PROCEEDINGS OF SPIE

SPIDigitalLibrary.org/conference-proceedings-of-spie

Front Matter: Volume 6926

, "Front Matter: Volume 6926," Proc. SPIE 6926, Modeling, Signal Processing, and Control for Smart Structures 2008, 692601 (2 May 2008); doi: 10.1117/12.797943

SPIE.

Event: SPIE Smart Structures and Materials + Nondestructive Evaluation and Health Monitoring, 2008, San Diego, California, United States

PROCEEDINGS OF SPIE

Modeling, Signal Processing, and Control for Smart Structures 2008

Douglas K. Lindner
Editor

10–12 March 2008
San Diego, California, USA

Sponsored by
SPIE

Cosponsored by
American Society of Mechanical Engineers (USA)

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

Published by
SPIE

Volume 6926

Proceedings of SPIE, 0277-786X, v. 6926

SPIE is an international society advancing an interdisciplinary approach to the science and application of light.

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 *Modeling, Signal Processing, and Control for Smart Structures 2008*, edited by Douglas K. Lindner, Proceedings of SPIE Vol. 6926 (SPIE, Bellingham, WA, 2008) Article CID Number.

ISSN 0277-786X
ISBN 9780819471123

Published by

SPIE

P.O. Box 10, Bellingham, Washington 98227-0010 USA
Telephone +1 360 676 3290 (Pacific Time) · Fax +1 360 647 1445
SPIE.org

Copyright © 2008, 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 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/08/\$18.00.

Printed in the United States of America.

Publication of record for individual papers is online in the SPIE Digital Library.

SPIEDigitalLibrary.org

Paper Numbering: 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. Numbers in the index correspond to the last two digits of the six-digit CID number.

Contents

vii	<i>Symposium Committee</i>
ix	<i>Conference Committee</i>

SESSION 1 DEVICE APPLICATIONS

- 6926 02 **Dynamic characterization and single-frequency cancellation performance of SMASH (SMA actuated stabilizing handgrip)** [6926-01]
A. Pathak, D. Brei, J. Luntz, Univ. of Michigan (USA); C. LaVigna, H. Kwatny, Techno-Sciences Inc. (USA)
- 6926 03 **Finite element analysis of a 3-dimensional acoustic wave correlator response for variable acoustic modes** [6926-48]
A. C. Tikka, S. F. Al-Sarawi, D. Abbott, The Univ. of Adelaide (Australia)
- 6926 04 **The development of a five DOF magnetorheological fluid-based telerobotic haptic system** [6926-03]
F. Ahmadkhanlou, G. N. Washington, S. E. Bechtel, The Ohio State Univ. (USA)
- 6926 05 **Modeling and simulation of a 2-DOF bidirectional electrothermal microactuator** [6926-05]
N. Topaloglu, C. Elbuen, P. M. Nieva, M. Yavuz, J. P. Huissoon, Univ. of Waterloo (Canada)

SESSION 2 CONTROL OF SMART STRUCTURES

- 6926 08 **An electro-mechanically coupled SDOF piezoelectric stack actuator model** [6926-07]
A. York, S. Seelecke, North Carolina State Univ. (USA)
- 6926 09 **Switching sliding mode control for a membrane strip with MFC actuators** [6926-09]
J. M. Renno, A. J. Kurdila, D. J. Inman, Virginia Polytechnic Institute and State Univ. (USA)

SESSION 3 ADVANCED CONTROL

- 6926 0A **Digital signal processing for an adaptive phase-locked loop controller** [6926-11]
J. Twiefel, Institute for Dynamics and Vibration Research (Germany); M. Klubal, C. Paiz, S. Mojzisch, H. Krüger, Heinz Nixdorf Institute (Germany)

SESSION 4 AEROSPACE APPLICATIONS

- 6926 0C **Contact-aided compliant mechanisms for morphing aircraft skin** [6926-15]
V. Mehta, M. Frecker, G. Lesieutre, The Pennsylvania State Univ. (USA)
- 6926 0E **Techniques and considerations for driving piezoelectric actuators at high speed** [6926-04]
A. J. Fleming, The Univ. of Newcastle (Australia)

SESSION 5 HYSTERESIS CONTROL

- 6926 OG **L1 adaptive control of hysteresis in smart materials** [6926-18]
X. Fan, R. C. Smith, North Carolina State Univ. (USA)
- 6926 OH **ANFIS based modeling and inverse control of a thin SMA wire** [6926-19]
A. Kilicarslan, G. Song, K. Grigoriadis, Univ. of Houston (USA)

SESSION 6 INVITED SESSION: INFORMATION MANAGEMENT FOR STRUCTURAL HEALTH MONITORING

- 6926 OK **Microstructure representation and material characterization for multiscale finite element simulations of local mechanical behavior in damaged metallic structures (Invited Paper)** [6926-22]
M. Parra Garcia, C. Luo, Arizona State Univ. (USA); A. Noshadravan, Univ. of Southern California (USA); A. Keck, R. Teale, A. Chattopadhyay, P. Peralta, Arizona State Univ. (USA)
- 6926 OL **Stochastic crack growth under variable loading for health monitoring and prognosis (Invited Paper)** [6926-23]
C. Willhauck, S. Mohanty, A. Chattopadhyay, P. Peralta, Arizona State Univ. (USA)
- 6926 OM **Physics based modeling for time-frequency damage classification (Invited Paper)** [6926-24]
D. Chakraborty, S. Soni, J. Wei, N. Kovvali, A. Papandreou-Suppappola, D. Cochran, A. Chattopadhyay, Arizona State Univ. (USA)
- 6926 ON **Sensor fusion and damage classification in composite materials (Invited Paper)** [6926-25]
W. Zhou, W. D. Reynolds, A. Moncada, N. Kovvali, A. Chattopadhyay, A. Papandreou-Suppappola, D. Cochran, Arizona State Univ. (USA)
- 6926 OO **Simulation of damage-features in complex joint using guided waves (Invited Paper)** [6926-26]
S. Soni, S. Banerjee, Arizona State Univ. (USA); S. Das, NASA Ames Research Ctr. (USA); A. Chattopadhyay, Arizona State Univ. (USA)
- 6926 OP **Ultrasonic sensing and time-frequency analysis for detecting plastic deformation in an aluminum plate (Invited Paper)** [6926-27]
L. Channels, Johns Hopkins Univ. (USA); D. Chakraborty, D. Simon, N. Kovvali, Arizona State Univ. (USA); J. Spicer, Johns Hopkins Univ. (USA); A. Papandreou-Suppappola, D. Cochran, P. Peralta, A. Chattopadhyay, Arizona State Univ. (USA)
- 6926 OQ **Binary tree SVM based framework for mining fatigue induced damage attributes in complex lug joints (Invited Paper)** [6926-28]
C. K. Coelho, Arizona State Univ. (USA); S. Das, NASA Ames Research Ctr. (USA); A. Chattopadhyay, Arizona State Univ. (USA)

SESSION 7 OPTIMIZATION AND HEALTH MONITORING

- 6926 OT **Optimal design of active, passive, and hybrid sandwich structures** [6926-32]
A. L. Araújo, Polytechnic Institute of Bragança (Portugal); C. M. Mota Soares, C. A. Mota Soares, Technical Univ. of Lisbon (Portugal)

SESSION 8 MATERIAL MODELING I

- 6926 0U **Thermal modeling of thermally isolated microplates** [6926-33]
N. Topaloglu, P. M. Nieva, M. Yavuz, J. P. Huissoon, Univ. of Waterloo (Canada)
- 6926 0V **Finite-element simulations of polycrystalline shape memory alloys** [6926-34]
F. Richter, Ruhr-Univ. Bochum (Germany)
- 6926 0W **Nonlinear solutions for circular membranes and thin plates** [6926-35]
F. Zhao, Celerity, Inc. (USA)
- 6926 0X **Simulation of surface effects in energy dissipation of ultra-high-frequency (UHF) nanocantilevers** [6926-36]
K. Yan, A.-K. Soh, Univ. of Hong Kong (Hong Kong China)
- 6926 0Y **Modeling of lossy piezoelectric polymers in SPICE** [6926-37]
R. S. Dahiya, Italian Institute of Technology (Italy) and Univ. of Genoa (Italy); M. Valle, Univ. of Genoa (Italy); G. Metta, Italian Institute of Technology (Italy) and Univ. of Genoa (Italy); L. Lorenzelli, Fondazione Bruno Kessler-IRST (Italy)

SESSION 9 MATERIAL MODELING II

- 6926 0Z **Roles of substrate and film properties upon remnant polarisation and coercive field of ferroelectric thin film memory** [6926-38]
I. Pane, Bandung Institute of Technology (Indonesia); J. E. Huber, Univ. of Oxford (United Kingdom)
- 6926 10 **New silicone dielectric elastomers with a high dielectric constant** [6926-39]
Z. Zhang, L. Liu, J. Fan, K. Yu, Y. Liu, L. Shi, J. Leng, Harbin Institute of Technology (China)
- 6926 11 **Force control of a shape memory alloy wire using fuzzy controller** [6926-13]
O. Rohani, A. Yousefi-Koma, A. Rezaeeian, A. Doosthoseini, Univ. of Tehran (Iran)
- 6926 12 **Fuzzy control of flexible structure using piezoelements** [6926-14]
A. Doosthoseini, A. Yousefi koma, B. Shasti, Univ. of Tehran (Iran); O. Rohani, Univ. of California, Irvine (USA)

POSTER SESSION

- 6926 13 **Optimization of monitoring parameters of a space tubular structure by using genetic algorithms** [6926-31]
J. R. V. Moura, Jr., V. Steffen, Jr., Federal Univ. of Uberlandia (Brazil); D. J. Inman, Virginia Polytechnic Institute and State Univ. (USA)
- 6926 14 **A new method to compact a bright line in the high resolution image** [6926-40]
L. Mu, J. Li, D. Li, D. Ma, Harbin Institute of Technology (China)

- 6926 15 **Hybrid control and acquisition system for remote control systems for environmental monitoring** [6926-41]
F. Garufi, Univ. degli Studi di Napoli Federico II (Italy) and Complesso Univ. di Monte S. Angelo (Italy); F. Acernese, Univ. degli Studi di Salerno (Italy) and Complesso Univ. di Monte S. Angelo (Italy); A. Boiano, Complesso Univ. di Monte S. Angelo (Italy); R. De Rosa, Univ. degli Studi di Napoli Federico II (Italy) and Complesso Univ. di Monte S. Angelo (Italy); R. Romano, F. Barone, Univ. degli Studi di Salerno (Italy) and Complesso Univ. di Monte S. Angelo (Italy)
- 6926 18 **Vibration suppression of beam by using magnet-coil** [6926-46]
T.-H. Cheng, I.-K. Oh, Chonnam National Univ. (South Korea)

Author Index

Symposium Committee

Symposium Chairs

Alison B. Flatau, University of Maryland, College Park (USA)
George Y. Baaklini, NASA Glenn Research Center (USA)
Donald J. Leo, Virginia Polytechnic Institute and State University (USA)
Kara J. Peters, North Carolina State University (USA)

Executive Committee

Alison B. Flatau, University of Maryland, College Park (USA)
George Y. Baaklini, NASA Glenn Research Center (USA)
Donald J. Leo, Virginia Polytechnic Institute and State University (USA)
Kara J. Peters, North Carolina State University (USA)
Mehdi Ahmadian, Virginia Polytechnic Institute and State University (USA)
Yoseph Bar-Cohen, Jet Propulsion Laboratory (USA)
Emilio P. Calius, Industrial Research Ltd. (New Zealand)
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)
Wolfgang Ecke, IPHT Jena (Germany)
Mehrdad N. Ghasemi-Nejhad, University of Hawai'i at Manoa (USA)
Victor Giurgiutiu, University of South Carolina (USA)
B. Kyle Henderson, Air Force Research Laboratory (USA)
Kumar V. Jata, Air Force Research Laboratory (USA)
Tribikram Kundu, The University of Arizona (USA)
Douglas K. Lindner, Virginia Polytechnic Institute and State University (USA)
Ajit K. Mal, University of California, Los Angeles (USA)
M. Brett McMickell, Honeywell, Inc. (USA)
Norbert G. Meyendorf, Fraunhofer-Institut für Zerstörungsfreie Prüfverfahren (Germany) and University of Dayton (USA)
Zoubaida Ounaies, Texas A&M University (USA)
Andrei M. Shkel, University of California, Irvine (USA)
Peter J. Shull, The Pennsylvania State University (USA)
Masayoshi Tomizuka, University of California, Berkeley (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

Douglas K. Lindner, Virginia Polytechnic Institute and State University
(USA)

Program Committee

Michael A. Demetriou, Worcester Polytechnic Institute (USA)
Mary I. Frecker, The Pennsylvania State University (USA)
Karolos M. Grigoriadis, University of Houston (USA)
Scott W. Hansen, Iowa State University (USA)
Hans Irschik, Johannes Kepler Universität Linz (Austria)
Katherine J. Jones, Rice University (USA)
Jaehwan Kim, Inha University (South Korea)
Andrew J. Kurdila, Virginia Polytechnic Institute and State University
(USA)
Arnold Lumsdaine, The University of Tennessee (USA)
S. O. Reza Moheimani, The University of Newcastle (Australia)
Stefan S. Seelecke, North Carolina State University (USA)
Emílio C. N. Silva, Escola Politécnica da Universidade de São Paulo
(Brazil)
Robert E. Skelton, University of California, San Diego (USA)
Ralph C. Smith, North Carolina State University (USA)
Wieslaw J. Staszewski, The University of Sheffield (United Kingdom)
Miao Yu, University of Maryland, College Park (USA)

Session Chairs

- 1 Device Applications
Jonathan E. Luntz, University of Michigan (USA)
- 2 Control of Smart Structures
William S. Galinaitis, Rose-Hulman Institute of Technology (USA)
- 3 Advanced Control
Jens Twiefel, Leibniz Universität Hannover (Germany)
- 4 Aerospace Applications
Mary I. Frecker, The Pennsylvania State University (USA)

- 5 Hysteresis Control
 Xiang Fan, North Carolina State University (USA)
- 6 Invited Session: Information Management for Structural Health
 Monitoring
 Aditi Chattopadhyay, Arizona State University (USA)
 Antonia Papandreou-Suppappola, Arizona State University (USA)
- 7 Optimization and Health Monitoring
 Cristovao M. Mota Soares, Instituto Superior Técnico (Portugal)
- 8 Material Modeling I
 Frank Richter, Ruhr- Universität Bochum (Germany)
- 9 Material Modeling II
 John E. Huber, University of Oxford (United Kingdom)