



Structural Health Monitoring 2007:

Quantification, Validation, and Implementation

Final Report - 07/01/08

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Submitted to:

Dr. Bruce LaMattina

Program Manager of Solid Mechanics
and

Dr. Gary Anderson

Program Manager of Structural Dynamics

US Army Research Office

P.O. Box 12211

Research Triangle Park, NC, 27709-2211

bruce.lamattina@us.army.mil

By

Fu-Kuo Chang

Department of Aeronautics and Astronautics

Stanford University, Stanford, CA 94305

fkchang@stanford.edu

Tel: 650 723-3466

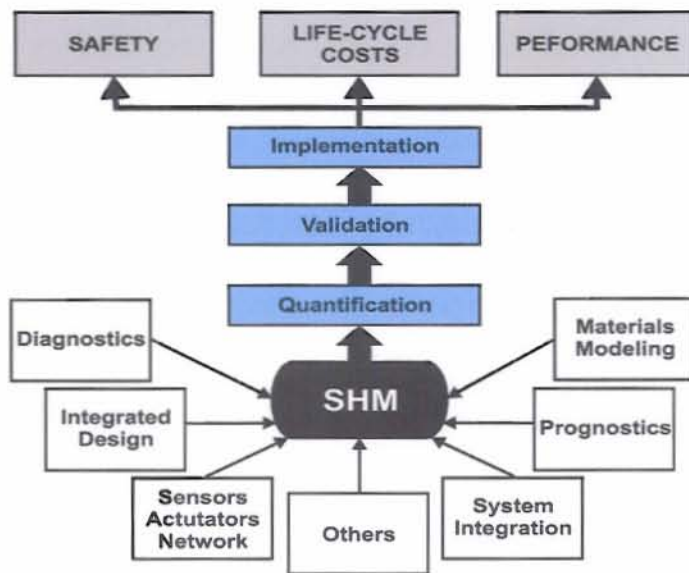
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Summary

Safety, performance and life cycle cost are the major concerns in the operation of structures that are in service, especially civil infrastructure and transportation. As demonstrated, structural health monitoring (SHM) provides a solution that addresses all these concerns. SHM technologies involve multi-disciplinary engineering and require in-depth developments from each engineering field as well as system-wide integration to optimize performance.

Since the first the International Workshop on Structural Health Monitoring (IWSHM) in 1997, the progress in the development of SHM technologies has advanced significantly as can be seen from the proceedings of the biennial meetings. More than 1000 papers in topics ranging from sensor and actuator design, sensor network communication, diagnostics, signal processing, prognostics, to integrated design and system integration have been presented and discussed extensively. Numerous prototypes and field trials were demonstrated and presented successfully, especially in the meetings of 2003 and 2005.

Although continuing the fundamental development of SHM is still very much needed and crucial for the advancement of SHM technologies, implementation of the current technologies for practical



applications is being widely considered and is in progress among the industrial and government sectors, especially in the aerospace and civil infrastructure industries. However, implementation of SHM technologies requires the integration of sensor/actuator networks with the structures, which makes the process very much different from that of traditional NDE or other inspection techniques. Appropriate SHM-system design procedures and validation methods must be developed to quantify the integrated system in order to assure the highest reliability and accuracy.

Therefore, the theme of the 6th International Workshop on Structural Health Monitoring is **“Quantification, Validation, and Implementation.”** Similar to the NDE community, the SHM community needs to work together to develop adequate quantification, validation and implementation procedures along with methodologies for SHM to lead to a successful implementation roadmap as shown in Figure 1. We hope that by the end of the 6th IWSHM workshop we will reach a fair assessment of the current SHM technology readiness in terms of quantification, validation, and implementation, and produce a consensus among the participating industries and government agencies on the need for standardized procedures and methodologies for SHM

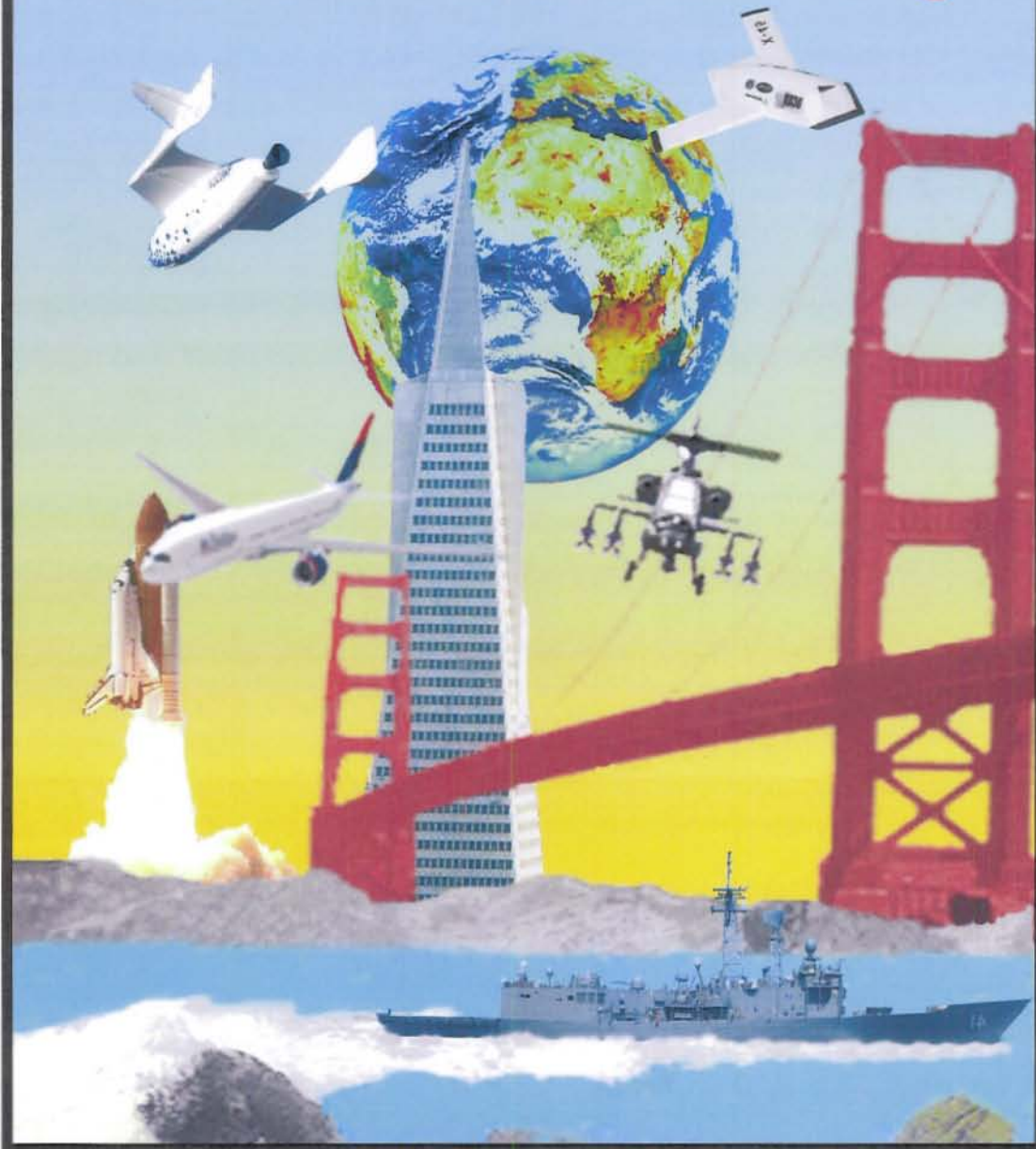
implementation, as well as the identification of key fundamental technology gaps for the research community to pursue.

The IWSHM proceedings of 2007 include not only the latest developments in key technology fields in sensor development, network design, signal processing, diagnostics, modeling and prognostics, system design, and applications in aerospace, civil infrastructures, machining, ground/offshore structures, marine structures, etc., but also include special sessions organized by experts in the fields on the following issues:

- Bio-inspired Sensor Networks by Akira Mita, Keio University, Japan
- Wave Propagation Models in Damage Assessment by Wieslaw Ostachowicz, Polish Academy of Science, Poland
- Emerging Sensing Technologies by Francesco Lanza di Scalea, UCSD, USA
- Ground and Air Vehicle Application by Doug Adam, Purdue University, USA
- Energy Harvesting by Dan Inman, Virginia Tech, USA
- Monitoring of Wind Energy Plants by Claus-Peter Fritzen, University of Siegen, Germany
- Civil Health Management by Emin Aktan, Drexel University, USA
- SHM for Structural Repair by Alfredo Guemes, Universidad Politecnica De Madrid, Spain
- HUMS for Rotorcraft Usage Credits by Dy D. Le, FAA
- Challenges and Lessons learned in SHM Applications by Mark Seaver, Naval Research Lab, USA
- Self-Diagnosis and Calibration Issues for SHM by J.B. Ihn, Boeing Company, USA
- Damage Quantification Methods for Aerospace Structures by J.B. Ihn, Boeing Company, USA
- Autonomic Structures by Dan Inman, Virginia Tech, USA

This workshop was co-sponsored by the Air Force Office of Scientific Research (Les Lee, Victor Giurgiutiu), the Army Research Office (Bruce LaMattina, Gary Anderson), the Office of Naval Research (Ignacio Perez, Shah Mahmood), and the National Science Foundation (Shih-Chi Liu). It was successfully organized and more than 400 people from around the world participated the meeting. A two-volume proceedings was produced. The topics and the workshop activities are outlined in the following:

The 6th International Workshop on Structural Health Monitoring



Stanford University, Stanford CA

September 11-13, 2007

<http://structure.stanford.edu/workshop>

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International Committee Members

Academia

D. Adams, Purdue University, USA
A. Emin Aktan, Drexel University, USA
C. Boller, University of Sheffield, United Kingdom
A. Braga, Rio Pontificia Universidade Catolica do Rio de Janeiro
F. Casciati, University of Pavia, Italy
F.K. Chang (Chairman), Stanford University, USA
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D. Inman, Virginia Tech, USA
A. Kiremidjian, Stanford University, USA
J. Ko, The Hong Kong Polytechnic University
C. Koh, National University of Singapore, Singapore
D. Thomson, University of Manitoba, Canada
A. Mita, Keio University, Japan
A. Mufti, Dalhousie University, Canada
W. Ostachowicz, Polish Academy of Sciences, Poland
J. Ou, Harbin Institute of Technology, China
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Z. Wu, Ibaraki University, Japan
C. Yun, KAIST, Korea
R. Zoughi, University of Missouri-Rolla, USA

Industry

S. Arms, Microstrain, USA
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P. Foote, BAE, UK
G. Gordon, Honeywell, USA
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S. Hyde, ATK, USA
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A. Kumar, Acellent Technologies, USA
H. Speckmann, Airbus, Germany

Government

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C. Farrar, Los Alamos National Laboratory, USA
S. Galea, DSTO Australia, Australia
V. Giurgiutiu, AFRL/AFOSR, USA
K. Jata, Air Force Research Laboratories, USA
B. Lamattina, Army Research Office, USA
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B.L. Lee, Air Force Office of Scientific Research, USA
S. Liu, National Science Foundation, USA
R. Livingston, Federal Highway Administration, USA
P. Lloyd, Defense Research Agency, United Kingdom
S. Mahmood, Naval Surface Warfare Center, USA
W. Prosser, NASA-Langley, USA
L. Richards, NASA-Dryden, USA
C. Sikorsky, California Department of Transportation, USA
O. Venta, VTT, Finland

The 6th International Workshop Structural Health Monitoring Stanford University 2007		Technical Program Overview					
10-Sep	Crowne Plaza Hotel Cabana						
14:00 ~ 17:00	Early Registration						
17:00 ~ 19:00	Reception						
11-Sep	Memorial Auditorium	Room 002	Room 034	Room 205	Room 203	Room 030	Room 305
07:00 ~ 08:00	Registration at Dohrman Grove, Light continental breakfast						
08:00 ~ 08:15	Opening Remarks						
08:15 ~ 09:05	Keynote Panel						
09:05 ~ 09:40	Keynote 1						
09:40 ~ 10:00	Coffee Break at Dohrmann Grove						
10:00 ~ 10:20	Aerospace, Aircraft, Rotorcraft, and Launch Systems: I	Civil Infrastructures, Offshore, Pipelines, and Power Plants: I	Signal Processing	Diagnostics: I	Modeling and Simulation: I	Special Session: Wave Propagation Models in Damage Assessment	Passive and Active Sensors for SHM: I
10:20 ~ 10:40							
10:40 ~ 11:00							
11:00 ~ 11:20							
11:20 ~ 11:40							
11:40 ~ 12:00							
12:00 ~ 13:00	Lunch at the Oval						
13:00 ~ 13:35	Keynote 2						
13:35 ~ 14:10	Keynote 3						
14:10 ~ 14:25	Coffee Break at Dohrmann Grove						
14:25 ~ 14:45	Special Session: Emerging Sensing Technology for SHM: I	Civil Infrastructures, Offshore Pipelines, and Power Plants: II	Special Session: Ground and Air Vehicle Applications	Diagnostics: II	Integrated SHM Design: I	Special Session: Energy Harvesting I	Special Session: Monitoring of Wind Energy Plants
14:45 ~ 15:05							
15:05 ~ 15:25							
15:25 ~ 15:45							
15:45 ~ 16:00	Coffee Break at Dohrmann Grove						
16:00 ~ 17:15	Panel Session						
18:50 ~ 22:00	Social Night at Frost Amphitheater (Student Best Paper Award)						
12-Sep	Memorial Auditorium	Room 002	Room 034	Room 205	Room 203	Room 030	Room 305
08:30 ~ 09:05	Keynote 1						
09:05 ~ 09:40	Keynote 2						
09:40 ~ 10:00	Coffee Break at Dohrmann Grove						
10:00 ~ 10:20	Aerospace, Aircraft, Rotorcraft, and Launch Systems: II	Special Session: Civil Health Management	Special Session: SIHM for Structural Repairs	Integrated Structural Health Management	Modeling and Simulation: II	Special Session: Energy Harvesting II	Passive and Active Sensors for SHM: II
10:20 ~ 10:40							
10:40 ~ 11:00							
11:00 ~ 11:20							
11:20 ~ 11:40							
11:40 ~ 12:00							
12:00 ~ 13:00	Lunch at the Oval, Demo/Poster at Dorman Grove						
13:00 ~ 13:20	Aerospace, Aircraft, Rotorcraft, Launch Systems: III	Civil Infrastructures, Offshore Pipelines, and Power Plants: III	Wired and Wireless Sensor Networks, Interfaces, & Infrastructure: I	Diagnostics: III	Integrated SIHM Design: II	Quantification and Validation	Special Session: IIUMS for Rotorcraft Usage Credits
13:20 ~ 13:40							
13:40 ~ 14:00							
14:00 ~ 14:20							
14:20 ~ 14:40							
14:40 ~ 15:40	Coffee at Dohrmann Grove, Demo/Poster at Dorman Grove						
15:40 ~ 17:10	SIHM in Action						
18:50 ~ 22:00	Banquet and Award Ceremony at Crown Plaza (SIHM Lifetime Achievement Award, Hans-Juergen Schmidt Award, Person of the Year Award, Best Paper Award)						
13-Sep	Memorial Auditorium	Room 002	Room 034	Room 205	Room 203	Room 305	
08:30 ~ 09:05	Keynote 1						
09:05 ~ 09:40	Keynote 2						
09:40 ~ 10:00	Coffee Break at Dohrmann Grove						
10:00 ~ 10:20	Aerospace, Aircraft, Rotorcraft, Launch Systems: IV	Civil Infrastructures, Offshore Pipelines, and Power Plants: IV	Special Session: Challenges and Lessons Learned in SHM Applications	Special Session: Bio-Inspired Sensor Networks	Special Session: Self-Diagnosis and Calibration Issues for SHM	Prognostics	
10:20 ~ 10:40							
10:40 ~ 11:00							
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11:20 ~ 11:40							
11:40 ~ 12:00							
12:00 ~ 13:00	Lunch at the Oval						
13:00 ~ 13:20	Special Session: Emerging Sensing Technology for SHM: II	Civil Infrastructures, Offshore Pipelines, Power Plants: V	Wired and Wireless Sensor Network, Interfaces, & Infrastructure: II	Special Session: Damage Quantification Methods for Aerospace Structures	Special Session: Autonomic Structures	Special Panel Discussion: SIHM Application for High-Speed Navel Ships	
13:20 ~ 13:40							
13:40 ~ 14:00							
14:00 ~ 14:20							
14:20 ~ 14:40							
14:40 ~ 15:00							
15:00 ~ 15:15	Coffee Break at Dohrmann Grove						
15:15 ~ 16:30	Panel Session						

The 6th International Workshop Structural Health Monitoring Stanford University 2007		Technical Program September 11th	
Morning Session			
08:00-08:15	Opening Remarks		
Keynotes Chair: Christian Boller, Sheffield University, UK Memorial Auditorium			
08.15 ~ 09:05	Keynotes Panel: Charles Farrar, LANL, USA; Stephen Galea, DSTO, Australia; Shih-Chi Liu, NSF, USA; Holger Speckmann, Airbus, Germany; Nobuo Takeda, U. of Tokyo, Japan; Serdar Uckun, NASA, USA		
	Ten Year Progress and Future Prospects in SHM		
09.05 ~ 09:40	Jan D. Achenbach, Northwestern University, USA		
	On the Road from Schedule-Based Nondestructive Inspection to Structural Health Monitoring		
	Civil Infrastructures, Offshore, Pipelines, Power Plants I Chair: Anne Kiremidjian, Stanford University, USA Room 002		
10:00 ~ 10:20	Benjamin L. Ervin, Jennifer Bernhard, Daniel A. Kuchma, Henrique Reis, University of Illinois at Urbana-Champaign		
	Monitoring Localized Corrosion in Reinforced Mortar using Guided Mechanical Waves		
10:20 ~ 10:40	Mike S. Wilson, Stefan Hurlbeaus, Zachry Department of Civil Engineering, Texas A&M University		
	Monitoring of Overhead Transmission Lines		
10:40 ~ 11:00	M. Azarbayejani, A.I. EL-Osery, K.-K. Choi, and M.M. Reda Taha, University of New Mexico		
	Optimal Sensor Placement for Efficient Structural Health Monitoring		
11:00 ~ 11:20	Dryver Huston, Nenad Gucunski, Ali Maher, Jianhong Cui, Dylan Burns, Frank Jalinoos, University of Vermont; Rutgers University, Piscataway; Federal Highway Administration		
	Bridge Deck Condition Assessment with Electromagnetic, Acoustic and Automated Methods		
11:20 ~ 11:40	K. Melhorn, J. Flachsbarth, W. Kowalsky and H.-H. Johannes, Institute for High-Frequencies Technology, Germany; CiS, Germany		
	Novel Sensors for Long-Term Monitoring of pH and Humidity in Concrete		
11:40 ~ 12:00	Kumar K. Ghosh and Vistasp M. Karbhari, UCSD		
	Non-Destructive Evaluation of Damage Progression in a FRP Composite Strengthened Slab-Girder System Through Modal Testing		
Aerospace, Aircraft, Rotorcraft, Launch Systems I Chair: Kumar Jata, AFRL, USA Memorial Auditorium			
10:00 ~ 10:20	Eric D. Swenson and Jeffrey S. Cride, Air Force Institute of Technology		
	Damage Detection Using Lamb Waves for Structural Health Monitoring on an Aircraft Bulkhead		
10:20 ~ 10:40	Alexi Rakow, Fu-Kuo Chang, Stanford University		
	An In-Situ Sensor Design for Monitoring Fatigue Damage in Bolted Joints		
10:40 ~ 11:00	Justin Kearns, Julio Peña-Macias, Alfredo Criado-Abad, Temoana Southward, David Evans, and Matthew Malkin, Boeing Phantom Works		
	Development and Flight Demonstration of a Piezoelectric Phased Array Damage Detection System		
11:00 ~ 11:20	T. Stepinski and M. Engholm, Uppsala University, Sweden		
	Structural Health Monitoring of Composite Structures for Temperature Varying Applications		
11:20 ~ 11:40	Ahmed A.S. Mohammed, Walied A. Moussa, Edmond Lou, University of Alberta, Edmonton, Alberta Canada		
	A Novel MEMS Strain Sensor for Structural Health Monitoring Applications under Harsh Environmental Conditions		
11:40 ~ 12:00	Matthew Malkin, Matthew Leonard, Eric Hauge, Mark Derriso, Boeing Phantom Works		
	Hot Spot Monitoring: Developing A Framework for SHM System Design		
Signal Processing I Chair: Hesham Azzam, GE, USA Room 034			
10:00 ~ 10:20	Gregoire Derveaux and George Papanicolaou, INRIA, France and Stanford University		
	Adaptive Imaging for Distributed Sensors		
10:20 ~ 10:40	Alessio Medda, Victor DeBrunner, Florida State University		
	Wavelet Packet Sub-band Beamforming for SHM		
10:40 ~ 11:00	Mustafa Gul and F. Necati Catbas, University of Central Florida		
	Identification of Structural Changes by Using Statistical Pattern Recognition		
11:00 ~ 11:20	Dimitry Gorinevsky, Seung-Jean Kim, Stephen Boyd, Grant Gordon, Shawn Beard, and Fu-Kuo Chang, Stanford University, Honeywell, and Acellent		
	Optimal Estimation of Accumulating Damage Trend from a Series of SHM Images		
11:20 ~ 11:40	Colin C. Olson, M. D. Todd, Structural Engineering Department, UC San Diego		
	Evolutionary Algorithms and Tailored Excitations: An Experimental Demonstration of Improved Damage Detection for Structural Health Monitoring		
11:40 ~ 12:00	Radek Hedl, Grant A. Gordon, Rida Hamza, Honeywell		
	Automated Corrosion Detection using Ultrasound Lamb Waves		
Diagnostics I Chair: Treven Baker, US Army, USA Room 205			
10:00 ~ 10:20	Jonathan R. White, Dr. Douglas E. Adams, Purdue University		
	Actuator-Sensor Pair Excitation Tuning and Self Diagnostics for Damage Identification of a Sandwich Plate		
10:20 ~ 10:40	M. Scheerer, P. A. Hahn, A. Pönniger, Th. Goss, A. Reutlinger, Austrian Research Centers GmbH, Kayser-Threde GmbH		
	Simultaneous Monitoring of Strain and Temperature in Composite Materials by one single FBG Sensor		
10:40 ~ 11:00	Danhui Dan, Yang wang, Limin Sun, Tongji University		
	Apply Online Identification on Donghai Bridge Anywhere, Anytime, and Anyway		
11:00 ~ 11:20	R. Perera, A. Ruiz, C. Manzano, Technical University of Madrid, Spain		
	Structural Damage Evaluation Combining Flexibility and a Fault Localization Indicator		
11:20 ~ 11:40	Yongsheng Fan, Gangtie Zheng, North University of China, Tsinghua University		
	Blind Separation of Gearbox Vibration Signal and its Application in Fault Diagnosis		
11:40 ~ 12:00	Hongying Yu, North University of China		
	Singularity Analysis using Dyadic Wavelet Transform for Bearing Fault Diagnosis		

Modeling and Simulation: I		
Chair: Raimund Rolfes, Leibniz-University Hannover, Germany Room 203		
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	Attenuation of Lamb Waves in Composites: Models and possible Applications	
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	Interaction of Guided Waves with Fastener Sites in Aircraft Structures	
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	Effect of a Fluid Wedge on the Wave Propagation Along a Fluid-solid Interface	
11:00 ~ 11:20	Jaime Y. Hernandez Jr. and Yozo Fujino, University of Tokyo, Japan	p. 927
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11:00 ~ 11:20	D. Francoeur, Y. Pasco, P. Micheau, P. Masson, GAUS, Mech. Eng. Dept., Universite de Sherbrooke, Sherbrooke (QC), CANADA	p. 2049
	A Reflectivity Damage Detection Approach for Lap Joint Structures in the Medium Frequency Range	
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	Application of Distributed Sensing Technique with FBG Sensors to Structural Health Monitoring	
11:00 ~ 11:20	Jeong K. Na, James L. Blackshire, Samuel J. Kuhr, Steven A. Martin, University Dayton Research Institute	p. 1064
	Low Impact Damage Detection and Analysis with Thin Film Piezo-electric Sensors	
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	Design, Fabrication, and Testing of Thin-Film, Surface-Wave Sensors for Crack Detection in Complex Geometry Aerospace Structures	
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	Continuous Monitoring for Performance Evaluation of the Dynamic Response of the School of Engineering Main Building at University of Naples Federico II	
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14:45 ~ 15:05	Ajit K. Mal, Sauvik Banerjee, Fabrizio Ricci, Ernesto Monaco, Leonardo Lecce, University of California, Los Angeles, Saint Louis University, University of Naples Federe	p. 1645
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13:40 ~ 14:00	Mark Agnello, FAA WJH Technical Center HUMS System Design Issues for usage Monitoring on Older Rotorcraft	p. 1855
14:00 ~ 14:20	Dy D. Le, FAA FAA Perspectives for Aircraft Structural Monitoring for Usage Credits	p. 1862
14:20 ~ 14:40	Dr. Richard "Pat" Anderson, Dr. Andrew Kornecki, Rachel Rajnick, Embry-Riddle Aeronautical University Certification Issues for a Level D HUMS Utilized for Usage Credits	p. 1845
14:40~15:40	Poster Session at Dorman Grove	
15:40~17:10	SIIM in Action at Memorial Auditorium	
18:50 ~ 22:00	Banquet Dinner and Awards Ceremony • SHM Lifetime Achievement Award • Hans-Juergen Schmidt Award • SHM Person of the Year Award • Best Paper Award	

The 6th International Workshop Structural Health Monitoring Stanford University 2007		Technical Program September 13th	
Morning Session			
Keynotes			
Chair: Victor Giurgiutiu, AFOSR Memorial Auditorium			
08:30 ~ 09:05	Mark Derriso, Air Force Research Laboratory		
	Why Are There Few Fielded SHM Systems for Aerospace Structures		p. 44
09:05 ~ 09:40	Paul Hess, The Office of Naval Research		
	Structural Health Monitoring for High-Speed Naval Ships		p. 3
Civil Infrastructures, Offshore Pipelines, and Power Plants: IV			
Chair:Cliff Lissenden, PSU, USA Room 002			
10:00 ~ 10:20	Dae-Hyun Kim, Jong-Jae Lee and Maria, Q. Feng, Seoul National University of Technology, KAIST, University of California Irvine		
	Structural Health Monitoring of Real Bridge by Using Novel Fiber Optic Accelerometer		p. 299
10:20 ~ 10:40	M. Bruns, Th. Nitschke-Pagel, K. Dilger, TU Braunschweig		
	Lifetime Prediction of weldments under variable amplitude loading with help of micromagnetic parameters		p. 339
10:40 ~ 11:00	Richard A. Livingston and Shuang Jin, Office of Infrastructure R&D, Turner-Fairbank Highway Research Center, FHWA, NDE Center, TFRHC/FHWA, Wiss, Janney, Elstner Associate, Inc.		
	Comparison of Numerical Simulations of Chaotic Behavior in Structural Health Monitoring of Cable-Stayed Bridge with Field Data		p. 346
11:00 ~ 11:20	Simon Hoffmann, Roman Wendner, Alfred Strauss, University of Natural Resources and Applied Life Science (BOKU), Vienna		
	Comparison of Stiffness Identification Methods for Reinforced Concrete Structures		p. 354
11:20 ~ 11:40	D.Y. Zhang and E.A. Johnson, University of Southern California		
	Structural Control System Design for Parameter Identification of Shear Structures		p. 307
11:40 ~ 12:00	W. Huang, R. Wang, X. Meng, L. Yao and B. Yang, Tongji University		
	Identification Studies on a Prototype Structural Health Monitoring System for the Nanpu Bridge in Shanghai, P. R. China.		p. 524
Aerospace, Aircraft, Rotorcraft, Launch Systems: IV			
Chair: Hasso Weiland, Alcoa, USA Memorial Auditorium			
10:00 ~ 10:20	James L. Blackshire, Steven A. Martin, and Jeong K. Na, AFRL/MLIP, NDE Computational Consultants, University of Dayton Research Institute		
	The Influence of Bond Material Type and Quality on Damage Detection for Surface-Bonded Piezoelectric Sensors		p. 203
10:20 ~ 10:40	Weiping Liu, Victor Giurgiutiu, Univ of South Carolina		
	Finite Element Simulation of Piezoelectric Wafer Active Sensors for Structural Health Monitoring		p. 1592
10:40 ~ 11:00	Jonathan Sumners, Kevin Champaigne, Invocon, Inc.		
	Wireless Data Acquisition System for Impact Detection and Structural Monitoring		p. 211
11:00 ~ 11:20	Hisao Fukunaga, Takao Umino and Ning Hu, Tohoku University		
	Impact Force Identification of CFRP Stiffened Panel under Multiple Loading		p. 177
11:20 ~ 11:40	ZHAO Hai tao,ZHANG Bo ming,WANG Rong guo,WU Zhan jun,WANG Dian fu, Harbin Institute of Technology		
	Monitoring of Composite Pressure Vessel Using Two Kinds Of Fiber Optic Sensors		p. 222
11:40 ~ 12:00	Gang Yan,Li Zhou,Fuh-Gwo Yuan, Nanjing University of Aeronautics and Astronautics, North Carolina State University		
	Identification of Impact Load for Composites Using Genetic Algorithms		p. 185
Special Session: Challenges and Lessons Learned in SHM Applications			
Chair: Mark Seaver, Naval Research Lab Room: 034			
10:00 ~ 10:20	K. Pran, A. Le Breton, G.Sagvolden, Light Structures AS, Hasleveien 38, NO-0571 Oslo, Norway		
	The Road from Prototype SHM for Defence to Commercial Product in Civilian Market		p. 1457
10:20 ~ 10:40	Liming W. Salvino and Thomas F. Brady, NSWCCD		
	Hull Structure Monitoring for High-Speed Naval Ships		p. 1465
10:40 ~ 11:00	Mark Seaver and Stephen T. Trickey, Naval Research Lab		
	Embedding Fiber Bragg Grating Arrays in Composite Propeller Blades		p. 1473
11:00 ~ 11:20	A. Milanese, P. Marzocca , J. M. Nichols , M. Seaver , S.T. Trickey, Clarkson University and Naval Research Laboratory		
	Joint Loosening Detection Via Output-Only Broad-Band Vibration Measurements: An Experimental Study		p. 1499
11:20 ~ 11:40	Wei-hua XIE, Boming ZHANG, Shanyi DU, Jianping Meng, Fuhong DAI, Harbin Institute of Technology		
	Experimental investigation of Bolt loosening Detection in Thermal Protection Panels at High Temperature		p. 1480
11:40 ~ 12:00	T. Ogisu, H. Soejima, H. Yoneda, Y. Okabe, N. Takeda and Y. Koshioka, Fuji Heavy Industries Ltd., The University of Tokyo, RIMCOF		
	Evaluation of the applicability for a damage growth detection system using an FBG sensor/AWG filter as the elastic wave receiver		p. 1491
Special Session: Bio-Inspired Sensor Networks			
Chair: Akira Mita, National Research Institute for Earth Science and Disaster Prevention Room 205			
10:00 ~ 10:20	Ken-ichiro Ishikawa, Akira Mita, National Research Institute for Earth Science and Disaster Prevention		
	Fine Time Synchronization System for Sensor grid		p. 1409
10:20 ~ 10:40	Yoshito Tobe, Yasuyuki Ishida, Yuichi Uehara, Masato Mori, Nayuta Ishii, Tokyo Denki University		
	Analysis of Human's Condition Using Wireless Sensors		p. 1416
10:40 ~ 11:00	Yoshihiro Nitta and Akira Nishitani, Ashikaga Institute of Technology, Waseda University		
	Bio-inspired Monitoring System Utilizing Piezoelectric Cables		p. 1423
11:00 ~ 11:20	Robert White, Robert Littrell, Karl Grosh, Tufts Univ, Univ of Michigan		
	Copying the Cochlea: Micromachined Biomimetic Acoustic Sensors		p. 1447
11:20 ~ 11:40	Ran Kudo, Yuuka Nakamura, Akira Mita, Hiroaki Harada, Keio University, Nikken Sekkei Ltd.		
	Performance Assessment of a Building with Passive Dampers using MIMO System Identification		p. 1431
11:40 ~ 12:00	Akira Mita, Osamu Iwasawa, Shuichi Ogawa, Keio University		
	Smart Sensor Networks for Biofication of Living Spaces		p. 1439

Special Session: Self-Diagnosis and Calibration Issues for SHM Chair: Jeong-Beom Ihn, Boeing Phantom Works; Co-chair: Hoon Sohn, KAIST, Korea Room 203		
10:00 ~ 10:20	Seth Kessler & Pramila Agrawal, Metis Design Corporation	
	Adaptive SHM Methodology to Accommodate Ageing, Maintenance and Repair	p. 1963
10:20 ~ 10:40	Sang Jun Lee, Hoon Sohn, Carnegie Mellon University, Korean Advanced Institute of Science and Technology	
	Reference-free Piezoelectric Transducer Self-diagnosis for Structural Health Monitoring Systems	p. 1947
10:40 ~ 11:00	Gyuhae Park, Timothy G. Overly, Charles R. Farrar, Los Alamos National Laboratory	
	Piezoelectric Active-Sensor Diagnostic and Validation Process for SHM applications	p. 1955
11:00 ~ 11:20	Martin Bach, Claus-Peter Fritzen, Benjamin Eckstein, Holger Speckmann, EADS Innovation Works, Airbus Deutschland	
	Self-Diagnostic Capabilities of Piezoelectric Transducers Using The Electromechanical Impedance	p. 1931
11:20 ~ 11:40	Seunghye Park, Gyuhae Park, Chung-Bang Yun, Charles R. Farrar, Korea Advanced Institute of Science and Technology, Los Alamos National Laboratory	
	Sensor Self-diagnosis Using a Modified Impedance Model for Active Sensing-based Structural Health Monitoring	p. 1923
11:40 ~ 12:00	J. D. Kearns, C. L. Davis and V. J. Mathews, Boeing	
	Sensor Health Diagnostics for Piezoelectric-based SHM Systems	p. 1939
Prognostics Chair: Shah Mahmood, Naval Surface Warfare Center Room 305		
10:00 ~ 10:20	Robert Valentine, Richard Holmes, and Matthew King, VEXTEC Corporation	
	Applications of Data Compression in Health Management Systems	p. 1075
10:20 ~ 10:40	Ville Lamsä & Jyrki Kullaa, Helsinki University of Technology, Helsinki Polytechnic Stadia	
	Nonlinear Factor Analysis in Structural Health Monitoring to Remove Environmental Effects	p. 1092
10:40 ~ 11:00	Roger K. Youree, Jeffrey S. Yalowitz, Aaron Corder, and Teng K. Ooi, Instrumental Sciences, Inc., Missile Defense Agency	
	Multivariate Statistical Analysis Technique for Predictive Structural Health Monitoring	p. 1100
11:00 ~ 11:20	S. Mohanty, R. Teale, A. Chattopadhyay, P. Peralta, and C. Willhauck, Arizona State University	
	Mixed Gaussian Process and State-Space Approach for Fatigue Crack Prediction	p. 1108
11:20 ~ 11:40	I. Cole, P. Corrigan, W. Ganther, T. Muster, D. Paterson, D. Price, A. Scott, D. Followell, S. Galea, B. Hinton, CSIRO Manufacturing and Materials Technology Australia, CSIRO Industrial Physics, The Boeing Company, Phantom Works, DSTO, Australia.	
	A novel system for corrosion monitoring, diagnosis and prognosis in aircraft structures	p. 1083
Afternoon Session September 13th Civil Infrastructures, Offshore Pipelines, Power Plants: V Chair: Vladislav Las, University of West Bohemia, Czech republic Room 002		
13:00 ~ 13:20	Mehmet Celebi, USGS	
	Health Monitoring of Buildings Using Threshold Drift Ratios - Now an Established Method	p. 467
13:20 ~ 13:40	Shuang Jin and Richard A. Livingston, Nde Center, FHWA, WJE Inc. Office of Infrastructure, TFIHRC/FHWA	
	Application of Polynomial Chaos to Analyze the Nonlinear Behavior in Structural Health Monitoring of Highway Infrastructures	p. 501
13:40 ~ 14:00	Yoji OKABE, Kazuki NATORI, Nobuo TAKEDA, and Toshimichi OGISU, The University of Tokyo	
	Simplified Evaluation Method of Debonding Length in CFRP Bonded Structures Using Lamb Waves	p. 332
14:00 ~ 14:20	Hesheng Tang, Mikio Fukuda and Songtao Xue, Tongji University, Kinki University	
	Particle Swarm Optimization for Structural System Identification	p. 483
14:20 ~ 14:40	M. Wooddell, G. Pickrell And T. K. Ooi, Virginia Tech	
	Development of Stochastic Optical Fiber Sensors for Structural Health Monitoring Applications	p. 435
14:40 ~ 15:00	Chun Liu, Xiaolin Meng, Lianbi Yao, Tongji University, China, The University of Nottingham, UK	
	A Real-Time Kinematic GPS Positioning Based Structural Health Monitoring System for the 32km Donghai Bridge in China	p. 1262
Special Session: Emerging Sensing Technologies for SHM II Chair: Francesco Lanza di Scalea, UCSD; Co-chair: Carlos E. Cesnik, University of Michigan, USA Memorial Auditorium		
13:00 ~ 13:20	Karim G. Sabra, Ankit Srivastava, Francesco Lanza di Scalea, UCSD	
	Structural Health Monitoring by Extraction of Coherent Guided Waves from Ambient Noise	p. 1637
13:20 ~ 13:40	Terrisa Duenas, Akhilesh Jha, Wei Lee, Robert Bortolin, Ajit Mal, Teng K. Ooi, and Aaron Corder, NextGen Aeronautics, UCLA and AMRDEC	
	Structural Health Monitoring with Self-Healing Morphing Skins	p. 1621
13:40 ~ 14:00	Timothy G. S. Overly and Gyuhae Park and Charles R. Farrar, Los Alamos National Laboratory	
	Development of Impedance-Based Wireless Active-Sensor Node for Structural Health Monitoring	p. 1660
14:00 ~ 14:20	H. GAO, J. L. ROSE and C. J. LISSENDEN, Penn State	
	Ultrasonic Guided Wave Mode Selection and Tuning in Composites Using Piezoelectric Phased Arrays	p. 1668
14:20 ~ 14:40	Andrei Zagari and Hakan Çakan, New Mexico Institute of Mining and Technology	
	Magneto-Mechanical Impedance Technique for Dynamic Identification of Metallic Structures.	p. 1693
14:40 ~ 15:00	Steve Anastasio, Sibel Pamukcu and Mesut Pervizpour, Lehigh University	
	Chemical Selective BOTDR Sensing for Corrosion Detection on Structural Systems	p. 1701
Wired and Wireless Sensor Network, Interfaces, and Infrastructure: II Chair: Teng Ooi, Missile Defense Agency and Office of Naval Research, USA; Co-chair: Aaron Corder, Missile Defense Agency, USA Room 034		
13:00 ~ 13:20	Joerg F. Wagner and T. Oertel, University of Stuttgart	
	Generalizing Integrated Navigation Systems for Structural Health Monitoring	p. 1245
13:20 ~ 13:40	Joshua K. Olund, Alan J. Cardini, Gino P. Troiano Jr., Chengyin Liu, Eric Feldblum, Paul D'Attilio, and John T. DeWolf, University of Connecticut, Storrs, Connecticut, Connecticut Department of Transportation Research Division	
	Development and Implementation of a Solar Powered Wireless Monitoring System on a Truss Bridge in Connecticut	p. 1174
13:40 ~ 14:00	Christian U. Grosse, Markus Krüger, Steven D. Glaser, Greg McLaskey, University of Stuttgart and University of California Berkeley	
	Structural Health Monitoring Using Acoustic Emission Array Techniques	p. 1157
14:00 ~ 14:20	Piervincenzo Rizzo, Joseph Kabara, Vladimir Zadorozhny, Kent Harries, David Tipper, University of Pittsburgh	
	Stress Wave-Based Bridge Monitoring Using Wireless Sensor Networks	p. 1255
14:20 ~ 14:40	Giulia Lanzara, Jianmin Feng, Kevin Huang, Rostam Dinyari, Jong Yon Kim, Peter Peumans, Fu-Kuo Chang, Stanford University	
	Stretching of a Monolithic Silicon-based Sensor Network for Large Area Embedded Structural Health Monitoring	p. 778

Special Session: Damage Quantification Methods for Aerospace Structures Chair: Jeong-Beom Ihn, Boeing Phantom Works; Co-chair: Hoon Sohn, KAIST, Korea Room 205		
13:00 ~ 13:20	V Sharma, M Ruzzene, S. Hanagud, Georgia Institute of Technology	
	Automation in SHM Using Damage Measure and Laser Doppler Vibrometer	p. 1568
13:20 ~ 13:40	Jennifer E. Michaels, Thomas E. Michaels and Adam C. Cobb, Georgia Institute of Technology	
	Ultrasonic Monitoring of Structural "Hot Spots" During Full Scale Fatigue Tests	p. 1576
13:40 ~ 14:00	Christian Boller, The University of Sheffield	
	Monitoring Strategies, Performance and Assessment of Multi-Riveted Metallic Aircraft Panels Using Acousto-Ultrasonics	p. 1584
14:00 ~ 14:20	M. P. Desimio, S. E. Olson, J. A. Montes De Oca and K. S. Brown, ATK, University of Dayton Research Institute, AFRL	
	SHM of Cracks and Corrosion in Aerospace Shell Structures	p. 280
14:20 ~ 14:40	Ankit Srivastava, Ivan Bartoli, Francesco Lanza di Scalea, Karim Sabra, NDE & SHM Laboratory	
	Global-Local Ultrasonic Method Applied to the Quantitative Detection of Bond Defects in Aircraft Panels	p. 1604
14:40 ~ 15:00	Jeong-Beom Ihn, Boeing Phantom Works	
	Lamb Wave Front-Back Scatter Method for Estimating Delamination Size in Composite Structures	p. 1612
Special Session: Autonomic Structures Chair: Daniel J. Inman, Virginia Tech Room 203		
13:00 ~ 13:20	P. M. Weaver, University of Bristol	
	Applications of Polymorphic Composites within Aerodynamic Structures	p. 1357
13:20 ~ 13:40	Dr. Ian Bond, Dr. Richard Trask, Gareth Williams, Hugo Williams, University of Bristol, ACCIS	
	Autonomic Self-Healing and Damage Visualisation in Fibre Reinforced Polymer Composites	p. 1364
13:40 ~ 14:00	Benjamin L. Grisso, Jina Kim, Justin R. Farmer, Dong S. Ha, and Daniel J. Inman, Virginia Tech	
	Autonomous Impedance-based SHM Utilizing Harvested Energy	p. 1373
14:00 ~ 14:20	Rye, P., Nemat-Naser, S., University of California, San Diego	
	Embedded Distributed Sensing Network: Integration Considerations and Findings	p. 1391
14:20 ~ 14:40	Steven A. Martin, Kumar V. Jata, NDE Comp. Consultants and AFRL	
	Artificial Neural Networks for Impact Location thru Transversely Isotropic Layers	p. 1381
14:40 ~ 15:00	T. N. Thanh, M. J. Perry and C. G. Koh, National University of Singapore	
	Moving Force Identification: A Time Subdomain Genetic Algorithm Approach	p. 1399
Special Panel Discussion: Structural Health Monitoring/Evaluation for High-Speed Naval Vessels Chair: Liming Salvino, Navy Surface Warfare Center Room 305		
13:00~15:00	Prof. Doug Adams, Purdue University	
	Automated structural diagnostics	5 min
	Prof. Fu-Kuo Chang, Stanford University	
	Design of built-in diagnostic systems for structural inspection	5 min
	Dr. Chuck Farrar, LANL; Prof. Mike Todd, UC San Diego	
	Collaborative efforts on SHM and Prognosis	10 min
	Prof. Masoud Ghandehari, Polytechnic	
	Chemical sensing for material health management	5 min
	Prof. Dan Inman, Virginia Tech	
	Smart materials and sensors	5 min
	Prof. Darryll Pines, University of Maryland	
	Signal processing and real-time SHM	5 min
	Prof. Jerry Lynch, University of Michigan; Prof. K Law, Stanford University	
	Wireless sensors	7 min
	Dr. Jon Nickels, NRL; Prof. Kevin Murphy, University of Connecticut	
	The importance of modeling and quantifying in damage detection problems	7 min
	Prof. Chris Earls, Cornell University	
	Hull SHM theoretic for decision support	5 min
Panel Discussion Memorial Auditorium		
15:15 ~ 16:30	Demands and Challenges for SHM in Civil and Mechanical System Infrastructures Moderator: Wieslaw Ostachowicz, Polish Academy of Science Panelists: Steven Chase, NHWA; Shah Mahmood, Naval Surface Warfare Center; Akira Mita, Kio University; Fuh-Gwo Yuan, NCSU; Helmut Wenzel, VCE Holding GmbH; H. Felix Wu, NIST	
	i-gift give-away for panel participants	

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 in conjunction with the International Workshop of SHM Program Committee.

Hans-Juergen Schmidt Award

Individuals in the SHM community, recognized for their outstanding leadership in advancing technologies in industry and government, will be selected by an Award Committee representative of the world-wide SHM community to receive during every SHM workshop (International Workshop on Structural Health Monitoring [IWSHM], European Workshop on Structural Health Monitoring [EWSHM] and Asia-Pacific Workshop on Structural Health Monitoring [APWSHM]) the SHM Hans-Juergen Schmidt Award.

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.

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 2007 IWSHM.

Student Best Paper Award

The IWSHM organizing committee is pleased to invite students to submit abstracts for the 2007 IWSHM Student Best Paper Award Competition. Papers will then be evaluated by a committee of experts from academia, industry, and the research community. Approximately 3-6 papers will then be selected to participate in the oral presentation competition at the workshop in September. Students will be evaluated during their presentation. 1st, 2nd, and 3rd place awards will be given out at the workshop.

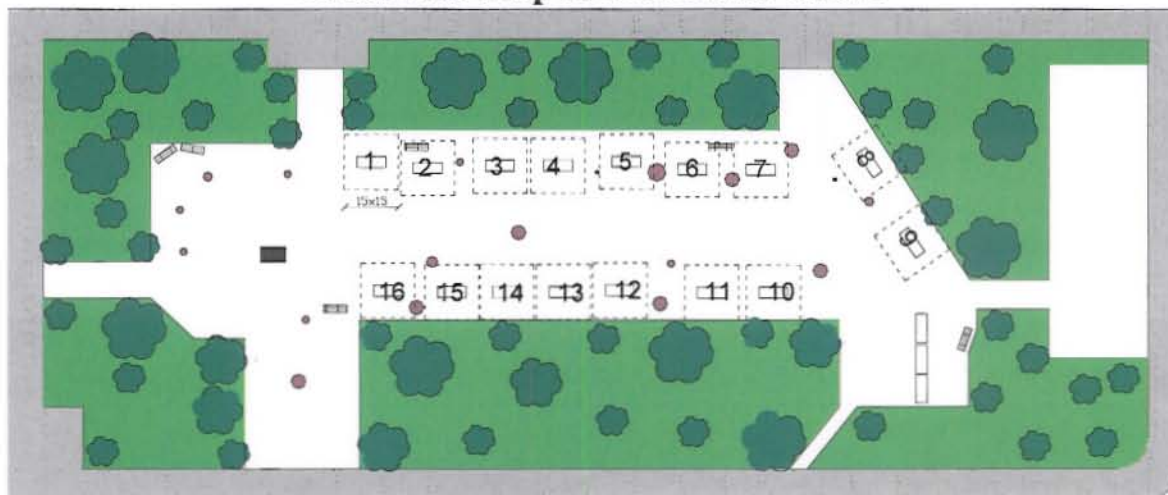
SHM in Action

Company/Institute Name	Company/Institute Logo	Demo Description
Laboratory for Intelligent Structural Technology (LIST)		A 5- minute video presentation about two aspects of a wireless monitoring system will be illustrated. A dense wireless monitoring system installed on a full-scale structure will be shown by video.
Tongji University		Donghai Bridge Health Monitoring System (DHBHMS) is an internet based bridge health monitoring system. It has totally 478 sensors including FPG strain and temperature, accelerometer, cable force meter, GPS, etc. The real time information from the sensors will be displayed.
UCSD/LANL Collaborative Research		A video will be played featuring a small RC Helicopter which is being developed by UC San Diego and Los Alamos National Labs.
Structures and composites Laboratory (SACL)		A 5- minute video will be played introducing the concept of a structural health monitoring fastener consisting of a built-in conformable eddy current sensor film for in-situ detection of fatigue cracks in multi-layered bolt hole locations. Included in the video will be results obtained from real-time monitoring during a recent fatigue test of a multi-layer joint.
Smart Fibres Ltd		The demonstration will be presented about the FBG interrogator "Wx" developed by Smart Fibres under the European defence program AHMOS.
Micron Optics Inc.		A demonstration on the operation and application of optical fiber Bragg grating (FBG) sensors for strain, stress and vibration measurements in SHM applications will be made.
Center for Infrastructure Engineering Studies		Wireless embedded system for SHM will be displayed. Embedded system measures temperature, water level, tilt, and acceleration and reports data via email, FTP, and SMS.
QPS photonics Inc.		Fast Diagnostic tool to identify structurally deficient Bridges by Two Wave Mixing Technology will be demonstrated. Two Wave Mixing (TWM) is a Hybrid solution combining the simple application of a piezoelectric actuator with QPS V fiber TM technology.
Acellent Technologies Inc		Live demonstrations of a complete SHM package consisting of a piezoelectric sensor network, lightweight hardware and integrated software for detecting impacts on a Thermal Protection System by displaying the location of impact.
MPA Stuttgart		Demonstration of the wireless sensor node system (based on MEMS and hybrid sensors) including recordings of acoustic emissions, strain, temperature, humidity. Presentation of a high-fidelity acoustic emission sensor.
Insensys Ltd		An embedded fibre optic acoustic laser system for detecting defects will be demonstrated.
Structural Monitoring Systems Limited		The principle behind the CVM (Comparative Vacuum Monitoring) technology will be outlined, including current implementations on metal and composite structures. A short demonstration of the new CVM Switch will be given.
MicroStrain, Inc.		Energy harvesting wireless sensors for SHM will be displayed. Breaking down the barriers of traditional sensors, MicroStrain's energy harvesting wireless sensors eliminate long cable runs as well as battery maintenance.
Los Gatos Research, Inc.		Los Gatos Research has developed a lock-in based laser demodulation technique for integrated fiber-optic strain and ultrasonic wave sensing. A laser locked-in-based FBG interrogation technique will be displayed to demonstrate real-time Lamb wave detection, temperature, and strain measurements.
VCE Holding GmbH		Permanent Ambient Vibration Monitoring applied at Industrial Facilities will be demonstrated. The presented investigations are based on the determination of the global condition of maintenance (the structure's integrity) as well as the load bearing capacity of a 200 m high industrial concrete chimney in the Czech Republic.

Company Exhibition



Exhibition Map in Dohrmann Grove



[1] Accellent

[6] Smart Fibers

[11] Micron Optics

[2] Structural Monitoring

[7] NEES@UCLA

[12] QPS

[3] Physical Acoustic

[8] Wiley

[13] MPA

[4] IFOS

[9] Structures Lab Stanford

[14] Insensys

[5] As Monitoring

[10] Metis Design

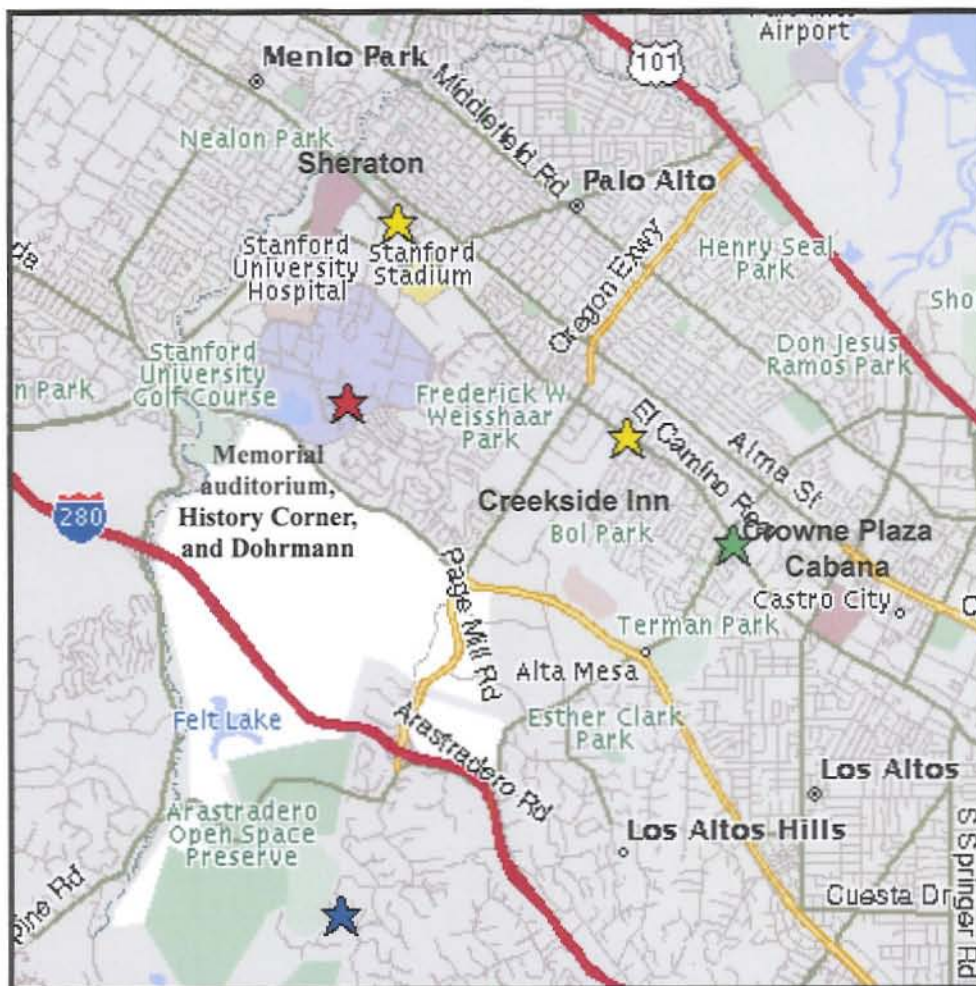
[15] BaySpec

[16] Micro Strain

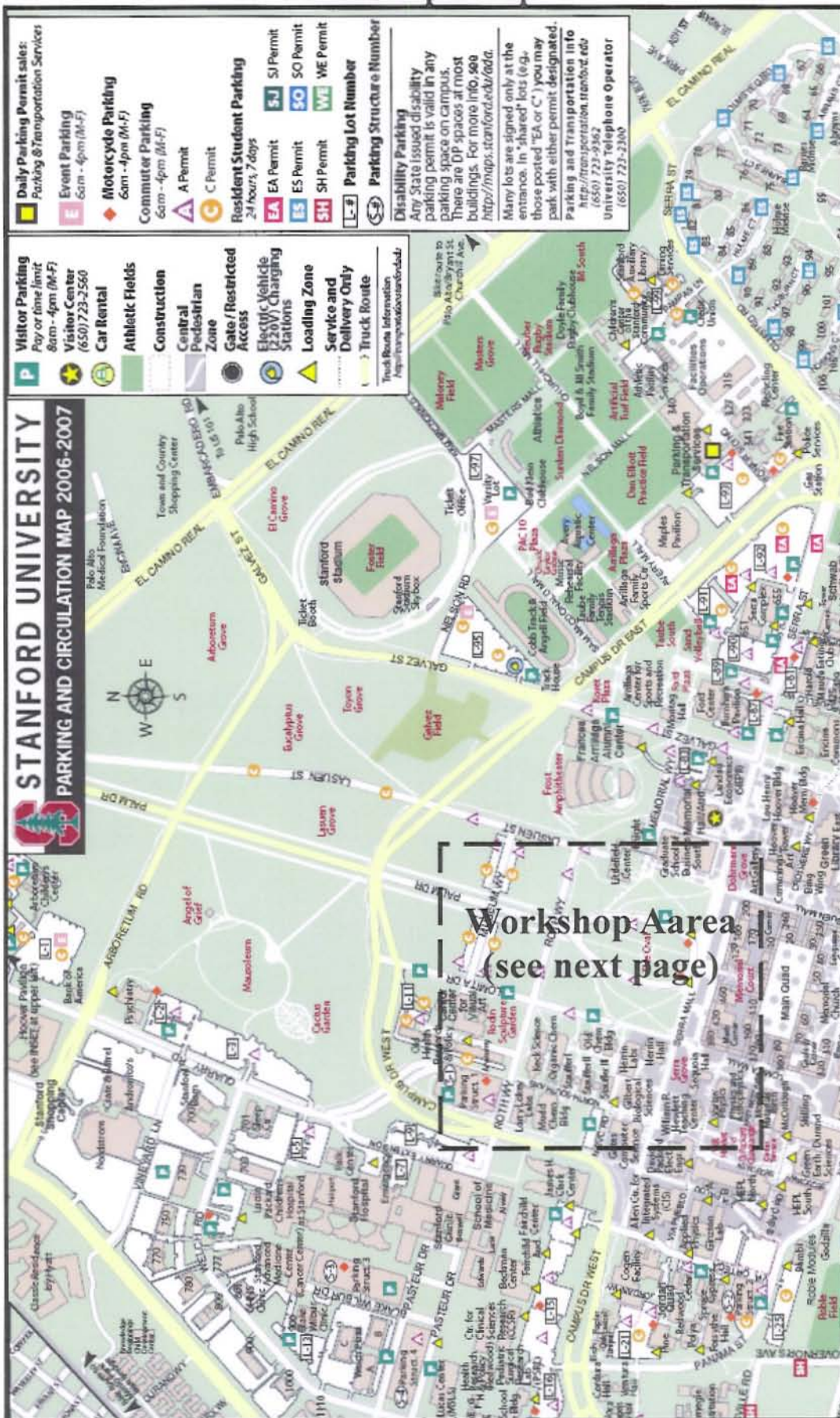
Workshop Sites

Site	Address	Phone
Memorial auditorium, History Corner, and Dohrmann Grove	Stanford, CA 94305	(650) 723-3466
Banquet Crowne Plaza Hotel Cabana	4219 El Camino Real Palo Alto, CA 94304	(650) 948-1800
BBQ Reception	Frost Amphitheater, Stanford, CA 94305	N/A
Crowne Plaza Hotel Cabana	4219 El Camino Real Palo Alto, CA 94306	(650) 352-1234
Creekside Inn	3400 El Camino Real Palo Alto, CA 94306	(650) 493-2411
Sheraton Hotel	625 El Camino Real Palo Alto, CA 94301	(650) 328-2800

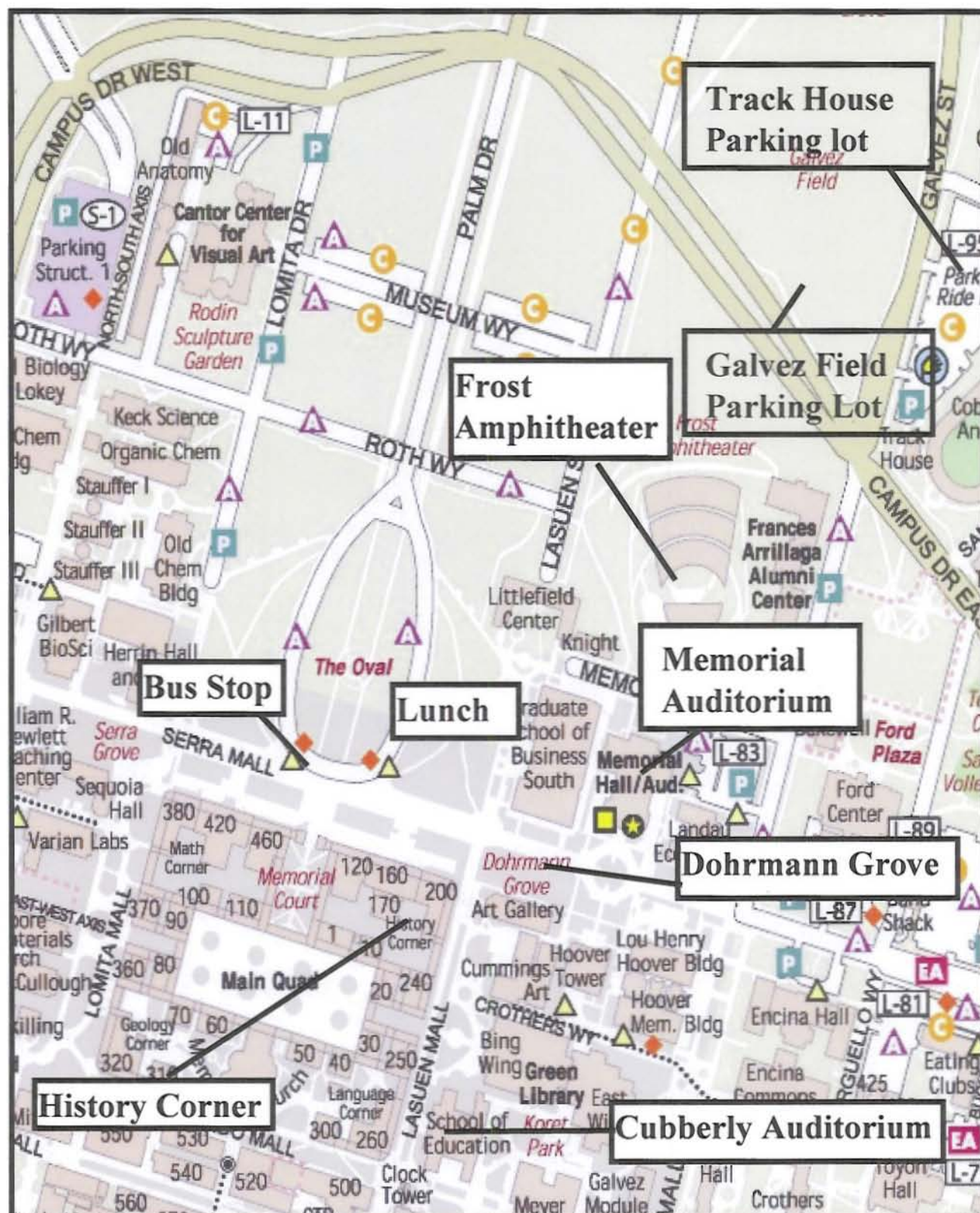
Map of Workshop Sites



Full Campus Map



Enlarged Workshop Area



The image displays four floor plans of a building, arranged in a 2x2 grid. The plans are labeled 'Ground Floor', 'First Floor', 'Second Floor', and 'Third Floor'. A north arrow points towards the top right of the image.

- Ground Floor:** Shows a large central area labeled '002'. To the left is a long corridor with rooms numbered 1 through 34. To the right are rooms labeled 'A', 'B', 'C', 'D', 'E2', 'J', 'M', 'VM', 'W', 'VW', and 'SI'.
- First Floor:** Shows a long corridor with rooms numbered 101 through 125. To the right are rooms labeled 'A', 'B', 'C', 'D', 'E2', 'J', 'M', 'VM', 'W', 'VW', and 'SI'.
- Second Floor:** Shows a long corridor with rooms numbered 201 through 230. To the right are rooms labeled 'A', 'B', 'C', 'D', 'E2', 'J', 'M', 'VM', 'W', 'VW', and 'SI'.
- Third Floor:** Shows a long corridor with rooms numbered 301 through 330. To the right are rooms labeled 'A', 'B', 'C', 'D', 'E2', 'J', 'M', 'VM', 'W', 'VW', and 'SI'.

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- From Hwy 101:
 - Take the University Ave exit towards Palo Alto. Continue on University for 2 mi. University Ave enters Stanford Campus and becomes Palm Drive. Take Palm Dr. straight to The Oval (see workshop area map on preceding pages). Park at any of the A-permit locations around the oval**.
- From Hwy 280:
 - Take the Page Mill Rd/ Arastradero Rd exit towards Palo Alto. Turn Left onto Page Mill Rd. Go 1.4 mi, and turn Left onto Junipero Serra Blvd. Take next Right onto Stanford Ave. Turn Left on Bowdoin St. Turn Right onto Campus Drive East. Turn Left on Palm Drive. Take Palm Drive straight to The Oval (see workshop area map on preceding pages). Park at any of the A-permit locations around the oval**.
- From Sheraton, Crown Plaza Cabana, and Creekside Inn:
 - Take El Camino Real Northeast and turn left at University Ave. University Ave enters Stanford Campus and becomes Palm Drive. Take Palm Drive straight to The Oval (see workshop area map). Park at any of the A-permit locations around the oval**.

** See below for additional parking information.

On Campus Parking

If you choose to drive, 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.

Due to other events on campus, parking will be very limited on Sept. 11. One day permits will be available for \$5 for use in the **Track House parking lot**. (See map – across from Galvez Field)

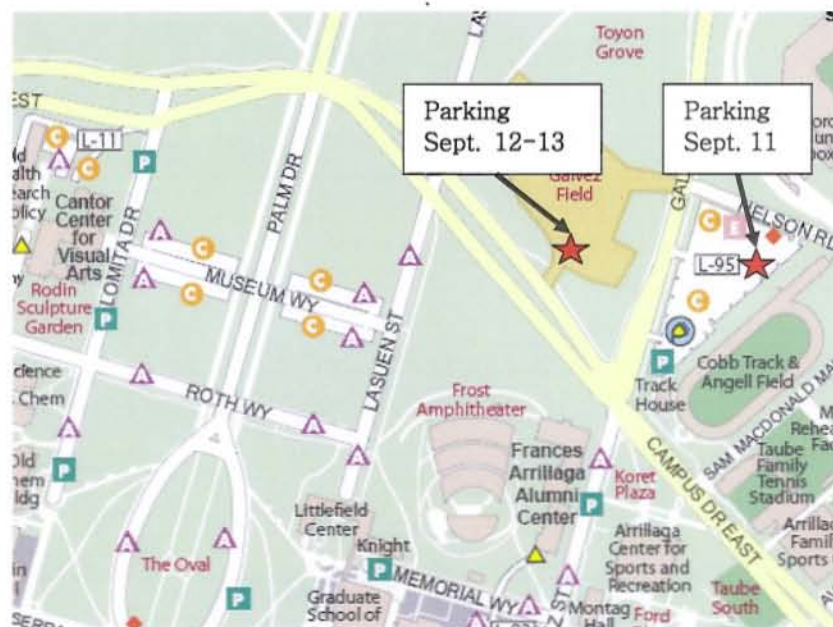
For Sept. 12-13, parking will be available at **Galvez Field parking lot**. An IWSHM window sticker is required to park there, but covers both days, and can be purchased for \$10 at the registration table.

Parking permits will also be available at the pre-registration Monday Sept. 10 at the Crowne Plaza Hotel. Purchasing permits there will save a walk to and from the parking lot, and is encouraged.

In addition to the conference registration table, parking permits can be purchased at- The Parking & Transportation Services office at 340 Bonair Siding (open 7:30-5)

Finally, there are parking permit machines in the Tresidder lot, in front of the Cantor Art Center, at 401 Quarry Road - Psychiatry, behind Memorial Auditorium, and at the Track House that accept credit cards, cash or coins. The receipt should be placed on the car dashboard.

Parking tickets range from \$35 for a permit violation to \$336 for illegally parking in a disabled space. More information about parking on Stanford's campus, including maps, is located on the Parking & Transportation website.



Workshop Internet Access

Access to Stanford wireless guest account will be open from Sept 10th to Sept 14th in the workshop area. Please use account name: IWSHM2007, Password: IW2007SHM.

Workshop Shuttle Schedule

Date	Session	Bus	Creekside	Crowne	Sheraton	Workshop
		1	7:00 AM	7:02 AM	7:11 AM	7:15 AM
		2	7:20 AM	7:22 AM	7:31 AM	7:35 AM
	Morning	3	7:35 AM	7:37 AM	7:46 AM	7:50 AM
		1	7:45 AM	7:47 AM	7:56 AM	8:00 AM
		2	7:55 AM	7:57 AM	8:06 AM	8:10 AM
		3	8:05 AM	8:07 AM	8:16 AM	8:20 AM
	Session	Bus	Workshop	Creekside	Crowne	Sheraton
		1	4:45 PM	4:53 PM	4:55 PM	5:04 PM
		2	5:00 PM	5:08 PM	5:10 PM	5:19 PM
Tuesday	Afternoon	3	5:10 PM	5:18 PM	5:20 PM	5:29 PM
		1	5:20 PM	5:28 PM	5:30 PM	5:39 PM
		2	5:30 PM	5:38 PM	5:40 PM	5:39 PM
09/11/07		3	5:40 PM	5:48 PM	5:50 PM	5:59 PM
	Session	Bus	Creekside	Crowne	Sheraton	BBQ
		1	6:30 PM	6:32 PM	6:41 PM	6:45 PM
	Evening	2	6:35 PM	6:37 PM	6:46 PM	6:50 PM
		3	6:40 PM	6:42 PM	6:51 PM	6:55 PM
		1	7:05 PM	7:07 PM	7:16 PM	7:20 PM
	Session	Bus	BBQ	Creekside	Crowne	Sheraton
		1	9:15 PM	9:23 PM	9:25 PM	9:34 PM
	Evening	2	9:30 PM	9:38 PM	9:40 PM	9:49 PM
		3	9:35 PM	9:43 PM	9:45 PM	9:54 PM
		1	9:50 PM	9:58 PM	10:00 PM	10:09 PM

Date	Session	Bus	Creekside	Crowne	Sheraton	Workshop
		1	7:10 AM	7:12 AM	7:21 AM	7:25 AM
		2	7:20 AM	7:22 AM	7:31 AM	7:35 AM
	Morning	3	7:30 AM	7:32 AM	7:41 AM	7:45 AM
		1	7:40 AM	7:42 AM	7:51 AM	7:55 AM
		2	7:50 AM	7:52 AM	8:01 AM	8:05 AM
		3	8:00 AM	8:02 AM	8:11 AM	8:15 AM
	Session	Bus	Workshop	Creekside	Crowne	Sheraton
		1	4:45 PM	4:53 PM	4:55 PM	5:04 PM
	Afternoon	2	5:00 PM	5:08 PM	5:10 PM	5:19 PM
Wednesday		3	5:10 PM	5:18 PM	5:20 PM	5:29 PM
		1	5:20 PM	5:28 PM	5:30 PM	5:39 PM
		2	5:30 PM	5:38 PM	5:40 PM	5:49 PM
09/12/07		3	5:40 PM	5:48 PM	5:50 PM	5:59 PM
	Session	Bus	Sheraton	Creekside	Crowne	
		1	6:40 PM	6:46 PM	6:48 PM	
	Evening	2	6:45 PM	6:51 PM	6:53 PM	
		3	6:50 PM	6:56 PM	6:58 PM	
		1	7:00 PM	7:06 PM	7:08 PM	
	Session	Bus	Crowne	Sheraton	Creekside	
		1	8:45 PM	8:54 PM	9:00 PM	
	Evening	2	9:00 PM	9:09 PM	9:15 PM	
		3	9:05 PM	9:14 PM	9:20 PM	
		1	9:10 PM	9:19 PM	9:25 PM	
Date	Session	Bus	Creekside	Crowne	Sheraton	Workshop
		1	7:15 AM	7:17 AM	7:26 AM	7:30 AM
	Morning	2	7:30 AM	7:32 AM	7:41 AM	7:45 AM
		1	7:45 AM	7:47 AM	7:56 AM	8:00 AM
Thursday		2	8:00 AM	8:02 AM	8:11 AM	8:15 AM
09/13/07	Session	Bus	Workshop	Creekside	Crowne	Sheraton
		1	4:00 PM	4:08 PM	4:10 PM	4:19 PM
	Afternoon	2	4:15 PM	4:23 PM	4:25 PM	4:34 PM
		1	4:30 PM	4:38 PM	4:40 PM	4:49 PM
		2	4:45 PM	4:53 PM	4:55 PM	5:04 PM