Sensors and Smart Structures
Technologies for Civil, Mechanical, and Aerospace Systems 2007

Masayoshi Tomizuka
Chung-Bang Yun
Victor Giurgiutiu
Editors

19–22 March 2007
San Diego, California, USA

Sponsored and Published by
SPIE—The International Society for Optical Engineering

Cosponsored by
American Society of Mechanical Engineers (USA)

Cooperating Organizations
Intelligent Materials Forum (Japan)
Jet Propulsion Laboratory (USA)
National Science Foundation (USA)

Volume 6529
Part One of Two Parts

SPIE is an international technical society dedicated to advancing engineering and scientific
applications of optical, photonic, imaging, electronic, and optoelectronic technologies.
The papers included in this volume were part of the technical conference cited on the cover and title page. Papers were selected and subject to review by the editors and conference program committee. Some conference presentations may not be available for publication. The papers published in these proceedings reflect the work and thoughts of the authors and are published herein as submitted. The publisher is not responsible for the validity of the information or for any outcomes resulting from reliance thereon.

Please use the following format to cite material from this book:


ISSN 0277-786X
ISBN 9780819466501

Published by
SPIE—The International Society for Optical Engineering
P.O. Box 10, Bellingham, Washington 98227-0010 USA
Telephone 1 360/676-3290 (Pacific Time) · Fax 1 360/647-1445
http://www.spie.org

Copyright © 2007, The Society of Photo-Optical Instrumentation Engineers

Copying of material in this book for internal or personal use, or for the internal or personal use of specific clients, beyond the fair use provisions granted by the U.S. Copyright Law is authorized by SPIE subject to payment of copying fees. The Transactional Reporting Service base fee for this volume is $18.00 per article (or portion thereof), which should be paid directly to the Copyright Clearance Center (CCC), 222 Rosewood Drive, Danvers, MA 01923. Payment may also be made electronically through CCC Online at http://www.copyright.com. Other copying for republication, resale, advertising or promotion, or any form of systematic or multiple reproduction of any material in this book is prohibited except with permission in writing from the publisher. The CCC fee code is 0277-786X/07/$18.00.

Printed in the United States of America.
Contents

Part One

  xvii National Science Foundation Paper Listing
  xxi Conference Committee
  xxv Symposium Committee
  xxvii Introduction

SESSION 1  INVITED LECTURES

652902 Sensors and actuators inherent in biological species (Invited Paper) [6529-01]
M. Taya, R. Stahlberg, F. Li, Univ. of Washington (USA); Y. J. Zhao, B&D Co. (USA)

652903 From photogrammetry, computer vision to structural response measurement (Invited Paper) [6529-02]
C. C. Chang, The Hong Kong Univ. of Science and Technology (Hong Kong China)

SESSION 2  PIEZOELECTRIC AND INTEGRATED SENSORS I

652904 Piezoelectric paint sensor for ultrasonic NDE [6529-03]
X. Li, Y. Zhang, Lehigh Univ. (USA)

652905 Enhancement of a unimorph actuator performance implementing the nonlinear characteristics of piezoceramic wafer (3203HD, CTS) [6529-04]
Q. V. Nguyen, H. C. Park, N. S. Goo, Konkuk Univ. (South Korea)

652906 Robust decision making in damage detection using piezoelectric transducers and Lamb wave propagation [6529-05]
Y. Lu, X. Wang, J. Tang, The Univ. of Connecticut (USA)

652907 Sensing region of PZT transducers bonded to concrete [6529-06]
Y. Hu, Y. Yang, Nanyang Technological Univ. (Singapore)

Pagination: Proceedings of SPIE follow an e-First publication model, with papers published first online and then in print and on CD-ROM. Papers are published as they are submitted and meet publication criteria. A unique, consistent, permanent citation identifier (CID) number is assigned to each article at the time of the first publication. Utilization of CIDs allows articles to be fully citable as soon they are published online, and connects the same identifier to all online, print, and electronic versions of the publication. SPIE uses a six-digit CID article numbering system in which:

- The first four digits correspond to the SPIE volume number.
- The last two digits indicate publication order within the volume using a Base 36 numbering system employing both numerals and letters. These two-number sets start with 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B ... 0Z, followed by 10-1Z, 20-2Z, etc.

The CID number appears on each page of the manuscript. The complete citation is used on the first page, and an abbreviated version on subsequent pages.
SESSION 3  PIEZOELECTRIC AND INTEGRATED SENSORS II

652908  Monitoring early age mortar using a pulse-echo ultrasonic guided wave approach [6529-07]
J. L. Borgerson, H. Reis, Univ. of Illinois at Urbana-Champaign (USA)

652909  A computational method for materials selection in a hybrid actuation system [6529-08]
B. J. Nickless, Univ. of Maryland (USA); J. Su, NASA-Langley Research Ctr. (USA); T.-B. Xu, National Institute of Aerospace (USA); J. E. Hubbard, Jr., Univ. of Maryland (USA)

65290A  Studies on effects of elevated temperature for guided-wave structural health monitoring [6529-09]
A. Raghavan, C. E. S. Cesnik, The Univ. of Michigan (USA)

65290B  Estimation of adhesive bond strength in laminated safety glass using guided mechanical waves [6529-10]
S. Huo, H. Reis, Univ. of Illinois at Urbana-Champaign (USA)

SESSION 4  NOVEL SENSORS I

65290C  Integrating broadband high-fidelity acoustic emission sensors and array processing to study drying shrinkage cracking in concrete [6529-11]
G. C. McLaskey, S. D. Glaser, Univ. of California, Berkeley (USA); C. U. Grosse, Univ. of Stuttgart (Germany)

65290D  Microfabrication of a wall shear stress sensor using side-implanted piezoresistive tethers [6529-13]
Y. Li, T. Nishida, D. P. Arnold, M. Sheplak, Univ. of Florida (USA)

65290E  Subsurface sampler and sensors platform using the ultrasonic/sonic driller/corer (USDC) [6529-18]
Y. Bar-Cohen, S. Sherrit, X. Bao, M. Badescu, J. Aldrich, Z. Chang, Jet Propulsion Lab./Caltech (USA)

65290F  Laser interferometric sensor for seismic waves measurement [6529-139]
F. Acernese, Univ. degli Studi di Salerno (Italy) and INFN, Complesso Univ. di Monte S. Angelo Via Cintia (Italy); R. De Rosa, F. Garufi, Univ. degli Studi di Napoli Federico II (Italy) and INFN, Complesso Univ. di Monte S. Angelo Via Cintia (Italy); R. Romano, F. Barone, Univ. degli Studi di Salerno (Italy) and INFN, Complesso Univ. di Monte S. Angelo Via Cintia (Italy)

SESSION 5  NOVEL SENSORS II

65290H  Surface functionalization of a microfluidic biosensor for bacteria detection and identification [6529-15]
D. A. Boehm, P. Gottlieb, S. Z. Hua, SUNY, Buffalo (USA)

65290I  Ferroelectric thin-film active sensors for structural health monitoring [6529-16]
B. Lin, V. Giurgiutiu, Univ. of South Carolina (USA); Z. Yuan, J. Liu, C. Chen, Univ. of Texas at San Antonio (USA); J. Jiang, Univ. of Texas at Arlington (USA); A. S. Bhalla, R. Guo, Pennsylvania State Univ. (USA)
<table>
<thead>
<tr>
<th>ID</th>
<th>Title</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>65290J</td>
<td>Development of a small reusable space release device using SMA</td>
<td>X. Yan, K. Zhang, Beijing Univ. of Aeronautics and Astronautics (China)</td>
</tr>
<tr>
<td>65290K</td>
<td>Tire tread deformation sensor and energy harvester development for smart-tire applications</td>
<td>K. S. Moon, San Diego State Univ. (USA); H. Liang, Texas A&amp;M Univ. (USA); J. Yi, San Diego State Univ. (USA); B. Mika, Texas A&amp;M Univ. (USA)</td>
</tr>
<tr>
<td>65290L</td>
<td>Development of ionic polymer transducers as flow shear stress sensors: effects of electrode architecture</td>
<td>D. Griffiths, J. Dominic, Virginia Polytechnic Institute and State Univ. (USA); B. J. Akle, Virginia Polytechnic Institute and State Univ. (USA) and Lebanese American Univ. (Lebanon); P. P. Vlachos, Virginia Polytechnic Institute and State Univ. (USA); D. J. Leo, Virginia Polytechnic Institute and State Univ. (USA) and Defense Advanced Research Projects Agency (USA)</td>
</tr>
<tr>
<td>65290M</td>
<td>Surface stress sensors for detection of chemical and biological species</td>
<td>K. Kang, J. Marquardt, P. Shrotriya, Iowa State Univ. (USA)</td>
</tr>
</tbody>
</table>

**SESSION 6 MONITORING SYSTEMS**

<table>
<thead>
<tr>
<th>ID</th>
<th>Title</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>65290O</td>
<td>A system-on-board approach for impedance-based structural health monitoring</td>
<td>J. Kim, B. L. Grisso, D. S. Ha, D. J. Inman, Virginia Tech (USA)</td>
</tr>
<tr>
<td>65290P</td>
<td>Remote control of a morphing model aircraft with distributed sensors</td>
<td>J. Smoker, A. Baz, Univ. of Maryland, College Park (USA)</td>
</tr>
</tbody>
</table>

**SESSION 7 ULTRASONICS FOR SHM**

<table>
<thead>
<tr>
<th>ID</th>
<th>Title</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>65290Q</td>
<td>Macro-fiber composite piezoelectric rosettes for acoustic source location in complex structures</td>
<td>H. Matt, F. Lanza di Scalea, Univ. of California, San Diego (USA)</td>
</tr>
<tr>
<td>65290R</td>
<td>Lamb waves time-reversal method using frequency tuning technique for structural health monitoring</td>
<td>B. Xu, V. Giurgiutiu, Univ. of South Carolina (USA)</td>
</tr>
<tr>
<td>65290S</td>
<td>Ultrasonic/sonic driller/corer as a hammer-rotary drill</td>
<td>M. Badescu, Jet Propulsion Lab. (USA); S. Kassab, Purdue Univ. (USA); S. Sherrit, J. Aldrich, X. Bao, Y. Bar-Cohen, Z. Chang, Jet Propulsion Lab. (USA)</td>
</tr>
<tr>
<td>65290T</td>
<td>Characterization of fibre Bragg gratings for temperature and strain sensing</td>
<td>N. Mrad, Defence R&amp;D Canada (Canada); A. Ivanov, J. Albert, Carleton Univ. (Canada); G. Z. Xiao, National Research Council Canada (Canada)</td>
</tr>
<tr>
<td>65290U</td>
<td>Miniaturized sensors for intelligent system fault detection and diagnosis (FDD)</td>
<td>I. Kao, K. Zhang, SUNY at Stony Brook (USA)</td>
</tr>
</tbody>
</table>
SESSION 8  MODELING AND DESIGN OF SMART SYSTEMS I

65290V  Time domain simulation of piezoelectric excitation of guided waves in rails using waveguide finite elements [6529-29]
        P. W. Loveday, C. S. Long, CSIR Material Science and Manufacturing (South Africa)

65290W  FEM modeling of guided wave behavior in integrally stiffened plate structures [6529-30]
        S. A. Martin, NDE Computational Consultants (USA); K. V. Jata, Air Force Research Lab. (USA)

65290X  Sensing rich drive trains for modern mechatronic systems: first year progress report [6529-31]
        M. Tomizuka, H. Cheng, C.-C. Wang, Univ. of California, Berkeley (USA)

65290Y  Fabrication and evaluation of hybrid silica/polymer optical fiber sensors for large strain measurement [6529-32]
        H. Huang, Univ. of Texas at Arlington (USA)

65290Z  Fabrication and evaluation of a LPFG-based whitelight interferometric distance sensor [6529-33]
        H. Huang, A. Majumdar, Univ. of Texas at Arlington (USA)

652910  Modeling of bimorph piezoelectric cantilever beam for voltage generation [6529-143]
        J. Ajitsaria, S. Choe, D. Kim, D. Shen, Auburn Univ. (USA)

652911  Application of zonal model on indoor air sensor network design [6529-147]
        Y. L. Chen, J. Wen, Drexel Univ. (USA)

SESSION 9  NOVEL SENSORS III

652912  Development of a MEMS acoustic emission sensor system [6529-34]

652913  A wire-guided transducer for acoustic emission sensing [6529-35]

652914  A sub-microwatt self-powered fatigue sensor [6529-36]
        N. Elvin, N. Lajnef, S. Chakrabarty, Michigan State Univ. (USA); A. Elvin, Univ. of Witwatersrand (South Africa)

652915  A linear peristaltic MRF/foam actuator [6529-37]
        J. J. Larsen, C. H. Jenkins, Montana State Univ. (USA); U. A. Korde, South Dakota School of Mines and Technology (USA)

652916  Electrical stiffness tuning in ferromagnetic shape memory Ni-Mn-Ga [6529-39]
        N. N. Sarawate, M. J. Sapino, The Ohio State Univ. (USA)
### SESSION 10  CORROSION DETECTION

| 65291B | Monitoring general corrosion of rebar embedded in mortar using high-frequency guided mechanical waves [6529-43] | B. L. Ervin, J. T. Bernhard, D. A. Kuchma, H. Reis, Univ. of Illinois at Urbana-Champaign (USA) |

### SESSION 11  SHM FOR CIVIL STRUCTURES

| 65291D | Integration of traffic information in the structural health monitoring of highway bridges [6529-45] | C. A. Tan, D. Beyene Ashebo, Wayne State Univ. (USA); M. Q. Feng, Y. Fukuda, Univ. of California Irvine (USA) |
| 65291E | Developing hybrid structural health monitoring via integrated global sensing and local infrared imaging [6529-46] | X. Han, Q. He, Wayne State Univ. (USA); N. Sebastijanovic, Univ. of California, Santa Barbara (USA); T. Ma, Univ. of Hawaii at Manoa (USA); H. T. Y. Yang, Univ. of California, Santa Barbara (USA) |
| 65291F | Application of XML database to autonomous configuration control and data transfer for sensor networks in buildings [6529-47] | M. Shoji, A. Mita, Keio Univ. (Japan) |
| 65291H | A study of train intelligent measurement system using acceleration of train [6529-49] | Y. Fujino, The Univ. of Tokyo (Japan) |

### SESSION 12  DATA-DRIVEN TECHNIQUES FOR SHM I

| 65291J | Reliable information management in a low-cost wireless structural monitoring and control network [6529-50] | Y. Wang, Stanford Univ. (USA); J. P. Lynch, Univ. of Michigan (USA); K. H. Law, Stanford Univ. (USA); C.-H. Loh, National Taiwan Univ. (Taiwan); A. Elgamal, Univ. of California at San Diego (USA) |
| 65291K | Non-target image technique for spatial-temporal structural responses measurement [6529-51] | C. C. Chang, Y. Ji, Hong Kong Univ. of Science and Technology (Hong Kong China) |
Flexibility-based structural damage identification using Gauss-Newton method [6529-52]
B. Chen, S. Nagarajaiah, Rice Univ. (USA)

The slow-flow method of identification in nonlinear structural dynamics [6529-53]
G. Kerschen, Univ. of Liege (Belgium); A. F. Vakakis, National Technical Univ. of Athens (Greece); Y. S. Lee, D. M. McFarland, L. A. Bergman, Univ. of Illinois at Urbana-Champaign (USA)

Application of pattern recognition techniques to identify structural change in a laboratory specimen [6529-54]
M. Gui, F. N. Catbas, M. Georgiopoulos, Univ. of Central Florida (USA)

SESSION 13 DATA-DRIVEN TECHNIQUES FOR SHM II

Integrated structural health monitoring system with interactively retrieved sensor data [6529-55]
Y. Zhang, Lehigh Univ. (USA); J. Li, Guangdong Provincial Academy of Building Research (China); Y. Chae, Lehigh Univ. (USA)

Real-time condition assessment of the Bill Emerson cable-stayed bridge using artificial neural networks [6529-56]
W. Wang, G. Chen, Univ. of Missouri, Rolla (USA); B. A. Hartnagel, Missouri Dept. of Transportation (USA)

Performance verification of a bivariate regressive adaptive index for structural health monitoring [6529-57]
S. Su, T. Kijewski-Correa, Univ. of Notre Dame (USA)

Some data-driven modeling approaches for detecting changes in nonlinear dampers [6529-58]
H.-B. Yun, S. F. Masri, F. Tasbihgou, R. W. Wolfe, Univ. of Southern California (USA)

Reduced surface wave transmission function and neural networks for crack evaluation of concrete structures [6529-59]
S. W. Shin, C. B. Yun, Korea Advanced Institute of Science and Technology (South Korea); H. Furuta, Kansai Univ. (Japan); J. S. Popovics, Univ. of Illinois at Urbana-Champaign (USA)

A heuristic neural network initialization scheme for modeling nonlinear functions in engineering mechanics: continuous development [6529-60]
J.-S. Pei, E. C. Mai, Univ. of Oklahoma (USA)

SESSION 14 DAMAGE DETECTION

The detection of hydrogen with a nanotube structured sensor [6529-61]
H. Gu, A. Polar, Univ. of Illinois at Chicago (USA); H. H. Wang, Argonne National Lab. (USA); J. E. Indacochea, M. L. Wang, Univ. of Illinois at Chicago (USA)

Continuous time parameter estimation of multi-story buildings [6529-62]
D. Ma, N.-S. Xu, Univ. of Hawaii at Manoa (USA)
Fatigue crack detection in a plate girder using Lamb waves [6529-63]

Part Two
SESSION 15 FIBER OPTIC SENSORS FOR SHM I

Restraint-free wearable sensing clothes using a hetero-core optic fiber for measurements of arm motion and walking action [6529-64]
M. Nishiyama, H. Sasaki, K. Watanabe, Soka Univ. (Japan)

Composite scarf repair monitoring using fiber Bragg grating sensors [6529-66]
H. C. H. Li, RMIT Univ. (Australia); I. Herszberg, Cooperative Research Ctr. for Advanced Composite Structures Ltd. (Australia); C. E. Davis, Defence Science and Technology Organisation (Australia); P. R. Stoddart, Swinburne Univ. of Technology (Australia)

Self-assembled PN semiconductor detectors on optical fibers [6529-67]
H. Ruan, Y. Kang, J. Lalli, A. Hill, NanoSonic, Inc. (USA); N. D. Sankir, TOBB Univ. of Economics and Technology (Turkey); F. J. Arregui, Public Univ. of Navarra (Spain); R. O. Claus, NanoSonic, Inc. (USA)

Miniature fiber Bragg grating sensor interrogator (FBG-Transceiver) system [6529-68]
E. A. Mendoza, C. Kempen, Redondo Optics, Inc. (USA); C. Lopatin, Naval Surface Warfare Ctr. (USA)

Self-powered multi-functional fiber sensors [6529-150]
K. P. Chen, C. Jewart, M. Buric, B. McMillen, Univ. of Pittsburgh (USA); P. R. Swinehart, M. Maklad, Lake Shore Cryotronics, Inc. (USA)

SESSION 16 SHM FOR COMPOSITE MATERIALS

Optimization of fiber Bragg sensor configurations for in situ failure identification in woven composites throughout impact [6529-69]
R. Garrett, J. Pearson, K. Peters, M. Zikry, North Carolina State Univ. (USA)

Electrical impedance tomography of carbon nanotube composite materials [6529-71]
T.-C. Hou, K. J. Loh, J. P. Lynch, Univ. of Michigan (USA)

Structural nanoskin based on carbon nanosphere chains [6529-72]
V. N. Shanov, Univ. of Cincinnati (USA); G. Choi, Korea Institute of Industrial Technology (South Korea); G. Maheshwari, Univ. of Cincinnati (USA); G. Seth, Korea Institute of Industrial Technology (South Korea); S. Chopra, G. Li, Y. Yun, J. Abot, M. J. Schulz, Univ. of Cincinnati (USA)

Effect of cyclic electric fields on crack growth in a moderately soft piezoelectric ceramic [6529-73]
S. H. Ferguson, H. W. King, Univ. of Victoria (Canada); N. Mrad, Defence R&D Canada (Canada); D. F. Waechter, B. Yan, R. Blacow, S. E. Prasad, Sensor Technology Ltd. (Canada)
Theoretical and experimental studies of Lamb wave propagation in attenuative composites [6529-151]
M. Calomfirescu, Faserinstitut Bremen e.V., Univ. of Bremen (Germany) and Univ. of South Carolina (USA); A. S. Herrmann, Faserinstitut Bremen e.V., Univ. of Bremen (Germany)

Magneto-mechanical characterization of iron-gallium nanowire arrays for use in underwater acoustic sensors [6529-74]
P. R. Downey, A. B. Flatau, Univ. of Maryland, College Park (USA)

Mechanical monolithic sensor for low-frequency seismic noise measurement [6529-75]
F. Acernese, Univ. degli Studi di Salerno (Italy) and INFN, Complesso Univ. di Monte S. Angelo Via Cintia (Italy); R. De Rosa, G. Giordano, Univ. degli Studi di Napoli Federico II (Italy) and INFN, Complesso Univ. di Monte S. Angelo Via Cintia (Italy); R. Romano, F. Barone, Univ. degli Studi di Salerno (Italy) and INFN, Complesso Univ. di Monte S. Angelo Via Cintia (Italy)

A MEMS vibration sensor based on Mach Zehnder interferometers [6529-76]
T. Ma, Univ. of Hawaii at Manoa (USA); W. Zhao, Global Communication Semiconductor (USA); J. Liu, Univ. of Hawaii at Manoa (USA) and Chongqing Univ. (China)

Design and modeling of a multifunctional MEMS Fabry-Perot sensor for the simultaneous measurement of displacement, pressure, and temperature [6529-77]
P. M. Nieva, Univ. of Waterloo (Canada); G. G. Adams, N. E. McGruer, Northeastern Univ. (USA)

Piezoresistive in-line integrated force sensors for on-chip measurement and control [6529-78]
K. Teichert, T. Waterfall, B. Jensen, L. Howell, T. McLain, Brigham Young Univ. (USA)

Seismic response control of frame structure braced with SMA tendons [6529-80]
S. Yan, Shenyang Jianzhu Univ. (China) and Univ. of Houston (USA); G. Song, Univ. of Houston (USA); L. Huo, Dalian Univ. of Technology (China) and Univ. of Houston (USA); H. Gu, Univ. of Houston (USA)

Mass-variable TLD systems and their seismic performance [6529-81]
Y. Xin, Tipping Mar & Associates Engineers (USA); G. Chen, Univ. of Missouri, Rolla (USA)

Non-model based vibration control of stay cables using magneto-rheological damper [6529-82]
M. Liu, Harbin Institute of Technology (China); G. Song, Univ. of Houston (USA); H. Li, Harbin Institute of Technology (China)

Leak detection using the pattern of sound signals in water supply systems [6529-83]
T. Sato, A. Mita, Keio Univ. (Japan)
Insurance derivatives based on information obtained by sensor networks to improve the safety of buildings and urban systems [6529-84]
H. Tamura, A. Mita, Keio Univ. (Japan)

Real-time damage monitoring scheme in PSC girder bridge using output-only acceleration data [6529-85]

Offline and online detection of damage using autoregressive models and artificial neural networks [6529-86]
P. Omenzetter, O. R. de Lautour, The Univ. of Auckland (New Zealand)

Damage indicator for building structures using artificial neural networks as emulators [6529-88]
A. Mita, Y. Qian, Keio Univ. (Japan)

SESSION 20 SYSTEM ID AND SIGNAL PROCESSING II

Structural parameter evaluation using incomplete vibration measurement time series [6529-90]
B. Xu, Hunan Univ. (China)

Substructure damage identification using damage tracking technique [6529-92]
J. N. Yang, Univ. of California, Irvine (USA); H. Huang, Tongji Univ. (China)

Experimental verification of an adaptive tracking technique for structural damage [6529-93]
J. N. Yang, Univ. of California, Irvine (USA); H. Huang, Tongji Univ. (China); L. Zhou, Nanjing Univ. of Aeronautics and Astronautics (China)

SESSION 21 NOVEL SENSORS IV

Piezoresistive and piezoelectric MEMS strain sensors for vibration detection [6529-94]
S. Kon, Univ. of California, Berkeley (USA); K. Oldham, Army Research Lab. (USA); R. Horowitz, Univ. of California, Berkeley (USA)

Monitoring pavement condition using Smart Dust under surge time synchronization [6529-97]
J.-S. Pei, Univ. of Oklahoma (USA); R. A. Ivey, Auburn Univ. (USA); H. Lin, A. Landrum, C. J. Sandburg, T. King, M. M. Zaman, H. H. Refai, E. C. Mai, Univ. of Oklahoma (USA); O. Oshlake, Rutgers Univ. (USA); A. Heriba, South Dakota School of Mines and Technology (USA); E. Hurt, Univ. of Oklahoma (USA)

Optimization studies of self-sensing composites [6529-98]
K. Schaaf, P. Rye, S. Nemat-Nasser, Univ. of California, San Diego (USA)
### SESSION 22  SIGNAL PROCESSING AND DAMAGE DETECTION I

<table>
<thead>
<tr>
<th>Paper ID</th>
<th>Title</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>652931</td>
<td>Reference-based damage diagnosis of structure using embedded statistical model</td>
<td>C.-H. Loh, A.-L. Wu, S.-G. Huang, S.-H. Chao, National Taiwan Univ. (Taiwan)</td>
</tr>
<tr>
<td>652932</td>
<td>Measuring three-axis force with four-part tactile sensing techniques</td>
<td>J. Liu, Chongqing Univ. (China) and Univ. of Hawaii at Manoa (USA); X. Mo, Chongqing Univ. (China); J. Wang, Chongqing Technology and Business Univ. (China); T. Ma, University of Hawaii at Manoa (USA); Y. Pan, Chongqing Univ. (China)</td>
</tr>
<tr>
<td>652933</td>
<td>High-strain and deformation measurements using imaging and smart material sensors</td>
<td>A. Carney, C. Niezrecki, P. Buaka, J. Chen, E. Niemi, Univ. of Massachusetts Lowell (USA)</td>
</tr>
</tbody>
</table>

### SESSION 23  SIGNAL PROCESSING AND DAMAGE DETECTION II

<table>
<thead>
<tr>
<th>Paper ID</th>
<th>Title</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>652935</td>
<td>Ultra-short fiber Bragg grating intrinsic Fabry-Perot interferometric sensors for quasi-distributed strain and temperature sensing</td>
<td>Z. Wang, M. Han, F. Shen, A. Wang, Virginia Polytechnic Institute and State Univ. (USA)</td>
</tr>
<tr>
<td>652936</td>
<td>Localization of damage and restoration of dynamic characteristics using distributed control</td>
<td>C.-L. Li, L. Zhou, Nanjing Univ. of Aeronautics and Astronautics (China); F.-G. Yuan, North Carolina State Univ. (USA)</td>
</tr>
<tr>
<td>652937</td>
<td>Studying the effect of coupling materials in sonic IR imaging</td>
<td>X. Han, R. Yu, Wayne State Univ. (USA)</td>
</tr>
<tr>
<td>652938</td>
<td>Exploring the resistance change trends associated with integrated piezoresistive sensing elements</td>
<td>G. K. Johns, T. L. Waterfall, L. L. Howell, B. D. Jensen, T. W. McLain, Brigham Young Univ. (USA)</td>
</tr>
<tr>
<td>652939</td>
<td>Omnidirectional guided wave PWAS phased array for thin-wall structure damage detection</td>
<td>L. Yu, V. Giurgiutiu, Univ. of South Carolina (USA); J. R. Kendall, Lockheed Martin Space Systems Co. (USA)</td>
</tr>
<tr>
<td>65293A</td>
<td>Coupled vibration control system for slender buildings constructed closely in urban area</td>
<td>T. Azuhata, T. Ishihara, National Institute for Land and Infrastructure Management (Japan); M. Midorikawa, Hokkaido Univ. (Japan)</td>
</tr>
</tbody>
</table>

### SESSION 24  FIBER OPTIC SENSORS FOR SHM II

<table>
<thead>
<tr>
<th>Paper ID</th>
<th>Title</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>65293B</td>
<td>Polymer optical fiber sensors for civil infrastructure systems</td>
<td>S. Kiesel, K. Peters, O. Abdi, T. Hassan, M. Kowalsky, North Carolina State Univ. (USA)</td>
</tr>
</tbody>
</table>
Low-cost fiber Bragg grating interrogation system for in situ assessment of structures
[6529-110]
J. R. Zayas, D. P. Roach, M. A. Rumsey, Sandia National Labs. (USA); W. R. Allan, D. A. Horsley, Univ. of California, Davis (USA)

Dynamic shape estimation by modal approach using fiber Bragg grating strain sensors
[6529-113]
S. Rapp, Korea Advanced Institute of Science and Technology (South Korea) and Technical Univ. of Munich (Germany); L.-H. Kang, Korea Advanced Institute of Science and Technology (South Korea); U. C. Mueller, Technical Univ. of Munich (Germany); J.-H. Han, Korea Advanced Institute of Science and Technology (South Korea); H. Baier, Technical Univ. of Munich (Germany)

Monitoring of an interstate highway bridge from construction thru service with a built-in fiber optic sensor system [6529-114]
R. L. Idriss, Z. Liang, New Mexico State Univ. (USA)

SESSION 25 FIBER OPTIC SENSORS FOR SHM III

Effect of residual strain on sensing property of FRP-OFBG smart rebar [6529-115]
Z. Zhang, Z. Zhou, C. Wang, Harbin Institute of Technology (China); J. Ou, Harbin Institute of Technology (China) and Dalian Univ. of Technology (China)

Multiplexing low-coherence interferometer sensors: laboratory tests and design for integration within RC structures [6529-117]
M. Pozzi, D. Zonta, H. Wu, Univ. of Trento (Italy); D. Inaudi, Smartec SA (Switzerland)

Multiple damage detection techniques by dynamic strain measurements using FBG sensors [6529-118]
H.-J. Park, K.-Y. Koo, C.-B. Yun, Korea Advanced Institute of Science and Technology (South Korea)

A fiber optic sensor for web edge detection [6529-141]
A. Seshadri, P. R. Pagilla, Oklahoma State Univ. (USA)

SESSION 26 WIRELESS FOR SHM I

In situ measurement of conductivity and temperature during concrete curing using passive wireless sensors [6529-120]
M. M. Andringa, J. M. Puryear, D. P. Neikirk, S. L. Wood, Univ. of Texas, Austin (USA)

Reliability of low-cost wireless sensors for civil infrastructure [6529-121]
J. M. Puryear, M. M. Andringa, S. L. Wood, D. P. Neikirk, Univ. of Texas at Austin (USA)

Field installation details of a wireless shape-acceleration array system for geotechnical applications [6529-122]
T. Abdoun, V. Bennett, Rensselaer Polytechnic Institute (USA); L. Danisch, Measurand, Inc. (Canada); T. Shantz, D. Jang, California Dept. of Transportation (USA)
<table>
<thead>
<tr>
<th>SESSION 27</th>
<th>MODELING AND DESIGN OF SMART SYSTEMS II</th>
</tr>
</thead>
<tbody>
<tr>
<td>65293P</td>
<td>Rectangular Mindlin plate element with a through crack [6529-123]</td>
</tr>
<tr>
<td></td>
<td>C. Liu, J. T. DeWolf, J.-H. Kim, Univ. of Connecticut (USA)</td>
</tr>
<tr>
<td>65293R</td>
<td>Finite element simulation of piezoelectric wafer active sensors for structural health monitoring with coupled-filed elements [6529-125]</td>
</tr>
<tr>
<td></td>
<td>W. Liu, V. Giurgiutiu, Univ. of South Carolina (USA)</td>
</tr>
<tr>
<td>65293S</td>
<td>Chaos theory analysis of a cable-stayed bridge: I. Finite element model development [6529-126]</td>
</tr>
<tr>
<td></td>
<td>S. Jin, Wiss. Janney, Estler Associates, Inc. (USA); R. A. Livingston, Turner-Fairbank Highway Research Ctr. (USA)</td>
</tr>
<tr>
<td>65293T</td>
<td>Chaos theory analysis of a cable-stayed bridge: II. Analysis of monitoring data for baseline conditions [6529-127]</td>
</tr>
<tr>
<td></td>
<td>R. A. Livingston, Turner-Fairbank Highway Research Ctr. (USA); S. Jin, Wiss. Janney, Estler Associates, Inc. (USA); G. Chen, Univ. of Missouri at Rolla (USA)</td>
</tr>
<tr>
<td>65293V</td>
<td>Molecular luminescence sensing for global strain measurement [6529-148]</td>
</tr>
<tr>
<td></td>
<td>J. P. Hubner, Univ. of Alabama (USA)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SESSION 28</th>
<th>MODELING AND DESIGN OF SMART SYSTEMS III</th>
</tr>
</thead>
<tbody>
<tr>
<td>65293W</td>
<td>Non-contact rail flaw detection system: first field test [6529-129]</td>
</tr>
<tr>
<td></td>
<td>P. Rizzo, Univ. of Pittsburgh (USA); S. Coccia, F. Lanza di Scalea, I. Bartoli, Univ. of California, San Diego (USA); M. Fateh, Federal Railroad Administration (USA)</td>
</tr>
<tr>
<td>65293Y</td>
<td>Multimode dynamics of atomic-force-microscope tip-sample interactions and application of sensitivity vector fields [6529-132]</td>
</tr>
<tr>
<td></td>
<td>J. Lim, B. I. Epureanu, Univ. of Michigan (USA)</td>
</tr>
<tr>
<td>65293Z</td>
<td>Characterization and 3-D modeling of Ni60Ti SMA for actuation of a variable geometry jet engine chevron [6529-133]</td>
</tr>
<tr>
<td></td>
<td>D. J. Hartl, D. C. Lagoudas, Texas A&amp;M Univ. (USA)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SESSION 29</th>
<th>WIRELESS FOR SHM II</th>
</tr>
</thead>
<tbody>
<tr>
<td>652940</td>
<td>Wireless piezoelectric acoustic-electric power feedthru [6529-134]</td>
</tr>
<tr>
<td></td>
<td>X. Bao, B. J. Doty, S. Sherrit, M. Badescu, Y. Bar-Cohen, J. Aldrich, Z. Chang, Jet Propulsion Lab. (USA)</td>
</tr>
<tr>
<td>652941</td>
<td>Energy harvesting by magnetostrictive material (MsM) for powering wireless sensors in SHM [6529-135]</td>
</tr>
<tr>
<td></td>
<td>L. Wang, F. G. Yuan, North Carolina State Univ. (USA)</td>
</tr>
<tr>
<td>652942</td>
<td>Power loss consideration in wireless piezoelectric acoustic-electric power feedthru [6529-136]</td>
</tr>
<tr>
<td></td>
<td>Z. Chang, X. Bao, B. J. Doty, S. Sherrit, Y. Bar-Cohen, M. Badescu, J. Aldrich, Jet Propulsion Lab. (USA)</td>
</tr>
</tbody>
</table>
Structural health monitoring utilizing Intel's Imote2 wireless sensor platform

T. Nagayama, Univ. of Tokyo (Japan); B. F. Spencer, Jr., J. A. Rice, Univ. of Illinois at Urbana-Champaign (USA)

Application of a wireless sensing and control system to control a torsion-coupling building with MR-dampers

S.-C. Hsu, K.-C. Lu, National Taiwan Univ. (Taiwan); P.-Y. Lin, National Ctr. for Research on Earthquake Engineering (Taiwan); C.-H. Loh, National Taiwan Univ. (Taiwan); J. P. Lynch, Univ. of Michigan (USA)

Revolutionary transitions of GE technology in NDE prognostics and health monitoring (Plenary Presentation)

E. Hindle, T. Patton, GE Aviation (USA); T. Batzinger, GE Global Research Ctr. (USA)

Author Index
National Science Foundation Papers

652904 Piezoelectric paint sensor for ultrasonic NDE [6529-03]  
X. Li, Y. Zhang, Lehigh Univ. (USA)

652906 Robust decision making in damage detection using piezoelectric transducers and Lamb wave propagation [6529-05]  
Y. Lu, X. Wang, J. Tang, The Univ. of Connecticut (USA)

652908 Monitoring early age mortar using a pulse-echo ultrasonic guided wave approach [6529-07]  
J. L. Borgerson, H. Reis, Univ. of Illinois at Urbana-Champaign (USA)

65290B Estimation of adhesive bond strength in laminated safety glass using guided mechanical waves [6529-10]  
S. Huo, H. Reis, Univ. of Illinois at Urbana-Champaign (USA)

65290C Integrating broadband high-fidelity acoustic emission sensors and array processing to study drying shrinkage cracking in concrete [6529-11]  
G. C. McLaskey, S. D. Glaser, Univ. of California, Berkeley (USA); C. U. Grosse, Univ. of Stuttgart (Germany)

65290D Microfabrication of a wall shear stress sensor using side-implanted piezoresistive tethers [6529-13]  
Y. Li, T. Nishida, D. P. Arnold, M. Sheplak, Univ. of Florida (USA)

65290H Surface functionalization of a microfluidic biosensor for bacteria detection and identification [6529-15]  
D. A. Boehm, P. Gottlieb, S. Z. Hua, SUNY, Buffalo (USA)

65290I Ferroelectric thin-film active sensors for structural health monitoring [6529-16]  
B. Lin, V. Giurgiutiu, Univ. of South Carolina (USA); Z. Yuan, J. Liu, C. Chen, Univ. of Texas at San Antonio (USA); J. Jiang, Univ. of Texas at Arlington (USA); A. S. Bhalla, R. Guo, Pennsylvania State Univ. (USA)

65290M Surface stress sensors for detection of chemical and biological species [6529-20]  
K. Kang, J. Marquardt, P. Shrotriya, Iowa State Univ. (USA)

65290O A system-on-board approach for impedance-based structural health monitoring [6529-22]  
J. Kim, B. L. Grisso, D. S. Ha, D. J. Inman, Virginia Tech (USA)

65290P Remote control of a morphing model aircraft with distributed sensors [6529-23]  
J. Smoker, A. Baz, Univ. of Maryland, College Park (USA)

65290Q Macro-fiber composite piezoelectric rosettes for acoustic source location in complex structures [6529-24]  
H. Matt, F. Lanza di Scalea, Univ. of California, San Diego (USA)
Lamb waves time-reversal method using frequency tuning technique for structural health monitoring [6529-25]
B. Xu, V. Giurgiutiu, Univ. of South Carolina (USA)

Miniaturized sensors for intelligent system fault detection and diagnosis (FDD) [6529-28]
I. Kao, K. Zhang, SUNY at Stony Brook (USA)

Sensing rich drive trains for modern mechatronic systems: first year progress report [6529-31]
M. Tomizuka, H. Cheng, C.-C. Wang, Univ. of California, Berkeley (USA)

Fabrication and evaluation of hybrid silica/polymer optical fiber sensors for large strain measurement [6529-32]
H. Huang, Univ. of Texas at Arlington (USA)

Fabrication and evaluation of a LPFG-based whitelight interferometric distance sensor [6529-33]
H. Huang, A. Majumdar, Univ. of Texas at Arlington (USA)

Development of a MEMS acoustic emission sensor system [6529-34]

A wire-guided transducer for acoustic emission sensing [6529-35]

Passive wireless strain and pH sensing using carbon nanotube-gold nanocomposite thin films [6529-41]
K. J. Loh, J. P. Lynch, N. A. Kotov, Univ. of Michigan (USA)

A magnetic sensing approach to characterize corrosion in reinforced concrete [6529-42]
J. S. Popovics, G. E. Gallo, M. Shelton, P. L. Chapman, Univ. of Illinois at Urbana-Champaign (USA)

Monitoring general corrosion of rebar embedded in mortar using high-frequency guided mechanical waves [6529-43]
B. L. Ervin, J. T. Bernhard, D. A. Kuchma, H. Reis, Univ. of Illinois at Urbana-Champaign (USA)

Integration of traffic information in the structural health monitoring of highway bridges [6529-45]
C. A. Tan, D. Beyene Ashebo, Wayne State Univ. (USA); M. Q. Feng, Y. Fukuda, Univ. of California Irvine (USA)

Scheduling of intelligent sensor and actuator network in flexible structures [6529-48]
M. A. Demetriou, R. Potami, Worcester Polytechnic Institute (USA)

Reliable information management in a low-cost wireless structural monitoring and control network [6529-50]
Y. Wang, Stanford Univ. (USA); J. P. Lynch, Univ. of Michigan (USA); K. H. Law, Stanford Univ. (USA); C.-H. Loh, National Taiwan Univ. (Taiwan); A. Elgamal, Univ. of California at San Diego (USA)
| 65291O | Integrated structural health monitoring system with interactively retrieved sensor data [6529-55] | Y. Zhang, Lehigh Univ. (USA); J. Li, Guangdong Provincial Academy of Building Research (China); Y. Chae, Lehigh Univ. (USA) |
| 65291S | Reduced surface wave transmission function and neural networks for crack evaluation of concrete structures [6529-59] | S. W. Shin, C. B. Yun, Korea Advanced Institute of Science and Technology (South Korea); H. Furuta, Kansai Univ. (Japan); J. S. Popovics, Univ. of Illinois at Urbana-Champaign (USA) |
| 65291U | The detection of hydrogen with a nanotube structured sensor [6529-61] | H. Gu, A. Polar, Univ. of Illinois at Chicago (USA); H. H. Wang, Argonne National Lab. (USA); J. E. Indacochea, M. L. Wang, Univ. of Illinois at Chicago (USA) |
| 65292V | Piezoresistive and piezoelectric MEMS strain sensors for vibration detection [6529-94] | S. Kon, Univ. of California, Berkeley (USA); K. Oldham, Army Research Lab. (USA); R. Horowitz, Univ. of California, Berkeley (USA) |
| 65292W | Monitoring pavement condition using Smart Dust under surge time synchronization [6529-97] | J.-S. Pei, Univ. of Oklahoma (USA); R. A. Ivey, Auburn Univ. (USA); H. Lin, A. Landrum, C. J. Sandburg, T. King, M. M. Zaman, H. H. Refai, E. C. Mai, Univ. of Oklahoma (USA); O. Oshlake, Rutgers Univ. (USA); A. Heriba, South Dakota School of Mines and Technology (USA); E. Hurt, Univ. of Oklahoma (USA) |
| 65292X | Optimization studies of self-sensing composites [6529-98] | K. Schaaf, P. Rye, S. Nemat-Nasser, Univ. of California, San Diego (USA) |
| 652935 | Ultra-short fiber Bragg grating intrinsic Fabry-Perot interferometric sensors for quasi-distributed strain and temperature sensing [6529-103] | Z. Wang, M. Han, F. Shen, A. Wang, Virginia Polytechnic Institute and State Univ. (USA) |
| 652936 | Localization of damage and restoration of dynamic characteristics using distributed control [6529-104] | C.-L. Li, L. Zhou, Nanjing Univ. of Aeronautics and Astronautics (China); F.-G. Yuan, North Carolina State Univ. (USA) |
| 652937 | Studying the effect of coupling materials in sonic IR imaging [6529-105] | X. Han, R. Yu, Wayne State Univ. (USA) |
| 652939 | Omnidirectional guided wave PWAS phased array for thin-wall structure damage detection [6529-107] | L. Yu, V. Giurgiutiu, Univ. of South Carolina (USA); J. R. Kendall, Lockheed Martin Space Systems Co. (USA) |
In situ measurement of conductivity and temperature during concrete curing using passive wireless sensors [6529-120]
M. M. Andringa, J. M. Puryear, D. P. Neikirk, S. L. Wood, Univ. of Texas, Austin (USA)

Reliability of low-cost wireless sensors for civil infrastructure [6529-121]
J. M. Puryear, M. M. Andringa, S. L. Wood, D. P. Neikirk, Univ. of Texas at Austin (USA)

Field installation details of a wireless shape-acceleration array system for geotechnical applications [6529-122]
T. Abdoun, V. Bennett, Rensselaer Polytechnic Institute (USA); L. Danisch, Measurand, Inc. (Canada); T. Shantz, D. Jang, California Dept. of Transportation (USA)

Finite element simulation of piezoelectric wafer active sensors for structural health monitoring with coupled-field elements [6529-125]
W. Liu, V. Giurgiuilu, Univ. of South Carolina (USA)

Non-contact rail flaw detection system: first field test [6529-129]
P. Rizzo, Univ. of Pittsburgh (USA); S. Coccia, F. Lanza di Scalea, I. Bartoli, Univ. of California, San Diego (USA); M. Fateh, Federal Railroad Administration (USA)

Energy harvesting by magnetostrictive material (MsM) for powering wireless sensors in SHM [6529-135]
L. Wang, F. G. Yuan, North Carolina State Univ. (USA)

Structural health monitoring utilizing Intel’s Imote2 wireless sensor platform [6529-137]
T. Nagayama, Univ. of Tokyo (Japan); B. F. Spencer, Jr., J. A. Rice, Univ. of Illinois at Urbana-Champaign (USA)

Application of a wireless sensing and control system to control a torsion-coupling building with MR-dampers [6529-138]
S.-C. Hsu, K.-C. Lu, National Taiwan Univ. (Taiwan); P.-Y. Lin, National Ctr. for Research on Earthquake Engineering (Taiwan); C.-H. Loh, National Taiwan Univ. (Taiwan); J. P. Lynch, Univ. of Michigan (USA)

Application of zonal model on indoor air sensor network design [6529-147]
Y. L. Chen, J. Wen, Drexel Univ. (USA)

Molecular luminescence sensing for global strain measurement [6529-148]
J. P. Hubner, Univ. of Alabama (USA)
Conference Committee

Conference Chair

Masayoshi Tomizuka, University of California, Berkeley (USA)

Cochairs

Chung-Bang Yun, Korea Advanced Institute of Science and Technology (South Korea)
Victor Giurgiutiu, University of South Carolina (USA)

Program Committee

H. Harry Asada, Massachusetts Institute of Technology (USA)
Amr M. Baz, University of Maryland, College Park (USA)
Fabio Casciati, Università degli Studi di Pavia (Italy)
C. C. Chang, The Hong Kong University of Science and Technology (Hong Kong China)
Fu-Kuo Chang, Stanford University (USA)
Genda Chen, University of Missouri, Rolla (USA)
Shirley J. Dyke, Washington University (USA)
Silvia Ferrari, Duke University (USA)
Alison B. Flatau, University of Maryland, College Park (USA)
Yozo Fujino, The University of Tokyo (Japan)
Robert X. Gao, University of Massachusetts, Amherst (USA)
Steven D. Glaser, University of California, Berkeley (USA)
Faramarz Gordaninejad, University of Nevada, Reno (USA)
Xiaoyan Han, Wayne State University (USA)
B. K. Henderson, Air Force Research Laboratory (USA)
Haiying Huang, Purdue University (USA)
Jerry Q. Huang, The Boeing Company (USA)
Kumar Jata, Air Force Research Laboratory (USA)
Jeong-Tae Kim, Pukyong National University (South Korea)
Ki Soo Kim, Hoseo University (South Korea)
Jan-Ming Ko, The Hong Kong Polytechnic University (Hong Kong China)
Francesco Lanza di Scalea, University of California, San Diego (USA)
Shih-Chi Liu, National Science Foundation (USA)
Chin-Hsiung Loh, National Taiwan University (Taiwan)
Jerome P. Lynch, University of Michigan (USA)
Stephen A. Mahin, University of California, Berkeley (USA)
Eduardo Misawa, National Science Foundation (USA)
Akira Mita, Keio University (Japan)
Slavouche Nemat-Nasser, University of California/San Diego (USA)
Irving J. Oppenheim, Carnegie Mellon University (USA)
<table>
<thead>
<tr>
<th>Session Chairs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Invited Lectures</td>
</tr>
<tr>
<td><strong>Chung-Bang Yun</strong>, Korea Advanced Institute of Science and Technology (South Korea)</td>
</tr>
<tr>
<td><strong>Victor Giurgiutiu</strong>, University of South Carolina (USA)</td>
</tr>
<tr>
<td>2 Piezoelectric and Integrated Sensors I</td>
</tr>
<tr>
<td><strong>Yunfeng Zhang</strong>, Lehigh University (USA)</td>
</tr>
<tr>
<td><strong>Jiong Tang</strong>, The University of Connecticut (USA)</td>
</tr>
<tr>
<td>3 Piezoelectric and Integrated Sensors II</td>
</tr>
<tr>
<td><strong>Henrique L. Reis</strong>, University of Illinois at Urbana-Champaign (USA)</td>
</tr>
<tr>
<td><strong>Rais Ahmad</strong>, The University of Arizona (USA)</td>
</tr>
<tr>
<td>4 Novel Sensors I</td>
</tr>
<tr>
<td><strong>Ming L. Wang</strong>, University of Illinois, Chicago (USA)</td>
</tr>
<tr>
<td><strong>Zhihong Xu</strong>, University of Illinois, Chicago (USA)</td>
</tr>
<tr>
<td>5 Novel Sensors II</td>
</tr>
<tr>
<td><strong>Douglas A. Boehm</strong>, SUNY Buffalo (USA)</td>
</tr>
<tr>
<td><strong>David J. Griffilhs</strong>, Virginia Polytechnic Institute and State University (USA)</td>
</tr>
<tr>
<td>6 Monitoring Systems</td>
</tr>
<tr>
<td><strong>Jina Kim</strong>, Virginia Polytechnic Institute and State University (USA)</td>
</tr>
<tr>
<td><strong>Amr M. Baz</strong>, University of Maryland, College Park (USA)</td>
</tr>
<tr>
<td>7 Ultrasonics for SHM</td>
</tr>
<tr>
<td><strong>Howard M. Matt</strong>, University of California, San Diego (USA)</td>
</tr>
<tr>
<td><strong>Mircea Badescu</strong>, Jet Propulsion Laboratory (USA)</td>
</tr>
</tbody>
</table>
8 Modeling and Design of Smart Systems I
Philip W. Loveday, Council for Scientific and Industrial Research (South Africa)
Steven A. Martin, NDE Computational Consultants (USA)

9 Novel Sensors III
Irving J. Oppenheim, Carnegie Mellon University (USA)
Niell G. Elvin, Michigan State University (USA)

10 Corrosion Detection
John S. Popovics, University of Illinois at Urbana-Champaign (USA)
Chin-Hsiung Loh, National Taiwan University (Taiwan)

11 SHM for Civil Structures
Chin An Tan, Wayne State University (USA)
Jan-Ming Ko, The Hong Kong Polytechnic University (Hong Kong China)

12 Data-Driven Techniques for SHM I
Jerome P. Lynch, University of Michigan (USA)
Jin-Song Pei, University of Oklahoma (USA)

13 Data-Driven Techniques for SHM II
Jerome P. Lynch, University of Michigan (USA)
Jin-Song Pei, University of Oklahoma (USA)

14 Damage Detection
Tianwei Ma, University of Hawaii at Manoa (USA)
Irving J. Oppenheim, Carnegie Mellon University (USA)

15 Fiber Optic Sensors for SHM I
Edgar A. Mendoza, Redondo Optics Inc. (USA)
Henry C. H. Li, RMIT University (Australia)

16 SHM for Composite Materials
Ryan C. Garrett, North Carolina State University (USA)
JiangYu Li, University of Washington (USA)

17 Vibration SHM and Other Sensors
Patrick R. Downey, University of Maryland, College Park (USA)
Patricia M. Nieva, University of Waterloo (Canada)

18 Structural Control
Shi Yan, Shenyang Architectural and Civil Engineering University (China) and University of Houston (USA)
Genda Chen, University of Missouri, Rolla (USA)
19 System ID and Signal Processing I
Steven D. Glaser, University of California, Berkeley (USA)
Akira Mita, Keio University (Japan)

20 System ID and Signal Processing II
Jann N. Yang, University of California, Irvine (USA)
Yan Deng, Tsinghua University (China)

21 Novel Sensors IV
Jeong-Hoi Koo, Miami University (USA)
Zhishen Wu, Ibaraki University (Japan)

22 Signal Processing and Damage Detection I
Ai-Lun Wu, National Taiwan University (Taiwan)
Amanda Carney, University of Massachusetts, Lowell (USA)

23 Signal Processing and Damage Detection II
Fabin Shen, Virginia Polytechnic Institute and State University (USA)
Lingyu Yu, University of South Carolina (USA)

24 Fiber Optic Sensors for SHM II
Rola L. Idriss, New Mexico State University (USA)
Jinping Ou, Harbin Institute of Technology (China) and Dalian University of Technology (China)

25 Fiber Optic Sensors for SHM III
Hiroyuki Yamanouchi, Building Research Institute (Japan)
Chung-Bang Yun, Korea Advanced Institute of Science and Technology (South Korea)

26 Wireless for SHM I
Hoon Sohn, Carnegie Mellon University (USA)
Tarek Abdoun, Rensselaer Polytechnic Institute (USA)

27 Modeling and Design of Smart Systems II
Ser-Tong Quek, National University of Singapore (Singapore)
Richard A. Livingston, Turner-Fairbank Highway Research Center (USA)

28 Modeling and Design of Smart Systems III
Piervincenzo Rizzo, University of Pittsburgh (USA)
Hoon Sohn, Carnegie Mellon University (USA)

29 Wireless for SHM II
Xiaoqi Bao, Jet Propulsion Laboratory (USA)
Fuh-Gwo Yuan, North Carolina State University (USA)
Symposium Committee

Symposium Chairs

Yoseph Bar-Cohen, Jet Propulsion Laboratory (USA)
Alison B. Flatau, University of Maryland, College Park (USA)
Norbert G. Meyendorf, University of Dayton (USA)
George Y. Baaklini, NASA Glenn Research Center (USA)

Executive Committee

Mehdi Ahmadian, Virginia Polytechnic Institute and State University (USA)
George Y. Baaklini, NASA Glenn Research Center (USA)
Yoseph Bar-Cohen, Jet Propulsion Laboratory (USA)
Marcelo J. Dapino, The Ohio State University (USA)
L. Porter Davis, Honeywell, Inc. (USA)
Michael A. Demetriou, Worcester Polytechnic Institute (USA)
Aaron A. Diaz, Pacific Northwest National Laboratory (USA)
Alison B. Flatau, University of Maryland, College Park (USA)
Victor Giurgiutiu, University of South Carolina (USA)
B. K. Henderson, Air Force Research Laboratory (USA)
Kumar Jata, Air Force Research Laboratory (USA)
Gabor M., Kovacs, EMPA (Switzerland)
Tribikram Kundu, The University of Arizona (USA)
Donald J. Leo, DARPA (USA) and Virginia Polytechnic Institute and State University (USA)
Douglas K. Lindner, Virginia Polytechnic Institute and State University (USA)
Ajit K. Mal, University of California, Los Angeles (USA)
Yuji Matsuizaki, Nagoya University (Japan)
M. Brett McMickell, Honeywell, Inc. (USA)
Norbert G. Meyendorf, University of Dayton (USA)
Zoubeida Ounaies, Texas A&M University (USA)
Kara J. Peters, North Carolina State University (USA)
Peter J. Shull, The Pennsylvania State University (USA)
Masayoshi Tomizuka, University of California, Berkeley (USA)
Eric Udd, Columbia Gorge Research (USA)
Vijay K. Varadan, University of Arkansas (USA)
Dietmar W. Vogel, Fraunhofer-Institut für Zuverlässigkeit und Mikrointegration (Germany)
H. Felix Wu, National Institute of Standards and Technology (USA)
Chung-Bang Yun, Korea Advanced Institute of Science and Technology (South Korea)
Introduction

This volume is a collection of technical papers presented at the 2007 SPIE Conference 6529 on Sensors and Smart Structures Technologies for Civil, Mechanical, and Aerospace Systems. This conference was part of the SPIE International Symposium on Smart Structures and Materials & Nondestructive Evaluation and Health Monitoring held 18 through 22 March 2007 in San Diego, California.

This conference is unique in the emerging area of sensors and smart structures technologies because of its multidisciplinary representations from the aerospace, civil, and mechanical engineering communities. Participants came from more than thirteen countries over the globe. The conference also served as the de facto grantees’ conference of the Sensor Innovation and Systems (SIS) Program of the Civil, Mechanical, and Manufacturing Innovation (CMMI) Division of the National Science Foundation. The support and participation of the Asian-Pacific Network of Centers for Research in Smart Structure Technology (ANCRiSSST) strengthened international participation. SISTeC at KAIST provided funds to support the participation of special invited participants. As you find in the roster of the program committee, members of the program committee represented the various fields of engineering.

The conference started with an invited session with two excellent presentations: “Sensors and actuators inherent in biological species,” by Professor Minoru Taya, University of Washington, Seattle, et al., and “From photogrammetry, computer vision to structural response measurement” by Professor C. C. Chang, Hong Kong University of Science and Technology.

The opening plenary session was followed by twenty-nine topical sessions and one poster session. The papers in these sessions covered a wide range of topics in fiber optics and other novel sensors, structural health monitoring, signal processing, damage detection and assessment, wireless technologies, and modeling and analysis of smart systems. Research papers supported by the National Science Foundation SIS Program were presented at both respective topical sessions and the NSF poster session. Lively discussions among Dr. Shih-Chi Liu, CMMI Program Director in charge of SIS, principal investigators of the NSF projects, and other participants took place during the poster session.

In conjunction with the broad technical base of the current conference program and its objectives, it is apparent that we must continue to develop and build a large, diverse constituency. In light of the increased number of submissions to this conference that we witnessed in recent years, we are optimistic in this regard. We would like to thank authors and presenters of this year’s conference for their contributions. The outstanding conference program was put together by the fine
effort of the program committee, and we are thankful to the members of the program committee members for their contributions.

We trust that readers will find this conference proceedings volume useful and informative.

Masayoshi Tomizuka
Chung-Bang Yun
Victor Giurgiutiu