ANCRiSST2017

July 22-23, 2017, The University of Tokyo, Japan

The thirteenth international workshop on advanced smart materials and smart structures technology will be held at the University of Tokyo, Tokyo, Japan on July 22-23, 2017. This workshop is organized by the Asian-Pacific Network of Centers for Research in Smart Structures Technology (ANCRiSST), which was established in 2002 and currently consists of 24 research institutes.

The purpose of the workshop is to assess the current progress of smart materials and structures technology and to develop synergies among researchers in various disciplines from different countries that will facilitate joint research projects that are of such scope and magnitude that cannot be easily carries out by the individual centers.

Those interested in the advanced smart materials and smart structures technology are all encourage to participate in the workshop. In particular, students are welcome to the keynote lectures of the workshop; students can participate in the keynote lecture sessions free of charge upon presenting their student IDs. Students can further participate in the following technical sessions and other activities by paying student registration fees. The keynote sessions will provide unique opportunities for students to be exposed to the state-of-the-art smart materials and structures through the distinguishing scholars. The time and the venue are as follows.

Time: Saturday, July 22, 2017 9:00-10:40
Sunday, July 23, 2017 9:10-10:20
Venue: Room 213, Engineering Building 2, The University of Tokyo
http://www.u-tokyo.ac.jp/campusmap/cam01_04_03_j.html

Scientific Committee
ANCRiSST2017
Website: http://www.bridge.t.u-tokyo.ac.jp/ancrisst2017/index.html
Email: ancrisst2017@bridge.t.u-tokyo.ac.jp

KEYNOTE LECTURE

Saturday, July 22, 2017, Chairperson: Prof. Chung Bang Yun

Data Science and Engineering in Civil Infrastructure

Prof. Hui Li

Harbin Institute of Technology, China

9:10-9:40

Abstract

The artificial intelligence has been comprehensively investigated in applied math, computing science and many other fields. “Brain” and “Action” are very critical issues in artificial intelligence. The “brain” is developed based on data, i.e. data is the basis of “brain”. Data science and engineering emerge a new branch in civil engineering. The data science and engineering in civil engineering can be categorized into data-driven approach and model-based approach by using various algorithms of machine learning, deep learning and enhancement learning. This presentation first introduces the advances in condition assessment of bridges by using the data driven approach based on machine learning and deep learning algorithms. For model-based approach, the computer vision technology is used to obtain the external loads and environmental actions, the three dimension geometry and size are then identified by computer vision technology and ultrasonic technology, a multiple-scale updated model is then obtained by incorporate the minor local damage into the macro-structural analysis model, and finally, the safety evaluation can be carried out based on the updated model for damaged structures. The future revolution in civil engineering to be achieved by the artificial intelligence, robots and virtual realization is figured out.

Biographical Sketch

Hui Li, a professor of Harbin Institute of Technology and the director of Key Lab of Intelligent Civil Infrastructure of Ministry of Industrials and Information Technology. She obtained her PhD in Engineering Mechanics in 1994 at Harbin Institute of Technology. She is current president of the International Association for Structural Control and Monitoring, and council member of International Society of Structural Health Monitoring for Intelligence Infrastructure. She was awarded by the Personal Year of Structural Health Monitoring. Her research interests include artificial intelligence in civil engineering, data science and engineering, structural health monitoring, smart materials and structures, structural control, wind engineering and earthquake engineering. She is the authors and coauthors of more than 200 journal papers, keynote lectures and conference papers.

High Fidelity Online Estimation of Infrastructure Displacement by Fusing Acceleration and GPS-RTK Measurements

Prof. Hoon Sohn

Korea Advanced Institute of Science and Technology, Korea

9:40-10:10

Abstract

When it comes to infrastructure monitoring, continuous displacement measurement is critical. However, continuous displacement measurement of large-scale civil infrastructure is challenging. GPS-RTK sensors are commonly used for civil infrastructure applications, but the accuracy and sampling rate of the GPS-RTK sensors are limited to around 10 to 20 mm and below 10 Hz, respectively. In this study, high accuracy (around 2 mm) and high sampling rate (up to 100 Hz) displacement is estimated by integrating GPS-RTK and accelerometer sensors into a single module and fusing their measurements using a two-stage Kalman filter. The two-stage Kalman filter improves accuracy, precision, and sampling rate of displacement estimation by recursively integrating the acceleration measured by the accelerometer and the displacement and velocity intermittently measured from the GPS-RTK sensor. The proposed online displacement sensor achieves an accuracy of around 2 mm at a sampling rate of 100 Hz. In addition, the quality of the estimated displacement is not much affected by surrounding conditions such as weather, multi-pass and signal blockage, which typically deteriorate the performance of conventional GPS-RTK sensors. A series of lab scale and field tests were conducted to evaluate the performance of the proposed displacement sensor.

Biographical Sketch

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 in the Civil and Environmental Engineering Department at Carnegie Mellon University for 2004-2006 as an Assistant Professor. 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. His research interest includes structural health monitoring, nondestructive testing, sensing technologies and data analytics. He has published over 150 refereed journal articles, over 300 conference proceedings, and 10 book & book chapters. His developed technologies have been licensed and commercialized by private companies, resulting in over 650,000 USD licensing agreements. He was the recipient of SHM Person-of-Year Award at 2011 International workshop on SHM, 2008 Young Scientists Award and 2017 Young Engineers Award, 2017 KAIST Best Research Award in Korea.

Hybrid Cyber-Physical Experimentation for Smart Structures

Prof. Shirley J. Dyke

Purdue University, United States

10:10-10:40

Abstract

Hybrid simulation is a powerful class of experimental techniques that couples physical experimentation with computational simulation. This approach enables a detailed examination of complex engineering systems while imposing realistic conditions on the selected, often unknown, physical subsystems. Real-time hybrid simulation is needed when rate dependence plays a significant role in the dynamics of the physical subsystem, and it often requires both high-fidelity control of the actuation system and real-time execution of the computational models and associated supervisory tasks. Originally pioneered in the field of earthquake engineering, this approach is increasingly being adopted and utilized in our laboratories. It offers the opportunity for evaluation and validation of a wide variety of smart infrastructure systems, typically with a significant reduction in time and cost. This talk will summarize some of the recent developments in this important emerging class of cyber-physical experimentation, and specifically the ways in which it has been used across the US for the demonstration and investigation of smart structures by enabling innovations that are intended to reduce fatalities, maintain business continuity, and minimize economic losses.

Biographical Sketch

Dr. Shirley J. Dyke is a professor of mechanical engineering and a professor of civil engineering at Purdue University. She was born near Chicago, Illinois, USA in 1969. She received her B.S. in Aeronautical and Astronautical Engineering from the University of Illinois, Champaign-Urbana and her Ph.D. degree in Civil Engineering from the University of Notre Dame in 1996. Professor Dyke teaches courses in structural dynamics, experimental methods and probability. Dr. Dyke established the Intelligent Infrastructure Systems Lab at Purdue's Bowen Lab. Dr. Dyke was awarded the Presidential Early Career Award for Scientists and Engineers (1998), the Short-term Invitation Fellowship from the Japan Society for the Promotion of Science (1998 & 2000), the International Association on Structural Safety and Reliability Junior Research Award (2001) and the ANCRiSST Young Investigator Award (2007). Dr. Dyke's research efforts have addressed a variety of issues related to the development and implementation of smart structures, including innovative control technologies for natural hazard mitigation, structural health monitoring and damage detection methods, and technologies such as RTHS and deep learning that magnify the impact of research in these areas.

Sunday, July 23, 2017, Chairperson: Prof. Emeritus Hirokazu Iemura

Exploration Research on Big Data Analysis for Health Monitoring of a Long Span Cable-Stayed Bridge

Prof. Limin Sun

Tongji University, China

9:00-9:30

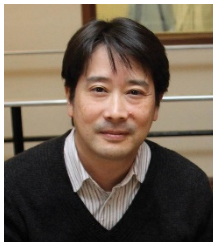
Abstract

The bridge health monitoring technology has been developed for several decades. With installed health monitoring system, massive data, including environmental loading and structural response, have been recorded for large scale and complex bridge structures. However, due to the backward of data processing and information mining technologies, the design purpose of structural health monitoring system has not been effectively implemented. In recent years, the rapid development of large data analysis technology in banking, retail, health industry, urban planning and other fields have been widely developed and applied. Based on the long-term monitoring data of a large span bridge, the authors try to use big data analysis techniques to explore the relationship between environment and loading effects and structural response, and to find out the abnormal conditions of bridge structure and sensor faults etc.. The advantages and disadvantages of the big data method were discussed by comparing with the traditional model-based method.

Biographical Sketch

Limin Sun received the B. E. degrees in civil engineering from Tsinghua University, Beijing, China in 1985, M. E. (in 1988) and Ph. D. (in 1991) of civil engineering from University of Tokyo, Japan. He obtained his license of PE (Orange) in 1997. He used to work as a research engineer in Technical Research Institute, Obayashi Corporation, Japan, from 1991-1999. He is currently a Professor and Director of Bridge Engineering Department of Tongji University, Shanghai, China. His research interests are in the areas of bridge engineering, in particular vibration control of bridge structures, health monitoring of long span bridges, and nonlinear seismic response of RC bridges. He is the member of IABSE and the member of CCES.

Towards the Whole Life Cycle Sensing of Infrastructure



Prof. Kenichi Soga

University of California, Berkeley, United States

9:30-10:00

Abstract

Timescales in infrastructure and construction are long, with construction time-scales alone stretching from two to 10 years, and asset lifetimes in the range of 60 to 100 years or even more. Civil engineering structures are fixed in space and time (e.g. 120-year design life) and provide independent services for transportation, energy supply, water, sewage and communication without any appreciable linkage. Each of these elements is operated with different business models, is guided by different performance metrics and deals with systems that involve different degrees of interconnectedness and time scales in terms of ageing and the requirements for repair and maintenance. Due to different rates of technical development between monitoring system versus infrastructure usage, some data we will be using may be from older sensors, and some of the sensors may be embedded now but data will be used 10, 20 or 50 years later. At present, there is a mismatch between the life span of infrastructure and that of sensor systems, which makes the concept of whole-life-cycle based asset management difficult to achieve. This talk will discuss the needs for sensor systems that can fulfil this concept ('intelligence for life') with either long-life or adaptable for replacement.

Biographical Sketch

Kenichi Soga is Chancellor's Professor at the University of California, Berkeley. He obtained his BEng and MEng from Kyoto University in Japan and PhD from the University of California at Berkeley. He was Professor of Civil Engineering at the University of Cambridge before joining UC Berkeley in 2016. He has published more than 350 journal and conference papers and is coauthor of "Fundamentals of Soil Behavior, 3rd edition" with Professor James K Mitchell. His current research activities are Infrastructure sensing, Performance based design and maintenance of underground structures, Energy geotechnics, and Geotechnics from micro to macro. He is a Fellow of the UK Royal Academy of Engineering and a Fellow of the Institution of Civil Engineers. He is recipient of many awards including George Stephenson Medal and Telford Gold Medal from the Institution of Civil Engineers and Walter L. Huber Civil Engineering Research Prize from the American Society of Civil Engineers.