8:00 AM
287 - Efficient Automated Operational Modal Analysis for Densely Instrumented Infrastructure
Rodrigo Sarlo and Pablo A. Tarazaga (Virginia Tech, USA)

8:20 AM
32 - Dynamic Impact Factor of Steel Box Girder Bridge Under Random Traffic Flow and Surface Roughness
Hoai Ho and Mayuko Nishio (Yokohama National University, Japan)

8:40 AM
351 - Quantifying the Impacts of Truck Loads on Bridge Performance: Objectives and Challenges
Kirk A. Grimmelsman and Jeffrey E. Purdy (Pennoni Associates, USA)

9:00 AM
156 - Remote Sensing of a Cable Stayed Bridge Through Displacement Influence Line
Mehrisadat Makki Alamdari and Linlin Ge (University of New South Wales, Australia), Kamyar Kildashti (Western Sydney University, Australia), Yincai Zhou (University of New South Wales, Australia)

INSPIRE UTC Research – Data Analytics (Grand B)

Moderator: Ruwen Qin

8:00 AM
18 - Synchro-Squeezed Adaptive Wavelet Transform and its Application to Impact Echo Signals for Pavement Delamination Detection
Hongya Qu, Tiantian Li and Genda Chen (Missouri University of Science and Technology, USA)

8:20 AM
150 - Distributed Strain Measurements in a Steel-Concrete Composite Floor Beam under Multi-Point Loading at Ambient Temperature
Matthew A. Klegseth (Missouri University of Science and Technology, USA), Yi Bao (Stevens Insitute of Technology, USA), Matthew S. Hoehler and Lisa Choe (National Institute of Standards and Technology, USA), Liang Fan and Genda Chen (Missouri University of Science and Technology, USA)

8:40 AM
186 - Updating Bridge Resilience Assessment Based on Corrosion and Foundation Scour Inspection Data
Yijian Zhang (Georgia Institute of Technology, USA), Reginald DesRoches (Rice University, USA), Iris Tien (Georgia Institute of Technology, USA)

9:00 AM
241 - Image Data Analytics to Support Engineers' Decision-Making
Tianyi Zhao, Zhaozheng Yin, Ruwen Qin and Genda Chen (Missouri University of Science and Technology, USA)

9:20 AM
372 - Defect Detection of Concrete Structures Through Sounding Data Analytics
Ran Cao and Anil K. Agrawal (The City College of New York, USA)

Evaluation of Bridges Using Sensors, Civionics and SHM 4 (Grand C)

Moderators: Richard Marz & Dryver Huston

8:00 AM
316 - Monitoring of Detensioning and Transport of Prefabricated and Prestressed Reinforced Concrete Bridge Girders
Dryver Huston, Robert Farrell, Daniel Orfeo, Robert Worley, Mauricio Pereira, Tian Xia, Mandar Dewoolkar and Mandar Dewoolkar (University of Vermont, USA)

8:20 AM
394 - A Bridge Weigh-in-Motion Method Using Bridge Acceleration and Inclination Data Measured from 3-Axis Accelerometers
Haoqi Wang and Tomonori Nagayama (The University of Tokyo, Japan)

8:40 AM
452 - Classification of Concrete Crack Using Deep Residual Network
Umme Hafsa Billah and Hung Manh La (University of Nevada, Reno, USA), Nenad Gucunski (Rutgers University, USA), Alireza Tavakkoli (University of Nevada, Reno, USA)

9:00 AM
469 - Issues in SHM of Existing Bridges: From Periodic Checks to Continuous Structural Health and Performance Assessment
Carlo Rainieri and Giovanni Fabbrocino (University of Molise, Italy)

9:20 AM
246 - Using Bayesian Statistics to Improve Modal Parameter Estimates from an Automatic OMA Algorithm
Silas Sverre Christensen and Anders Brandt (University of Southern Denmark, Denmark)

Nondestructive Evaluation and Virtual Reality (Mills 1)

Moderator: Fernando Moreu Alonso

8:00 AM
138 - Acoustic Emissions Monitoring of Welded Structural Members Partially Embedded in Concrete
Francisco J. Carrion, Juan A. Quintana, Jorge A. Hernandez, Jose M. Machorro, Luis A. Martínez, Miguel Martínez and Hector M. Gasca (Instituto Mexicano del Transporte, Mexico), Saúl E. Crespo (Instituto Tecnológico de Estudios Superiores de Monterrey - Campus Queretaro, Mexico)

8:20 AM
232 - Nondestructive Evaluation of Asphalt Overlaid Bridge Deck with Ground Penetrating Radar and Automated Acoustic Scanning System
Jinying Zhu, Sepehr Pashoutani and Hongbin Sun (University of Nebraska-Lincoln, USA)

8:40 AM
388 - Electrical Resistivity and Chargeability to Assess Cracking in Concrete
Jinho Park, Morgan Wilder, Benjamin L Worsfold, Khalid Mosalam and Kenichi Soga (University of California, Berkeley, USA)

9:00 AM
352 - Infrastructure Stakeholders' Perspective in New Structural Health Monitoring (SHM) Technologies for Infrastructure Maintenance and Management
Dilendra Maharjan (University of New Mexico, USA), Marlon Aguero (University of New Mexico, USA), Christopher Lippitt (University of New Mexico, USA), Fernando Moreu (University of New Mexico, USA)

Concurrent Sessions 6 — 8:00 AM – 9:40 AM (Wednesday, August 7)

Presentations are noted by abstract/paper number, which corresponds to the Abstract Book

Nondestructive Evaluation and Virtual Reality (Mills 1), Continued...

9:20 AM
417 - Learning to Detect Important Visual Changes for Structural Inspections Using Physics-Based Graphics Models
Vedhus A. Hoskere and Billie F. Spencer Jr. (University of Illinois at Urbana-Champaign, USA)

Damage Diagnosis and Prognosis Using Soft Computing 3 (Mills 3)

Moderators: Ling Yu & Hua-Peng Chen

8:00 AM
221 - Blind Modal Identification in Frequency Domain for High Damping Structures Through Independent Component Analysis
Ting-Hua Yi, Xiao-Jun Yao, Chunxu Qu and Hong-Nan Li (Dalian University of Technology, China)

8:20 AM
247 - Identifying Nonlinear Characteristics of Model-Free MR Dampers in Structures with Partial Response Data
Han Su, Lijun Liu and Ying Lei (Xiamen University, China)

8:40 AM
269 - Damage Identification of Non-Classically Damped Structure by Sensitivity Analysis of Complex Eigenparameter and Modal Kinetic Energy
Zhongrong Lu, Jike Liu and Minli Yu (Sun Yat-sen University, China)

9:00 AM
363 - Laplace Approximation Technique in Sparse Bayesian Learning for Structural Damage Detection
Xiaoyou Wang and Yong Xia (The Hong Kong Polytechnic University, China)

9:20 AM
320 - Identification of Time-Varying Structural Parameters by Integrated Wavelet Multiresolution Analysis and Kalman Filtering with Partial Measurements
Ying Lei and Siyi Chen (Xiamen University, China)

SHM-based Structural Performance Evaluation and Case Studies (Mills 6)

Moderator: Hongyan Ma

8:00 AM
29 - Determination Method of Construction Closure Temperature of Spatial Steel Structure
Wei Lu, Kai Huang, Jun Teng and Weihua Hu (Harbin Institute of Technology, Shenzhen, China)

8:20 AM
72 - Structural Safety Assessment Based on Stress Response and Multi-scale Simulation
Jun Teng, Yan Cui, Wei Lu and Weihua Hu (Harbin Institute of Technology, Shenzhen, China)

8:40 AM
174 - Human Fall Detection Using Floor Vibration and Machine Learning
Zhaoshuo Jiang (San Francisco State University, USA), Chengyin Liu (Harbin Institute of Technology Shenzhen Graduate School, China), Xiangxiang Su (Harbin Institute of Technology Shenzhen Graduate School, China), Samuel Joseph Benzoni (San Francisco State University, USA), John Christian Hanson (San Francisco State University, USA), A. Maxwell (San Francisco State University, USA)

SHM-based Structural Performance Evaluation and Case Studies (Mills 6), Continued...

9:00 AM
276 - A New S-N Curve Model and Fatigue Assessment of Steel Bridges
Guang-Dong Zhou, Huan Zhang, T.Y. Zhu (Hohai University, China)

9:20 AM
113 - A Review of Fiber Optic Sensing Technologies for Bridge Health Monitoring
Susom Dutta and Pradeep Kurup (University of Massachusetts Lowell, USA)

Technology Transfer (Mills 8)

Moderator: Eric Foster

8:00 AM
297 - Analysis of Sampling Strategies for Extracting Thermal Load Effects from Continuous Structural Health Monitoring Measurements of Bridges
Kirk A. Grimmelsman and Navid Zolghadri (Intelligent Infrastructure Systems, USA)

8:20 AM
292 - Damage Detection of Multi Span Beam with Column Supports by Rayleigh-Ritz Method
Hasan Daneshvar (Islamic Azad University, Iran), Alireza Gharighoran (University of Isfahan, Isfahan, Iran), Abbas Karamodin (Ferdowsi University of Mashhad, Iran), Seyed Reza Zareei (Islamic Azad University, Iran)

8:40 AM
111 - Development of Bridge Weigh-in-Motion Using Deck Slab Response
Keigo Suzuki and Tomoya Tamamura (University of Fukui, Japan), Takeshi Miyashita (Nagaoka University of Technology, Japan), Saiji Fukada (Kanazawa University, Japan), Tsuyoshi Okano (Tokyo Sokki Kenkyujo Co., Ltd, Japan), Kenro Aihara, Atsuhiro Takasu, Atsuhiro Takasu and Akira Kinoshita (National Institute of Informatics, Japan)

9:00 AM
27 - On the Standardization of Procedures for Structural Health Monitoring
Maria Pina Limongelli (Politecnico di Milano, Italy)

9:20 AM
465 - An Integrated NDE Survey to Develop the As-Built of the Underground Wall in Botafogo Metro Station, Rio de Janeiro, Brazil
Jose T. Araruna Jr., Jorge Lucas Ferreira and Paola M.B. Manhaes (Pontifical Catholic University of Rio de Janeiro, Brazil)

St. Louis, Missouri USA

During your stay, make sure to discover our energizing city and all the fun things to do in St. Louis. Situated along the scenic riverfront, the conference hotel puts you in the heart of the culture, history and spirit of St. Louis. Ride the tram up the Gateway Arch to take in panoramic views of the city. See the Cardinals round the bases at Busch Stadium.

For activities to enjoy at the hotel, check out the 24-hour StayFit™ Fitness Center, YogaAway™ program, and nearby walking and jogging paths.

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Popular Attractions

Anheuser-Busch Brewery 3.9 mi / 6.29 km away
Nestled in the historic Soulard neighborhood, originally selected based on its access to the Mississippi River, the large presence of German immigrants in the area, and natural caves to store beer, Anheuser-Busch, one of the world's largest beer brewers was established at this site in the 1860's and many architectural gems from that time period including three National Historic Landmarks, remain at the 100-acre brewery today.

Ballpark Village 0.6 mi / 918 meter away
This dining and entertainment venue is located next to Busch Stadium within walking distance of the hotel. Eat, drink and play at the various restaurantsand bars within the entertainment district. There's something for everyone! Ballpark Village offers concerts, festivals, family events and sports watch parties throughout the year.

Gateway Arch 1.2 mi / 1.96 km away
No visit to the city is complete without a visit to the Arch, an impressive symbol of St. Louis' status as the gateway to the West. The Gateway Arch is the largest arch in the world and just steps from the hotel. At an astounding 630-feet tall, the Gateway Arch remains the tallest man-made national monument in the United States. Ride the tram to the top, visit the new Museum at the Gateway Arch or hop on a riverboat cruise.

Missouri Botanical Garden 5.7 mi/ 9.17 km
Founded in 1859, the Missouri Botanical Garden is the nation's oldest botanical garden in continuous operation and a National Historic Landmark. The Garden offers 79 acres of beautiful horticultural display, including a 14-acre Japanese strolling garden, Henry Shaw's original 1850 estate home, and one of the world's largest collections of rare and endangered orchids. The Garden is a center for botanical research and science education as well as an oasis in the city of St. Louis.

St. Louis Science Center 5.3 mi/ 8.5 km away
Specializing in making science fun! People of all ages investigate, explore and engage with science through fun and interactive learning experiences. Enjoy the Science Center's permanent galleries, demonstrations, live science museum, OMNIMAX Theater, Planetarium shows and exhibitions. General Admission is always free.

City Musuem 1.3 mi/ 2.1 km away
Where imagination runs wild! Housed in the 600,000 square-foot former International Shoe Company, is an eclectic mixture of children's playground, funhouse, surrealistic pavilion, and architectural marvel – made out of unique, found objects.

Laclede's Landing 0.4 mi/ 0.6 km away
Located on the banks of the mighty Mississippi River and just north of the world-famous Gateway Arch, Laclede's Landing is downtown St. Louis' oldest district and ONLY riverfront entertainment and dining destination. The nine-block area of Historic Laclede's Landing – once the manufacturing, warehousing and shipping hub of St. Louis – is now home to over twenty great restaurants, clubs, shops and attractions.

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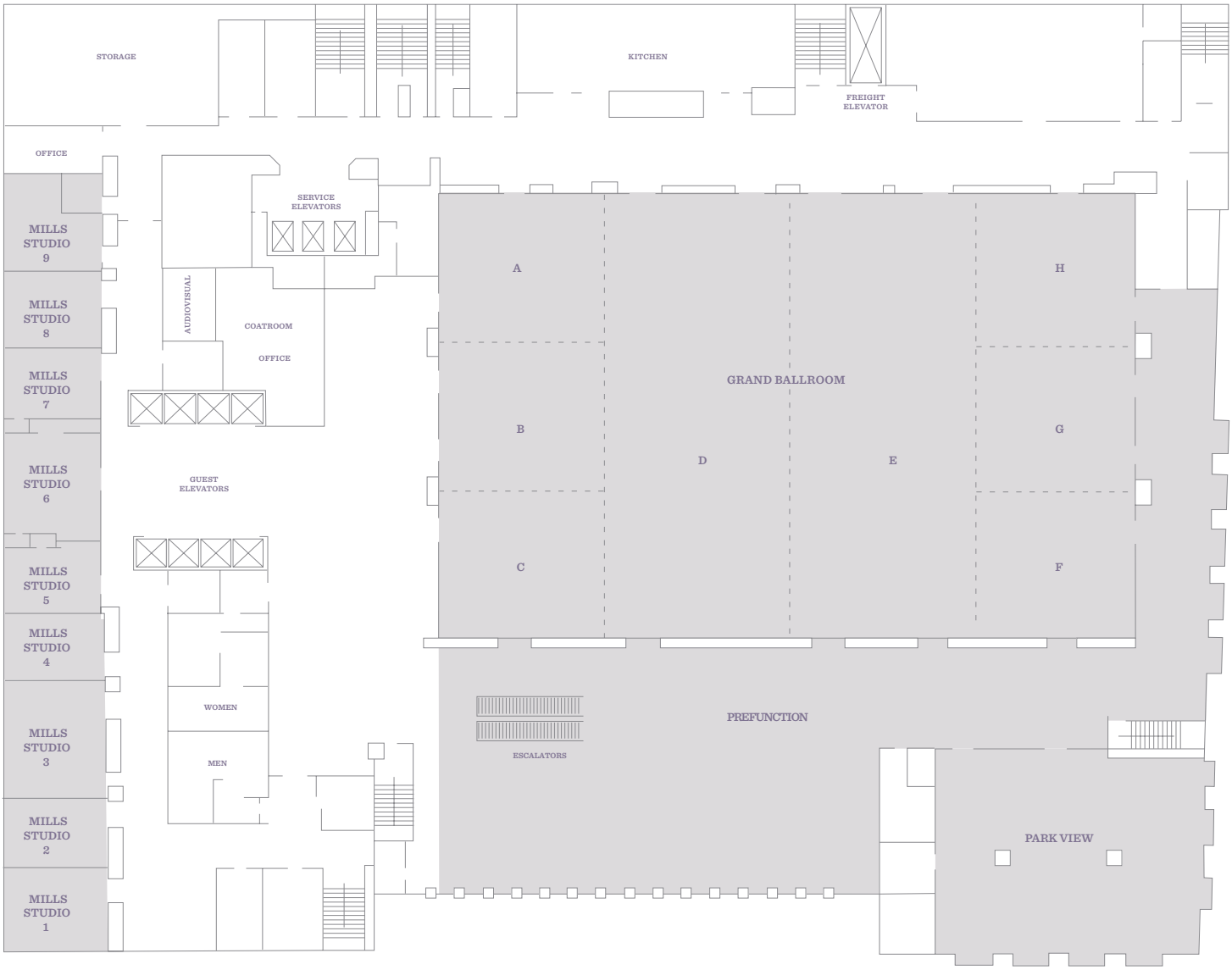


SHMII-10

2021 Porto 10th International Conference on **Structural Health Monitoring of Intelligent Infrastructure**

10th International Conference on Structural Health Monitoring of Intelligent Infrastructure

30 June – 2 July 2021, Porto, Portugal

The Faculty of Engineering of University of Porto (FEUP) is pleased and honored to host the 10th International Conference on Structural Health Monitoring of Intelligent Infrastructure. The Organizing Committee will work with the ISHMII Advisory Committee defining the structure of the Scientific Program after all inputs also received from the International Scientific Committee. A post conference tour with a technical visit to an outstanding structure will be also organized.

Porto is an old city, origin of the world-famous Port wine, located in the North of Portugal, classified as World Heritage by Unesco in 1996 and awarded as the Best European Destination in 2017. The airport has direct regular connections with several main European cities and also with USA and Brazil. Porto is a city of outstanding bridges over Douro river, with old monuments and a peculiar atmosphere, but also a city of modern architecture, as is the case of Casa da Música or Serralves Contemporary Art Museum. Besides several interesting city tours, there is the possibility to an unforgettable river journey, discovering one of Portugal's most beautiful landscapes while travelling through the Douro Valley, the oldest Wine Demarcated Region in the world.

See you at Porto!

ISHMII

U.PORTO

Álvaro Cunha
(*Conference Chair*)

JSTI

LONG SPAN BRIDGE HEALTH MONITORING DATA CENTER OF JIANGSU PROVINCE

In October 2010, Jiangsu Transportation Holdings Co., Ltd. and JSTI GROUP jointly initiated the establishment of 'Long span bridge health monitoring data center of Jiangsu Province', which implements specialized, centralized and uniPed management on the health monitoring data of large-span cable-stayed bridges under the jurisdiction of Jiangsu Transportation Holdings Co., Ltd.

The data center is the first regional bridge health monitoring system data center in China. It owns a professional and stable technical team to serve the analysis of the health monitoring data of the provincial bridges. Long-term data accumulation and tracking of research results provide a scientific basis for the maintenance and repair of the bridge.

MORE THAN 50 LONG-SPAN BRIDGES INCLUDING 7 CROSS-YANGTZE-RIVER BRIDGES

- First provincial Bridge Health Monitoring Data Center in China
- Largest regional bridge monitoring system in the world
- One of four Transport Science Data Sharing Platform in China

CIVIL STRUCTURES INTELLIGENT DETECTION & MONITORING TECHNOLOGY SERVICE ---TYPICAL PROJECTS

SUTONG YANGTZE RIVER BRIDGE

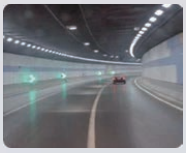
Bridge status real-time monitoring technology

- Cable-stayed bridge with world's longest main span(1088m)
- Design and implementation of Sutong Bridge SHM system undertaken by JSTI

SHENGLI OILFIELD OFFSHORE DRILLING PLATFORM

Offshore platform SHM technology

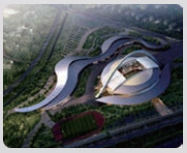
- First comprehensive offshore drilling platform SHM system project in China
- Design and implementation of 1# platform SHM system undertaken by JSTI



TUNNEL STRUCTURAL SAFETY MONITORING

Underground space SHM technology

- G213 Highway tunnel in Sichuan Province (4km)
- Design and implementation of Wuzhishan Tunnel SHM system undertaken by JSTI



ORDOS STADIUM

Building structural mechanics monitoring technology

- Grade A stadium in China
- Construction control project undertaken by JSTI
- Design and implementation of steel structure SHM system undertaken by JSTI

CONTACT INFORMATION:

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