10th International Workshop on Structural Health Monitoring

IWSHM 2015

"System Reliability for Verification and Implementation"

September 1 – 3, 2015
Stanford University

www.iwshm.org

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Keynote Presentations

Hewlett Auditorium 200 (Tuesday – Thursday, September 1st-3rd)

"Structural Health Management: A Rotorcraft OEM Perspective"

Sept. 1st, 08:10-08:40

Mark Davis

Chief Engineer, Sikorsky Aircraft Corporation

Health and Usage Monitoring Systems (HUMS) have been fielded in the rotorcraft industry for over twenty years. HUMS maturation and lessons learned from widespread deployment over the last ten years have led to significant benefits during the industry's journey to transform to a Condition-Based Maintenance (CBM) paradigm with the objective to reduce maintenance burden while ensuring aircraft structural integrity. Structural Health Monitoring (SHM) technologies have proven capable in R&D tests of detecting and isolating cracks within complex airframe structures with sufficient accuracy for practical fleet applications; however, transition remains allusive similar to HUMS in the early days. The subject paper will provide highlights from Sikorsky's SHM journey and a perspective on leveraging HUMS lessons to achieve transition.

"Developing Structural Health Monitoring Technologies at Airbus Group"

Sept. 1st, 08:40-09:10

Jean Botti

Chief Technical Officer, Airbus Group

Today, SHM systems are well proven as tools to monitor structural and in-flight certification tests, and the first applications for monitoring structures in service are now flying on commercial and military aircraft and helicopters. In the Airbus Group, limited-area monitoring close to sensors has moved away from R&D and is now ready for qualification for specific aircraft applications. In his keynote presentation, Dr. Botti will first provide an overview of the company's R&T strategy in material and structural science, before giving some insights into the vision on SHM developments in the Airbus Group. He will outline the company's roadmap and give examples of SHM applications and address the need for standardization in the process for qualification and implementation in specific aircraft applications. Dr. Botti will also speak about the Airbus Group's Innovation-to-Business Center in the Silicon Valley and the Big Data aspect of the digitalization initiative within the Airbus Group.

“Structural Health and Strain Monitoring Sensing Through Fourier-Based Wave Transducers”

Sept. 2nd, 08:10-08:40

Massimo Ruzzene

Program Director, NSF

The seminar reports on the design of a novel class of transducers for structural health monitoring and strain sensing designed using a Fourier-based approach. The design procedure formulates the problem considering an arbitrarily shaped distribution of the sensing surface. Interrogation of the sensors is based on the generation of guided and surface acoustic waves generated in the region surrounding the transducers. The representation of the distribution of the sensing material is analyzed and designed in the spatial Fourier domain, where the emission characteristics of the transducer in relation to the interrogating wave can be tailored to a specific application. For structural health monitoring, the sensing material distribution is defined to provide the transducers with frequency-dependent directional properties, which can be employed as part of an interrogation scheme based on generation and processing of guided waves in the structure. For strain sensing, one-dimensional and two-dimensional grating configurations monitor frequency shifts of radiation associated to local straining of the gratings. These frequency shifts can be related to the local strain components, so that a rosette-like configuration can be implemented. The talk illustrates the commonalities of the design procedure, which leads to novel Lamb wave and strain transducers, and suggests the potential integration of the two sensing modalities as a single device for health and usage monitoring of structural components.

“Structural Health Monitoring and Its Role in Affordability”

Sept. 2nd, 08:40-09:10

Naveed Hussain

Vice President of Aeromechanics Technology, Boeing Research & Technology

Structural Health Monitoring (SHM) is a fundamental element of structural airworthiness management, which is a significant airframe life cycle cost (LCC) driver. Advances in SHM technologies can reduce LCCs by improving early detection of flaws when they are more easily repairable, reducing inspection times, helping to expedite repair planning via remote diagnosis, greater understanding of as-experienced loads and environments and potentially enabling higher performing structural designs. This presentation will give an overview of potential benefits of SHM technology for both commercial and military applications, explain the necessity for well-defined system-level requirements, and outline the important elements of assessing LCC affordability and how SHM technology can affect it.

"SHM-Enriched High Speed Rail Systems"

Sept. 2nd, 09:10-09:40

Yiqing Ni
Professor, Department of Civil and Environmental Engineering
Director, Research Center for Advanced Sensing and Monitoring Technology
Hong Kong Polytechnic University

To keep safe and efficient operations of high speed rail (HSR), a great endeavor is being devoted to creating smarter railways by integrating sensors, information technology, data analysis and predictive modelling tools, aiming at online evaluation of the HSR operational condition and prognosis of breakdown before it occurs. In addition to the on-board instrumentation for rail assets including tracks, trains and pantographs, the sensory system involves monitoring external actions (aerodynamic and earthquake) and detecting obstacles as well. The analytic and predictive modelling tools would be able to tackle the highly heterogeneous data, uncertainties associated with changing operation and interface status, false positives resulting from sensor fault, as well as evolutionary updating and self-adapting of data-driven prognostic models in real time or near real time. Such a smart rail technology is anticipated to empower rail operators to sense and respond quickly to irregular operations and to act appropriately once a breakdown is forecasted.

"Challenges Facing the Reliable Performance of Autonomous Passenger Car and Truck, Sensors and Systems"

Sept. 2nd, 09:40-10:10

James Buczkowski
Henry Ford Technical Fellow and Director
Electrical and Electronics Systems, Research and Innovation
Ford Motor Company

The recent headlines have been filled with the near term promise for autonomous vehicles. Much progress has been made to develop the sensor set, data, computing power, control algorithms and mechatronics that are required to deliver a level 4 or level 5 (SAE) autonomous solution. Assuring that each part of the system is ready to support safe and secure autonomous activity will be critical for a satisfying user experience. This keynote will discuss the impact to the design along with proposing the level of system reliability required to satisfy today's consumer.

"Challenges with Adopting New Material and Process Technologies"

Sept. 3rd, 08:10-08:40

Dick Cheng
Science, Engineering, and Technology Advisor, DARPA DSO

It has become increasingly more difficult to utilize new material, processing, and manufacturing technologies, such as structural health monitoring, on DoD platforms. There are numerous reasons for this but the impact on performance, cost, and schedule is clear. DARPA has a portfolio of programs that are seeking to address development speed and

confidence issues that are hindering the process. This is being accomplished through the development of frameworks that utilize Integrated Computational Process Engineering (ICME), probabilistic process modeling, and material informatics that focus the community on speed to adoption.

"Fatigue-Free Platforms: Vision for Next-Generation Aircraft"

Sept. 3rd, 08:40-09:10

Dy D. Le
Chief of Mechanics Division
U.S. Army Research, Development and Engineering Command (RDECOM)
Army Research Laboratory (ARL)

The goal for the Army Aviation Platform Sustainment is "zero-maintenance". Scientists and engineers from the U.S. Army are exploring the underpinning science and technology (S&T), which can be used to achieve this vision. Researchers from the U.S. Army Research Laboratory (ARL) and Aviation and Missile Research, Development and Engineering Center (AMRDEC) have developed a holistic system approach, "Virtual Risk-informed Aviation Maneuver Sustainment" (VRAMS), which integrates a wide range of futuristic technologies to provide autonomous state awareness at the material level and ensure acceptable stress levels to sustain "fatigue-free" structural components without maintenance during the Maintenance-Free Operating Periods. This talk will highlight the Army Aviation Sustainment S&T and VRAMS vision including planned demonstration and transition path for Army next-generation aircraft as well as examples of recent technological breakthroughs.

"Applications of Structural Health Monitoring Technology"

Sept. 3rd, 09:10-09:40

Soh Chee Kiong
School of Civil and Environmental Engineering
Nanyang Technological University, Singapore

Asia is the largest and most populous continent in the world with about 45 million square kilometers of land mass and 4.5 billion people. It has 49 countries, including some of the rich like Japan, poor like Afghanistan and densely populated like Singapore. Structural health monitoring (SHM) is a non-issue for the poor where basic amenities of survival are more important, but crucial for the rich and densely populated where any infra-structural failure could be devastating to their society and economy. SHM of mechanical and aerospace structures is mostly similar world-wide, but of civil infrastructures could varies due to socio-economical, cultural, geographical and governmental reasons across countries and even across provinces within the same country. This article introduces some of the better known SHM studies of key civil infrastructures in some of the Asian countries. In addition, the authors' research and applications of SHM technology carried out at the Nanyang Technological University (NTU) for civil infrastructures in Singapore is presented. At the end, we also discussed our recent work on energy harvesting using piezo electrics as an alternative to wired SHM for automated and self-powered SHM.

Technical Sessions at-a-Glance

The 10th International Workshop on Structural Health Monitoring - Stanford University - 2015

TECHNICAL PROGRAM

Overview

Monday, August 31st		
15:00 ~ 17:00	**Early Registration**	Location: Crowne Plaza Hotel Cabana, Palo Alto
17:00 ~ 19:00	**Reception**	Location: Crowne Plaza Hotel Cabana, Palo Alto

Tuesday, September 1st

	Hewlett 101	Hewlett 102	Hewlett 103	380-380C	380-380D	380-380F	380-380W	380-380X	380-380Y	420-040	420-041
07:00 ~ 08:00	**Registration**		Light Continental Breakfast						Location: The Oval		
08:00~ 08:10		**Opening Remarks**	Speaker: Prof. Charbel Farhat (Chair of Department of Aeronautics and Astronautics)				Chair: F.-K. Chang Co-chair: F. Kopsaftopoulos		Location: Hewlett Auditorium (200)		
08:10 ~ 09:10	**Keynote Presentations** Chair: H. Speckmann	08:10 ~ 08:40	Speaker: Mr. Mark Davis, Chief Engineer, Sikorsky Aircraft						Location: Hewlett Auditorium (200)		
		08:40 ~ 09:10	Speaker: Dr. Jean Botti, CTO, Airbus								
09:10 ~ 10:10	**Aerospace Round Table Discussion:** Paul Swindell (FAA), Eric Lindgren (AFRL), Matthias Buderath (Airbus), Mark Davis (Sikorsky), Chris Davis (Boeing)								Location: Hewlett Auditorium (200)		
10:10 ~ 10:30	**Coffee Break**								Location: The Oval		
10:30 ~ 12:10	**General Session** Civil Structures I Chair: F. Casciati & Co-Chair: M. Domaneschi	**SPECIAL SESSION** SHM Technology in Wind Turbines I Chair: J. Lynch	**General Session** Environmental Effects I Chair: E. B. Flynn & Co-Chair: M. Tur	**General Session** Signal Processing I Chair: F.-G. Yuan & Co-Chair: C. H. Loh	**General Session** Sensors/Actuators I Chair: P. Rizzo & Co-Chair: K. Kuang	**SPECIAL SESSION** Multifunctional Materials I Chair: K. Loh & Co-Chair: F. Ko	**SPECIAL SESSION** Embedded Sensors for Detecting Damage in Composites I Chair: K. Wang & Co-Chair: B. Loyola	**SPECIAL SESSION** Recent Advances in Ultrasonic and Acoustic Emission Techniques for SHM/NDE I Chair: S. Salamone & Co-Chair: F. G. Yuan	**SPECIAL SESSION** Probabilistic SHM I Chair: D. Zonta & Co-Chair: A. Kontsos	**SPECIAL SESSION** SHM Certification for Airborne Applications Chair: M. Buderath & Co-Chair: N. Takeda	**SPECIAL SESSION** Guided Waves in Structures for SHM I Chair: W. Ostachowicz & Co-Chair: J. Hwang
12:10 ~ 13:30	**Lunch at the Oval**								Location: The Oval		
13:30 ~ 15:10	**General Session** Civil Structures II Chair: T. Kundu & Co-Chair: E. Safak	**SPECIAL SESSION** SHM Technology in Wind Turbines II Chair: W. Ostachowicz & Co-Chair: C. F. Chen	**General Session** Environmental Effects II Chair: A. Kuraishi & Co-Chair: S. Dixit	**General Session** Signal Processing II Chair: Y. Zhang & Co-Chair: C. G. Koh	**General Session** Sensors/Actuators II Chair: H. LI & Co-Chair: J. V. Filho	**SPECIAL SESSION** Multifunctional Materials II Chair: D. Ryu & Co-Chair: S. Advani	**SPECIAL SESSION** Embedded Sensors for Detecting Damage in Composites II Chair: B. Loyola & Co-Chair: K. Loh	**SPECIAL SESSION** Recent Advances in Ultrasonic and Acoustic Emission Techniques for SHM/NDE II Chair: S. Huang & Co-Chair: C. Keilers Jr.	**SPECIAL SESSION** Probabilistic SHM II Chair: B. Glisic & Co-Chair: L. D. Cot	**SPECIAL SESSION** Reliability of SHM for Aerospace Chair: P. Swindell & Co-Chair: E. Lindgren	**SPECIAL SESSION** Guided Waves in Structures for SHM I Chair: V. Giurgiutiu & Co-Chair: M. H. Aliabadi
15:10 ~ 15:30	**Coffee Break**								Location: The Oval		
15:30 ~ 17:30	**SHM in Action**						Chair: Christian Boller Co-chair: Branko Glisic		Location: Hewlett Auditorium (200)		
19:00 ~ 22:00	**BBQ/Welcome Night**								Location: Frost Amphitheater		

Wednesday, September 2nd

	Hewlett 201	Hewlett 102	Hewlett 103	380-380C	380-380D	380-380F	380-380W	380-380X	380-380Y	420-040	420-041
08:10 ~ 10:10	**Keynote Presentations** Chair: A. Guemes	08:10 ~ 08:40	Speaker: Dr. Massimo Ruzzene, Program Director, NSF						Location: Hewlett Auditorium (200)		
		08:40 ~ 09:10	Speaker: Dr. Naveed Hussain, VP of Aeromechanics Technology, Boeing R&T								
		09:10 ~ 09:40	Speaker: Prof. Yiqing Ni, Hong Kong Polytechnic University								
		09:40 ~ 10:10	Speaker: Mr. James Buczkowski, Director of Research & Advanced Engineering, Ford Motor Company								
10:10 ~ 10:30	**Coffee Break**								Location: The Oval		
10:30 ~ 12:10	**General Session** Civil Structures III Chair: Y. Wang & Co-Chair: K. Smarsly	**SPECIAL SESSION** SHM Technology in Wind Turbines III Chair: M. Jahanshahi & Co-Chair: W. Weijtjens	**SPECIAL SESSION** Monitoring and Health Management of High-speed Railways I Chair: Y. Ni & Co-Chair: C. Y. Wang	**General Session** Signal Processing III Chair: F. Pozo & Co-Chair: C. Westerkamp	**General Session** Sensors/Actuators III Chair: D. Mascarenas & Co-Chair: A. D. Grosso	**SPECIAL SESSION** Civil SHM Standardisation; Progress and Status 2015 I Chair: H. Wenzel & Co-Chair: V. L. Cam	**SPECIAL SESSION** Embedded Sensors for Detecting Damage in Composites III Chair: K. Loh & Co-Chair: E. Cross	**SPECIAL SESSION** Recent Advances in Ultrasonic and Acoustic Emission Techniques for SHM/NDE III Chair: F. Scalea & Co-Chair: P. Malinowski	**SPECIAL SESSION** Probabilistic SHM III Chair: P. Leser & Co-Chair: B. Glisic	**General Session** Aerospace Structures I Chair: J. B. Ihn & Co-Chair: L. G. Santos	**SPECIAL SESSION** Guided Waves in Structures for SHM III Chair: P. Masson & Co-Chair: D. Soeffker
12:10 ~ 14:00	**Lunch at the Oval**								Location: The Oval		
12:10 ~ 14:00	**Poster Sessions: Q & A**								Location: The Oval		
12:10 ~ 14:00	**IJSHM Board Meeting**								Location: Hewlett 101		
14:00 ~ 15:40	**General Session** Civil Structures IV Chair: M. Limongelli & Co-Chair: M. Gul	**General Session** Bondline Monitoring Chair: F. Rodriguez-Lence & Co-Chair: L. Salvino	**SPECIAL SESSION** Monitoring and Health Management of High-speed Railways II Chair: D. Or & Co-Chair: K. Ding	**SPECIAL SESSION** Very dense arrays of sensors: 1D, 2D, and 3D distributed and quasi-distributed sensors I Chair: B. Glisic & Co-Chair: S. Roy	**General Session** Bio-inspired Sensors and Networks, Smart Sensor Technologies Chair: A. Chattopadhyay & Co-Chair: V. Giurgiutiu	**SPECIAL SESSION** Civil SHM Standardisation; Progress and Status 2015 II Chair: J. Lynch & Co-Chair: C. K. Soh	**General Session** Diagnostics I Chair: M. Todd & Co-Chair: I. Georgiou	**SPECIAL SESSION** Recent Advances in Ultrasonic and Acoustic Emission Techniques for SHM/NDE IV Chair: S. Banerjee & Co-Chair: Z. Li	**SPECIAL SESSION** Probabilistic SHM IV Chair: Z. Su & Co-Chair: K. U. Schroder	**General Session** Aerospace Structures II Chair: C. Bockenheimer & Co-Chair: A. Kumar	**SPECIAL SESSION** Guided Waves in Structures for SHM IV Chair: N. Chrysochoidis & Co-Chair: C. Li
15:40 ~ 16:00	**Coffee Break**								Location: The Oval		
16:00 ~ 17:30	**Panel Discussion: SHM Basic Research Roadmap (sponsored by NSF)** Massimo Ruzzene (NSF), David Stargel (AFOSR), Ignacio Perez (ONR), Hoda Azari (DoE), Dan Inman (U of Michigan), Anne Kiremidjian (Stanford University)						Moderator: M. Ruzzene		Location: Hewlett Auditorium (200)		
19:00 ~ 22:00	**Banquet and Award Night**								Location: Crowne Plaza		

Thursday, September 3rd

	Hewlett 201	Hewlett 102	Hewlett 103	380-380C	380-380D	380-380F	380-380W	380-380X	380-380Y	420-040	420-041
08:10 ~ 09:40	**Keynote Presentations** Chair: S. Galea	08:10 ~ 08:40	Speaker: Dr. Dick Cheng, Science, Engineering, and Technology Advisor, DARPA DSO						Location: Hewlett Auditorium (200)		
		08:40 ~ 09:10	Speaker: Mr. Dy D. Le, Chief of Mechanics Divisiion, ARL								
		09:10 ~ 09:40	Speaker: Prof. Soh Chee Kiong, Nanyang Technology University, Singapore								
09:40 ~ 10:00	**Coffee Break**								Location: The Oval		
10:00 ~ 12:00	**General Session** System Identification I Chair: A. Smyth & Co-Chair: M. Carter	**General Session** Modelling and Simulation Chair: S. Olson & Co-Chair: A. Kontsos	**General Session** Electromechanical Impedance Based Methods Chair: P. Qing & Co-Chair: M. Dvorak	**SPECIAL SESSION** Very dense arrays of sensors: 1D, 2D, and 3D distributed and quasi-distributed sensors II Chair: D. Zonta & Co-Chair: F. Kopsaftopoulos	**SPECIAL SESSION** Technologies for Health-conscious Aircraft and Maneuver Chair: N. Pham & Co-Chair: E. Habtour	**SPECIAL SESSION** Acoustic Emission in Aerospace Applications I Chair: D. Zarouchas & Co-Chair: T. Shiotani	**General Session** Diagnostics II Chair: C. Lissenden	**SPECIAL SESSION** SHM within Harsh Extreme Environments I Chair: D. Senesky & Co-Chair: R. Werlink	**SPECIAL SESSION** Probabilistic SHM V Chair: W. Meeker & Co-Chair: R. Matalie	**General Session** Vibration-based SHM I Chair: W. Chiu & Co-Chair: H. Y. Noh	**SPECIAL SESSION** Guided Waves in Structures for SHM V Chair: C. Schaal & Co-Chair: P. Hubert
12:00 ~ 13:30	**Lunch Box Mini Forum: V&V/Standardization for Civil Infrastructure**						Moderator: H. Wenzel		Location: Hewlett Auditorium (200)		
12:00 ~ 13:30	**Faculty / Student Panel**						Moderator: C. Farrar		Location: Hewlett 201		
12:00 ~ 13:30	**Lunch at the Oval**								Location: The Oval		
13:30 ~ 15:10	**General Session** System Identification II Chair: F. Dotta & Co-Chair: C. Surace	**General Session** Civil Structures V Chair: C.-P. Fritzen & Co-Chair: I. Oppenheim	**SPECIAL SESSION** Monitoring and Health Management of High-speed Railways III Chair: O. Lin	**SPECIAL SESSION** Very dense arrays of sensors: 1D, 2D, and 3D distributed and quasi-distributed sensors III Chair: T. Uhl	**General Session** SHM-based Structural Design Chair: P. Foote & Co-Chair: A. Paleologue	**SPECIAL SESSION** Acoustic Emission in Aerospace Applications II Chair: C. Stolz & Co-Chair: D. Zarouchas	**General Session** Diagnostics III Chair: N. Salowitz & Co-Chair: K. Goebel	**SPECIAL SESSION** SHM within Harsh Extreme Environments II Chair: R. Werlink & Co-Chair: D. Senesky	**SPECIAL SESSION** Probabilistic SHM VI Chair: C. Papadimitriou & Co-Chair: L. Mujica	**General Session** Vibration-based SHM II Chair: J. Bielak & Co-Chair: F. Pozo	**SPECIAL SESSION** Guided Waves in Structures for SHM VI Chair: C. S. Kabban & Co-Chair: F. Wu
15:10 ~ 15:30	**Coffee Break**								Location: The Oval		
15:30 ~ 17:00	**Panel Discussion: SHM Emerging Applications Roadmap (sponsored by NSF)** Liming Salvino (ONR Global), James Buczkowski (Ford), Clemens Bockenheimer (Airbus), Akira Kuraishi (Kawasaki), Fabio Casciati (University of Pavia)						Moderator: P. Rizzo		Location: Hewlett Auditorium (200)		
17:00 ~ 17:30	**Workshop Adjourn**								Location: Hewlett Auditorium (200)		

Technical Program (Tuesday, September 1st)

Civil Structures I

Chair: F. Casciati (University of Pavia) ***Co-chair:*** M. Domaneschi (Politecnico Di Milano) **Location: Hewlett 101**

TIME	TUESDAY, SEPTEMBER 1
10:30 ~ 10:50	**Challenges in Damage Detection Based on Finite Element Analyses and Monitoring of Dynamic Curvature of Concrete-steel Composite Structures** M. Domaneschi[1], D. Sigurdardottir[2], B. Glisic[2] [1) Politecnico di Milano, Italy; 2) Princeton University, USA]
10:50 ~ 11:10	**A Suggestion of Health Monitoring for the Road Bridge Floor with Fiber Optic Sensor** Y. Kawano[1], T. Mikami[1], K.Ikushima[2] [1) IHI Inspection & Instrumentation Co., Ltd., Japan; 2) Tokyo University of Agriculture and Technology, Japan]
11:10 ~ 11:30	**Hil Excitation in the Damage Assessment of a Timber Footbridge** S. Casciati[1], L. Faravelli[2], F. Casciati[2] [1) University of Catania, Italy; 2) University of Pavia, Italy]
11:30 ~ 11:50	**Fatigue Crack Identification and Lifetime Prediction for Steel Bridge Deck Structures** L. Pahlavan, R. Pijpers, H. Hakkesteegt, R. Jansen, W. Peelen [TNO, Netherlands]
11:50 ~ 12:10	**Experimental Validation of Structural Damage Identification Using Vibration Transmissibility** X. He[1], H. Tang[2] [1) University of Illinois at Urbana Champaign, USA; 2) Tongji University, China]

SHM Technology in Wind Turbines I

Chair: J. Lynch (University of Michigan) ***Co-chair:*** TBD **Location: Hewlett 102**

TIME	TUESDAY, SEPTEMBER 1
10:30 ~ 10:50	**Kalman Filter Based Data Fusion for Bi-Axial Neutral Axis Tracking in Wind Turbine Towers** R. Soman[1], P. Malinowski[1], U.-S. Paulsen[2], W. Ostachowicz[1] [1) Polish Academy of Science, Poland; 2) Technical University of Denmark, Denmark]
10:50 ~ 11:10	**Vibration-based Damage Detection on a Blade of a Small Scale Wind Turbine** Y. Ou[1], B. Grauvogl[1], M. Spiridonakos[1], V. Dertimanis[1], E. Chatzi[1], J. Vidal[2] [1) ETH Zürich, Switzerland; 2) SONKYO Energy, Spain]
11:10 ~ 11:30	**Monitoring the Consumed Fatigue Life on Three Offshore Wind Turbines** W. Weijtjens, N. Noppe, A. Iliopoulos, C. Devriendt [Vrije Universiteit Brussel, Belgium]
11:30 ~ 11:50	**Wear Aging and Related Impact on System Reliability** N. Beganovic, D. Baccar and D. Söffker [University of Duisburg-Essen, Germany]
11:50 ~ 12:10	**Long-term Prediction of Dynamic Responses on an Offshore Wind Turbine Using a Virtual Sensor Approach** A.-N. Iliopoulos, W. Weijtjens, D. Van Hemelrijck, C. Devriendt [Vrije Universiteit Brussel, Belgium]

Environmental Effects I

Chair: E. B. Flynn (Los Alamos National Laboratory) ***Co-chair:*** M. Tur (Tel-Aviv University) **Location: Hewlett 103**

TIME	TUESDAY, SEPTEMBER 1
10:30 ~ 10:50	**The Long Term Performance of a Guided Wave SHM System on a Steel Tank** M.-R. Courtier[1], A.-J. Croxford[1], K. Atherton[2] [1) University of Bristol, UK; 2) Airbus Operations Ltd, UK]
10:50 ~ 11:10	**Effect of Load and Temperature Changes on Nonlinear Ultrasonic Measurements: Implications for SHM** V.-K. Chillara, H.CHO, M. Hasanian, C.-J. Lissenden [Penn State, USA]
11:10 ~ 11:30	**Temperature Effects on Strains of a Continuous Box-Girder Bridge with a Long-Term Monitoring System** C. Chen[1], Z. Wang[1], M. R. Kaloop[2], Q. Gao[1] [1) Harbin Institute of Technology, China; 2) Mansoura University, Egypt]
11:30 ~ 11:50	**A Framework for Damage Detection under Varying Temperature Effects Using Artificial Neural Networks and Time Series Analysis** B. Kostic, M. Gul [University of Alberta, Canada]
11:50 ~ 12:10	**An Acousto-Ultrasonics Pattern Recognition Approach for Damage Detection Under Variable Temperature Conditions** M. A. Torres-Arredondo[1], D. A. Tibaduiza-Burgos[2], J. S. Perez[3] [1) MAN Diesel & Turbo SE, Germany; 2) Universidad Santo Tomás, Colombia; 3) Universidad Pontificia Bolivariana, Colombia]

Signal Processing I

Chair: F.-G. Yuan (North Carolina State University) ***Co-chair:*** C.-H. Loh (National Taiwan University) **Location: 380-380C**

TIME	TUESDAY, SEPTEMBER 1
10:30 ~ 10:50	**Non-planar Ising Graphical Model for Efficient Inference in Structural Health Monitoring** R. Mohammadi-Ghazi, O. Büyüköztürk [Massachusetts Institute of Technology, USA]
10:50 ~ 11:10	**Modified Compressive Sensing-based Migration for GPR Probing of Reinforced Concrete Bridge Decks** X. Wei[1], J. Zhou[2], Y. Zhang[1] [1) Georgia Institute of Technology, USA; 2) Tsinghua University, China]
11:10 ~ 11:30	**Structural Diagnostics via Anomaly-driven Demixing of Wavefield Data** J. Druce, M. Kadkhodaie, J. Haupt, S. Gonella [University of Minnesota, USA]
11:30 ~ 11:50	**Principal Component Analysis and Self-organizing Maps for Damage Detection and Classification under Temperature Variations** M. A. Vejar[1], D. A. Tibaduiza-Burgos[2], M. A. Torres-Arredondo[3], F. Pozo[1] [1) Universitat Politècnica de Catalunya, Spain; 2) Universidad Santo Tomás, Colombia; 3) MAN Diesel & Turbo SE, Germany]
11:50 ~ 12:10	**Clustering Studies for Damage Detection in Bridges: A Comparison Study** A. Santos[1], E. Figueiredo[2], J. Costa[1] [1) Universidade Federal do Pará, Brazil; 2) Faculdade de Engenharia da Universidade Lusófona, Portugal]

Sensors/Actuators I

Chair: P. Rizzo (University of Pittsburgh) ***Co-chair:*** K. Kuang (National University of Singapore) **Location: 380-380D**

TIME	TUESDAY, SEPTEMBER 1
10:30 ~ 10:50	**Energy Harvesting Using Arrays of Granular Chains and Solid Rods** K. Li, P. Rizzo [University of Pittsburgh, USA]
10:50 ~ 11:10	**Wireless Sensor Network for Structural Health Monitoring by Means of Lamb-Waves** M. Salas[1], O. Focke[2], G. Stoltenberg[1], A. S. Herrmann[3], W. Lang[4] [1) Friedrich Wilhelm Bessel Institut Forschungsgesellschaft m.b.H., Germany; 2) Faserinstitut Bremen e.V., Germany; 3) University of Bremen, Germany; 4) Institut für Mikrosensoren, -aktoren und -systeme (IMSAS), Germany]
11:10 ~ 11:30	**Structural Optimization of a Piezoelectric Transducer for Selective Guided Wave Excitation** M. Miszczynski, T. Stepinski, T. Uhl, P. Packo [AGH - Univeristy of Science and Technology, Poland]
11:30 ~ 11:50	**FE Tool for Drape Modelling and Resin Pocket Prediction of Fully Embedded Optical Fiber Sensor System** N. Lammens[1], G. Chiesura[1], T. Ahmed[2], A. Brodsjo[2], E. Voet[1], G. Luyckx[1], W. Van Paepegem[1], J. Degrieck[1] [1) UGent, Belgium; 2) Airborne Technology Centre, Netherlands]
11:50 ~ 12:10	**A Method of Displacement Measurement for Structural Constructions Based on the Microwave Radar and Active Transponder** D. Zheng, W. Chen, X. Liu, X. Lei, L. Chen, C. Li [Chongqing University, China]

SPECIAL SESSION

Multifunctional Materials I

Chair: K. Loh (University of California, Davis) ***Co-chair:*** F. Ko (University of British Columbia) **Location: 380-380F**

TIME	TUESDAY, SEPTEMBER 1
10:30 ~ 10:50	**Characterization of Carbon Nanotube Strain Sensors Using Experimental Tests and Percolation Modeling** B. M. Lee, L. Wang, K. J. Loh [University of California, Davis, USA]
10:50 ~ 11:10	**Multiscale Modeling and Characterization of Stress-sensitive Mechanophore-embedded Nanocomposites** B. Koo, E. Nofen, A. Chattopadhyay, L. Dai [Arizona State University, USA]
11:10 ~ 11:30	**Mechanoluminescent Composites Towards Autonomous Impact Damage Detection of Aerospace Structures** D. Ryu, N. Castaño, K. Vedera [New Mexico Tech, USA]
11:30 ~ 11:50	**Carbon Nanotubes for Assessing the Structural Integrity of Composite Bonded Joints with Film Adhesives** C. García, M. Sánchez, A. Ureña, J. Rams [Rey Juan Carlos University, Spain]
11:50 ~ 12:10	**Investigation on Large-area and Flexible PZT/PVB/additives Composite Films for New Piezoelectric Sensor Application** X. Fang, J. He, Y. Zhang [Beihang University, China]

SPECIAL SESSION

Embedded Sensors for Detecting Damage in Composites I

Chair: K.-W. Wang (University of Michigan) ***Co-chair:*** B. Loyola (Sandia) **Location: 380-380W**

TIME	*TUESDAY, SEPTEMBER 1*
10:30 ~ 10:50	**Towards an Unified Approach for Guided Ultrasonic Wave Dispersion Curves in Metallic and Composites Materials** D. Barazanchy, V. Giurgiutiu [University of South Carolina, USA]
10:50 ~ 11:10	**Impact Damage Identification in Glass Fiber/Epoxy Laminates with Carbon Black Filler via Electrical Impedance Tomography** T. N. Tallman, K. W. Wang [University of Michigan, USA]
11:10 ~ 11:30	**Carbon Nanotube Appliques for Fatigue Crack Diagnostics** S. S. Kessler, G. Thomas, M. Borgen, C. T. Dunn [Metis Design Corporation, USA]
11:30 ~ 11:50	**Internal Defect Detection in Composite Plates on Demand** M. Rutner, D. Donskoy, J. Pavlov, R. Besser [Stevens Institute of Technology, USA]
11:50 ~ 12:10	**Guided Wave Sensing with Fiber Bragg Grating Optic Sensors and Embedment** Z. Tian, X. Sun, L. Ma, B. Lin, L. Yu [University of South Carolina, USA]

SPECIAL SESSION

Recent Advances in Ultrasonic and Acoustic Emission Techniques for SHM/NDE I

Chair: S. Salamone (University in Buffalo) ***Co-chair:*** F.-G. Yuan (North Carolina State University) **Location: 380-380X**

TIME	*TUESDAY, SEPTEMBER 1*
10:30 ~ 10:50	**Small Defect Detection Through Local Analysis of Acoustic Spatial Wavenumber** E. B. Flynn, A. J. Haugh, S. B. Lopez [Los Alamos National Laboratory, USA]
10:50 ~ 11:10	**Estimating the Mechanical Properties of Layered Media Using Ultrasonics: Numerical Study with High Resolution Wave Propagation** R. Rashetnia, M. Pour-Ghaz [North Carolina State University, USA]
11:10 ~ 11:30	**Sparse Reconstruction of Flaw Signal from Noisy Ultrasonic Data: A Bayesian Framework** B. Wu, Y. Huang, H. Li [Harbin Institute of Technology, China]
11:30 ~ 11:50	**Damage Detection for Composites Using Time Reversal Method with Different Amplitudes of Excitation** J. Zhou1, Y. Yang1, L. Xiao1, W. Qu1, G. Chen2 [1) Wuhan University, China; 2) Inner Mongolia Dynamic Machines Research Institute, China]

SPECIAL SESSION

Probabilistic SHM I

Chair: D. Zonta (University of Trento) ***Co-chair:*** A. Kontsos (Drexel University) **Location: 380-380Y**

TIME	*TUESDAY, SEPTEMBER 1*
10:30 ~ 10:50	**Mechanical Equivalent of Logical Inference for Structural Health Monitoring** D. Bolognani[1], C. Cappello[2], D. Zonta[1] [1) University of Trento, Italy; 2) Princeton University, USA]
10:50 ~ 11:10	**Probabilistic Fatigue Damage Prognosis Using a Surrogate Model Trained via 3D Finite Element Analysis** P. E. Leser[1], J. D. Hochhalter[1], J. A. Newman[1], W. P. Leser[1], J. E. Warner[1], P. A. Wawrzynek[2], F.-G. Yuan[3] [1) NASA Langley Research Center, USA; 2) Fracture Analysis Consultants, Inc., USA; 3) North Carolina State University, USA]
11:10 ~ 11:30	**The Influence of Redundant Structural System Characteristics on the Value of SHM Information** S. Thöns [Technical University of Denmark, Denmark]
11:30 ~ 11:50	**SHM Using Acoustic Sources of Opportunity: Monitoring Green's Correlations** R. Vincent[1], M. Carmona[1], O. Michel[2], J.-L. Lacoume[2] [1) CEA, France; 2) GIPSA-Lab, France]
11:50 ~ 12:10	**Structural Health Monitoring of Wind Turbine Blades Using Statistical Pattern Recognition** D. A. Tibaduiza-Burgos[1], M. A. Torres-Arredondo[2], M. Anaya[1] [1) Universidad Santo Tomás, Colombia; 2) MAN Diesel & Turbo SE, Germany]

SPECIAL SESSION

SHM Certification for Airborne Applications

Chair: M. Buderath (Airbus Defence and Space) ***Co-chair:*** N. Takeda (University of Tokyo) **Location: 420-040**

TIME	*TUESDAY, SEPTEMBER 1*
10:30 ~ 10:50	**Verification and Validation Framework for Certification of Integrated Vehicle Health Management and Prognostic Health Management** C. Stolz, M. Buderath [Airbus Defence and Space, Germany]
10:50 ~ 11:10	**Guidance on Integrating Matured SHM Systems into UK Military Aircraft** H. Azzam[1], J. McFeat[2] [1) HAHN Spring Limited, UK; 2) BAE Systems, UK]
11:10 ~ 11:30	**Evaluation of Long-term Flight Data from On-board SMART Layers** V. Janapati[1], H. Chung[1], F. Li[1], A. Kumar[1], S. Huang[2] [1) Acellent Technologies Inc., USA; 2) Aeroflightdynamics Directorate (AFDD), USA]
11:30 ~ 11:50	**Implementation of Structural Health Monitoring (SHM) into an Airline Maintenance Program** D. Piotrowski[1], D. Roach[2], A. Melton[1], J. Bohler[1], T. Rice[2], S. Neidigk[2], J. Linn[3] [1) Delta, USA; 2) Sandia National Labs, USA; 3) Boeing, USA]
11:50 ~ 12:10	**Developments Towards the Qualification of Two SHM Systems for S-SHM Application** R. P. Rulli, F. Dotta [Embraer S.A., Brazil]

SPECIAL SESSION

Guided Waves in Structures for SHM I

Chair: W. Ostachowicz (PAS) ***Co-chair:*** J. Hwang (National Aerospace Laboratory NLR) **Location: 420-041**

TIME	*TUESDAY, SEPTEMBER 1*
10:30 ~ 10:50	**A Boundary Element Formulation for Modelling Structural Health Monitoring Applications** F. Zou[1], I. Benedetti[2], M. H. Aliabadi[1] [1) Imperial College London, UK; 2) University of Palermo, Italy]
10:50 ~ 11:10	**Towards the Deployment of Acousto-ultrasonics-based SHM in Industry** L. Shubert[1], M. Bach[2], U. Berger[3], I. Buethe[4], C.-P. Fritzen[4], H. Jung[4], U. Lieske[1], F. Raddatz[5] [1) Fraunhofer Institute for Ceramic Technologies and Systems IKTS, Germany; 2) Airbus Group Innovations, Germany; 3) MAQUET GmbH, Germany; 4) University of Siegen, Germany; 5) German Aerospace Center, Germany]
11:10 ~ 11:30	**Implementation of the Surface Response to Excitation (SuRE) Method with DSP's for Detection of the Damage of Thick Blocks** H. Fekrimandi, I. N. Tansel, R. Gonzalez, S. Rojas,D. Meiller, K. Lindsay, A. Baghalian, S. Tashakori [Florida International University, USA]
11:30 ~ 11:50	**Ultrasonic Guided Wave Sensor Network Optimization for Monitoring Rivet Line** N. B. Ravi, N. Chakraborty, D. R. Mahapatra [Indian Institute of Science, India]
11:50 ~ 12:10	**Development of An Integrated Process and Structural Health Monitoring System Based on Piezosensors for CFRP Reinforcements Made by Resin Transfer Molding** M. Scheerer[1], Z. Simon[1], M. Marischler[1], T. Roser[2], B. Rittenschober[3] [1) Aerospace & Advanced Composites GmbH, Austria; 2) Airbus Helicopters, Germany; 3) ALPEX Technologies GmbH, Austria]

Civil Structures II

Chair: T. Kundu (University of Arizona) ***Co-chair:*** E. Safak (Bogazici University) **Location: Hewlett 101**

TIME	*TUESDAY, SEPTEMBER 1*
13:30 ~ 13:50	**Comparison of Identified Models for Static Deformation of Arch Dam** J.-S. Lew[1], C.-H. Loh[2] [1) Tennessee State University, USA; 2) National Taiwan University, Taiwan]
13:50 ~ 14:10	**Monitoring of Rail Bridge Displacements Using Digital Image Correlation** A. J. Hoag[1], N. A. Hoult[1], W. A. Take[1], H. Le[2] [1) Queen's University, Canada; 2) Canadian National Railway, Canada]
14:10 ~ 14:30	**State of the Art of Geodetic Bridge Monitoring** W. Lienhart, M. Ehrhart [Graz University of Technology, Austria]
14:30 ~ 14:50	**Monte Carlo Localization and Multiple Vision Sensor Based 6-DOF Displacement Measurement System for The Rendezvous of Pc Bridge Members** W. C. Myeong, S. Y. Choi, H. Myung [Korea Advanced Institute of Science and Technology, Korea]

SHM Technology in Wind Turbines II

Chair: W. Ostachowicz (PAS) ***Co-chair:*** C.-F. Chen (National Taiwan University) **Location: Hewlett 102**

TIME	TUESDAY, SEPTEMBER 1
13:30 ~ 13:50	**Impact Location Procedure for Composite Structure Using Rosette with 25 Degree Angles between Sensors** S. Opoka, K. Majewska, P. Kudela, W. Ostachowicz [Institute of Fluid-Flow Machinery PASci, Poland]
13:50 ~ 14:10	**Framework for a Spectral Element Wind Turbine Model Development for Load and Damage Estimation** T. Arsenault[1], K. Black[1], K. Janoyan[1], P. Marzocca[2] [1) Clarkson University, USA; 2) RMIT University, Australia]
14:10 ~ 14:30	**Acoustic Emission Damage Detection for Wind Turbine Rotor Blades Using Airborne Sound** T. Krause, S. Preihs, J. Ostermann [Leibniz Universität Hannover, Germany]
14:30 ~ 14:50	**Monitoring of a 34 m Wind Turbine Rotor Blade during a Fatigue Test by A Modular SHM-scheme** S. Tsiapoki, M. W. Häckell, R. Rolfes [Leibniz Universität Hannover, Germany]
14:50 ~ 15:10	**Application of a Finite Element Model Updating Approach to Damage Localization at Offshore Wind Energy Converters** K. Schröder, R. Rolfes [Leibniz University of Hannover, Germany]

Environmental Effects II

Chair: A. Kuraishi (Kawasaki Heavy Industries) ***Co-chair:*** S. Dixit (Northrop Grumman) **Location: Hewlett 103**

TIME	TUESDAY, SEPTEMBER 1
13:30 ~ 13:50	**Development of a Multi-Functional Installed Ultrasonic System for Detection of Pitting Corrosion and Bolt Loosening on Aerospace Vehicles** J. Bergman[1], F. Li[1], H. Chung[1], V. Janapati[1], A. Kumar[1], D. Furstinger[1], A. Timmons[2] [1) Acellent Technologies Inc., USA; 2) NAVAIR, USA]
13:50 ~ 14:10	**Non-stationary Random Coefficient Models for Vibration-based SHM In Structures Influenced by Strong Operational and Environmental Variability** L. D. Avendaño-Valencia1, E. N. Chatzi2 [1) University of Patras, Greece; 2) ETH Zurich, Switzerland]
14:10 ~ 14:30	**Structural Condition Assessment in a Prestressed Concrete Bridge based on Analysis of Environmental Effects on Long-term Strain Monitoring Data** M. Nishio, J. Xu, J. Mizutani [Yokohoma National University, Japan]
14:30 ~ 14:50	**Structural Damage Detection Using Modal Frequencies under Temperature Variability with Modified Auto-Associative Neural Network Technique** J. Gu, M. Gül [University of Alberta, Canada]
14:50 ~ 15:10	**Fatigue Property of Accelerated Corroded High-Strength Steel Wires in Laboratory and Naturally Corroded Bridge Wires from Replaced Cables** S. Li, Y. Xu, H. Li [Harbin Institute of Technology, China]

Signal Processing II

Chair: Y. Zhang (Georgia Inst. of Technology) ***Co-chair:*** C.-G. Koh (National University of Singapore) **Location: 380-380C**

TIME	TUESDAY, SEPTEMBER 1
13:30 ~ 13:50	**Application of Acceleration-based Damage Detection Algorithms to Experimental Data from Multi-story Steel Structures** Y. Liao[1], K. Balafas[1], A. Kiremidjian[1], R. Rajagopal[1], C. -H. Loh[2] [1) Stanford University, USA; 2) National Taiwan University, Taiwan]
13:50 ~ 14:10	**Application of SHM Pattern Recognition to Assess Decision Making of Humans in the Loop** J. J. Meyer[1], W. -L. Hu[2], Z. Wang[2], D. E. Adams[1], T. Reid[2], A. Chaturvedi[2] [1) Vanderbilt University, USA; 2) Purdue University, USA]
14:10 ~ 14:30	**Animation Future Prediction Method by PCA and SST** K. Demachi [The University of Tokyo, Japan]
14:30 ~ 14:50	**Updating the Mathematical Models of Bridges Using Data-driven Techniques** A. Sabamehr, C. Lim, A. Bagchi [Concordia University, Canada]
14:50 ~ 15:10	**Noise Reduction Methods for Hammering Impact Acoustic Inspection: An Experimental Comparison** J. Ye[1], A. Iwata[1], M. Murakawa[1], T. Higuchi[1], Y. Kubota[2], T. Yui[2] [1) National Institute of Advanced Industrial Science and Technology, Japan; 2) Shutoko Engineering Company Limited, Japan]

Sensors/Actuators II

Chair: H. Li (Harbin Institute of Technology) ***Co-chair:*** J. V. Filho (UNESP) **Location: 380-380D**

TIME	TUESDAY, SEPTEMBER 1
13:30 ~ 13:50	**A Motion Based Power Management Technique for Wireless Sensor Networks Deployed for SHM** V. Chandrasekaran, C. Olsen, E. Spence [Analog Devices Inc., USA]
13:50 ~ 14:10	**RFID Sensing Platform in Structure Deformation Monitoring** M. Lisowski, P. Gonek, K. Grabowski, T. Uhl, W. Staszewski [AGH University of Science and Technology, Poland]
14:10 ~ 14:30	**Subharmonic Resonance of Geometrical Nonlinear Structure in 2-D Periodic Elastic System for Mechanical Wave Filtering** C. Li[1], Z. Liu[1], M. Li[1], H. Li[1], Y. Li[2], W. K. Liu[2] [1) Shanghai Jiao Tong University, China; 2) Northwestern University, USA]
14:30 ~ 14:50	**Optimised Actuator/Sensor Combinations for Structural Health Monitoring: Simulation and Experimental Validation** R. S. Venkat[1], C. Boller[1], N. B. Ravi[2], N. Chakraborty[2], G. S. Kamalakar[2], K. Ukirde[2], D. R. Mahapatra[2] [1) Saarland University, Germany; 2) Indian Institute of Science, India]
14:50 ~ 15:10	**Performance Evaluation of FBG Sensors under Fatigue and Weathering** A. Rahmatian[1], A. Bagchi[2], M. Nokken[2] [1) University of Houston-Downtown, USA; 2) Concordia University, Canada]

SPECIAL SESSION

Multifunctional Materials II

Chair: D. Ryu (New Mexico Tech.) ***Co-chair:*** S. Advani (University of Delaware) **Location: 380-380F**

TIME	TUESDAY, SEPTEMBER 1
13:30 ~ 13:50	**Long Term Electrical Characterization of Thermal Cycled Carbon Nanotube Thin Films** M. Riosbaas, B. R. Loyola [Sandia National Laboratories, USA]
13:50 ~ 14:10	**A Remotely Readable, Self-authenticating Tamper Evident Seal Based on Graphene-based Materials and Compressive Sensing** A. Marchi[1], A. Cattaneo[1], J. Bossert[1], J. Dumont[1], S. J. See[2], G. Gupta[1], C. Farrar[1], D. Mascarenas[1] [1) Los Alamos National Laboratory, USA; 2) Chonbuk National University, Korea]
14:10 ~ 14:30	**Multifunctional Energy Storage Composites for SHM Distributed Sensor Networks** P. Ladpli[1], R. Nardari[1], Y. Wang[1], P. R. Hernandez-Gallegos[2], R. Rewari[1], H. T. Kuo[1], F. Kopsaftopoulos[1], K.D. Kelper[3], H. A. Lopez[2], F. -K. Chang[1] [1) Stanford University, USA; 2) Envia Systems, Inc., USA; 3) Farasis Energy, Inc., USA]
14:30 ~ 14:50	**Composite Nanofibers for Structural Health Monitoring** P. Servati, S. Soltanian, L. Y. Wan, D. Badawy, Y. Li, K. Walus, D. Michelson, F. Ko [The University of British Columbia, Canada]
14:50 ~ 15:10	**Piezoresistivity of Nickel Powder Filled Cement-based Composite** H. Xiao[1], G. Wang[1], M. Liu[1], H. Li[1], J. Jiang[2], J. Ou[2] [1) Harbin Institute of Technology, China; 2) Dalian University of Technology, China]

SPECIAL SESSION

Embedded Sensors for Detecting Damage in Composites II

Chair: B. Loyola (Sandia) ***Co-chair:*** K. Loh (UC Davis) **Location: 380-380W**

TIME	TUESDAY, SEPTEMBER 1
13:30 ~ 13:50	**Assessment of Embedded Fiber Bragg Gratings for Structural Health Monitoring of Composites** M. Todd[1], M. Yeager[1], C. Key[2], W. Gregory[2] [1) University of California San Diego, USA; 2) Hi-Test Laboratories Inc., USA]
13:50 ~ 14:10	**Rapid Processing of Full-Spectral Data from Embedded FBG Sensors** K. Peters, S. Webb [North Carolina State University, USA]
14:10 ~ 14:30	**Finite Element Modeling of PVDF Matrix Carbon Fiber Composites** M. A. Greminger, G. Haghiashtiani [University of Minnesota, USA]
14:30 ~ 14:50	**Maximum Strain Detection of Structures Using Fiber Optic Bocda Sensor With Aluminum Foil Packaged Optical Fiber** I. -B. Kwon[1], B. -H. Choi[2] [1) Korea Research Institute of Standards and Science, Korea; 2) Dong-A University, Korea]
14:50 ~ 15:10	**Structural Health Monitoring of an America's Cup Sailing Catamaran Using Embedded FBG Sensors** A. Sigg[1], D. Costantini[2], A. Mendez[3] [1) Artemis Team, USA; 2) Micron Optics Inc., USA; 3) MCH Engineering LLC, USA]

SPECIAL SESSION

Recent Advances in Ultrasonic and Acoustic Emission Techniques for SHM/NDE II

Chair: S. Huang (RDECOM, Army) ***Co-chair:*** C. Keilers Jr. (USDOE/NNSA) **Location: 380-380X**

TIME	TUESDAY, SEPTEMBER 1
13:30 ~ 13:50	**Damage Localization in Plate-like Structures Using Guided Ultrasonic Waves Edge Reflections** A. Ebrahimkhanlou, B. Dubuc, S. Salamone [University at Buffalo, USA]
13:50 ~ 14:10	**Simulation of Guided Waves in CIVA Platform: Models for SHM of Composite Structures** B. Chapuis, K. Jezzine, V. Baronian, L. Taupin, D. Ségur [CEA, France]
14:10 ~ 14:30	**On-site Evaluation of Fatigue Damage in Concrete Bridge Deck with Innovative NDT** T. Shiotani[1], K. -C. Chang[1], T. Nishida[1], H. Nakayama[1], M. Ohara[2], H. Yatsumoto[3] [1)Kyoto University, Japan; 2) West Nippon Expressway Company Limited, Japan; 3) Hanshin Expressway Company Limited, Japan]
14:30 ~ 14:50	**Ultrasonic Guided Wave based Damage Detection Using Low-Dimensional Data from Laser Doppler Scan** G. K. Geetha, D. R. Mahapatra [Indian Institute of Science, India]
14:50 ~ 15:10	**Modeling on Propagation of Shock Waves induced by Hypervelocity Impact (HVI) with Application to Evaluation of HVI Damage** M. Liu[1]; Z. Su[1], Q. Zhang[2], R. Long[2] [1) The Hong Kong Polytechnic University, Hong Kong; 2) Beijing Institute of Technology, China]

SPECIAL SESSION

Probabilistic SHM II

Chair: B. Glisic (Princeton University) ***Co-chair:*** L. D. Cot (Institut National des Sciences Appliquées) **Location: 380-380Y**

TIME	TUESDAY, SEPTEMBER 1
13:30 ~ 13:50	**Development of the USACE Automated SMART Gate System for Lock Gates: Part 1 - Structural Monitoring and Analysis in Real Time for Gates** Z. Treece[1], M. Smith[2], N. Wierschem[1], S. Sweeney[2], B. Spencer[1] [1) The University of Illinois at Urbana - Champaign, USA; 2) United States Army Corps of Engineers, USA]
13:50 ~ 14:10	**Probabilistic Data-Driven Assessment Of Pavement Management Systems** Y. S. H. Tari, M. L. Wang [Northeastern University, USA]
14:10 ~ 14:30	**Study of Vibration based SHM Technologies, Part III: Localization Using Statistical Learning Theory** M. K. Hovgaard[1], J. B. Hansen[2], A. Skafte[2], P. Olsen[2], R. Brincker[2] [1) Rambøll, Denmark; 2) Aarhus University, Denmark]
14:30 ~ 14:50	**Motion Magnification Based Damage Detection Using High Speed Video** Y. -J. Cha[1], J. Chen[2], O. Buyukozturk[2] [1) University of Manitoba, Canada; 2) Massachusetts Institute of Technology, USA]
14:50 ~ 15:10	**An Operation Reliability Prediction Method for CNC Machine Tool based on Hidden Markov Chain Model** J. Wu, C. Deng, Y. M. Zhu, C. Y. Wu [Huazhong University of Science and Technology, China]

SPECIAL SESSION

Reliability of SHM for Aerospace

Chair: P. Swindell (FAA) ***Co-chair:*** E. Lindgren (Air Force) **Location: Herrin 420-040**

TIME	TUESDAY, SEPTEMBER 1
13:30 ~ 13:50	**Structural Health Monitoring (SHM) Reliability Workshop** P. Swindell [FAA, USA]
13:50 ~ 14:10	**SHM Reliability and Implementation Overview – A Personal Military Aviation Perspective** E. A. Lindgren [United States Air Force Research Laboratory, USA]
14:10 ~ 14:30	**Establishing the Reliability of SHM Systems Through the Extrapolation of NDI Probability of Detection Principles** D. Roach[1], T. Rice[1], S. Neidigk[1], D. Piotrowski[2], J. Linn[3] [1) Sandia National Labs, USA; 2) Delta Air Lines, USA; 3) Boeing, USA]
14:30 ~ 14:50	**Probability of Detection Assessment of a Guided Wave Structural Health Monitoring System** G. Jarmer, S. Kessler [Metis Design Corporation, USA]
14:50 ~ 15:10	**Inverse Estimation for Damage Assessment in SHM: Moving Beyond the Probability of Detection** C. M. S. Kabban[1], B. M. Greenwell[2], M. M. Derriso[3] [1) Air Force Institute of Technology, USA; 2) InfoSciTex Corporation, USA; 3) 711th Human Performance Wing, USA]

SPECIAL SESSION

Guided Waves in Structures for SHM II

Chair: V. Giurgiutiu (University of South Carolina) ***Co-chair:*** M. H. Aliabadi (Imperial College London) **Location: 420-041**

TIME	*TUESDAY, SEPTEMBER 1*
13:30 ~ 13:50	**The Influence of Stiffeners on the Propagation of Guided Ultrasonic Waves** C. Schaal[1], X. Cao[2], A. Mal[1] [1) University of California, Los Angeles, USA; 2) Tianjin University, China]
13:50 ~ 14:10	**An Insight into High-order Harmonic Generation of Lamb Waves induced by A Breathing Crack Using A Spring Model and A Local Interaction Simulation Approach** R. Radecki, Z. Su, L. Cheng [The Hong Kong Polytechnic University, Hong Kong]
14:10 ~ 14:30	**Optimization of PZT Rebar Active Sensing System and its Application for CA Mortar Layer Fell-off Detection** N. N. Song, F. Wu [Shanghai Jiao Tong University, China]
14:30 ~ 14:50	**Lamb Waves Mode Decomposition Using the Cross-Wigner-Ville Distribution** A. B. Zoubi, V. J. Mathews, J. B. Harley, D. O. Adams [University of Utah, USA]
14:50 ~ 15:10	**Lamb Wave Based Structural Damage Detection Method Using Bayesian Updating** J. Yang, J. He, W. Zhang [Beihang University, China]

Technical Program (Wednesday, September 2nd)

Civil Structures III

Chair: Y. Wang (Georgia Tech) ***Co-chair:*** K. Smarsly (Bauhaus University Weimar) **Location: Hewlett 201**

TIME	WEDNESDAY, SEPTEMBER 2
10:30 ~ 10:50	**A New Model for Predicting Fatigue Damage** M.H. Hafezi, T. Kundu [University of Arizona, USA]
10:50 ~ 11:10	**Maturation of Real-time Active Pipeline Integrity Detection System for Natural Gas Pipelines** J. Bergman[1], H. Chung[1], F. Li[1], D. Zhang[1], V. Janapati[1], C. Cheung[1], A. Bining[2] [1) Acellent Technologies Inc., USA; 2) California Energy Commission, USA]
11:10 ~ 11:30	**Field Monitoring of Reinforced Concrete Closure Strip Behavior with Wireless Sensors** A. Brault[1], N. Hoult[1], T. Greenough[2], I. Trudeau[2], S. Masoud[2], B. Charnish[2] [1) Queen's University, Canada; 2) Entuitive, Canada]
11:30 ~ 11:50	**Analysis of Stress Corrosion Crack Growth and Related Structural Reliability Considerations** D. Lee [Northwestern University, USA]
11:50 ~ 12:10	**Monitoring Early Age Properties of Cementitious Material Using Ultrasonic Guided Waves In Embedded Rebar** H. Sun, J. Zhu [University of Nebraska at Lincoln, USA]

SPECIAL SESSION
SHM Technology in Wind Turbines III

Chair: M. Jahanshahi (Purdue University) ***Co-chair:*** W. Weijtjensi (Vrije Universiteit Brussel) **Location: Hewlett 102**

TIME	WEDNESDAY, SEPTEMBER 2
10:30 ~ 10:50	**Wireless Monitoring and Spectral Analysis of a 3 kW Wind Turbine for Condition Monitoring** Y. Zhang[1], J. Zhang[1], M. B. Kane[1], M. Hackell[2], E. Byon[1], R. Rolfes[2], J. P. Lynch[1] [1) University of Michigan, USA; 2) Leibniz Universiat, Germany]
10:50 ~ 11:10	**Extreme Function Theory for SHM: A Case Study for Wind Turbines** E. Papatheou[1], N. Dervilis[1], E. A. Maguire[2], C. Campos[2], I. Antoniadou[1], K. Worden[1] [1) University of Sheffield, UK; 2) Vattenfall Research & Development, UK]
11:10 ~ 11:30	**Numerical Model Quality Assessment of Offshore Wind Turbine Supporting Structure Based on Experimental Data** M. Kahsin[1], M. Luczak[2] [1) Gdansk University of Technology, Poland; 2) Polish Academy of Sciences, Poland]
11:30 ~ 11:50	**Structural Health Monitoring Considerations on Offshore Wind Turbine Models** E. Di Lorenzo[1], S. Manzato[1], B. Peeters[1], F. Marulo[2], W. Desmet[3] [1) Siemens Industry Software NV, Belgium; 2) University of Naples "Federico II", Italy; 3) KU Leuven, Belgium]
11:50 ~ 12:10	**Vibration-based Ice Detection of Rotor Blades in Wind Turbines – The Industrial Realization of an SHM-System** P. Kraemer, H. Friedmann, C. Ebert [Wolfel Beratende Ingenieure GmbH + Co. KG, Germany]

SPECIAL SESSION
Monitoring and Health Management of High-speed Railways I

Chair: Y. Ni (Hong Kong Polytechnic University) ***Co-chair:*** C.-Y. Wang (National Central University) **Location: Hewlett 103**

TIME	WEDNESDAY, SEPTEMBER 2
10:30 ~ 10:50	**Magnetoelectric Wireless Condition Monitor for Trackside Monitoring of Train Traction Systems** S. W. Or[1], C. M. Leung[1], S. L. Ho[1], K. Y. Lee[2] [1) The Hong Kong Polytehnic University, Hong Kong; 2) MTR Corporation Limited, Hong Kong]
10:50 ~ 11:10	**Cylindrical Guided Wave Approach for Damage Detection in Hollow Train Axles** A. Ziaja[1], L. Cheung[1], R. Radecki[1], P. Packo[2], W. Staszewski[2] [1) The Hong Kong Polytehnic University, Hong Kong; 2) AGH University of Science and Technology, Poland]
11:10 ~ 11:30	**Monitoring of Temperature Gradient Effects on the Mechanical Behavior of a Real Ballastless Track Structure** X. Chapeleau[1], L.-M. Cottineau[1], T. Sedran[1], A. Brisson[2], S. Kolodziejski[2], C. Masson[3], J. Cailliau[4] [1) IFSTTAR, France; 2) CEF-Railway Testing Center, France; 3) Alstom, France; 4) Railtech International, France]
11:30 ~ 11:50	**Chinese Turnout Crack Monitoring System of High-Speed Railway** P. Wang[1], J. Xiao[1], X. Sheng[1], D. Qin[2] [1) Southwest Jiaotang University, China; 2) Southwest Jiaotong University Railway Development Co., Ltd.]

Signal Processing III

Chair: F. Pozo (Univ. Politècnica de Catalunya)
Co-chair: C. Westerkamp (Univ. of Applied Sciences Osnabrueck)
Location: 380-380C

TIME	WEDNESDAY, SEPTEMBER 2
10:30 ~ 10:50	**A Computationally Compact Algorithm for Real-time Detection of Abrupt Structural Stiffness Degradations** Y. Lei[1], H. Zhou[1], Z.-L. Lai[2] [1) Xiamen University, China; 2) Rice University, USA]
10:50 ~ 11:10	**Health Monitoring of Corrosion Control Coatings Used on Ship Tanks and Enclosures** K. Farinholt, G. Bunget, H. Rees, F. Friedersdorf [Luna Innovations, Inc. USA]
11:10 ~ 11:30	**Content Adaptive Signal Compression for Remote SHM and NDT Operation** M. Schaarschmidt[1], C. Westerkamp[1], A. Hennewig[2], D. Pieper[1], H. Speckmann[3], W. Bisle[4][1) University of Applied Sciences Osnabrueck, Germany; 2) c.a.r.u.s. IT GmbH Hannover, Germany; 3) Testia Company GmbH, Germany; 4) Airbus Operations GmbH, Germany]
11:30 ~ 11:50	**Using the Subharmonic Resonance to Detect Bolted Joint Looseness** M. Zhang[1], J. Zhou[1], W. Qu[1], L. Xiao[1], X. Chen[2] [1) Wuhan University, China; 2) Inner Mongolia Dynamic Machines Research Institute, China]
11:50 ~ 12:10	**Application of Multifractal Detrended Fluctuation Analysis for Structural Health Monitoring** H. Fajri, T.-K. Lin [National Chiao Tung University, Taiwan]

Sensors/Actuators III

Chair: D. Mascarenas (Los Alamos National Laboratory) ***Co-chair:*** A. D. Grosso (University of Genoa) **Location:380-380D**

TIME	WEDNESDAY, SEPTEMBER 2
10:30 ~ 10:50	**Influences of Adhesive Properties on Strain Measurement Results of Rayleigh Backscattering Based Fibre Optic Sensors** M. Mahl, M. Friemel, L. Capobianco, A. Haridas, H. Baier [TU München, Germany]
10:50 ~ 11:10	**A Multirotor-based Approach for Tap-testing Difficult-to-access Structures** D. Mascarenas[1], A. Green[1], T. Trombetta[2], C. Farrar[1] [1) Los Alamos National Laboratory, USA; 2) US Navy, USA]
11:10 ~ 11:30	**A Low-Cost, Wireless Chemiluminescence-Based Deformation Sensor for Soil Movement and Landslide Monitoring** K. S. C. Kuang, Q. H. Cao [National University of Singapore, Singapore]
11:30 ~ 11:50	**Linear Guide with Material Integrated Strain Gauges for Structural Health Monitoring** G. Humstorff, C. Winkelmann, W. Lang [University of Bremen, Germany]
11:50 ~ 12:10	**A Novel, Wireless Acceleration Evaluator Used for Health Monitoring of Aging Structures and Bridges** A. Sabato [University of Calabria, Italy]

SPECIAL SESSION

Civil SHM Standardization; Progress and Status 2015 I

Chair: H. Wenzel (VCE) ***Co-chair:*** V. Le Cam (IFSTTAR)
Location: 380-380F

TIME	WEDNESDAY, SEPTEMBER 2
10:30 ~ 10:50	**A NoSQL-based Data Management Infrastructure for Bridge Monitoring Database** S. Jeong[1], Y. Zhang[2], J. P. Lynch[2], H. Sohn[3], K. H. Law[1] [1) Stanford University, USA; 2) University of Michigan, Ann Arbor, USA; 3) Kaist, Republic of Korea]
10:50 ~ 11:10	**Structural Health Monitoring of Unique Structures: Normandy and Tancarville** S. Schorn, N. Cortes [Advitam Inc., USA]
11:10 ~ 11:30	**British Columbia Smart Infrastructure Monitoring System (BCSIMS)** Y. Kaya, C. Ventura [University of British Columbia, Canada]
11:30 ~ 11:50	**An Update on a Large Scale SHM Deployment on Sydney's Harbour Bridge and Associated Research Activities** P. Runcie [National ICT Australia, Australia]
11:50 ~ 12:10	**The e-Bridge 2.0 Approach for SHM of Bridges in Costa Rica** G. Ortiz, C. Garita [Costa Rica Institute of Technology, Costa Rica]

SPECIAL SESSION

Embedded Sensors for Detecting Damage in Composites III

Chair: K. Loh (UC Davis) ***Co-chair:*** E. Cross (University of Sheffield) **Location: 380-380W**

TIME	WEDNESDAY, SEPTEMBER 2
10:30 ~ 10:50	**In-situ Strain and Damage Sensing in Glass Fiber Laminates Using Embedded CNT** S. Datta, M. Y. Fard, J. P. Johnston, E. Quigley, A. Chattopadhyay [Arizona State University, USA]
10:50 ~ 11:10	**Impact Localization Monitoring of the CFRP Composite Plate Based on Low-sampling Rate FBF Sensors by SVM** Z. Pang[1], M. Yuan[1], H. Song[2], W. Wang[2] [1) Beihang University, China; 2) The Aviation Industry Corporation of China, China]
11:10 ~ 11:30	**Screening Failure Detection of Structural Composite Systems: Embedded Triboluminescent Structronic Wires** K. Joshi, J. B. Frketic, M. Raley, D. Olawale, T. Dickens, O. Okoli [Florida A & M University, USA]
11:30 ~ 11:50	**Design of Embedded FBG Sensor System for Ultralight Aircraft Wing Monitoring** M. Dvorak[1], M. Ruzicka[1], M. Kabrt[2] [1) Czech Technical University in Prague, Czech Republic; 2) Vanessa Air spol. s r.o., Czech Republic]
11:50 ~ 12:10	**Sensitive Skin Based on pH Sensitive Smart Materials for Crack Detection** F. Camci [Antalya International University, Turkey]

SPECIAL SESSION

Recent Advances in Ultrasonic and Acoustic Emission Techniques for SHM/NDE III

Chair: F. di Scalea (UCSD) ***Co-chair:*** P. Malinowski (IFFM PASci) **Location: 380-380X**

TIME	WEDNESDAY, SEPTEMBER 2
10:30 ~ 10:50	**Tomographic Imaging of Structural Flaws with New Adaptive Weights on Array** S. Sternini, T. V. Nguyen, F.L. Di Scalea [University of California San Diego, USA]
10:50 ~ 11:10	**Nonlinear Damage Detection and Localisation Using a Time Domain Approach** S. Boccardi, D. Calla, G.-P. M. Fierro, F. Ciampa, M. Meo [University of Bath, USA]
11:10 ~ 11:30	**Recent Advances in the Ultrasonic Polar Scan Method for Characterizing (Degraded) Fiber Reinforced Plastics** M. Kersemans[1], A. Martens[2], W. Van Paepegem[1], S. Delrue[2], J. Degrieck[1], K. Van Den Abeele[2] [1) Ghent University, Belgium; 2) KULeuven – KULAK, Belgium]
11:30 ~ 11:50	**Advances in Smart Hangar and Its Real-world Applications** H.-J. Shin[1], S.-C. Hong[1], C.-T. Truong[2], J.-R. Lee[2] [1) Chonbuk National University, Korea; 2) KAIST, Korea]
11:50 ~ 12:10	**Detection of Defects in Composites Using Vibro-acoustic Modulation** B.-Y. Chen, S.-K. Soh, H.-P. Lee, T.-E. Tay, V. B. C. Tan [National University of Singapore, Singapore]

SPECIAL SESSION

Probabilistic SHM III

Chair: P. Leser (NASA Langley Research Center) ***Co-chair:*** B. Glisic (Princeton University) **Location: 380-380Y**

TIME	WEDNESDAY, SEPTEMBER 2
10:30 ~ 10:50	**System-level Inspection Scheduling: An Approach Based on Stochastic Future Allocation** M. Memarzadeh, M. Pozzi [Carnegie Mellon University, USA]
10:50 ~ 11:10	**Enhanced Recursive Probabilistic Integration Method for Probabilistic Fatigue Life Management Using Structural Health Monitoring** T. Chen, M. Shiao [Army Research Laboratory, USA]
11:10 ~ 11:30	**Efficient Bayesian Model Selection for Identifying Locally Nonlinear Systems Incorporating Dynamic Measurements** S. De[1], E. A. Johnson[1], S .F. Wojtkiewicz[2], P. T. Brewick[1] [1) University of Southern California, USA; 2) Clarkson University, USA]
11:30 ~ 11:50	**Uncertainty Quantification in Ultrasonic Wave Based Detection of Delamination in Composite Structures** R. K. Munian, D. R. Mahapatra, S. Gopalakrishnan [Indian Institute of Science, India]
11:50 ~ 12:10	**Online Fatigue Damage Prediction for Metallic Structures Via Output Only Vibration Measurements** S.E. Azam[1], C. Papadimitriou[1], E. Chatzi[2] [1) University of Thessaly, Greece; 2) ETH Zurich, Switzerland]

Aerospace Structures I

Chair: J. B. Ihn (Boeing) ***Co-chair:*** L. G. Santos (Embraer) **Location: 420-040**

TIME	WEDNESDAY, SEPTEMBER 2
10:30 ~ 10:50	**Detection of Impact Damages in Composite Stiffened Ribs by a PZT Network** A. Lozano-Martin[1], J. Garcia-Alonso[2], A. Fernandez-Lopez[1], M. Iglesias[2], F. Rodriguez-Lence[3], A. Guemes[1] [1) Polytechnic University of Madrid, Spain; 2) Airbus Group, Spain; 3) FIDAMC Composites Research, Development and Application Centre, Spain]
10:50 ~ 11:10	**Fatigue Cracks Detection and Their Growth Monitoring During Fatigue Test of a Helicopter Tail Boom** M. Dziendzikowski[1], K. Dragan[1], A. Kurnyta[1], S. Klimaszewski[1], A. Leski[1] and G. Vallone[2] [1) Air Force Institute of Technology, Poland; 2) Politecnico di Milano, Italy]
11:10 ~ 11:30	**Monitoring of Perturbations in Aeronautical Structures and its Application in Active Vibration Control** J.-M. Rodriguez-Fortun, J. Orus, M. Escolano, J. Saumell [ITAINNOVA, Spain]
11:30 ~ 11:50	**Applicability of a UK MASAAG Guidance Paper to F-35 SPHM Evolution Process** I. Hebden[1], S. Diehl[2], J. McFeat[1], H. Azzam[3] [1) BAE Systems, UK; 2) Lockheed Martin, USA; 3) HAHN Spring Limited, UK]
11:50 ~ 12:10	**An Energy-weighted Factor Based Localization Method for On-line Wireless Impact Networking Monitoring** Y. Ren, S. Yuan, L. Qiu, H. Mei [Nanjing University of Aeronautics and Astronautics, China]

SPECIAL SESSION

Guided Waves in Structures for SHM III

Chair: P. Masson (Universite de Sherbrooke) ***Co-chair:*** D. Soffker (University of Duisburg-Essen) **Location: 420-041**

TIME	WEDNESDAY, SEPTEMBER 2
10:30 ~ 10:50	**Multi-frequency Approach to Imaging Damage in Stiffened Structures Exhibiting Multi-path Reflections** E. Chan, L. R. F. Rose, C. H. Wang [Sir Lawrence Wackett Aerospace Centre, Australia]
10:50 ~ 11:10	**Structural Health Monitoring Platform for Sensorised Composite Structures** Z. Sharif-Khodaei, M. Thiene, M. H. Aliabadi [Imperial College London, UK]
11:10 ~ 11:30	**Investigating Efficiency of Non-linear Wave Modulation Spectroscopy for Early Detection of Critical Buckling Damages in Sandwich Composite Panels** N.A. Chrysochoidis, E. GutiéRrez [European Commission, Italy]
11:30 ~ 11:50	**Adaptive Reverberation Suppression Techniques for SHM in Composite Materials** V. Rosa[1], V. Lopes Jr.[1], E. Flynn[2], M. Todd[3], C. Farrar[2] [1) UNESP - Campus de Ilha Solteira, Brazil; 2) Los Alamos National Laboratory, USA; 3) UC San Diego, USA]
11:50 ~ 12:10	**Guided Wave Displacement Validation for SHM Applications Using Air Coupled Ultrasonic Scanning Technique** A. Szewieczek[1], C. Heinze[1], M. Sinapius[2] [1) German Aerospace Center (DLR), Germany; 2) Technical University Braunschweig, Germany]

Civil Structures IV

Chair: M. P. Limongelli (Politecnico di Milano) ***Co-chair:*** M. Gul (University of Alberta) **Location: Hewlett 201**

TIME	WEDNESDAY, SEPTEMBER 2
14:00 ~ 14:20	**Validation of Long-Term Data from FBG Temperature Sensors** H. Abdel-Jaber, B. Glisic [Princeton University, USA]
14:20 ~ 14:40	**Wind Driven Damage Localization in a High-rise Building** M. P. Limongelli[1], L. Martinelli[1], A. Zambrano[2] [1) Politecnico di Milano, Italy; 2) Zambrano Consulting, Italy]
14:40 ~ 15:00	**Validation of Finite Element Models of Existing Concrete Dams, Through Monitoring Data** M. Colombo, M. Domaneschi, A. F. Ghisi [Politecnico di Milano, Italy]
15:00 ~ 15:20	**Compensation of Environmental Effects on Modal Properties by Second Order Blind Source Separation Techniques** C. Rainieri, G. Fabbrocino [University of Molise, Italy]
15:20 ~ 15:40	**Prospect of Structural Health Monitoring Application for Offshore Wind Farm in Taiwan** C.-F. Chen[1], H.-H. Huang[1], H. Wu[2], C.-L. Tsai[2] [1) National Taiwan University, Taiwan; 2) Ship and Ocean Industries R&D Center, Taiwan]

Bondline Monitoring

Chair: F. Rodriguez-Lence (Airbus) ***Co-chair:*** L. Salvino (NSWC) **Location: Hewlett 102**

TIME	WEDNESDAY, SEPTEMBER 2
14:00 ~ 14:20	**Study on Adhesive Bonds Influence on EMI Signatures** P. Malinowski, T. Wandowski, W. Ostachowicz [Polish Academy of Sciences, Institute of Fluid-Flow Machinery, Poland]
14:20 ~ 14:40	**Finite Element Analysis of Quantitative Percussion Diagnostics for Evaluating the Strength of Bonds Between Composite Laminates** S. Poveromo[1], D. Malcolm[2], J. Earthman[1] [1) University of California - Irvine, USA; 2) MSC Software Corporation, USA]
14:40 ~ 15:00	**Bondline Integrity Monitoring of Adhesively Bonded Structures Via an Electromechanical Impedance Based Approach** Y. Zhuang, F. Kopsaftopoulos, F.-K. Chang [Stanford University, USA]
15:00 ~ 15:20	**Damage Assessment in Adhesively Bonded Structures by Using SmartSHM** A. Preisler, Z. Sadeghi, A. Adomeit, K.-U. Schröder [RWTH Aachen University, Germany]
15:20 ~ 15:40	**Bond Line Monitoring Technology For Aircraft CFRP Structure Using Lamb Wave** K. Takahashi[1], H. Soejima[1], M. Nakajima[1], Y. Okabe[2], N. Takeda[2], H. Kojima[3] [1) Fuji Heavy Industries LTD., Japan; 2) The University of Tokyo, Japan; 3) SOKEIZAI Center, Japan]

SPECIAL SESSION

Monitoring and Health Management of High-speed Railways II

Chair: D. Or (Hong Kong Polytechnic University)
Co-chair: K. Ding (China Speial Equipment Inspection and Research Institute) **Location: Hewlett 103**

TIME	WEDNESDAY, SEPTEMBER 2
14:00 ~ 14:20	**Outlier Detection in Sensor-assisted Online Ride Comfort Assessment of High-speed Trains** Y.-Q. Ni[1], X.-Z. Liu[1], W.-Z. Zhao[2], S.-L. Liang[3] [1) The Hong Kong Polytechnic University, Hong Kong; 2) Dalian Jiaotong University, China; 3) Changchun Railway Vehicles Co. Ltd., China]
14:20 ~ 14:40	**Train Wheel Condition Monitoring by Rail Pad Sensor** S. L. Zhang, C. G. Koh, K. S. C. Kuang [National University of Singapore, Singapore]
14:40 ~ 15:00	**Monitoring of Mission Critical Components of Railways Using Smart Railway System** K.-K. Lee, H.-Y. Tam, S.-L. Ho [Hong Kong Polytechnic University, Hong Kong]
15:00 ~ 15:20	**Damage Allocation for Railway Rails Using PZT Sensors** Y. Song, F. Wu [Shanghai Jiao Tong University, China]
15:20 ~ 15:40	**Health Condition Monitoring Based on ABA Measurements for High Speed Railway Tracks** J. Hendriks, A. Núñez, Z. Li [Delft University of Technology, Netherlands]

SPECIAL SESSION

Very Dense Arrays of Sensors: 1D, 2D, and 3D Distributed and Quasi-Distributed Sensors I

Chair: B. Glisic (Princeton University) ***Co-chair:*** S. Roy (Pacific Northwest National Laboratory) **Location: 380-380C**

TIME	WEDNESDAY, SEPTEMBER 2
14:00 ~ 14:20	**CLoVER Transducers for Static and Dynamic Strain Sensing** Y. Shen, H. Zhang, C. E. S. Cesnik [University of Michigan, USA]
14:20 ~ 14:40	**Distributed Fibre Optic Sensors for Stiffened Skin Panels Strain Monitoring and Failure Mode Detection** P. F. Díaz-Maroto, A. F. López, J. A. Güemes [Polytechnic University of Madrid, Spain]
14:40 ~ 15:00	**Direct State-Space Models for Time-Varying Sensor Networks** T. J. Matarazzo, S. N. Pakzad [Lehigh University, USA]
15:00 ~ 15:20	**Detecting and Locating Defects in Coated Metallic Structures Using Arrays of Small Microwave Resonators** A. M. Ali, O. M. Ramahi [University of Waterloo, Canada]
15:20 ~ 15:40	**Fatigue Damage Detection of Rib-to-Deck Welded Joints Using 5cm High-Spatial-Resolution DDP-BOTDA System** J. Xu, Y. Dong, H. Li, S. Li, T. Jiang, M. Xia [Harbin Institute of Technology, China]

Bio-inspired Sensors and Networks, Smart Sensor Technologies

Chair: A. Chattopadhyay (Arizona State University) ***Co-chair:*** V. Giurgiutiu (Univ. of South Carolina) **Location: 380-380D**

TIME	*WEDNESDAY, SEPTEMBER 2*
14:00 ~ 14:20	**Real-time Time-frequency Spectrogram Construction Based on Mimicry of Human Auditory Systems** R. Yao, J. P. Lynch [University of Michigan, USA]
14:20 ~ 14:40	**Citizen-Engaged Structural Health Monitoring Using Smartphone Sensors** E. Ozer, M. Q. Feng [Columbia University, USA]
14:40 ~ 15:00	**A Haptic Approach for Impact Detection on Airplane Wings** H. K. Jung, M. J. Lee, C. W. Lee, G. Park [Chonnam National University, Republic of Korea]
15:00 ~ 15:20	**Evaluation of Different Topologies of Integrated Capillaries in Effective Structural Health Monitoring System Produced by 3D Printing** M. Strantza[1], R. Vafadari[2], D. De Baere[1], M. Rombouts[3], I. Vandendael[1], H. Terryn[1], M. Hinderdael[1], A. Rezaei[2], W. Van Paepegem[2], P. Guillaume[1], D. Van Hemelrijck[1] [1) Vrije Universiteit Brussel, Belgium; 2) Ghent University, Belgium; 3) VITO Vlaamse Instelling voor Technologisch Onderzoek, Belgium]
15:20 ~ 15:40	**Influence of the Relative Humidity to the Damage Detection Effectiveness of an ITO/PMMA Nanocomposite Film Sensor** B. E. Takiuti, V. Lopes, Jr., M. J. Brennan, M. O. Orlandi [Univ. Estadual Paulista – UNESP, Brazil]

SPECIAL SESSION

Civil SHM Standardization; Progress and Status 2015 II

Chair: J. Lynch (Univ. of Michigan, Ann Arbor) ***Co-chair:*** C.-K. Soh (Nanyang Technology University) **Location: 380-380F**

TIME	*WEDNESDAY, SEPTEMBER 2*
14:00 ~ 14:20	**Activities of the Italian UNI-WG06 on Standardization in SHM** A. E. Del Grosso [University of Genoa, Italy]
14:20 ~ 14:40	**Comparative Damage Detection in the IASC-ASCE Benchmark Structure Using SHE™** E. K. Ervin [The University of Mississippi, USA]
14:40 ~ 15:00	**Seismic Retrofitting and Structural Health Monitoring of a Masonry Vault by using GFRP Grids with Embedded FBG Sensors** V. Gattuli, F. Potenza, J. Toti, F. Valvona [University of L'Aquila, Italy]
15:00 ~ 15:20	**SHM using Eulerian-based Virtual Visual Sensors: Introduction of a New Black-and-white Target for Improved SNR** A. Shariati, T. Schumacher [University of Delaware, USA]
15:20 ~ 15:40	**A Tale of Two Tunnels – Understanding the Performance of Existing and New Tunnels During Construction Works** M. Z. E. B. Elshafie, C. Y. Gue, N. de Battista, M. Alhaddad, M. Wilcock, K. Soga, R. J. Mair [University of Cambridge, United Kingdom]

Diagnostics I

Chair: M. Todd (UCSD) ***Co-chair:*** I. Georgiou (National Technical University of Athens) **Location: 380-380W**

TIME	*WEDNESDAY, SEPTEMBER 2*
14:00 ~ 14:20	**Quality Assessment for the EMI-based Inspection of PWAS** I. Buethe, C.-P. Fritzen [University of Siegen, Germany]
14:20 ~ 14:40	**Improvement and Comparison of Wear-oriented State-of-health Classification Methods Using Optimization Techniques** S. Rothe[1], A. Leite[2], P. Padrao[2], D. Söffker[1] [1) University of Duisburg-Essen, Germany; 2) Instituto Federal Fluminense, Brazil]
14:40 ~ 15:00	**A Local Sensor Configuration for Mutliscale Damage Detection in an Aluminum Beam Alloy Structure with a Loose Bolt Joint** I. T. Georgiou [National Technical University of Athens, Greece]
15:00 ~ 15:20	**Signal-based Fault Prognosis Approach Based on Time-frequency Analysis Applied to Industrial Data** A. Rother[1], M. Jelali[2], D. Söffker[3] [1) ThyssenKrupp Steel Europe AG, Germany; 2) Cologne University of Applied Sciences, Germany; 3) University of Duisburg-Essen, Germany]
15:20 ~ 15:40	**Research on Monitoring and Forecasting Method of Fatigue Damage in the Hot Spots of the Metallurgy Crane** K.-Q. Ding, G.-S. Liu, L. Chen, G. Chen, F.-F. Kong [China Special Equipment Inspection and Research Institute, China]

SPECIAL SESSION

Recent Advances in Ultrasonic and Acoustic Emission Techniques for SHM/NDE IV

Chair: S. Banerjee (University of South Carolina) ***Co-chair:*** Z. Li (Peking University) **Location: 380-380X**

TIME	WEDNESDAY, SEPTEMBER 2
14:00 ~ 14:20	**Precursor Damage Inception Quantification** S. Patra, S. Banerjee [University of South Carolina, USA]
14:20 ~ 14:40	**Impact Damage Imaging Using Non-contact ACT/LDV System** M. Harb, F.-G. Yuan [National Institute of Aerospace/ North Carolina State University, USA]
14:40 ~ 15:00	**Development of Laser-powered Wireless Ultrasonic Device for Aircraft Structural Heath Monitoring** M. Choi[1], J.-R. Lee[2], C.-Y. Park[3] [1) Chonbuk National University, Republic of Korea; 2) Korea Advanced Institute of Science and Technology, Republic of Korea; 3) Aeronautical Technology Directorate, Agency for Defense Development, Republic of Korea]
15:00 ~ 15:20	**Development of Wireless Ultrasonic Propagation Imaging System** M. M. Shrestha[1], S. Y. Chong[2], J.-R. Lee[2] [1) Chonbuk National University, Republic of Korea; 2) Korea Advanced Institute of Science and Technology, Republic of Korea]
15:20 ~ 15:40	**A Novel Coda Wave Interferometry Calculation Approach Using Taylor Series Expansion** S. Liu[1], Z. Wu[1], J. Zhu[2] and H. Yang[1] [1) Northwestern Polytechnical University, China; 2) The University of Nebraska at Lincoln, USA]

SPECIAL SESSION

Probabilistic SHM IV

Chair: Z. Su (Hong Kong Polytechnic University) ***Co-chair:*** K.-U. Schroder (RWTH Aachen University) **Location: 380-380Y**

TIME	WEDNESDAY, SEPTEMBER 2
14:00 ~ 14:20	**Multiple Damage Identification Using the Reversible Jump Markov Chain Monte Carlo** D. Tiboaca, R. J. Barthorpe, I. Antoniadou, K. Worden [The University of Sheffield, UK]
14:20 ~ 14:40	**Sensor Placement Optimization for Structural Health Monitoring** C. Malings, M. Pozzi, I. Velibeyoglu [Carnegie Mellon University, USA]
14:40 ~ 15:00	**Damage Characterization in Concrete Jack Arch Bridges Using Symbolic Time Series Analysis** M. M. Alamdari[1], V. V. Nguyen[2], P. Runcie[1], S. Mustapha[3] [1) National ICT Australia, Australia; 2) University of Technology, Sydney, Australia; 3) American University of Beirut, Lebanon]
15:00 ~ 15:20	**A Probabilistic Model for Quantifying Uncertainty of Acoustic Nonlinearities of Lamb Waves and Its Application to the Characterization of Damage in Composite Laminates** M. Hong[1], Z. Mao[2], M. D. Todd[2], Z. Su[1], X. Qing[3] [1) The Hong Kong Polytechnic University, Hing Kong; 2) University of California San Diego, USA; 3) Beijing Aeronautical Science and Technology Research Institute of COMAC, China]
15:20 ~ 15:40	**Damage Detection Sensitivity, Specificity and Classification Data Analysis for SHM Systems Design, Verification and Validation** G. K. Geetha, N. B. Ravi, N. Chakraborty, K. C. Ukirde, G. S. Kamalakar, D. R. Mahapatra [Indian Institute of Science, India]

Aerospace Structures II

Chair: C. Bockenheimer (Airbus Group Innovations) ***Co-chair:*** A. Kumar (Acellent Technologies) **Location: 420-040**

TIME	WEDNESDAY, SEPTEMBER 2
14:00 ~ 14:20	**Analysis of Loading Effects on Guided Ultrasonic Waves and Damage Assessment in a Full-scale CFRP Fuselage Structure** B. Eckstein[1], M. Bach[1], M. M. Bonet[2] [1) Airbus Group Innovations, Germany; 2) German Aeorspace Center, Germany]
14:20 ~ 14:40	**ROC and Cost Curves for SHM Performance Characterization in a Multilevel Defect Classification Framework: Application to Impact Damage in Aircraft Composites Structures** A. Apicella[1], G. Cottone[2], L. De Marchi[3], U. Heckenberger[4], A. Marzani[3] [1) Alenia Aermacchi S.p.A, Italy; 2) Eracons GmbH, Germany; 3) University of Bologna, Italy; 4) Airbus Group Innovations, Germany]
14:40 ~ 15:00	**SHM Certification Requirements for Military Aircraft – An Australian Perspective** S. Galea, N. Rajic [Defence Science and Technology Group, Australia]
15:00 ~ 15:20	**Large Deflection Prediction of Simplified Wing for Antenna Signal Compensation** S. Park[1], H. Lee[1], I.-G. Kim[1], M.-S. Kim[2] [1) Chungnam National University, Republic of Korea; 2) Agency for Defence Development, Republic of Korea]
15:20 ~ 15:40	**Integrated Structural Health Monitoring System for Civil Aircraft Structures** X. P. Qing, H. Sun, M. Lu [Beijing Aeronautical Science and Technology Research Institute of COMAC, China]

SPECIAL SESSION

Guided Waves in Structures for SHM IV

Chair: N. Chrysochoidis (European Commission) ***Co-chair:*** C. Li (Hong Kong Polytechnic University) **Location: 420-041**

TIME	*WEDNESDAY, SEPTEMBER 2*
14:00 ~ 14:20	**Guided Wavefield Reconstruction from Sparse Measurements Using Compressed Sensing** O. Mesnil, H. Yan, M. Ruzzene, K. Paynabar, J. Shi [Georgia Institute of Technology, USA]
14:20 ~ 14:40	**Selection of Structural Features for the Systematic Study of Guided Wave Propagation and Interaction with Damage** P.-C. Ostiguy[1], M. H. Sherafat[2], D. R. Franca[3], N. Bouslama[1], N. Quaegebeur[1], A. Maslouhi[1], L. Lessard[2], P. Hubert[2], M. Viens[3], M. R. Mofakhami[4], Z. Hajjar[5], P. Masson[1] [1) Universite de Sherbrooke,Canada; 2) McGill University, Canada; 3) Ecole de Technologie Superieure, Canada; 4) Bombardier Inc., Canada; 5) L-3 Communications MAS (Canada) Inc., Canada]
14:40 ~ 15:00	**Development of a Hyperelastic Transversely Isotropic Materials Law for the Simulation of the Higher Harmonic Lamb Wave Generation in Composite Structures** N. Rauter, R. Lammering [Helmut-Schmidt-University / University of the Federal Armed Forces, Germany]
15:00 ~ 15:20	**Multi-path Exploitation in a Sparse Reconstruction Approach to Lamb Wave Based Structural Health Monitoring** A. Golato, S. Santhanam, F. Ahmad, M. G. Amin [Villanova University, USA]
15:20 ~ 15:40	**Effect of Piezoelectric Transducer Bonding on Time Reversibility of Lamb Waves in Plates** J. K. Agrahari, S. Kapuria [Indian Institute of Technology, India]

Technical Program (Thursday, September 3rd)

System Identification I

Chair: A. Smyth (Columbia University) ***Co-chair:*** M. Carter (US Army) **Location: Hewlett 201**

TIME	THURSDAY, SEPTEMBER 3
10:00 ~ 10:20	**Monitoring Early Damage Initiation of Very High Cycle Fatigued Composite Material Using a Nonlinearities Based Inverse Approach** S. Bagchi[1], R. Sridaran[2], C. Boller[2], P. Starke[2], M. Mitra[1] [1) Indian Inst. of Technology, India; 2) Saarland University, Germany]
10:20 ~ 10:40	**Novel Reduced Model Based Damage Detection of Frame Structures** D. Zhang, H. Li [Harbin Institute of Technology, China]
10:40 ~ 11:00	**Modelling the Damage Monitoring Capability of Conductive Glass/Epoxy Laminates** P. A. Carraro, F. Panozzo, M. Quaresimin, M. Zappalorto [University of Padova, Italy]
11:00 ~ 11:20	**Study of Vibration Based SHM Technologies, Part IV: Localization Using Physical-Based Methods** J. B. Hansen[1], M. K. Hovgaard[2], P. Olsen[1], A. Skafte[1], R. Brincker[1] [1) Aarhus University, Denmark; 2) Rambøll, Denmark]
11:20 ~ 11:40	**Decentralized Damage Detection under Ambient Excitations with Random Decrement Functions** P. Ni, Y. Xia [The Hong Kong Polytechnic University, Hong Kong]
11:40 ~ 12:00	**Wave-Propagation and Transfer-Matrix Approach for System Identification** E. Afak, E. Çakti [Boğaziçi University, Turkey]

Modelling and Simulation

Chair: S. Olson (University of Dayton Research Institute) ***Co-chair:*** A. Kontsos (Drexel University) **Location: Hewlett 102**

TIME	THURSDAY, SEPTEMBER 3
10:00 ~ 10:20	**Multi-Physics Modeling and Simulation of a Frequency Doubling Antenna Sensor for Passive Wireless Strain Sensing** C. Cho, X. Yi, Y. Wang, M. M. Tentzeris [Georgia Institute of Technology, USA]
10:20 ~ 10:40	**Wave Propagation in Fluid Loaded Thin Walled Waveguides** M. Mazzotti, J. Cuadra, A. Kontsos, I. Bartoli [Drexel University, USA]
10:40 ~ 11:00	**Multiscale Flow Modeling and Simulation to Predict Void Formation and Transport in Composite Manufacturing** M. Yeager, P. Simacek and S. Advani [University of Delaware, USA]
11:00 ~ 11:20	**Efficient Numerical Simulation Method for Lamb Wave Propagation and Its Verfication** J. M. V. Perez, F. Raddatz [German Aerospace Center (DLR), Germany]
11:20 ~ 11:40	**Analysis and Optimization of Pipeline Assembly and Correcting Based on Finite Element Technology** Z. Lu, W. Dai, J. Chu, Y. Zhao [Beihang University, China]
11:40 ~ 12:00	**Simulation of Guided Wave Inspections Using Hybrid Modal/Finite Element Formulation: Application to a SHM System for Pipe Monitoring with Complex Geometries** V. Baronian, K. Jezzine, B. Chapius [CEA, France]

Electromechanical Impedance Based Methods

Chair: P. Qing (COMAC) ***Co-chair:*** M. Dvorak (Czech Technical University in Prague) **Location: Hewlett 103**

TIME	THURSDAY, SEPTEMBER 3
10:00 ~ 10:20	**Online Electro-Mechanical Impedance-Based Structural Tamper Detection** A. Cattaneo[1], P. Sanila[2], K. A. Miller[1], C. R. Farrar[1], E. B. Flynn[1], D. D. L. Mascareñas[1] [1) Los Alamos National Laboratory, USA; 2) Internationella Engelska Gymnasiet, Sweden]
10:20 ~ 10:40	**An Integrated SHM System Based on Electromechanical Impedance and Guided Ultrasonic Waves** P. Rizzo[1], V. Gulizzi[2], A. Milazzo[2] [1) University of Pittsburgh, USA; 2) University of Palermo, Italy]
10:40 ~ 11:00	**Evaluation of the E/M Impedance Method as a SHM Technique for Large Civil Aircraft Spoilers: Analytical, Numerical and Experimental Studies Performed with Simple Structures** C. Viechtbauer, T. Erlinger, M. Schagerl [Johannes Kepler University Linz, Austria]
11:00 ~ 11:20	**Smart Wireless Sensor Node for Impedance-Based SHM Applications with Multi-Sensor Capability and Automatic Compensation for Temperature Effects** N. E. Cortez, J. V. Filho, F. G. Baptista [UNESP – Univ Estadual Paulista, Brazil]
11:20 ~ 11:40	**A Statistical Approach for Assessing Reliability for Impedance-Based Structural Health Monitoring Using Probability of Detection** V. Steffen Jr., R. M. F. Neto, H. B. Lacerda [Federal University of Uberlandia, Brazil]
11:40 ~ 12:00	**PCA-Based Method for Damage Detection Exploring Electromechanical Impedance in a Composite Beam** M. A. de Oliveira[1], D. J. Inman[2] [1) Federal Institute of Education, Science and Technology of Mato Grosso, Brazil; 2) University of Michigan, USA]

SPECIAL SESSION

Very Dense Arrays of Sensors: 1D, 2D, and 3D Distributed and Quasi-Distributed Sensors II

Chair: D. Zonta (University of Trento) ***Co-chair:*** F. Kopsaftopoulos (Stanford University) **Location: 380-380C**

TIME	THURSDAY, SEPTEMBER 3
10:00 ~ 10:20	**Crack Identification Using Sensing Sheets** Y. Yao, B. Glisic [Princeton University, USA]
10:20 ~ 10:40	**Long Distance Video Camera Measurements of Structures** J. G. Chen, N. Wadhwa, A. Davis, F. Durand, W. T. Freeman, O. Büyüköztürk [Massachusetts Institute of Technology, USA]
10:40 ~ 11:00	**Dense Network of Large Area Electronics for Fatigue Crack Detection and Localization** S. Laflamme[1], J. Vens[1], D. Qiao[1], A. Downey[1], J. Li[2] [1) Iowa State University, USA; 2) University of Kansas, USA]
11:00 ~ 11:20	**Morphopipe: Curvature Monitoring of Flexible Risers with MEMS Accelerometers** M. Carmona[1], R. Perrier[1], L. Jouanet[1], N. Saguin-Sprynski[1], O. Delcroix[2] [1) CEA, France; 2) Technip, France]
11:20 ~ 11:40	**Mechanochromic Photonic Crystals for Structural Health Monitoring** A. Piotrowska[1], V. Piccolo[1], A. Chiappini[1], M. Ferrari[1], M. Pozzi[2], L. Deseri[1], D. Zonta[1] [1) University of Trento, Italy; 2) Carnegie Mellon University, USA]
11:40 ~ 12:00	**Identification of Impact Force Based on Compressive Sensing in Large Structural Health Monitoring** D. Liang, Z.-F. Fan [Xiamen University, China]

SPECIAL SESSION

Technologies for Health-Conscious Aircraft and Maneuver

Chair: N. Pham (NAVAIR) ***Co-chair:*** E. Habtour (US Army) **Location: 380-380D**

TIME	*THURSDAY, SEPTEMBER 3*
10:00 ~ 10:20	**Selecting Features for Data Based Damage Detection** J. Long, O. Büyüköztürk [Massachusetts Institute of Technology, USA]
10:20 ~ 10:40	**Damage Characterization and Classification for Composite Honeycomb Structures** V. Janapati[1], F. Li[1], R. Ikegami[1], C. Cheung[1], A. Kumar[1], W. Milan[2] [1) Acellent Technologies Inc., USA; 2) NAVAIR, USA]
10:40 ~ 11:00	**Detecting Impacts on a Representative Aerospace Structure: An Implementation with Tests** S. Bemment[1], I. Read[2], P. Hubbard[1] [1) Loughborough University, UK; 2) BAE Systems PLC, UK]
11:00 ~ 11:20	**Decision Making for Reference-Free Damage Detection** R. Hajrya[1], F. Kopsaftopoulos[2], S. Roy[3], P. Ladpli[3], F.-K. Chang[2] [1) IRSEEM-Embedded Electronic Systems Research Institute, France; 2) Stanford University, USA; 3) Pacific Northwest National Laboratory, USA]
11:20 ~ 11:40	**Structural Health Monitoring of a UAV Fleet Using Fiber Optic Distributed Strain Sensing** O. Shapira[1], U. Ben-Simon[2], A. Bergman[3], S. Shoham[2], B. Glam[1], I. Kressel[2], T. Yehoshua[3], M. Tur[3] [1) Israeli Air Force (IAF), Israel; 2) Israel Aerospace Industries, Israel; 3) Tel-Aviv University, Israel]
11:40 ~ 12:00	**Exploring the Efficiency of BIGDATA Analyses in SHM** T. J. Matarazzo, S. G. Shahidi, S. N. Pakzad [Lehigh University, USA]

SPECIAL SESSION

Acoustic Emission in Aerospace Applications I

Chair: D. Zarouchas (DELFT) ***Co-chair:*** T. Shiotani (Kyoto Universityl) **Location: 380-380F**

TIME	*THURSDAY, SEPTEMBER 3*
10:00 ~ 10:20	**Optimization of Acoustic Source Localization in Large Plates** K. Grabowski[1], H. Nakatani[2], M. Gawronski[1], P. Packo[1], W. J. Staszewski[1], T. Uhl[1], T. Kundu[3] [1) AGH University of Science and Technology, Poland; 2) Osaka City University, Japan; 3) University of Arizona, USA]
10:20 ~ 10:40	**Acoustic Emission Monitoring of Crack Propagation in Titanium Samples** M. Strantza, D. de Baere, P. Guillaume, D. Van Hemelrijck, D. G. Aggelis [Vrije Universiteit Brussel, Belgium]
10:40 ~ 11:00	**Acoustic Emission-Based Impact Location Estimation for Composite Structures** J. Zhou, V. J. Mathews, D. O. Adams [University of Utah, USA]
11:00 ~ 11:20	**Acoustic Emission of 3D Angle Interlock Glass Fibre Composites** M. Gresil, M. Saleh, M. Arshad, C. Soutis [University of Manchester, UK]
11:20 ~ 11:40	**Detection and Quantification of Fatigue Cracks in Rail Steel Using Acoustic Emission Technique** D. Li, K.S.C. Kuang, C.G. Koh [National University of Singapore, Singapore]
11:40 ~ 12:00	**Damage Evaluation for Aircraft CFRP Components Using Piezoelectric Sensing** R. Austin[1], M. K. ElBatanouny[2], P. H. Ziehl[3] [1) Texas Research Institute Austin, Inc., USA; 2) Wiss, Janney, Elstner Associates, Inc., USA; 3) University of South Carolina, USA]

Diagnostics II

Chair: C. Lissenden (Penn State University) ***Co-chair:*** F. Rose (DSTO Aerospace) **Location: 380-380W**

TIME	THURSDAY, SEPTEMBER 3
10:00 ~ 10:20	**Detection and Characterization of Cracks Using Lamb Wave Propagation** B. Poddar, V. Giurgiutiu [University of South Carolina, USA]
10:20 ~ 10:40	**Development of a State-Related Evaluation for Diagnostic-Oriented Data Filtering Approach** S. Rothe, D. Söffker [University of Duisburg-Essen, Germany]
10:40 ~ 11:00	**Development of the USACE Automated SMART Gate System for Lock Gates: Detection of Barge Impact Events Using Statistical Process Control** M. D. Smith[1], Z. R. Treece[2], S. L. Bunkley[1], V. P. Chiarito[1] [1) US Army Corps of Engineers, USA; 2) University of Illinois Urbana-Champaign, USA]
11:00 ~ 11:20	**Structural Damage Identification in an Aeronautical Panel Exploring the PCA and Delaunay Triangulation** M. A. de Oliveira[1], J. V. Filho[2], V. Lopes, Jr.[2], D. J. Inman[3] [1) Federal Institute of Education, Science and Technology of Mato Grosso, Brazil; 2) UNESP- Univ. Estadual Paulista, Brazil; 3) University of Michigan, USA]
11:20 ~ 11:40	**A Novel Modal Strain Method for Damage Detection in SHM Based on FBG and iFEM** H. Yang, Z. Wu, P. Sun [Northwestern Polytechnical University, China]
11:40 ~ 12:00	**A Numerical Study for Damage Detection of a Thin Plate Using Pseudo Local Felxibility Method with Rotary Measurement** T.-Y. Hsu[1], W.-I. Liao[2], Y-C. Shi[2] [1) NCREE, Taiwan; 2) National Taipei University of Technology, Taiwan]

SPECIAL SESSION

SHM within Harsh Extreme Environments I

Chair: D. Senesky (Stanford University) ***Co-chair:*** R. Werlink (NASA) **Location: 380-380X**

TIME	THURSDAY, SEPTEMBER 3
10:00 ~ 10:20	**Laboratory Validation of a Piezoelectric Scour Monitoring Sensor** F. Azhari, K. J. Loh, F. A. Bombardelli [University of California, Davis, USA]
10:20 ~ 10:40	**NASA Prototype All Composite Tank Cryogenic Pressure Tests to Failure with Structural Health Monitoring** R. J. Werlink, F. Pena [NASA, USA]
10:40 ~ 11:00	**Fully-Distributed Fiber Optic Sensor for Strain Measurement at High Temperature** Y. Bao, G. Chen [Missouri University of Science and Technology, USA]
11:00 ~ 11:20	**Scour Monitoring on a Field Bridge Using FBG-Based Instrumentation** X. Kong, C. S. Cai, J. Hu [Louisiana State University, USA]
11:20 ~ 11:40	**Modal Property-Based Approach for Lateral Distribution Evaluation of Intact and Damaged Reinforced Concrete Bridge** Y. Jiao, H. Liu, X. Wang, G. Luo [Jilin University, China]
11:40 ~ 12:00	**Empowering the QA Technician with Intuitive 3D Optical Inspection Tools** P. Bottcher[1], E. Klaas[2], A. Chhabra[2] [1) 8tree GmbH, Germany; 2) 8tree LLC, USA]

SPECIAL SESSION

Probabilistic SHM V

Chair: W. Meeker (Iowa State University) ***Co-chair:*** R. Matalie (Helmut-Schmidt University) **Location: 380-380Y**

TIME	THURSDAY, SEPTEMBER 3
10:00 ~ 10:20	**A Compressed Sensing Approach in Structural Damage Identification** S. G. Shahidi, S. N. Pakzad [Lehigh University, USA]
10:20 ~ 10:40	**Detecting Damage on Wind Turbine Bearings Using Acoustic Emissions and Gaussian Process Latent Variable Models** R. Fuentes[1], T. Howard[1], M. B. Marshall[1], E. J. Cros[1], R. Dwyer-Joyce[1], T. Huntley[2], R. H. Hestmo[3] [1) University of Sheffield, UK; 2) Ricardo Ltd, UK; 3) Kongsberg Maritime AS, UK]
10:40 ~ 11:00	**Susceptibility on the Strain Field Change as Function of the Coupling Between the Effect Produced by Damage Appearance and the Change in the Load Conditions** J. Sierra-Pérez[1], M. A. Torres-Arredondo[2], A. Güemes[3] [1) Universidad Pontificia Bolivariana, Colombia; 2) MAN Diesel & Turbo SE, Germany; 3) Universidad Politécnica de Madrid, Spain]
11:00 ~ 11:20	**Aircraft Composite Structure Preventive Maintenance** L. D. Cot[1], S. Mukherjee[2], M. Melgar[1], R. Ganguli[2] [1) Institut Clément Ader, Université de Toulouse, France; 2) Indian Institute of Science, India]
11:20 ~ 11:40	**Peaks Over Threshold Method for Structural Health Monitoring Detector Design** O. Hmad, N. Mechbal, M. Rebillat [Arts et Métiers ParisTech, France]
11:40 ~ 12:00	**Remaining Useful Life Estimations Using Acoustic Emissions** S. Rajaram[1], U. Guclu[1], P. Abraham[2], S. Esola[1], A. Kontsos[1] [1) Drexel University, USA; 2) Corning Incorporated, USA]

Vibration-Based SHM I

Chair: W. K. Chiu (Monash University) ***Co-chair:*** H. Y. Noh (Carnegie Mellon University) **Location: 420-040**

TIME	THURSDAY, SEPTEMBER 3
10:00 ~ 10:20	**Rail-Infrastructure Monitoring through the Dynamic Response of a Passing Train** G. Lederman, H. Y. Noh, J. Bielak [Carnegie Mellon University, USA]
10:20 ~ 10:40	**Comparing Three Derivative Discontinuities Detection Methods for the Localisation of Cracks in Beam-Like Structures** N. Corrado[1], C. Surace[1], L. Montanari[2], A. Spagnoli[2] [1) Politecnico di Torino, Italy; 2) Università di Parma, Italy]
10:40 ~ 11:00	**Experimental Evaluation of Vibration-Based Damage Identification Methods on a Composite Aircraft Structure with Internally-Mounted Piezo Diaphragm Sensors** J. Hwang[1], R. Loendersloot[2], T. Tinga[2] [1) National Aerospace Laboratory NLR, The Netherlands; 2) University of Twente, The Netherlands]
11:00 ~ 11:20	**Shock of Vibration-Based Technologies, Part I: Experimental Setup and Automated Identification** P. Olsen[1], M. K. Hovgaard[2], J. B. Hansen[1], A. Skafte[1], R. Brincker[1] [1) Aarhus University, Denmark; 2) Rambøll, Denmark]
11:20 ~ 11:40	**Impact Force Identification of Isogrid-Stiffened Panels Using Experimental Transfer Matrices** S. Atobe, H. Tanaka, H. Fukunaga [Tohoku University, Japan]
11:40 ~ 12:00	**Comparison on Identification and Damage Detection Methods Using Output-Only Measurement: Application to Bridge Monitoring During Scouring Test** C.-H. Loh, W.-T. Hsu, S.-F. Chen, C.-K. Chan [National Taiwan University, Taiwan]

SPECIAL SESSION

Guided Waves in Structures for SHM V

Chair: C. Schaal (UCLA) ***Co-chair:*** P. Hubert (McGill University) **Location: 420-041**

TIME	*THURSDAY, SEPTEMBER 3*
10:00 ~ 10:20	**Characterization of Guided Wave Propagation in a Composite Skin-Stringer Assembly** M. H. Sherafat[1], R. Guitel[2], N. Quaegebeur[1], L. Lessard[1], P. Hubert[1], P. Masson[2] [1) McGill University, Canada; 2) Université de Sherbrooke, Canada]
10:20 ~ 10:40	**Independent Component Analysis for Improved Defect Detection in Guided Wave SHM** J. Dobson, P. Cawley [Imperial College of Science, Technology and Medicine, UK]
10:40 ~ 11:00	**Scattering of the Symmetrical Edge-Guided Wave by a Small Edge Crack in an Isotropic Plate** B.S. Vien[1], N. Nadarajah[1], L.R.F. Rose[2], W.K. Chiu[1] [1) Monash University, Australia; 2) Defence Science & Technology Organisation, Australia]
11:00 ~ 11:20	**Analytical Investigation of the Interaction of Rayleigh and Lamb Waves at a Delamination-Like Discontinuity in a Thick Plate** C. Schaal[1], S. Zhang[2], H. Samajder[1], A. Mal[1] [1) University of California, Los Angeles, USA; 2) East China University of Science and Technology, China]
11:20 ~ 11:40	**Phased Array Quantitative Imaging of Fatigue Cracks Based on Linearly Dispersive Signal Construction** J. Cai[1], S. Yuan[1], X. P. Qing[2] [1) Nanjing University of Aeronautics and Astronautics, China; 2) Beijing Aeronautical Science and Technology Research Institute of COMAC, China]
11:40 ~ 12:00	**Towards Passive Guided Wave Tomography of Extended Defects Using Ambient Elastic Noise Cross-Correlations** T. Druet[1], M. Jules[1], B. Chapuis[1], G. Laffont[1], E. Moulin[2] [1) CEA, France; 2) University of Valenciennes, France]

System Identification II

Chair: F. Dotta (Embraer) ***Co-chair:*** C. Surace (Politecnico di Torino) **Location: Hewlett 201**

TIME	*THURSDAY, SEPTEMBER 3*
14:00 ~ 14:20	**An Approach in Dynamic Monitoring Using Long-gage Fiber Optic Sensors** K. Kliewer, B. Glisic [Princeton University, USA]
14:20 ~ 14:40	**Modal Analysis of a Full-Scale Four-Story Reinforced-Concrete Base-Isolated Building Subjected to Random and Simulated Earthquake Shake Table Excitations** P. Brewick[1], J. Hernandez[1], W. Elhaddad[1], E. Johnson[1], R. Christenson[2], E. Sato[3], T. Sasaki[3] [1) University of Southern California, USA; 2) University of Connecticut, USA; 3) NIED, Japan]
14:40 ~ 15:00	**Increasing the Efficiency of Blind Source Separation Methods for Improved Modal Parameter Estimation** P. Brewick[1], A. Smyth[2] [1) University of Southern California, USA; 2)Columbia University, USA]
15:00 ~ 15:20	**Damage Precursor Detection Using Nonlinear Dynamic Parameters and Micromechanics** E. Habtour[1], D. Cole[1], A. Dasgupta[2], M. Robeson[3] [1) US Army Research Laboratory, USA; 2) University of Maryland, USA; 3) Aviation Applied Technology Directorate, USA]
15:20 ~ 15:40	**Parametric Identification of a Cable-stayed Bridge under Earthquake Excitation Using LSE and Substructure Approaches** H. Huang, Y. Yang, L. Sun [Tongji University, China]

Civil Structures V

Chair: C.-P. Fritzen (University of Siegen) ***Co-chair:*** I. Oppenheim (Carnegie Melion University) **Location: Hewlett 102**

TIME	THURSDAY, SEPTEMBER 3
14:00 ~ 14:20	**Heterogeneous Data Fusion for Traffic-induced Excitation Identification of Truss Bridges** H. Sun; O. Buyukozturk [Massachusetts Institute of Technology, USA]
14:20 ~ 14:40	**Pulse Phase Thermography Inspection of Bond Defects in Environmentally Conditioned FRP-to-Concrete Specimens** N. Mabry, R. Seracino, K. Peters [North Carolina State University, USA]
14:40 ~ 15:00	**Embedding Numerical Models into Wireless Sensor Nodes for Structural Health Monitoring** K. Dragos, K. Smarsly, [Bauhaus University Weimar, Germany]
15:00 ~ 15:20	**Identifications of Structural State Parameters of Concrete Columns with Self-sensing Basalt-Fiber-Reinforced Polymer Bars** Z. Wu[1] , H. Huang[2] [(1) Ibaraki University, Japan; 2) Southeast University Southeast University, China]

SPECIAL SESSION
Monitoring and Health Management of High-speed Railways III

Chair: O. Lin (Hong Kong Polytechnic University) ***Co-chair:*** X. Chapeleau (IFSTTAR) **Location: Hewlett 103**

TIME	THURSDAY, SEPTEMBER 3
14:00 ~ 14:20	**Applications of Structural Health Monitoring on Intelligent High-Speed Trains** J. Liang, X. Deng [Csr Qingdao Sifang Co. Ltd, China]
14:20 ~ 14:40	**Some Techniques for the Performance Evaluation of Railway System** Chung-Yue Wang[1], Hsin-Chu Tsai[2], Hao-Lin Wang[1], R. Wang[3] [(1) National Central University, Taiwan; 2) China Engineering consultants, Inc, Taiwan; 3)National Center for Research on Earthquake Engineering, Taiwan]
14:40 ~ 15:00	**AET-based Pattern Recognition Technique for Rail Defect Detection** X. Liu[1], Y. Ni[1], W. Wu[1], Y. Pei[1], Y. Hou[2], D. Qin[2] [(1) The Hong Kong Polytechnic University, Hong Kong; 2) Southwest Jiaotong University Ralway Development CO.,LTD, China]
15:00 ~ 15:20	**Research on Fatigue Crack Detection of Rail Vehicle Axle Based on Acoustic Emission** X. Deng, G. Xu, S. Liu [Csr Qingdao Sifang Co. Ltd, China]

SPECIAL SESSION
Very dense arrays of sensors: 1D, 2D, and 3D distributed and quasi-distributed sensors III

Chair: T. Uhl (University of Science and Technology AGH)
Co-chair: C. L. Tsai (National Taiwan University) **Location: 380-380C**

TIME	THURSDAY, SEPTEMBER 3
14:00 ~ 14:20	**Damage Detection Using Smart Concrete Engineered with Nanocomposite Cement-Aggregate Interfaces** S. Gupta, J. Gonzalez, K. Loh [University of California, Davis , USA]
14:20 ~ 14:40	**Accurate Source Localization Using Highly Narrowband and Densely Populated MEMS Acoustic Emission Sensors** M. Kabir, H. Saboonchi, D. Ozevin [University of Illinois at Chicago, USA]
14:40 ~ 15:00	**Development of a Generalized Excitation Algorithm for Modeling Phased Array Acoustic Sensors Using Distributed Point Source Method** A. Vempati, V. Durgesh, R. Ahmad, [California State University, USA]
15:00 ~ 15:20	**Electrical Impedance Tomography-based Sensing Skin for Structural Health Monitoring** Milad Hallaji[1], A. Seppanen[2], M. Pour-Ghaz[1] [(1) North Carolina State University, USA 2) University of Eastern Finland, Finland]
15:20 ~ 15:40	**High-resolution Distributed Fiber-optic Monitoring of Composite Beams Production** Y. London[1], M. Silbiger[2], Y. Antman[1], L. Efraim[1], G. Adler[2], A. Zadok[1] [(1) Bar-Ilan University, Israel ; 2) Xenom Ltd., Israel]

SHM-based Structural Design

Chair: P. Foote (Cranfield University) ***Co-chair:*** A. Paleologue (CEA) **Location: 380-380D**

TIME	THURSDAY, SEPTEMBER 3
14:00 ~ 14:20	**SHM Enabled Design: Application to Damage Tolerance Design with Bonded, Composite Joints** P. Liddel, P. Foote [Cranfield University, UK]
14:20 ~ 14:40	**Design and Supply of a SHM Based Condition Assessment of Critical Structures System Using the Techniques of Corrosion and Stray Current Monitoring on the Cityringen Metro Project in Copenhagen** T. Gooderham, G. John [Intertek, UK]
14:40 ~ 15:00	**Design of a Corrosion Detection System for a Shelter Structure** T. Null[1], D.L. Parker[1] J. Vreuls[2] [1) AVNIK Defense, USA; 2) US Army Aviation & Missile Research, Development and Engineering Center, USA]
15:00 ~ 15:20	**Optimal Placement of Fiber Optical Sensors along Zero-strain Trajectories to Detect Damages in Thin-walled Structures with Highest Sensitivity** M. Schagerl, C. Viechtbauer, M. Schaberger [Johannes Kepler University Linz, Austria]
15:20 ~ 15:40	**Ultra-lightweight Composite Stiffened Panel Designed Based on SHM and Rapid Repair System** S. Minakuchi, K. Yokota, N. Takeda [The University of Tokyo, Japan]

SPECIAL SESSION

Acoustic Emission in Aerospace Applications II

Chair: C. Stolz (Airbus) ***Co-chair:*** D. Zarouchas (DELFT) **Location: 380-380F**

TIME	THURSDAY, SEPTEMBER 3
14:00 ~ 14:20	**Generic Methodology for Validating Acoustic Emission Structural Health Monitoring Installations** D. Gagar, P. Foote [Cranfield University, UK]
14:20 ~ 14:40	**Damage Identification Using Acoustic Emission Data Obtained from Large Composite Structures** J. Awerbuch[1], D. Ozevin[2], A. Khanolkar[3], T. Tan[1] [1) Drexel University, USA; 2) University of Illinois at Chicago, USA; 3) University of Washington, USA]
14:40 ~ 15:00	**Acoustic Emission Based Damage Characterization in Composite Plates Using Low-velocity Impact Testing** S. Kim, B. Uprety, D. Adams, V. J. Mathews, J. Harley [University of Utah, USA]
15:00 ~ 15:20	**Acoustic Emissions from Damage Mechanisms in Composites** B. Mills-Dadson[1], K. Asamene[1], T. Whitlow[1], M. Sundaresan[1] [1) NC A&T State University, USA; 2) University of Dayton Research Institute, USA]
15:20 ~ 15:40	**Strong Interference Denoising Method for the Multiple Damage Acoustic Emission Signals of the Aircraft Composite Structures** S. Dong, M. Yuan, L. Yu, B. Niu, Z. Jiao [Beihang University, China]

Diagnostics III

Chair: N. Salowitz (University of Wisconsin) ***Co-chair:*** K. Goebel (NASA) **Location: 380-380W**

TIME	THURSDAY, SEPTEMBER 3
14:00 ~ 14:20	**Autonomous Mobile Inspection System for Detecting Hidden Voids in LNG Carrier Triplex Bonding Layers** S. Lee[1], H. J. Lim[1], H. Sohn[1], W. Yun[2], E. Song[2] [1) Korea Advanced Institute of Science and Technology, Korea; 2) Hyundai Heavy Industries Co. Ltd. Korea]
14:20 ~ 14:40	**Evaluation of Multiple Damage-Mode Models for Prognostics of Carbon Fiber-reinforced Polymers** M. Corbetta[1], A. Saxena[2], M. Giglio[1], K. Goebel[2] [1) Politecnico di Milano, Italy; 2) NASA Ames Research Center, USA]
14:40 ~ 15:00	**Composite Diagnostics with Use of Embedded PZT Transducers—A Smart Structure Example** K. Dragan, M. Dziendzikowski, A. Kurnyta, M. Salacinski, A. Leski [Air force Institute of Technology, Poland]
15:00 ~ 15:20	**A Validation Study for a Crack-Detected Method by Intelligent Coating Under Operational Environment** M. Liu, L. Li, J. Sun, [1) Xi'an Jiaotong University, China; 2) Jinggong Group Corparation, China]
15:20 ~ 15:40	**Influence of Loading on the Near Field Based Passive Metamaterial in Structural Health Monitoring** V. G. M. Annamdas, C. K. Soh [Nanyang Technological University, Singapore]

SPECIAL SESSION

SHM within Harsh Extreme Environments II

Chair: R. Werlink (NASA) ***Co-chair:*** D. Senesky (Stanford University) **Location: 380-380X**

TIME	THURSDAY, SEPTEMBER 3
14:00 ~ 14:20	**Clustering of Vehicular Cable Tension of Cable-stayed Bridge Under Normal Operation Conditions** S. Wei, S. Li, H. Li, [Harbin Institute of Technology, China]
14:20 ~ 14:40	**Hypervelocity Impact Events – Who Cares?** S. Close[1], D. Heermann[2] [1) Stanford University, USA; 2) Invocon, Inc, USA]
14:40 ~ 15:00	**Early Warning System Development for Highway Bridge Scouring** K.-C. Chang[1], Y.-B. Lin[1], W.-T. Chou[2] [1) National Center for Research on Earthquake Engineering, Taiwan; 2) National Chiao Tung University, Taiwan]
15:00 ~ 15:20	**The Performance of a Surface-bonded PZT Sensor Based Rocket Tanks SHM System Under the Cryogenic Temperature Operating Environment** D. Gao, Z. Wu, Y. Zheng, L. Yang [Dalian University of Technology, China]
15:20 ~ 15:40	**Consideration of Thermal Effects in Electro-mechanical Impedance Measurement for Space Structures** M. L. anderson[1], A. N. Zagrai[1], D. Doyle[2], D. Hengeveld[3], M. R. Wilson[3] [1) New Mexico Institute of Mining and Technology, USA, 2) AFRL Space Vehicles Directorate, USA; 3) LoadPath, USA]

SPECIAL SESSION

Probabilistic SHM VI

Chair: C. Papadimitriou (Univ. of Thessaly) ***Co-chair:*** L. Mujica (Universitat Politècnica de Catalunya) **Location: 380-380Y**

TIME	THURSDAY, SEPTEMBER 3
14:00 ~ 14:20	**A Data-driven Bayesian Ascent Method for Maximizing Wind Farm Power Production** J. Park[1], S. Kwon[2], K. H.Law[1] [1) Stanford University, USA; 2) Chonbuk National University, Korea]
14:20 ~ 14:40	**Structural Damage Detection Using Extended Kalman Filter Combined with Statistical Process Control in Nonlinear Systems** C. Jin, S. Jang, X. Sun [University of Connecticut, USA]
14:40 ~ 15:00	**Identification of Barely Visible Impact Damages on a Stiffened Composite Panel with a Probability-based Approach** M. M. Bonet[1], B. Eckstein[2], R. Loendersloot[3], P. Wierach[1] [1) German Aerospace Center, Germany; 2) Airbus, Germany; 3) University of Twente, Netherlands]
15:00 ~ 15:20	**Leak Detection and Localization on Hydrocarbon Transportation Lines by Combining Real-time Transient Model and Multivariate Statistical Analysis** L. E. Mujica[1], M. Ruiz[1], J. M. Mejia[2] [1) Universitat Politècnica de Catalunya, Spain; 2) Universidad Nacional de Colombia, Colombia]
15:20 ~ 15:40	**In-line Inspection of Pipelines by Using a Smart Pig (ITION) and Multivariate Statistical Analysis** M.Ruiz[1], L. E. Mujica[1], M. Quintero[2], S. Quintero[2], J. Flórez[2] [1) Universitat Politècnica de Catalunya, Spain; 2) Research Institute of Corrosion CIC, Colombia]

Vibration-based SHM II

Chair: J. Bielak (Carnegie Mellon University) ***Co-chair:*** F. Pozo (Universitat Politecnica de Catalunya) **Location: 420-040**

TIME	THURSDAY, SEPTEMBER 3
14:00 ~ 14:20	**Healing Assessment of Fractured Femur: Orthopaedic SHM** W. H. Ong[1], W. K. Chiu[1], M. Russ[2], Z. K. Chiu[1] [1) Monash University, Australia; 2) The Alfred Hospital, Australia]
14:20 ~ 14:40	**Long Sensor Layers for Machinery Monitoring** F. Li[1], J. Li[1], H. Chung[1], Cas Cheung[1], H. Kettunen[2], T. Pikanen[2], A. Kumar[1] [1) Acellent Technologies Inc., USA; 2) Valmet, Finland]
14:40 ~ 15:00	**Damage Detection in a Laboratory Model Using a Nonlinear Constraint Satisfaction Processor for Finite Element Model Updating** T. P. Kernicky, M. J. Whelan, U. Rauf, E. Al-Shaer [UNC Charlotte, USA]
15:00 ~ 15:20	**Detection of Stiffness and Mass Changes Separately Using Time Series Analysis with Output-only Vibration Data** N. T. Do, M. Gül [University of Alberta, Canada]
15:20 ~ 15:40	**Nonlinear Vibro-acoustic Interactions for Crack Detection in Beams** D. Broda[1], L. Pieczonka[1], V. Hiwarkar[2], W. J. Staszewski[1], V. V. Silberschmidt[2] [1) AGH University of Science and Technology, Poland; 2) Loughborough University, UK]

SPECIAL SESSION

Guided Waves in Structures for SHM VI

Chair: C. S. Kabban (Air Force Inst. of Technology) ***Co-chair:*** F. Wu (Shanghai Jiao Tong Univeristy) **Location: 420-041**

TIME	THURSDAY, SEPTEMBER 3
14:00 ~ 14:20	**A Finite Wavelet Domain Method for the Rapid Simulation of Wave SHM Systems in Composite Plate Strips for Impact and Damage Detection** N. Christos, T. theodosiou, C. Rekatsinas, D. Saravanos [University of Patras ,Greece]
14:20 ~ 14:40	**Modal Based Damage Indicators for Monitoring of Delamination and Disbond in Composite Structures Using Linear Array Transducers** B. Ren, C. J. Lissenden [The Pennsylvania State University, USA]
14:40 ~ 15:00	**Quantitative Characterization of the A0 Scattered Field Due to Edge Delamations as a Function of the Through Thickness Position** N. Nadarajah[1], B.S. Vien[1], L.R.F. Rose[2], W.K. Chiu[1] [1) Monash University, Australia; 2) Defence Science & Technology Organisation, Australia]
15:00 ~ 15:20	**Practical Evaluation of SHM Damage Detection Under Complex Environmental Conditions Using Receiver Operating Characteristics** C. Liu, J. Dobson, P. Cawley [Imperial College, UK]
15:20 ~ 15:40	**Application of the PCA to Guided Ultrasonic Waves to Evaluate Tensile Stress in a Solid Rod** J. Q. Méndez[1], R. V. Mejía[1], J. L. Q. Pineda[1], L. E. Mujica[2], M. Ruiz[2] [1) Universidad Industrial de Santander, Colombia; 2) Universitat Politècnica de Catalunya, Spain]

Poster Session

Poster Session
(Display starts at 10:10, Q&A Session : 12:10 ~ 14:00)
Location: The Oval

TIME	WEDNESDAY, SEPTEMBER 2
12:10 ~ 14:00	**Internal Strain Monitoring of Composite Materials with Microstructed Optical Fiber Bragg Grating Sensors** C. Sonnenfeld[1], G. Luyckx[2], S. Sulejmani[3], T. Geernaert[3], S. Eve[4], F. Berghmans[3], M. Gomina[4] [1) ONERA, France; 2) Universiteit Gent, Belgium; 3) Vrije Universiteit Brussel, Belgium; 4) Université de Caen Basse-Normandie, France]
12:10 ~ 14:00	**Feasibility of a Guided Wave-based SHM Technique for Stiffeners Disbond Detection** B. Lamboul, J. Bue, D. Osmont [ONERA, France]
12:10 ~ 14:00	**Embedded Interface Debonding Detection for an Irregular Complex Multi-chamber Steel Reinforced Concrete Column with PZT Impedance** B. Xu[1], Z. Shu[1], S. J. Dyke[2] [1) Hunan University, China; 2) Purdue University, United States]
12:10 ~ 14:00	**Integrated FBG Sensor Responses and Full Field Thermo-elastic Stress Approach to Monitor Damage Accumulation in Glass Fibre Reinforced Composite Plates** A. Kakei[1], J. A. Epaarachchi[1], N. Rajic[2], J. Leng[3], M. Islam[1], G. Kahandawa[4] [1) University of Southern Queensland, Australia; 2) Defence Science & Technology Organisation, Australia; 3) Harbin Institute of Technology, China; 4) Federation University, Australia]
12:10 ~ 14:00	**Damage Imaging of Aircraft Composite Structure Based on 2-D Cruciform PZT Array and Spatial-Wavenumber Filters** L. Qiu, S. Yuan, B. Liu [Nanjing University of Aeronautics and Astronautics, China]
12:10 ~ 14:00	**40 KM Reach Distributed FBG Sensing System for Oil and Gas Pipeline, Railway and Subway, and Geological Features** H. Hung [Optilab, USA]
12:10 ~ 14:00	**An Abnormal Detection Analysis for Shield Tunnel SHM Based on Fuzzy Cluster Method** F. Zhou, W. Zhang, K. Sun, B. Shi [Nanjing University, China]
12:10 ~ 14:00	**Investigation of Ultrasonic Feature Guided Waves for the Monitoring of Structural Bends** X. Yu[1], P. Manogharan[2], Z. Fan[1], P. Rajagopal[2] [1) Nanyang Technological University, Singapore; 2) Indian Institute of Technology Madras, India]
12:10 ~ 14:00	**Damage Localization in Composite Lattice Truss Core Sandwich Structures Based on a Curvature Mode Shape** B. Li, J. Zhou, K. Feng, Z. Li [Peking University, China]
12:10 ~ 14:00	**A Novel Probabilistic Diagnostic Algorithm-Based Damage Localization for Aluminum Plates with Non-uniform Sections** J. Zhao[1], X. Miao[2], F. Li[1], H. Li[1] [1) Shanghai Jiao Tong University, China; 2) Shanghai Electro-Mechanical Engineering Institute, China]
12:10 ~ 14:00	**A Framework for Damage Tolerance and Optimization of Stiffened Panels** M. Jrad[1], S. B. Mulani[2], R. K. Kapania[1] [1) Virginia Polytechnic Institute and State University, USA; The 2) University of Alabama, USA]
12:10 ~ 14:00	**Long-term Dynamic Response of Hagia Sophia in Istanbul to Earthquakes and Atmospheric Conditions** E. Çakti, E. Dar [Boğaziçi University, Turkey]
12:10 ~ 14:00	**An Explicit Time Domain Spectral Finite Element for Guided Wave SHM in Composite Plate Strips with Physically Modelled Active Piezoelectric Sensors** C. Rekatsinas, T. Theodosiou, D. Saravanos [University of Patras, Greece]
12:10 ~ 14:00	**A Gyroscope Free Inertial Measurement Unit for Human Gesture Recognition and Applications: A Preliminary Study** Y. Yang, D.-L. Chow, X. Yu [Case Western Reserve University, USA]
12:10 ~ 14:00	**Conductive Polymer-based TDR Sensing Ice Accretion for Wind Turbine Blade** Q. Gao[1], M. Kelley[2], X. Yu[1] [1) Case Western Reserve University, USA; 2) Texas A&M University, USA]
12:10 ~ 14:00	**Towards a Population-based SHM: A Case Study on an Offshore Wind Farm** E. Papatheou[1], N. Dervilis[1], E. A. Maguire[2], I. Antoniadou[1], K. Worden[1] [1) University of Sheffield, UK; 2) Vattenfall Research & Development, UK]
12:10 ~ 14:00	**Scour Genius: Monitoring Scour Effects on Structures** S. Schorn, B. Kroely [Advitam Inc., United States]

12:10 ~ 14:00	**Multifunctional Magneto-Au/mSiO$_2$ Core-shell Nanoparticles for Advanced Theranostics: Synthesis and Modeling** Y. Wang, P. Smith, M. Yuan [State University of New York, Stony Brook, USA]
12:10 ~ 14:00	**Structural Health Monitoring Applications of Ultrasonic Surface Wave Generating Inter-digital Transducer (IDT)** J. K. Na[1], T. Kang[2] [1) Wyle Laboratories Inc., USA; 2) Korea Atomic Energy Research Institute, Korea]
12:10 ~ 14:00	**Application of Strutural Health Monitoring System for Long-span Cantilever Steel Truss Bridges** T. Miyashita, E. Iwasaki, M. Nagai, D. G. Garcia [Nagaoka University of Technology, Japan]
12:10 ~ 14:00	**Evaluation of the Performance of an Energy Harvesting Chain Based on Piezopolymer Sensors** N. A. Chrysochoidis[1], E. Gutierrez[1], G. Renaldi[2] [1) European Commission, Italy; 2) European Laboratory of Structural Assessment, Italy]
12:10 ~ 14:00	**Monitoring Manufacturing of Composites Using Embedded Distributed Optical Fibre Sensors** D. M. Sanchez, M. Gresil, C. Soutis [University of manchester, UK]
12:10 ~ 14:00	**Application and Prospect of Fiber Bragg Grating Sensing Technology in Structural Health Monitoring of High-speed Train** S.-Q. Liu, W.-J. Wang, L. Ma, Z.-Y. Ju [CSR Qingdao Sifang Co. Ltd, China]
12:10 ~ 14:00	**Research Progress in Structural Health Monitoring of Axle Box Bearings in Highspeed Train** J.-Y. Liang, H.-T. Li, L. Ma [CSR Qingdao Sifang Co. Ltd, China]
12:10 ~ 14:00	**Application of Electromagnetic Acoustic Emission on an Aluminum Plate with Crack** F. Long[1], D. Ozevin[2], L. Li[1] 1) Northeast Petroleum University, China; 2) University of Illinois at Chicago, US]
12:10 ~ 14:00	**Structural Identification of Large Finite Element Models Using Commodity Computing Clusters for Parallel Genetic Algorithms** M. J. Whelan, T. P. Kernicky, N. S. Zamudio [UNC Charlotte, United States]
12:10 ~ 14:00	**Virtual Fatigue Test Method for the Fatigue Life Prediction of Welded Structure in Railway Vehicle Based on the Virtual Strain Gauge Technology** W.-Z. Zhao, J. Fang, J.-T. Li, S-Q. Ma, S.-L. Liang, X.-Z. Mi, F. Wang [Department of Railway Transportation Engineering, China]
12:10 ~ 14:00	**Dynamics Analysis and Controller Design of a Quadrotor-based Wall-climbing Robot for Structural Health Monitoring** J.-U. Shin, D. Kim, S. Jung, H. Myung [Korea Advanced Institute of Science and Technology, Korea]
12:10 ~ 14:00	**Comparative Study of Two Hardware Development Boards for Implementation of PCA-based Algorithms in Structural Damage Detection** J. Camacho-Navarro[1], M. L. Ruiz[1], O. Perez-Gamboa[2], R. Villamizar-Mejia[2], L. E. Mujica[1] [1) Universidad Politecnica de Cataluña, Spain; 2) Universidad Industrial de Santander, Spain]
12:10 ~ 14:00	**A Combined Model-Based Identification and Model Validation Approach for Damage Identification** R. J. Madden, A. H. Pesch, J. T. Sawicki [Cleveland State University, United States]
12:10 ~ 14:00	**SHM-based Service Safety Evaluation of Dashengguan Bridge on Beijing-Shanghai High Speed Railway** Z. Shi, Q. Pu [Southwest JiaoTong University, China]
12:10 ~ 14:00	**Structural Safety Monitoring System for Intertidal Zone Wind Turbine Tower** M. Zhao[1], D. Tang[1], X. Shi[2], J. Zhang[2], Y. Liu[2] [1) Tongji University, China; 2) Shanghai Keming Construction Consultants. Co. LTD, China]
12:10 ~ 14:00	**A Design Strategy to Improve the Directivity of Wavenumber-Spiral Frequency-Steerable Acoustic Transducers** L. de Marchi, N. Testoni, A. Marzani [University of Bologna, Italy]
12:10 ~ 14:00	**Spread Spectrum Pulse Coding in Lamb Wave Inspections** L. de Marchi[1], A. Marzani[1], J. Moll[2], P. Kudela[3], M. Radzienski[3], W. Ostachowicz[3] [1) University of Bologna, Italy; 2) Goethe University of Frankfurt am Main, Germany; 3) Polish Academy of Sciences, Poland]
12:10 ~ 14:00	**Identification of Multi-impact Locations Using Metal-core Piezoelectric Fiber Rosettes** H. Wang, J. Qiu, H. Ji, C. Zhang, J. Zhao [Nanjing University of Aeronautics and Astronautics, China]
12:10 ~ 14:00	**Examples of Output-only Modal Identification Using Compressive Sensing Techniques** A. Zebadua[1], P.-O. Amblard[1], E. Moisan[1], O. Michel[1], M. Carmona[2], A. Paleologue[2], M. Billerès[2] [1) GIPSA-Lab, France; 2) CEA, France]
12:10 ~ 14:00	**Optical Fiber Sensors, MEMS Accelerometers and Acoustic-based Non-Destructive Technique: Three High-ends and Complementary Technologies for Advanced SHM Applications** M. Carmona, G. Laffont, M. Jules, B. Chapuis, A. Paléologue, M. Billères [CEA, France]

12:10 ~ 14:00	**Deferred Cost Savings for an Inventory of Bridges Using SHM** B. Westcott[1], D. Thomson[2] [1) Intelligent Structures Inc, USA; 2) University of Manitoba, Canada]
12:10 ~ 14:00	**Experimental Fabrication and Nondestructive Testing of Carbon Fiber Beams for Delaminations Using Embedded Terfenol-D Particles** J. Rudd[1], O. Myers[2] [1) Mississippi State University, USA; 2) Clemson University, USA]
12:10 ~ 14:00	**Ultrasonic Quantification of Volume Loss in Thick-Wall Components** P. Gong[1], T. R. Hay[2], D. W. Greve[1], W. R. Junker[3], I. J. Oppenheim[1] [1) Carnegie Mellon University, USA; 2) TechKnowServ Corporation, USA; 3) Consultant, USA]
12:10 ~ 14:00	**Cost Wise Readiness Enabled through Condition Based Maintenance Plus (CBM+)** J. Kennedy[1], J. Carter[2], M. Carter[3] [1) AMCOM, ALC, SSD, SOA, USA; 2) Aviation & Missile Research, Development & Engineering Center (AMRDEC), USA; 3) Modern Technology Solutions, Inc., USA]
12:10 ~ 14:00	**Assessing the Performance of a High Damping Rubber Bearing in Beyond-design Conditions** M. Domaneschi, L. Martinelli, F. Perotti, M. Tomasin [Politechnico di Milano, Italy]
12:10 ~ 14:00	**Research on Propagation of Guided Wave in Narrow Plate and Damage Detection** J. Qiu, F. Li [Shanghai Jiao Tong University, China]
12:10 ~ 14:00	**Study of Vibration Based SHM Technologies, Part IV: Localization Using Physical-based Methods** J. B. Hansen, M. K. Hovgaard, P. Olsen, A. Skafte, R. Brincker [1) Rambøll DK, Denmark; 2) Aarhus University, Denmark]
12:10 ~ 14:00	**Research on Merging Signal Processing Based on Mode Separation for PZT Performance** Y. Zhu, T. Mu, C. He [Nanjing University of Aeronautics and Astronautics, China]
12:10 ~ 14:00	**Structural Fatigue Capacity Assessment on Gearbox in the High-Speed Train Based on Dynamic Monitoring Data and Fatigue Evaluation System** X.-F. Li[1], J. Fang[1], S.-L. Liang[2], J.-J. Ma[2], M.-G. Li[2], S.-Q. Ma[1], W.-Z. Zhao[1] [1) Dalian Jiaotong University, China; 2) CNR Changchun Railway Vehicles Co.,Ltd., China]

SHM-in-Action

Hewlett Auditorium 200 (Tuesday, September 1st (15:30 – 17:30))

One of our highlighted events showcasing how Structural Health Monitoring works in practical applications. The session features demonstrations on a variety of SHM applications from many leading SHM companies and educational institutions. Participating organizations are listed in alphabetical order; a finalized schedule will be announced at the workshop.

Session Chair: C. Boller (Fraunhofer IZFP, Germany) & B. Glisic (Princeton University, USA)

8tree, LLC (USA)

8tree will demonstrate two different patented surface inspection products that perform Fastener-Flushness inspection and Dent-Mapping. The aerospace manufacturing and aircraft maintenance industries have begun broad adoption of these products in the manufacturing and shop-floor environments. These two SHM products are designed to empower the operator/mechanic to perform instant 'go/no-go' structural health inspections with reliably consistent results each time, every time. These products were previously featured in their prototype-stage at IWSHM 2013.

Acellent Technologies, Inc. (USA)

Acellent will present our proven end-to-end approach to design, manufacturing and deployment of SMART Layers solutions for applications ranging from aerospace to pipelines. We will showcase our capability for the complete gamut of damage detection - detection, localization, quantification/sizing and characterization. We will demonstrate (1) our IMGenie passive impact monitoring system to provide the location, force and time of impact events in real-time, (2) our ScanGenie active monitoring hardware with SHM Composite software and SMART Layer sensor network to detect, localize and quantify damage. Finally, we will introduce to you our new ³STAR HELPER² designed by Acellent!

Advitam, Inc. (USA)

Structural health monitoring applications are often discussed but rarely shown in use. This demonstration will utilize a structural model to help the audience visualize how various sensor types can be used to collect live information on a structure. In addition to viewing real time movements and numerical data for vibration and strain, graphical representations can be produced automatically to provide a visual of the phenomena acting on the bridge. An alert system can also be implemented in case of critical responses and will be demonstrated.

Ambher Monitoring Systems, LLC. (MEX & USA)

Our application consists of a web interface that allows you to monitor civil structures such as buildings, offshore structures and bridges in a very simple way. We design each SHM system according to the clients' needs based on complexity of the structure and the client requirements. Our goal is to offer a cost effective solution with budgets under $1,000 USD per month that include the web interface and the sensors lease.

AVNIK Defense Solutions, Inc. (USA)

AVNIK has a track record of applying an optimal-sensor-placement-strategy to structures, and is tasked with designing a Structural Health Monitoring (SHM) system for damage detection and localization. In this presentation, AVNIK is partnered with the US Army to pull in on-platform sensor parametric readings and performs a series of calculations to conduct localization of the damage that was detected. The damage location information is mapped onto a 3D finite element model (FEM) of the subject structure being analyzed. The FEM model is displayed with a heat map highlighting where damage is located. Users have the freedom to change the orientation view of the FEM model to more accurately identify the damage location. The advantage of our localization technology is an automated system to 'see' hidden damage behind a structure without tearing the platform apart.

Columbia University, Civil Engineering and Engineering Mechanics Department (USA)

A crowdsourcing-based, SHM-oriented smartphone application, namely, Citizen Sensors for SHM (CS4SHM) is demonstrated. The demonstration includes vibration measurement from a small-scale structural model, wireless data submission to the web server, and viewing the identification results online. CS4SHM enables users to collect vibration data from smartphone sensors, extract the time history in text format, and submit the data via a web view connected to an online server. The vibration time history received by the server is automatically processed from the time to the frequency domain via Discrete Fourier Transform (DFT). In this way, the server determines the peak frequency and stores the results as well as the raw input data for further post-processing uses. Monitoring the modal identification results over time allows users to notice changes in dynamic characteristics of a structure.

IN-DEUS (IND & GER)

Within the Indo-German IN-DEUS project we are establishing a simulation platform for the design of optimized ultrasonics based SHM-systems for any arbitrary structural components. Starting from a CAD design and loads applied, stresses and strains are simulated, fatigue damage including the locations where cracks will start to initiate and propagate are determined, and a conventional NDT process can be simulated as an option. Finally any transducer network can be placed by simulation around a crack to be monitored on the structural component considered and the behaviour of the resulting SHM system can be simulated in real time.

Kinemetrics Open Systems & Services (USA)

Our demonstration consists of a short presentation describing the recently completed commercial project on implementation of an Emergency Management and Business Continuity Plan for two iconic buildings in Dubai; Dubai World Trade Center and Burj Khalifa. To illustrate the process, a 1/300 scale of the Burj Khalifa is instrumented and excited by a small shake table while real-time data processing and live display is presented, capped off with the automatic generation of SAFE Report; the key tool that bridges the gap between SHM technology/data and non-technical decision makers. Our objective is to empower onsite personnel to confidently recognize potentially unsafe conditions, make rapid safety assessments, and ultimately make the right decisions on evacuation and re-entry.

Luna (USA)

Luna Innovations' ODiSI product platform uses high definition fiber optic sensing (HD-FOS) to make real time strain and temperature measurements. The advanced capabilities of the ODiSI will be demonstrated with a single telecom grade optical fiber that is both surface bonded and embedded in a carbon fiber composite panel. Strain data is collected every 625 microns along the fiber. As the carbon fiber beam is cantilevered, the full field strain profile shows higher strain gradients around rivet holes, demonstrating the ability to detect potential defects and failure points. Distributed data provided by the fiber shows tremendous detail about the composite structure. Mapping Luna's high resolution strain data onto a 3D model demonstrates the ability to HD-FOS for 3D visualization, FEA model comparison, detection of crack initiation and other damage not visible through inspection. Fibers embedded within the structure can also provide valuable information regarding residual strains.

Metis Design Corporation (USA)

The Metis Design Corporation (MDC) will demonstrate the capabilities of its latest MD7-Pro Digital SHM system on a complex aerospace structure. Both passive Acoustic Emission (AE) and active Guided Wave (GW) approaches will be shown for detection of impact events and damage on a composite bonded/bolted skin/spar configuration. PZT actuators and sensors bonded to spar will make use of beamforming algorithms to localize the damage in the skin, with all the hardware being bonded to the structure within lightweight digital nodes. This self-contain demonstration is representative of a system being developed for fielding in UAV structures.

National ICT Australia (NICTA) (AUS)

National ICT Australia (NICTA) have developed a large scale structural health monitoring system for the Sydney Harbour Bridge. The systems consists of 2400 sensors and uses several data analysis techniques including machine learning classifiers to monitor health of the structure. Research and development continues into both data driven predictive analysis and integration of data science with engineering numerical modelling analysis. The demonstration will be of the web based application user interface as used by the bridge asset manager.

Optilab, LLC (USA)

Optilab's demonstration will be 40KM Distributed FBG Sensing System for oil pipeline transport, railways, subways, geological events and seismology. The distributed sensing system will have a total of four Optilab rack-mountable FBG Sensor Interrogators (FSI) each with 18 channels to cover 40 km. Each FSI will have the capability to cover 10.8 km distance. The FSI covering the last 10 km will have a higher power SWL to achieve required signal to noise ratio and compensate the optical loss over the extended distance.

Resensys, LLC (USA)

The demonstration shows the most important features of Resensys SenSpot sensors, which is super fast and easy installation and high precision of SenSpot sensors in a live demo.

Smart Fibres, Ltd (UK)

Smart Fibres is developing a quasi-distributed acoustic emission monitoring system based on fiber Bragg gratings (FBGs). It offers very high sensitivity detection of acoustic noise at multiple points on a single optical fibre attached to or embedded within a structure. This provides a capability for detecting and locating matrix cracking in complex composite structures, or cracking of metallic welded structures. Other applications for the technology include flow monitoring, equipment condition monitoring, and leak detection. Unlike alternative piezo or fibre-laser based measurement approaches, the sensors are simple to install/embed and multiplex, the system can be ATEX certified for explosive atmospheres, and the equipment is suited to development for flight use. In this presentation, the sensing concept will be introduced, and a live demonstration will be made of the prototype system's ability to identify and locate miniature acoustic emission events.

Smart Structures and Systems (SSS) Lab (ROK)

Among various LNG carrier types, Mark III type membrane LNG carrier is one of the most popular LNG carrier types. The storage tank of LNG carrier is made of two-level barriers. The Primary barrier is made of stainless steel (SUS) and the secondary barrier, called triplex layer. During the installation of triplex layers, hidden air voids can be formed within bonding layer of the triplex. An autonomous mobile inspection system (AMIS) which can detect, locate and quantify hidden voids in triplex bonding layers using active lock-in thermography is presented.

Structures and Composites Laboratory, Stanford University (USA)

The Structures and Composites Lab (SACL) will demonstrate a novel “fly-by-feel” smart UAV wing technology with high-resolution state sensing and awareness capabilities. Micro-fabricated sensor networks, including piezoelectric, strain, and temperature sensors, are designed and embedded in the layup of a composite wing. Real-time signal processing and diagnostic algorithms are employed to accurately interpret the sensing data and identify the wing configuration and structural health state. A live video connection will be established with the Stanford wind tunnel and data from the wing will be collected and processed in real time. The designed software provides the wing configuration, stall and flutter monitoring and detection, and on-line active sensing SHM.

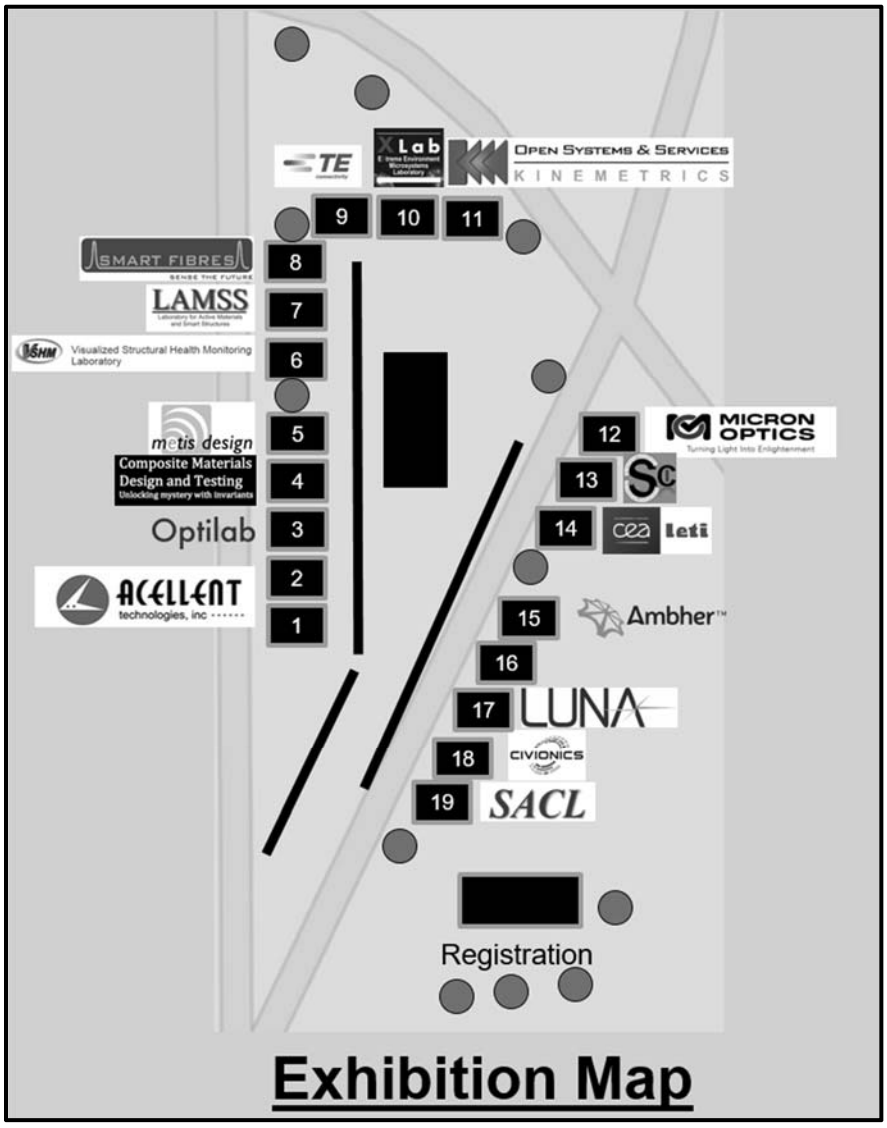
VCE Innovation Services (AUT)

The data collected by our monitoring systems are analysed for parameter extraction. In a next step key performance indicators are selected which are monitored online and in real-time. They form the basis for decision making after an event. The demonstration will show two applications. The first one is monitoring the pushing operation of a 33.000 ton steel bridge in Turkey with certain displacement thresholds. The second case is a bridge of the Taiwan High speed Railways where an earthquake has hit and was recorded by the permanent SHM system. The risk analysis identifies the hazard and automatically stops the train traffic in case those thresholds are exceeded. It is desired to open the line as quick as possible for which an online assessment based on monitoring data will be used.

Company & Institution Exhibition

Grove by the Oval (Tuesday (7:30 – 16:00) Wednesday & Thursday (7:30 – 16:30), September 1st – 3rd)

The Company & Institution Exhibition highlights the state-of-the art Structural Health Monitoring technologies provided by leading companies and institutions working in the field.



Exhibition Map – Oval, Stanford University

Ambher Monitoring Systems, LLC. (USA)
(Booth number 15)

Structural Health Monitoring solutions in the Americas with most of our work based in Mexico and Latin America.

Acellent Technologies, Inc. (USA)

(Booth number 1-2)

Acellent® Technologies Inc., provides state-of-the-art Structural Health Monitoring systems including SMART Layers®, diagnostic hardware, and software platforms. Acellent® systems can be used for active and/or passive monitoring of composite and metal structures. Our systems can either be on-board the structure or off-board. Acellent® products are currently used in several markets including aircraft, spacecraft, automobiles, and pipelines.

Civionics, LLC (USA)

(Booth number 18)

Civionics was established in 2009 to provide wireless sensing and embedded control solutions to the structural health monitoring community and beyond. Civionics' wireless acquisition hardware and intelligent processing architecture provides our customers with a scalable means with which to make intelligent decisions in real-time. We strive to use our experience building intelligent wireless systems for civil, naval, aerospace, and wind energy applications to create a safer and more efficient world.

XLab, Stanford University (USA)

(Booth number 10)

The EXtreme Environment Microsystems Laboratory (XLab) is a part of the Aero/Astro Department at Stanford University. We are focused on the development of micro- and nano-systems for operation within extreme harsh environments. Researchers in the XLab are investigating the synthesis of temperature tolerant, chemically resistant and radiation-hardened wide bandgap semiconductor thin films and nanostructures. These new material sets serve as a platform for the realization of sensor, actuator and electronic components that can operate and collect data under the most hostile conditions. More specifically, smart and adaptable structures for extreme environments are enabled through the technology developed in the XLab. Our research efforts support a variety of applications including deep space systems, hypersonic aircrafts, combustion monitoring and subsurface monitoring.

Kinemetrics Open Systems & Services (USA)

(Booth number 11)

Specializing in seismic and structural monitoring systems, our complete array of comprehensive services and systems are designed to protect human lives, capital assets, and critical infrastructure investments around the globe.

Metis Design Corporation (USA)

(Booth number 5)

The Metis Design Corporation (MDC) is a small technical consulting firm specializing in multi-disciplinary solutions for the defense & aerospace industry. Our focus over the last decade has been structural health monitoring (SHM) and multifunctional materials (such as CNT-based anti-icing). MDC has a diverse staff of engineers and a robust IP portfolio designed to deliver novel solutions for challenging real-life applications.

Micron Optics (USA)

(Booth number 12)

Micron Optics, Inc., is an established leader of innovative optical components and laser-based equipment that advance the quality of optical measurements, allowing the sensing, imaging and telecommunications industries to make the critical measurements they need.

Optilab (USA)

(Booth number 3)

Optilab, a photonics technology company, designs, manufactures and markets innovative and cost-effective laser and photonics solutions to its customer's systems. The innovative products include FBG Sensing Interrogator (FSI), FBG Analyzer, FBG's Qualification, and LIDAR products. The FBG sensor interrogators span 3 models: FSI-OEM is a compact, rugged, dynamic interrogator module designed for demanding aerospace applications while FSI-OD is a weather resistant, water proof interrogator system designed for demanding outdoor applications. The indoor, single 1U applications are carried out by FSI-RM with 18 channels, 10Hz to 2kHz sweep rate. The recent expansion in research and development facilities marks a milestone for Optilab.

Structures and Composites Lab, Stanford University (USA)

(Booth number 19)

Structures And Composites Laboratory (SACL) is in the Department of Aeronautics & Astronautics at Stanford University. The main focus of the group is to build intelligent and light-weight structures, with emphasis on structural health monitoring.

Simontic Composite, Inc. (USA)

(Booth number 13)

Innovators for the next generation composites. A leader in 3D braided and woven composites, complex shape high temperature carbon-carbon composites, fire resistant core materials. Simontic Composite creates and manufactures composite structures for application in aerospace, military, marine, automotive, infrastructures, transportations, biomedical and niche market needs. The capabilities include subsystem integration of composite structures, including sensors, radars, electronics and other systems to create a robust unitized structure.

Smart Fibres, Ltd (UK)

(Booth number 8)

Since the 1990's, Smart Fibres has been active with pioneering projects to introduce optical fiber sensing systems to many application areas. This work continues, both under our direct control, and through our growing network of international partners.

Luna (USA)

(Booth number 17)

Luna has developed high resolution, distributed measurement technology that has revolutionized strain and temperature sensing. Its unique fiber-optic technology offers a more complete and cost-effective way to measure strain using lightweight optical fiber as the sensing element. Measurements are distributed along the entire fiber, providing thousands of individual sensing points.

Composites Design Group (USA)

(Booth number 4)

Composites Design Group at Stanford University's Aeronautics & Astronautics offers online design workshops, publishes books and develops design tools for composites industry around the world. A brand new book on invariants greatly simplifies design and testing of composite materials will be on sale with a special price of US$80 for IWSHM. Books will be delivered onsite. Please come to our booth and examine the book and meet the senior author Stephen Tsai.

Visualized Structural Health Monitoring laboratory (USA)

(Booth number 6)

Visualized Structural Health Monitoring Laboratory

The Visualized Structural Health Monitoring laboratory is devoted to develop state of the art quantitative guided wave evaluation methods for various structural components, from aluminum to composite materials. Wavenumber analysis based on multidimensional Fourier transform has shown promising results in guided wave propagation characterization. The approaches based on wavefield measurements acquired from scanning laser Doppler vibrometer have been successfully demonstrated on laminated composite plates for quantifying the impact induced delamination defects, in addition to crack full dimension quantification in aluminum plates. Our research results have been adopted for aerospace, civil, and nuclear applications.

CEA LETI (FRA)

(Booth number 14)

DE LA RECHERCHE À L'INDUSTRIE cea leti

Leti is a Research & Technology Organization providing R&D services in the fields of microelectronics, micronanotechnologies and electronic systems. We run 8" and 12" wafer fabs for prototyping advanced devices (semiconductor, sensors, actuators) and we have system integration activities for various application sectors such as medical, transportation, telecommunication and smart buildings.

TE Connectivity (USA)

(Booth number 9)

TE connectivity

TE Connectivity/Measurement Specialties, Inc. Global manufacturing facility that design and manufacture highly engineered connectors, sensors and electronic components essential in our increasingly connected world, and turn key cable assembly.

Laboratory for Active Materials and Smart Structures (USA)

(Booth number 7)

LAMSS
Laboratory for Active Materials and Smart Structures

The research focus of LAMSS is on developing innovative sensor and enabling technologies for nondestructive evaluation (NDE) and structural health monitoring (SHM) of aerospace, mechanical, infrastructure, and civil structures. LAMSS conducts research in the multidisciplinary fields of piezoelectric wafer active sensors (PWAS), fiber Bragg grating sensors (FBG), scanning laser Doppler vibrometry (SLDV), smart adaptive and multi-functional materials, emerging nano-sensors, energy harvesting, and mechatronics. The research strength of LAMSS covers the fundamentals of active sensor interaction with engineering structures, analytical and numerical modeling of structural sensing and sensor data fusion and processing methods. The long-term vision is to achieve the integration of mechanical, electronics, and information technology into smart active “skins” and “coating” that will provide on-demand bulletins of structural health and predicted future performance. Combining comprehensive research in active sensor, SHM, and NDE, LAMSS teams up with government and industrial partners to provide state-of-the-art solutions that will meet the requirement of military and civilian applications.

Round Table Discussion of SHM in Aerospace

Hewlett Auditorium 200 (Tuesday, September 1st (09:10 – 10:10))

Paul Swindell (FAA), Eric Lindgren (AFRL), Matthias Buderath (Airbus),
Mark Davis (Sikorsky), Chris Davis (Boeing)

Specialists and experts from aerospace to discuss progress & challenges of SHM implementation in technology development, reliability, V&V, and certifications.

Faculty/Student Panel

Hewlett 201 (Thursday, September 3rd (12:00 – 13:30))

Moderator: C. Farrar (Los Alamos National Laboratory, USA)

The purpose of this session is to provide mentoring and guidance to students and early-career researchers and practitioners who are considering the further pursuit of a SHM-related career. The session is meant to be an open forum driven by the students and early-career participants' interests and concerns. A panel of senior researchers and practitioners will be present to provide their insight into questions raised by the participants. A moderator will attempt to promote wide participation while keeping the session focused on the students' and early-career participants' questions. Possible topics for discussion include: Emerging research topics in SHM, Starting a career in SHM, Entrepreneurial options for early career researchers, How do I find funding for SHM research? As well as any other topics of interest. In addition to providing mentoring and guidance, it is hoped that this session will promote more extensive technical exchanges and communication between workshop participants who are at different stages of their careers after the session has concluded.

*The panel is open for all participants of IWSHM 2013; students, early-career researchers and practitioners are particularly encouraged to attend and to actively discuss.

Lunch Box Mini Forum:
V&V/Standardization for Civil Infrastructure

Hewlett Auditorium 200 (Thursday, September 3rd (12:00 – 13:30))

Moderator: H. Wenzel (VCE, Austria)

The SHM community acknowledges the importance of codes and standards in accelerating the adoption of civil infrastructure SHM technologies. This Mini-Forum will focus on the review of existing standardization efforts and the discussion of current research trends towards SHM field deployment aiming to create a roadmap towards a globally harmonized approach to SHM code and standard development.

Panel Discussions:

SHM Basic Research Roadmap

Hewlett Auditorium 200 (Wednesday, September 2nd (16:00 – 17:30))

Panelists: Massimo Ruzzene (NSF), David Stargel (AFOSR), Ignacio Perez (ONR), Hoda Azari (DoE), Dan Inman (University of Michigan), Anne Kiremidjian (Stanford University)

Moderator: M. Ruzzene (Georgia Institute of Technology, USA)

SHM Emerging Applications Roadmap

Hewlett Auditorium 200 (Thursday, September 3rd (15:30 – 17:00))

Panelists: Liming Salvino (ONR Global), James Buczkowski (Ford), Clemens Bockenheimer (Airbus), Akira Kuraishi (Kawasaki), Fabio Casciati (University of Pavia)

Moderator: P. Rizzo (University of Pittsburg, USA)

SHM technology involves the use of sensor data to gain information on structural integrity for various applications. Maturing this technology for different market applications and filling in the gaps in the next few years remain issues to be addressed. What do we need to pursue as researchers, program managers, educators, and engineers to mature SHM?

A distinguished panel consisting of prominent researchers, educators, engineers, and program managers will share their views and exchange ideas with the audience in an effort to shape the roadmap of SHM for the next years. All workshop participants are welcome to attend the session.

Awards

SHM Lifetime Achievement Award

An individual in the SHM community who has championed SHM over their career by advancing the state-of-the-art through their meritorious accomplishments in research, applications, education or sponsorship of the discipline will be selected to receive the prestigious SHM Lifetime Achievement Award by a committee of researchers, educators and practicing scientists and engineers. **This award is sponsored by 'Boeing'.**

SHM Person of the Year Award

A structural health monitoring person of the year (SHM-POY) will be selected by the editors and associate editors of Structural Health Monitoring: An International Journal. The Person of the Year should have made an outstanding contribution to the field of SHM that will benefit society. This contribution can be in the form of theory, analysis, applications, education, or other ways that support the discipline of SHM and benefit society. The award is meant to recognize accomplishments within the past year or few years. **This award is sponsored by 'SAGE'.**

The Achenbach Medal

The Achenbach Medal has been created to recognize an individual (within 10 years of PhD) who has made an outstanding contribution to the advancement of the field of Structural Health Monitoring. It is an international award and nominations from all over the world are encouraged. **This award is sponsored by 'Embraer'.**

Best Paper Award

The SHM Best Paper Award is presented to one or more individuals whose paper(s) are selected to have the highest quality and innovation from the Proceedings of the 2015 IWSHM. The Award Committee is formed by all the Session Chairmen for this Workshop. They may propose among the articles from the sessions of their specialty, one or two papers which may be candidates for the Award, justifying their proposal. **This award is sponsored by 'Boeing'.**

Student Best Paper Award

The IWSHM organizing committee is pleased to invite students to submit abstracts for the 2015 IWSHM Student Best Paper Award Competition. Papers will then be evaluated by a committee of experts from academia, industry, and the research community. **This award is sponsored by 'DEStech Publications'.**

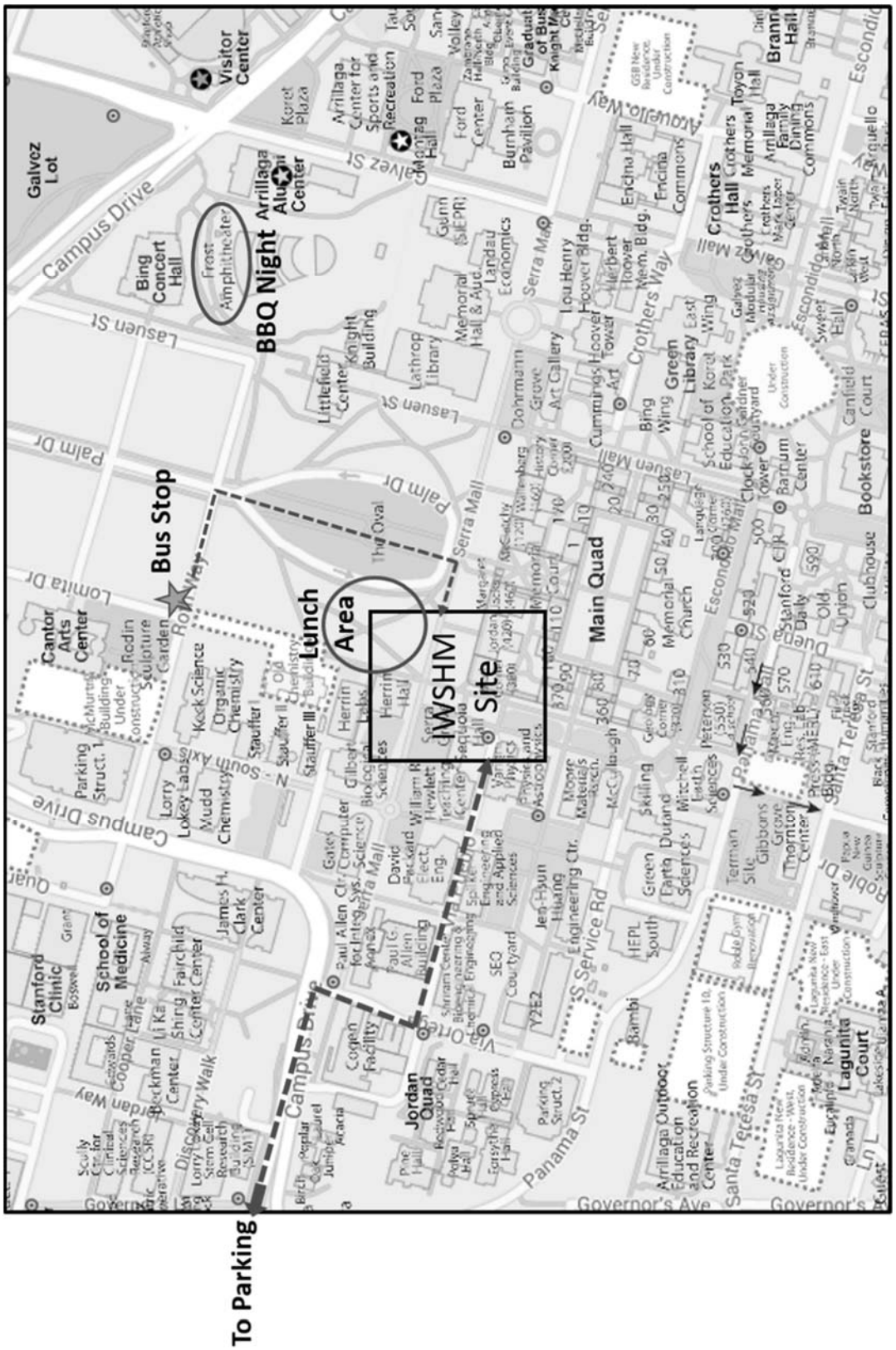
The Most Practical SHM Solutions for Aerospace Award

Airbus is proud to sponsor a prize for the "Most Practical SHM Solutions for Aerospace" to be demonstrated in SHM in Action. The session will be judged by a panel of representatives from industry and government. The prize will be awarded at the end of the session. **This award is sponsored by 'Airbus'.**

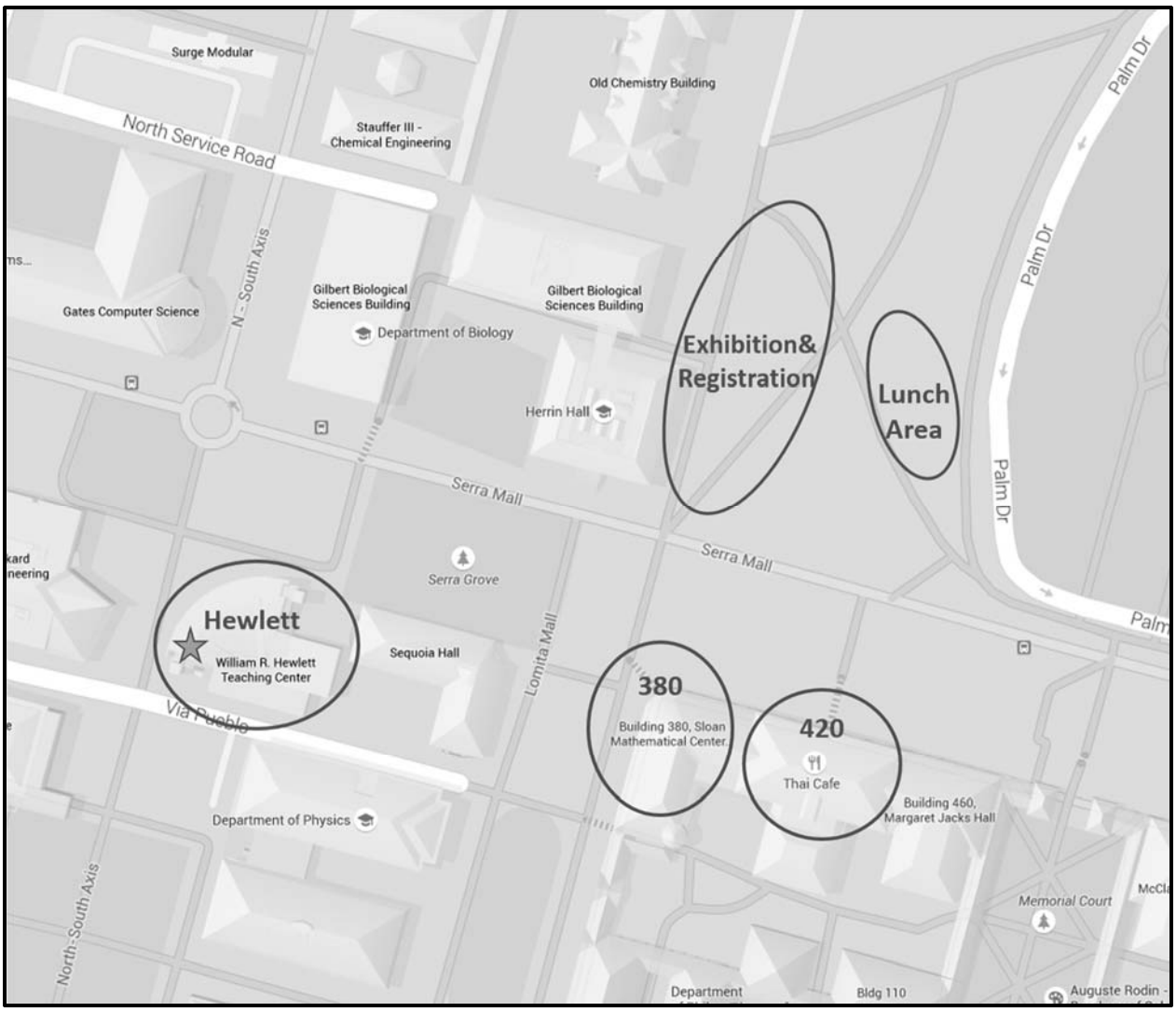
The Most Practical SHM Solutions for Civil/Mechanical Systems Award

Verizon will sponsor the Most Practical SHM Solution for Civil & Mechanical Systems to be demonstrated in the SHM in Action. The session will be judged by a panel of representatives from industry and government. The prize will be awarded at the end of the session. **This award is sponsored by 'Verizon'.**

Stanford Campus Map



Workshop Area Map



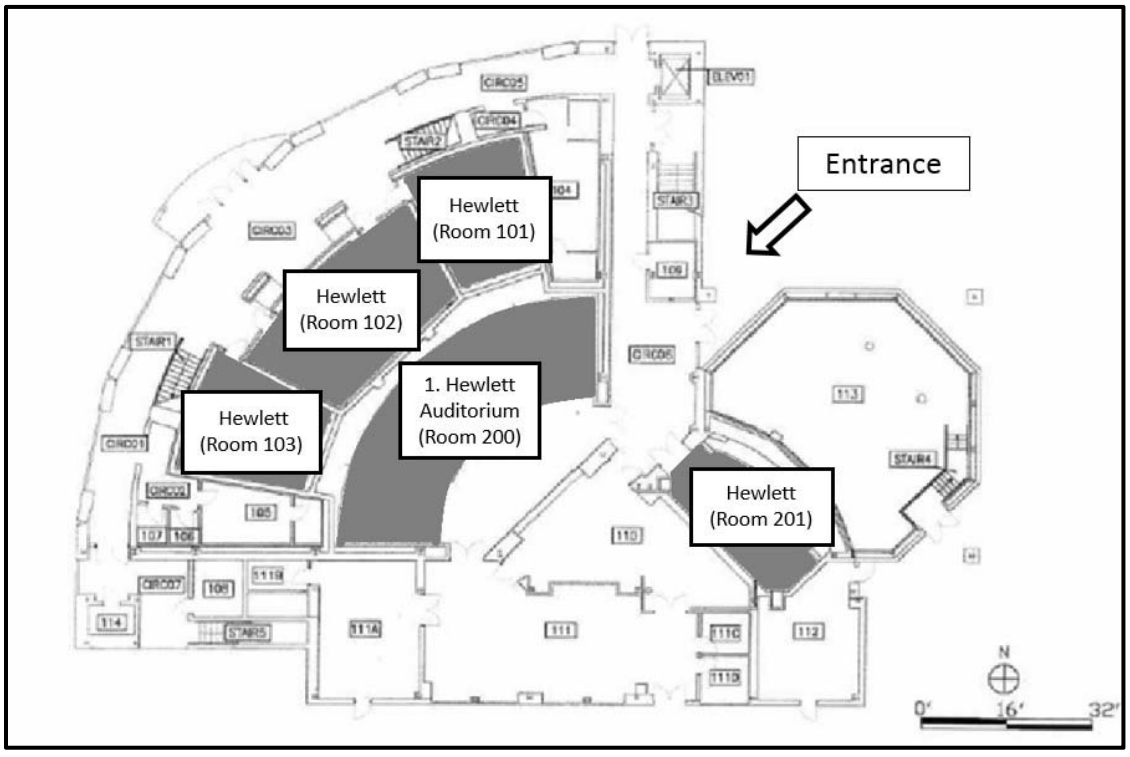
Workshop Locations

Stanford University Campus 450 Serra Mall, Stanford, CA, 94305

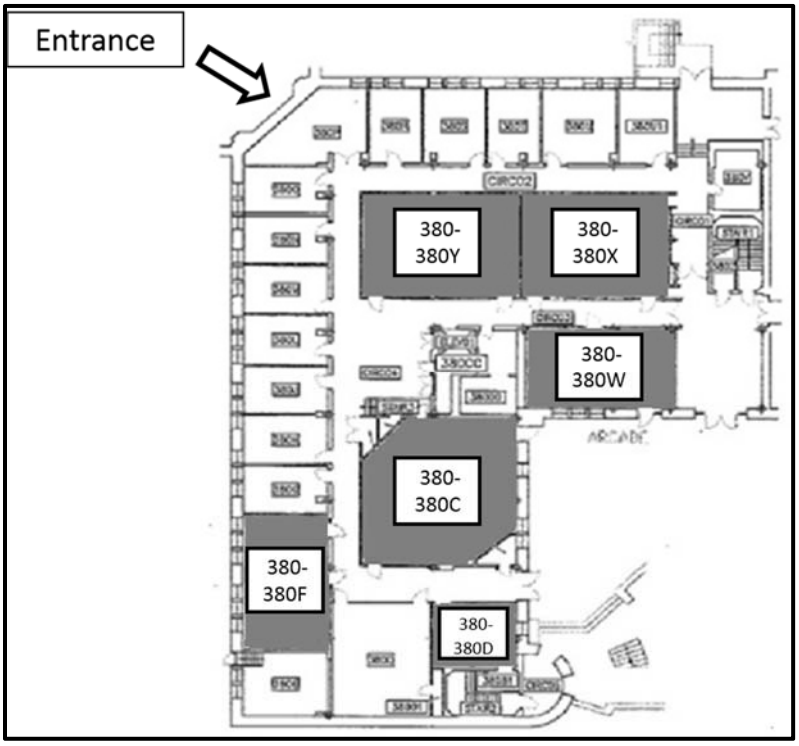
Hewlett Auditorium 200
Hewlett Rm 201
Hewlett Rm 101
Hewlett Rm 102
Hewlett Rm 103
380-380C
380-380D
380-380F
380-380W
380-380X
380-380Y
420-040
420-041
Grove by the Oval (Exhibition, Lunch & Registration)
Frost Amphitheater (BBQ/Welcome Night)

Crowne Plaza Hotel Cabana (Early Registration) 4290 El Camino Real, Palo Alto, CA, 94301
Crowne Plaza Hotel Cabana (Banquet and Award Night) 4290 El Camino Real, Palo Alto, CA, 94301

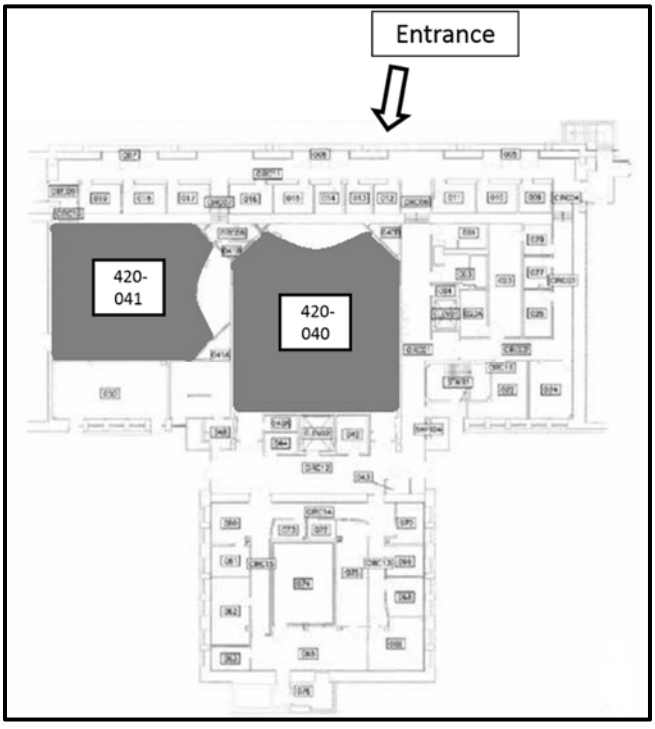
Hewlett Teaching: 1st & 2nd Floor



380: C/D/F/W/X/Y



420: Basement



Transportation

Driving Directions

From Highway 101 North & South

Exit onto Embarcadero Road and travel west, following the signs directing you to Stanford University. About three miles after you exit the freeway, Embarcadero Road becomes Galvez Street as you cross El Camino Real. Stay in the left lane and turn right onto Campus Drive. Follow Campus Drive for 1 mile. Turn right on Welch Road and then left on Oak Road. Parking Structure 5 will be on your left, please park on the roof level only.

From Highway 280 North & South

Exit onto Sand Hill Road and follow the signs for Stanford University. Heading east, drive approximately 2.5 miles. Turn right onto Stock Farm Road and then turn left onto Oak Road. Parking Structure 5 will be on your right, please park on the roof level only.

From Crowne Plaza Cabana, Creekside Inn

Take El Camino Real northeast and turn left at Page Mill Road. Move to the right lane and take a right turn on Junipero Serra Boulevard. Continue on Junipero Serra almost 2 miles until taking a right turn on Campus Drive (across from the Stanford Golf Course). Continue on Campus Drive until making a left turn on Stock Farm Road and then a right turn on Oak Road. Parking Structure 5 will be on your right, please park on the roof level only.

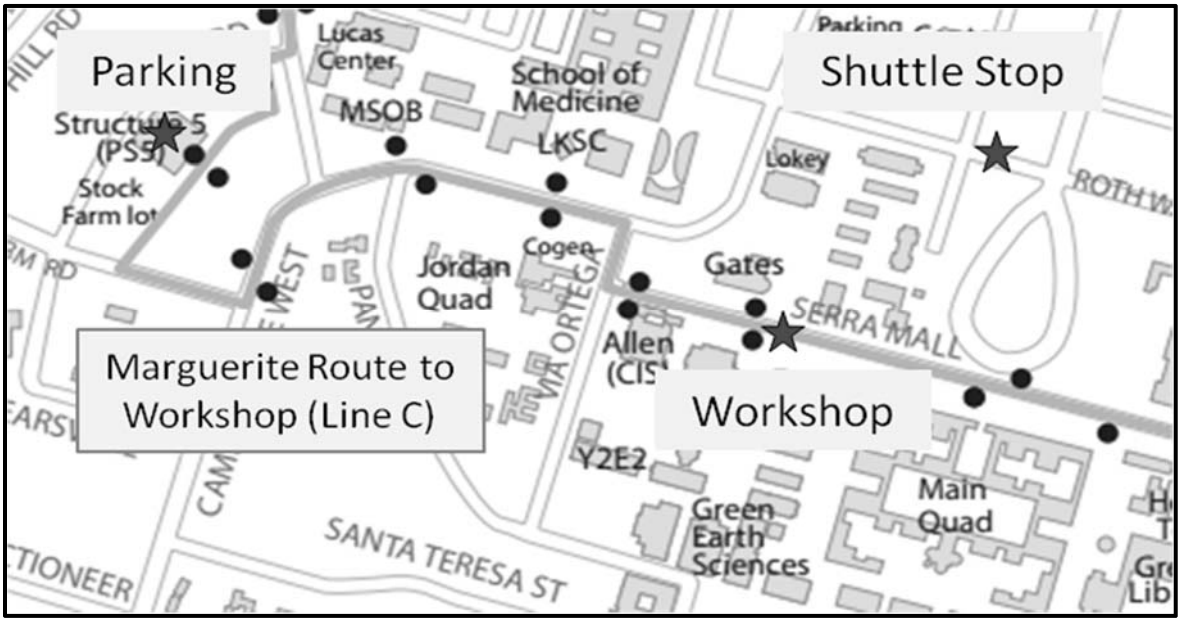
Parking Information

If you choose to drive to Stanford University campus, parking permits are available from the workshop registration table. As is typical for a college campus, parking is limited and you are highly encouraged to take the workshop shuttle (see Shuttle Information section). Please note that only cash and checks can be accepted as payment for on-campus parking.

For September 1-3, parking will be available on the TOP LEVEL only of PARKING STRUCUTRE 5. An IWSHM window sticker is required to park there. It covers all days and can be purchased for $15 at the registration desk or directly at the parking structure (Tuesday only). On Tuesday morning IWSHM staff volunteers will be at Parking Structure 5 and on the top level to sell permits. Volunteers will also be there to direct you to the free Marguerite C line shuttle stop right outside the parking structure, which can take you directly to the conference area if you do not wish to walk (refer to the parking map for more information). “A” parking permits will also be available for purchase for $15 per day. “A” parking spots are located all around campus and especially by the Oval (close to the workshop’s area).

Parking permits will be available at Early Registration on Monday, August 31 at the Crowne Plaza Hotel in addition to at the registration desk in front of the Hewlett Building September 1-3. Purchasing parking permits there is encouraged. Please note that only cash and checks can be accepted. In addition to the conference registration table, parking permits can be purchased at the Parking & Transportation Services office at 340 Bonair Siding (open 7:30am-5:00pm). Moreover, there are parking permit machines in several parking lots and structures across campus. Please refer to the Parking & Transportation website (http://transportation.stanford.edu) for more information.

Map of the Marguerite Route from the Parking to the Workshop

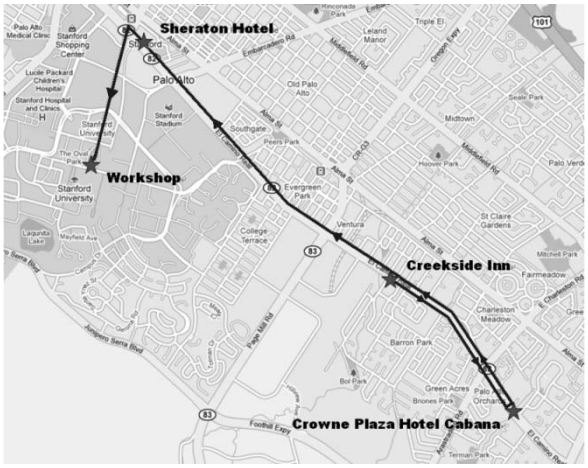


Shuttle Information

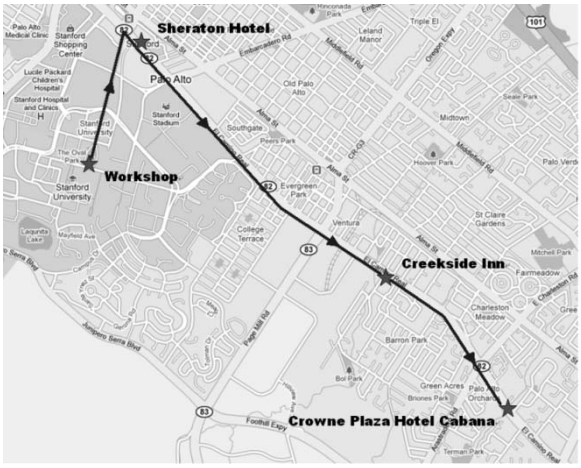
A complimentary shuttle service that connects all workshop locations is provided for all participants from September 1-3. Please refer to the following full schedule. Note that all shuttle buses will be taking circuitous routes, continuously driving to all stops listed on each section of the schedule. The stops for the shuttle are the following:

- **Stanford University Campus**
  - **Workshop: on Roth Way, at the top of the Oval**
  - **BBQ: intersection of Galvez St. & Memorial Way, near Frost Amphitheater**
- **The Sheraton Hotel (625 El Camino Real, Palo Alto, CA, 94301)**
- **Creekside Inn (3400 El Camino Real, Palo Alto, CA, 94301)**
- **Crowne Plaza Hotel (4290 El Camino Real, Palo Alto, CA, 94301)**

Shuttle Map (To Stanford University)



Shuttle Map (From Stanford University)



*Note: The schedule is subject to change. Please refer to the latest schedule available at the registration.

Shuttle Schedule

Tuesday, September 1st

ROUTE	BUS	CREEKSIDE INN	CROWNE PLAZA	SHERATON	WORKSHOP
Morning	IWSHM 1	6:15 AM	6:25 AM	6:45 AM	6:55 AM
	IWSHM 2	6:30 AM	6:40 AM	7:00 AM	7:10 AM
	IWSHM 3	6:45 AM	6:55 AM	7:15 AM	7:25 AM
	IWSHM 4	7:00 AM	7:10 AM	7:30 AM	7:40 AM
	IWSHM 1	7:15 AM	7:25 AM	7:45 AM	7:55 AM
	IWSHM 2	7:30 AM	7:40 AM	8:00 AM	8:10 AM
	IWSHM 3	7:45 AM	7:55 AM	8:15 AM	8:25 AM
	IWSHM 4	8:00 AM	8:10 AM	8:30 AM	8:40 AM
	IWSHM 1	8:15 AM	8:25 AM	8:45 AM	8:55 AM
	IWSHM 2	8:30 AM	8:40 AM	9:00 AM	9:10 AM

ROUTE	BUS	WORKSHOP	CREEKSIDE INN	CROWNE PLAZA	SHERATON	BBQ
Evening	IWSHM 1	5:20 PM	5:35 PM	5:45 PM	6:00 PM	6:15 PM
	IWSHM 2	5:40 PM	5:55 PM	6:05 PM	6:20 PM	6:35 PM
	IWSHM 3	6:00 PM	6:15 PM	6:25 PM	6:40 PM	6:55 PM
	IWSHM 1	6:20 PM	6:35 PM	6:45 PM	7:00 PM	7:15 PM
	IWSHM 2	6:40 PM	6:55 PM	7:05 PM	7:20 PM	7:35 PM
	IWSHM 3	7:00 PM	7:15 PM	7:25 PM	7:40 PM	7:55 PM

ROUTE	BUS	BBQ	CREEKSIDE INN	CROWNE PLAZA	SHERATON
Evening (After BBQ)	IWSHM 1	9:00 PM	9:15 PM	9:25 PM	9:40 PM
	IWSHM 2	9:15 PM	9:30 PM	9:40 PM	9:55 PM
	IWSHM 3	9:30 PM	9:45 PM	9:55 PM	10:10 PM
	IWSHM 1	9:45 PM	10:00 PM	10:10 PM	10:25 PM
	IWSHM 2	10:00 PM	10:15 PM	10:25 PM	10:40 PM
	IWSHM 3	10:15 PM	10:30 PM	10:40 PM	10:55 PM
	IWSHM 1	10:30 PM	10:45 PM	10:55 PM	11:10 PM

Wednesday, September 2nd

ROUTE	BUS	CREEKSIDE INN	CROWNE PLAZA	SHERATON	WORKSHOP
Morning	IWSHM 1	6:15 AM	6:25 AM	6:45 AM	6:55 AM
	IWSHM 2	6:30 AM	6:40 AM	7:00 AM	7:10 AM
	IWSHM 3	6:45 AM	6:55 AM	7:15 AM	7:25 AM
	IWSHM 4	7:00 AM	7:10 AM	7:30 AM	7:40 AM
	IWSHM 1	7:15 AM	7:25 AM	7:45 AM	7:55 AM
	IWSHM 2	7:30 AM	7:40 AM	8:00 AM	8:10 AM
	IWSHM 3	7:45 AM	7:55 AM	8:15 AM	8:25 AM
	IWSHM 4	8:00 AM	8:10 AM	8:30 AM	8:40 AM
	IWSHM 1	8:15 AM	8:25 AM	8:45 AM	8:55 AM

ROUTE	BUS	WORKSHOP	CREEKSIDE INN	CROWNE PLAZA	SHERATON	WORKSHOP
Evening (To Banquet at Crowne Plaza)	IWSHM 1	5:15 PM	5:30 PM	5:40 PM	6:00 PM	6:15 PM
	IWSHM 2	5:30 PM	5:45 PM	5:55 PM	6:15 PM	6:30 PM
	IWSHM 3	5:45 PM	6:00 PM	6:10 PM	6:30 PM	6:45 PM
	IWSHM 4	6:00 PM	6:15 PM	6:25 PM	6:45 PM	7:00 PM
	IWSHM 1	6:15 PM	6:30 PM	6:40 PM	7:00 PM	7:15 PM
	IWSHM 2	6:30 PM	6:45 PM	6:55 PM		
	IWSHM 3	6:45 PM	7:00 PM	7:10 PM		
	IWSHM 4	7:00 PM	7:15 PM	7:25 PM		
	IWSHM 1	7:15 PM	7:30 PM	7:40 PM		

ROUTE	BUS	CROWNE PLAZA	SHERATON	CREEKSIDE INN
Night (After Banquet)	IWSHM 1	10:00 PM	10:15 PM	10:30 PM
	IWSHM 2	10:15 PM	10:30 PM	10:45 PM
	IWSHM 3	10:30 PM	10:45 PM	11:00 PM
	IWSHM 1	10:45 PM	11:00 PM	11:15 PM
	IWSHM 2	11:00 PM	11:15 PM	11:30 PM
	IWSHM 3	11:15 PM	11:30 PM	11:45 PM
	IWSHM 1	11:30 PM	11:45 PM	12:00 AM

Thursday, September 3rd

ROUTE	BUS	CREEKSIDE INN	CROWNE PLAZA	SHERATON	WORKSHOP
Morning	IWSHM 1	6:20 AM	6:30 AM	6:50 AM	7:00 AM
	IWSHM 2	6:40 AM	6:50 AM	7:10 AM	7:20 AM
	IWSHM 3	7:00 AM	7:10 AM	7:30 AM	7:40 AM
	IWSHM 1	7:20 AM	7:30 AM	7:50 AM	8:00 AM
	IWSHM 2	7:40 AM	7:50 AM	8:10 AM	8:20 AM
	IWSHM 3	8:00 AM	8:10 AM	8:30 AM	8:40 AM
	IWSHM 1	8:20 AM	8:30 AM	8:50 AM	9:00 AM

ROUTE	BUS	WORKSHOP	CREEKSIDE INN	CROWNE PLAZA	SHERATON
Afternoon	IWSHM 1	4:30 PM	4:45 PM	4:55 PM	5:10 PM
	IWSHM 2	4:45 PM	5:00 PM	5:10 PM	5:25 PM
	IWSHM 1	5:15 PM	5:30 PM	5:40 PM	5:55 PM
	IWSHM 2	5:30 PM	5:45 PM	5:55 PM	6:10 PM

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