

PROCEEDINGS OF SPIE

***Sensor Systems and Networks:  
Phenomena, Technology, and  
Applications for NDE and  
Health Monitoring 2007***

**Kara J. Peters**

*Editor*

**19–21 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 6530



The International Society  
for Optical Engineering

Proceedings of SPIE—The International Society for Optical Engineering, 9780819466518, v. 6530

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:

Author(s), "Title of Paper," in *Sensor Systems and Networks: Phenomena, Technology, and Applications for NDE and Health Monitoring 2007*, edited by Kara J. Peters, Proceedings of SPIE Vol. 6530 (SPIE, Bellingham, WA, 2007) Article CID Number.

ISSN 0277-786X  
ISBN 9780819466518

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

- ix *Symposium Committee*  
xi *Conference Committee*

---

## SESSION 1 SENSOR SYSTEMS AND PACKAGING FOR HARSH ENVIRONMENTS

---

- 653002 **Fiber-optic Bragg grating sensors for structural health monitoring at cryogenic temperatures** [6530-01]  
W. Ecke, I. Latka, T. Habisreuther, Institute of Photonic Technology (Germany);  
J. Lingertat, Max Planck Institute for Plasma Physics (Germany)
- 653003 **Extension of fiber optic grating sensor technology toward very high temperatures for structural monitoring** [6530-02]  
E. Udd, Columbia Gorge Research (USA)
- 653004 **FlexPatch: a rugged miniature FBG strain sensor** [6530-03]  
S. Ferguson, D. Snyder, T. Graver, Micron Optics Inc. (USA); A. Méndez, MCH Engineering, LLC (USA)
- 653005 **Miniature UAV telemetry using a portable integrated FOS system** [6530-04]  
W. Kunzler, J. Newman, D. Wilding, R. Selfridge, S. Schultz, M. Wirthlin,  
A. Rodriguez, Brigham Young Univ. (USA)
- 653006 **Large scale distribution monitoring of FRP-OF based on BOTDR technique for infrastructures** [6530-05]  
Z. Zhou, J. He, K. Yan, Harbin Institute of Technology (China); J. Ou, Harbin Institute of Technology (China) and Dalian Univ. of Technology (China)

---

## SESSION 2 SENSOR NETWORKS FOR NDE IMAGING

---

- 653007 **X-ray detectors for NDE applications** [6530-06]  
M. Kroening, Fraunhofer Institute for Non-Destructive Testing (Germany);  
R. G. Melkadze, T. M. Lezhneva, L. B. Khvedelidze, G. D. Kalandadze, Tbilisi State Univ. (Georgia); T. Baumbach, Forschungszentrum Karlsruhe (Germany);  
A. Berthold, Fraunhofer Institute for Non-Destructive Testing (Germany)

---

**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.

- 653008 **Emission of multiple types of radiation using a miniature ferroelectric-based single source** [6530-07]  
Y. Bar-Cohen, S.-S. Lih, X. Bao, S. Sherrit, M. Badescu, Jet Propulsion Lab. (USA)
- 653009 **Ultrasonic 3D imaging system for the automated application in milling machines** [6530-08]  
R. Schmitt, P. Hafner, RWTH Aachen Univ. (Germany)
- 65300A **Process monitoring system for laser transmission welding of plastics using direct visualisation of the weld seam** [6530-09]  
D. Herzog, M. Fargas, O. Meier, A. von Busse, Laser Zentrum Hannover e.V. (Germany)
- 65300B **Nondestructive testing of ferroelectrics by thermal wave methods** [6530-10]  
G. Gerlach, G. Suchanek, Technische Univ. Dresden (Germany);  
A. Movchikova, O. Malyshkina, Tver State Univ. (Russia)

---

**SESSION 3 NEW SENSING PRINCIPLES**

- 65300C **New sensor principles based on Barkhausen noise** [6530-11]  
J. Schreiber, N. Meyendorf, Fraunhofer Institute for Nondestructive Testing (Germany)
- 65300D **Structure-integrated fiber-optic sensors for reliable static and dynamic analysis of concrete foundation piles** [6530-12]  
M. Schallert, Federal Institute for Materials Research and Testing (Germany) and Technical Univ. of Braunschweig (Germany); D. Hofmann, W. R. Habel, Federal Institute for Materials Research and Testing (Germany); J. Stahlmann, Technical Univ. of Braunschweig (Germany)
- 65300E **Behavior of intrinsic polymer optical fiber sensor for large-strain applications** [6530-13]  
S. Kiesel, K. Peters, T. Hassan, M. Kowalsky, North Carolina State Univ. (USA)
- 65300F **Side-polished and tilted fiber Bragg grating sensors for structural health monitoring applications** [6530-14]  
C.-F. Chan, G. A. Ferrier, D. J. Thomson, Univ. of Manitoba (Canada); C. Chen, J. Albert, Carleton Univ. (Canada); A. Vincelette, P. Lefebvre, LxSix Photonics Inc. (Canada)
- 65300G **Nondestructive evaluation and quality control of surface treatments** [6530-15]  
C. A. Rideout, S. J. Ritchie, Positron Systems, Inc. (USA)
- 65300H **Development of a wireless bridge monitoring system for condition assessment using hybrid techniques** [6530-16]  
M. J. Whelan, M. P. Fuchs, M. V. Gangone, K. D. Janoyan, Clarkson Univ. (USA)
- 65300I **A study of implantable power harvesting transducers** [6530-17]  
B.-S. Lee, P.-J. Shih, J.-J. He, W.-P. Shih, W.-J. Wu, National Taiwan Univ. (Taiwan)

---

**SESSION 4 SENSING OF GUIDED WAVES I**

---

- 65300J **Effect of adhesive properties on elastic wave generation by bonded sensors** [6530-18]  
S. A. Martin, NDE Computational Consultants (USA); J. L. Blackshire, Air Force Research Lab. (USA)
- 65300K **Structural health monitoring in fuselage lap joint** [6530-19]  
G. Grandhi, F. Nkrumah, M. Jacques, M. Sundaresan, North Carolina A&T State Univ. (USA)
- 65300L **Disbonding effects on elastic wave generation and reception by bonded piezoelectric sensor systems** [6530-20]  
J. L. Blackshire, Air Force Research Lab. (USA); S. A. Martin, NDE Computational Consultants (USA); J. K. Na, Univ. of Dayton Research Institute (USA)

---

**SESSION 5 APPLICATIONS OF SENSOR SYSTEMS TO SHM I**

---

- 65300M **Demonstration of an instrumented patch** [6530-21]  
M. Martinez, G. Renaud, D. Backman, M. Genest, M. Delannoy, National Research Council Canada (Canada)
- 65300O **Small-diameter optical fiber and high-speed wavelength interrogator for FBG/PZT hybrid sensing system** [6530-23]  
S. Komatsuzaki, S. Kojima, A. Hongo, Hitachi Cable, Ltd. (Japan); N. Takeda, The Univ. of Tokyo (Japan); T. Sakurai, R&D Institute of Metals and Composites for Future Industries (Japan)
- 65300P **Guided wave diagnosis in composite grid structure with embedded FBG sensors** [6530-24]  
M. Amano, T. Arai, N. Takeda, Univ. of Tokyo (Japan)
- 65300Q **Quantification of impact damage in CMC thermal protection systems using thin-film piezoelectric sensors** [6530-25]  
S. J. Kuhr, Univ. of Dayton Research Institute (USA); J. L. Blackshire, Air Force Research Lab. (USA)

---

**SESSION 6 APPLICATIONS OF SENSOR SYSTEMS TO SHM II**

---

- 65300R **Performance monitoring of a short-span integral-abutment bridge using wireless sensor technology** [6530-26]  
M. V. Gangone, M. J. Whelan, M. P. Fuchs, K. D. Janoyan, Clarkson Univ. (USA)
- 65300S **Real-time wireless sensing with spatiotemporal tracking** [6530-27]  
M. J. Whelan, K. D. Janoyan, Clarkson Univ. (USA)
- 65300T **Multiple damage identification on a wind turbine blade using a structural neural system** [6530-29]  
G. R. Kirikera, M. J. Schulz, Univ. of Cincinnati (USA); M. J. Sundaresan, North Carolina A&T State Univ. (USA)

- 65300U **The application of ultrasonic phased array technology to offshore platform structures inspection** [6530-30]  
S. Baohua, W. Hua, D. Zhongdong, Harbin Institute of Technology (China);  
O. Jinping, Harbin Institute of Technology (China) and Dalian Univ. of Technology (China)

---

**SESSION 7 EMBEDDED SENSORS: MODELING AND STRUCTURAL INTEGRITY**

---

- 65300V **Effects of embedded SHM sensors on the structural integrity of glass fiber/epoxy laminates under in-plane loads** [6530-31]  
F. Ghezzi, S. Nemat-Nasser, Univ. of California, San Diego (USA)
- 65300W **Structural integrity of composite laminates with embedded micro-sensors** [6530-32]  
Y. Huang, S. Nemat-Nasser, Univ. of California, San Diego (USA)
- 65300X **Intelligent FRP retrofits for critical civil infrastructures** [6530-33]  
G. Jiang, K. Peters, North Carolina State Univ. (USA)
- 65300Y **Interface transferring mechanism and error modification of OFBG strain sensor based on mono-scalar isotropic damage constitutive model** [6530-34]  
J. Li, Z. Zhou, Harbin Institute of Technology (China); J. Ou, Harbin Institute of Technology (China) and Dalian Univ. of Technology (China)
- 65300Z **Study on the fabricating process monitoring of thermoplastic based materials packaged OFBG and their sensing properties** [6530-35]  
C. Wang, Z. Zhou, Z. Zhang, Harbin Institute of technology (China); J. Ou, Harbin Institute of Technology (China) and Dalian Univ. of Technology (China)
- 653011 **Strain measurements using FBG on composite over wrap pressure vessels (COPV) in stress rupture test** [6530-37]  
J. Grant, C. Banks, NASA Marshall Space Flight Ctr. (USA)

---

**SESSION 8 SENSING OF GUIDED WAVES II**

---

- 653012 **Investigation of bond quality effects on piezoelectric sensing of impact damage** [6530-38]  
J. K. Na, Univ. of Dayton Research Institute (USA); J. L. Blackshire, Air Force Research Lab. (USA)
- 653013 **Eddy current enhancement for EMATs** [6530-39]  
S. B. Palmer, X. Jian, S. Dixon, Univ. of Warwick (United Kingdom)
- 653014 **Monitoring network for SHM in aircraft applications** [6530-40]  
B. Frankenstein, D. Hentschel, F. Schubert, Fraunhofer Institute for Non-Destructive Testing (Germany)

---

**SESSION 9    SENSOR AND SENSOR SYSTEM PERFORMANCE ASSESSMENTS AND ISSUES**

---

- 653016    **Shape determination of large deployable space structures through the use of fiber-optics with integrated fiber-Bragg's gratings** [6530-42]  
B. J. Arritt, Air Force Research Lab (USA); C. Klimcak, Aerospace Corp. (USA); E. Pollard, CSA Engineering (USA); H.-P. Dumm, Jackson and Tull Engineering (USA); T. Murphey, Air Force Research Lab. (USA)
- 653017    **Early detection of changes in dynamic properties of cyclically symmetric structures** [6530-43]  
H. Vold, K. Napolitano, ATA Engineering, Inc. (USA)
- 653018    **Development of signal processing tools and hardware for piezoelectric sensor diagnostic processes** [6530-44]  
T. G. S. Overly, G. Park, C. R. Farrar, Los Alamos National Lab. (USA)

---

**SESSION 10    MULT-SENSOR DATA FUSION AND SIGNAL PROCESSING I**

---

- 65301B    **Low-cost smart embedded sensor for single throw mechanical equipment** [6530-47]  
N. Lehrasab, Air Univ. (Pakistan); Z. Mahmood, Univ. of Peshawar (Pakistan); S. Fararooy, rcm2 Ltd (United Kingdom)
- 65301C    **Development of an integrated software solution for piezoelectric active-sensing in structural health monitoring** [6530-48]  
L. D. Jacobs, Georgia Institute of Technology (USA); G. Park, C. R. Farrar, Los Alamos National Lab. (USA)

---

**SESSION 11    MULT-SENSOR DATA FUSION AND SIGNAL PROCESSING II**

---

- 65301E    **Monitoring and evaluation of cracked beams based on nonlinear wave modulation** [6530-50]  
A. Masuda, T. Shinagawa, S. Maekawa, Y. Kinugawa, D. Iba, A. Sone, Kyoto Institute of Technology (Japan)
- 65301F    **Embedded microcontroller networks: acoustic materials health monitoring** [6530-51]  
P. M. Rye, Univ. of California, San Diego (USA)
- 65301G    **Classification of novel events for structural health monitoring systems** [6530-52]  
N. J. Dhruve, D. K. McNeill, Univ. of Manitoba (Canada)
- 65301I    **Statistical damage diagnosis of in-service structure under high noise environment using multiple reference data** [6530-55]  
A. Iwasaki, Gunma Univ. (Japan); A. Todoroki, Tokyo Institute of Technology (Japan); Y. Shimamura, Shizuoka Univ. (Japan)
- 65301J    **Structural shape identification using distributed strain data from PPP-BOTDA** [6530-56]  
M. Nishio, T. Mizutani, N. Takeda, The Univ. of Tokyo (Japan)

---

**POSTER SESSION**

---

- 65301M **Hybrid control and acquisition system for distributed sensors for environmental monitoring** [6530-59]  
F. Garufi, Univ. degli Studi di Napoli Federico II (Italy) and INFN, Complesso Univ. di Monte S. Angelo Via Cintia (Italy); F. Acernese, Univ. degli Studi di Salerno (Italy) and INFN, Complesso Univ. di Monte S. Angelo Via Cintia (Italy); A. Boiano, INFN, Complesso Univ. di Monte S. Angelo Via Cintia (Italy); R. De Rosa, 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)
- 65301P **Optical fiber gratings for structural health monitoring in high-temperature environments** [6530-62]  
R. J. Black, K. Chau, G. Chen, B. Moslehi, L. Oblea, K. Sourichanh, Intelligent Fiber Optic Systems Corp. (USA)
- 65301Q **High-speed high-resolution fiber Bragg grating matrix structural health monitoring system** [6530-63]  
K. Chau, Intelligent Fiber Optic Systems Corp. (USA); P. Qiao, W. Lestari, Washington State Univ. (USA); R. J. Black, B. Moslehi, Intelligent Fiber Optic Systems Corp. (USA)
- 65301R **High-resolution extended distance distributed fiber-optic sensing using Rayleigh backscatter** [6530-64]  
S. T. Kreger, D. K. Gifford, M. E. Froggatt, A. K. Sang, R. G. Duncan, M. S. Wolfe, B. J. Soller, Luna Innovations, Inc. (USA)
- 65301S **High-accuracy fiber-optic shape sensing** [6530-65]  
R. G. Duncan, M. E. Froggatt, S. T. Kreger, R. J. Seeley, D. K. Gifford, A. K. Sang, M. S. Wolfe, Luna Innovations, Inc. (USA)
- 65301U **Integrated sensor system for smart materials: multidisciplinary approach using COTS optic fiber sensors. Design, validation, and calibration in aeronautical components area** [6530-67]  
A. M. Calabro, Ctr. Italiano Ricerche Aerospaziali (Italy); L. Mazzola, C. Caneva, Univ. degli Studi di Roma La Sapienza (Italy)

*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*



# 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) and Fraunhofer Institute  
of Non-Destructive Testing (Germany)  
**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 Matsuzaki**, 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)



# Conference Committee

## *Conference Chair*

**Kara J. Peters**, North Carolina State University (USA)

## *Cochairs*

**Norbert G. Meyendorf**, University of Dayton (USA) and Fraunhofer Institute for Non-Destructive Testing (Germany)

**Eric Udd**, Columbia Gorge Research (USA)

## *Program Committee*

**Farhad Ansari**, University of Illinois at Chicago (USA)

**George Y. Baaklini**, NASA Glenn Research Center (USA)

**Xiaoyi Bao**, University of Ottawa (Canada)

**Axel Berthold**, Fraunhofer Institute for Non-Destructive Testing (Germany)

**Bharat Bhushan**, The Ohio State University (USA)

**James L. Blackshire**, Air Force Research Laboratory (USA)

**Richard O. Claus**, Virginia Polytechnic Institute and State University (USA)

**Brian Culshaw**, University of Strathclyde (United Kingdom)

**Wolfgang Ecke**, Institute for Photonic Technology (Germany)

**Richard D. Finlayson**, Physical Acoustics Corporation (USA)

**Gerald U. Gerlach**, Technische Universität Dresden (Germany)

**Neil J. Goldfine**, Jentek Sensors, Inc. (USA)

**Joseph Grant**, NASA Marshall Space Flight Center (USA)

**Wolfgang R. Habel**, Bundesanstalt für Materialforschung und -prüfung (Germany)

**Manfred P. Hentschel**, Bundesanstalt für Materialforschung und -prüfung (Germany)

**Daniele Inaudi**, Smartec SA (Switzerland)

**Albrecht Jander**, Oregon State University (USA)

**Kerop D. Janoyan**, Clarkson University (USA)

**YeonWan Koh**, FiberPro, Inc. (South Korea)

**David A. Krohn**, Light Wave Venture Consulting, LLC (USA)

**Silvio Kruger**, National Research Council Canada (Canada)

**Marley Kunzler**, Blue Road Research (USA)

**Alexis Méndez**, MCH Engineering LLC (USA)

**Bernd Michel**, Fraunhofer-Institut für Zuverlässigkeit und Mikrointegration (Germany)

**Jeff W. Miller**, Micron Optics, Inc. (USA)

**Philipp M. Nellen**, EMPA (Switzerland)

**Marc Niklès**, Omnisens S.A. (Switzerland)

**Stanislave I. Rokhlin**, The Ohio State University (USA)

**Jaswinder S. Sandhu**, Santec Systems, Inc. (USA)

**Carl Smith**, NVE Corp. (USA)  
**Holger Speckmann**, Airbus Deutschland GmbH (Germany)  
**Nobuo Takeda**, The University of Tokyo (Japan)  
**Roderick C. Tennyson**, Fiber Optic Systems Technology, Inc. (Canada)  
**Michael D. Todd**, University of California, San Diego (USA)  
**Zhishen Wu**, Ibaraki University (Japan)  
**Chung-Bang Yun**, Korea Advanced Institute of Science and Technology  
(South Korea)  
**Zhi Zhou**, Harbin Institute of Technology (China)

### *Session Chairs*

- 1 Sensor Systems and Packaging for Harsh Environments  
**Kara J. Peters**, North Carolina State University (USA)  
**Eric Udd**, Columbia Gorge Research (USA)
- 2 Sensor Networks for NDE Imaging  
**Norbert G. Meyendorf**, University of Dayton (USA)  
**Axel Berthold**, Fraunhofer Institute for Non-Destructive Testing (Germany)
- 3 New Sensing Principles  
**Eric Udd**, Columbia Gorge Research (USA)  
**Kara J. Peters**, North Carolina State University (USA)
- 4 Sensing of Guided Waves I  
**James L. Blackshire**, Air Force Research Laboratory (USA)  
**Mannur J. Sundaresan**, North Carolina A&T State University (USA)
- 5 Applications of Sensor Systems to SHM I  
**Alexis Méndez**, MCH Engineering LLC (USA)  
**Nobuo Takeda**, The University of Tokyo (Japan)
- 6 Applications of Sensor Systems to SHM II  
**Wolfgang Ecke**, Institute for Photonic Technology(Germany)  
**Kara J. Peters**, North Carolina State University (USA)
- 7 Embedded Sensors: Modeling and Structural Integrity  
**Joseph Grant**, NASA Marshall Space Center (USA)  
**Yi Huang**, University of California, San Diego (USA)
- 8 Sensing of Guided Waves II  
**Norbert G. Meyendorf**, University of Dayton (USA)  
**Bernd B. F. Frankenstein**, Fraunhofer-Institut für Zerstörungsfreie  
Prüfverfahren (Germany)
- 9 Sensor and Sensor System Performance Assesments and Issues  
**Michael D. Todd**, University of California, San Diego (USA)  
**Gyuhae Park**, Los Alamos National Laboratory (USA)

- 10    Mult-Sensor Data Fusion and Signal Processing I  
      **Gyuhae Park**, Los Alamos National Laboratory (USA)  
      **Michael D. Todd**, University of California, San Diego (USA)
- 11    Mult-Sensor Data Fusion and Signal Processing II  
      **Nobuo Takeda**, The University of Tokyo (Japan)  
      **Patrick M. Rye**, University of California, San Diego (USA)

