## PROCEEDINGS OF SPIE

# Active and Passive Smart Structures and Integrated Systems 2013

**Henry A. Sodano** *Editor* 

10–14 March 2013 San Diego, California, United States

Sponsored by SPIE

Cosponsored by American Society of Mechanical Engineers (United States)

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

Published by SPIE

Volume 8688

Proceedings of SPIE 0277-786X, V. 8688

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

Active and Passive Smart Structures and Integrated Systems 2013, edited by Henry A. Sodano, Proc. of SPIE Vol. 8688, 868801 ⋅ © 2013 SPIE ⋅ CCC code: 0277-786X/13/\$18 doi: 10.1117/12.2021916

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 Active and Passive Smart Structures and Integrated Systems 2013, edited by Henry A. Sodano, Proceedings of SPIE Vol. 8688 (SPIE, Bellingham, WA, 2013) Article CID Number.

ISSN: 0277-786X ISBN: 9780819494719

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 © 2013, 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/13/\$18.00.

Printed in the United States of America.

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



**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 as 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**

xi Conference Committee

| SESSION 1 | ENERGY HARVESTING AND SCAVENGING: GENERAL I  |
|-----------|--|
| 8688 03   | Design and performance enhancement of hydraulic pressure energy harvesting systems [8688-3] E. A. Skow, K. A. Cunefare, A. Erturk, The George W. Woodruff School of Mechanical Engineering (United States)       |
| 8688 04   | Piezoelectric PVDF film energy harvester for powering a wireless sensor system [8688-4] E. Bischur, N. Schwesinger, Technische Univ. München (Germany)   |
| 8688 05   | Steady-state dynamics of a bistable energy harvester with linear appendage oscillator [8688-2]<br>R. L. Harne, M. Thota, K. W. Wang, Univ. of Michigan (United States)   |
| SESSION 2 | ENERGY HARVESTING AND SCAVENGING: CIRCUITRY  |
| 8688 06   | Piezoelectric array of oscillators with respective electrical rectification [8688-5] I. C. Lien, Y. C. Shu, National Taiwan Univ. (Taiwan)   |
| 8688 07   | Toward efficient aeroelastic energy harvesting: device performance comparisons and improvements through synchronized switching [8688-6] M. Bryant, A. D. Schlichting, E. Garcia, Cornell Univ. (United States)   |
| 8688 08   | Influence of the topology for a networked SSHI piezoelectric harvesting configuration [8688-7] Y. Li, D. Guyomar, C. Richard, Lab. de Génie Electrique et de Ferroélectricité, INSA-Lyon, Univ. de Lyon (France) |
| 8688 09   | Review of power electronics for kinetic energy harvesting systems [8688-8] P. Li, C. Zhang, L. Zuo, Stony Brook Univ., SUNY (United States)  |
| 8688 OA   | Practical implementation of piezoelectric energy harvesting synchronized switching schemes [8688-9] A. D. Schlichting, A. Phadke, E. Garcia, Cornell Univ. (United States)                                       |
| SESSION 3 | ENERGY HARVESTING AND SCAVENGING: BROADBAND TECHNIQUES   |
| 8688 OB   | Broadband energy harvesting using nonlinear 2-DOF configuration [8688-10]<br>H. Wu, L. Tang, P. V. Avvari, Y. Yang, C. K. Soh, Nanyang Technological Univ. (Singapore)   |

| 8688 OD                     | Fundamental power limits of piezoelectric energy harvesters based on material strength [8688-12]<br>M. W. Shafer, E. Garcia, Cornell Univ. (United States)  |
|-----------------------------|---|
| 8688 OE                     | A micro piezoelectric energy harvester based on stainless steel substrate with dual oscillators [8688-13] CC. Wang, YS. Shih, SC. Lin, JY. Zeng, WJ. Wu, National Taiwan Univ. (Taiwan)   |
| 8688 OF                     | A multiaxial piezoelectric energy harvester [8688-14] H. D. Mousselmal, Lab. de Génie Electrique et de Ferroélectricité, INSA-Lyon, Univ. de Lyon (France) and Institut des Nanotechnologies de Lyon, CNRS, Univ. de Lyon (France); P. J. Cottinet, Lab. de Génie Electrique et de Ferroélectricité, INSA-Lyon, Univ. de Lyon (France); L. Quiquerez, B. Remaki, Institut des Nanotechnologies de Lyon, CNRS, Univ. de Lyon (France); L. Petit, Lab. de Génie Electrique et de Ferroélectricité, INSA-Lyon, Univ. de Lyon (France)                                |
| 8688 0G                     | A cantilevered piezoelectric bi-stable composite concept for broadband energy harvesting [8688-100]  A. F. Arrieta, T. Delpero, ETH Zürich (Switzerland); A. Bergamini, EMPA (Switzerland); P. Ermanni, ETH Zürich (Switzerland)  |
| SESSION 4                   | BIOLOGICAL-INSPIRED SYSTEMS AND BIO-MEMS  |
|                             |   |
| 8688 OH                     | Synthesizing fluidic flexible matrix composite based cellular structures [8688-15] S. Li, KW. Wang, Univ. of Michigan (United States)   |
| 8688 0H  SESSION 5          |   |
|                             | S. Li, KW. Wang, Univ. of Michigan (United States)  |
| SESSION 5                   | S. Li, KW. Wang, Univ. of Michigan (United States)  ENERGY HARVESTING AND SCAVENGING: GENERAL II  Vibration shape effects on the power output in piezoelectric vibro-impact energy harvesters [8688-18]   |
| <b>SESSION 5</b><br>8688 0K | S. Li, KW. Wang, Univ. of Michigan (United States)  ENERGY HARVESTING AND SCAVENGING: GENERAL II  Vibration shape effects on the power output in piezoelectric vibro-impact energy harvesters [8688-18]  J. Twiefel, Leibniz Univ. Hannover (Germany)  Analysis and optimization of thermoacoustic-piezoelectric energy harvesters: an electrical circuit analogy approach [8688-19]  M. Nouh, Univ. of Maryland (United States); O. Aldraihem, King Saud Univ. (Saudi Arabia) and King Abdulaziz City of Science and Technology (Saudi Arabia); A. Baz, Univ. of |

| SESSION 6 | MODELING, SIMULATION, OPTIMIZATION, SIGNAL PROCESSING, CONTROL, AND DESIGN OF INTEGRATION   |
|-----------|---|
| 8688 00   | Identification of flexible structures by frequency-domain observability range context [8688-22] M. A. Hopkins, Rochester Institute of Technology (United States)  |
| 8688 OP   | Modeling and control of a jellyfish-inspired AUV [8688-23] C. T. Faria, Virginia Polytechnic Institute and State Univ. (United States) and Univ. of Michigan (United States); S. Priya, Virginia Polytechnic Institute and State Univ. (United States); D. J. Inman, Univ. of Michigan (United States)  |
| 8688 OQ   | Computation of 2D vibroacoustic wave's dispersion for optimizing acoustic power flow in interaction with adaptive metacomposites [8688-24] M. Collet, M. Ouisse, FEMTO-ST (France); M. Ichchou, Lab. de Tribologie et Dynamique des Systèmes, CNRS, Ecole Centrale de Lyon (France); R. Ohayon, 3LMSSC, Conservatoire National des Arts et Métiers (France) |
| 8688 OR   | Wind farm power maximization based on a cooperative static game approach [8688-25] J. Park, Stanford Univ. (United States); S. Kwon, Chonbuk National Univ. (Korea, Republic of); K. H. Law, Stanford Univ. (United States)   |
| 8688 OS   | Design of smart composite platforms for adaptive trust vector control and adaptive laser telescope for satellite applications [8688-26] M. N. Ghasemi-Nejhad, Univ. of Hawai'i at Manoa (United States)   |
| SESSION 7 | PASSIVE AND ACTIVE VIBRATION ISOLATION SYSTEMS I  |
| 8688 OT   | Vibration damping of a cantilever beam utilizing fluidic flexible matrix composites [8688-27] B. Zhu, C. D. Rahn, C. E. Bakis, The Pennsylvania State Univ. (United States)   |
| 8688 OU   | H <sub>2</sub> optimization of electricity-generating tuned mass dampers for simultaneous vibration control and energy harvesting [8688-28] W. Cui, X. Tang, L. Zuo, Stony Brook Univ., SUNY (United States)  |
| 8688 OV   | A new global approach using a network of piezoelectric elements and energy redistribution for enhanced vibration damping of smart structure [8688-29] D. Wu, D. Guyomar, C. Richard, Lab. de Génie Electrique et de Ferroélectricité, INSA-Lyon, Univ. de Lyon (France)   |
| 8688 OW   | Experimental investigation of dynamic performance of a prototype hybrid tuned mass damper under human excitation [8688-30]  N. Noormohammadi, P. Reynolds , The Univ. of Sheffield (United Kingdom)   |
| 8688 0X   | Simultaneous supply of infinite and infinitesimal stiffness of active isolation systems that are exposed to multiple vibration sources [8688-31]  B. T. Kletz, Technical Univ. Braunschweig (Germany) and German Aerospace Ctr. (DLR) (Germany); J. Melcher, German Aerospace Ctr. (DLR) (Germany)  |

| SESSION 8  | MAGNETO RHEOLOGICAL SYSTEMS I  |
|------------|--|
| 8688 OY    | Analysis and testing of an inner bypass magnetorheological damper for shock and vibration mitigation [8688-32] XX. Bai, Univ. of Maryland (United States) and Chongqing Univ. (China); W. Hu, N. M. Wereley, Univ. of Maryland (United States) |
| 8688 OZ    | Modeling of a new magnetorheological elastomer-based isolator [8688-33] M. Behrooz, X. Wang, F. Gordaninejad, Univ. of Nevada, Reno (United States)  |
| 8688 10    | Continuous variable transmission and regenerative braking devices in bicycles utilizing magnetorheological fluids [8688-34] W. M. Cheung, WH. Liao, The Chinese Univ. of Hong Kong (Hong Kong, China)  |
| SESSION 9  | SMA- AND PIEZO-BASED MATERIALS AND SYSTEMS   |
| 8688 12    | Simultaneous measurement of longitudinal and lateral piezoelectric strain coefficients using digital image correlation [8688-36] M. H. Malakooti, H. A. Sodano, Univ. of Florida (United States)   |
| 8688 13    | Design and control of direct drive servo-valve operated by the piezostack actuator [8688-37] J. Jeon, QH. Nguyen, SB. Choi, Inha Univ. (Korea, Republic of)  |
| 8688 14    | Effect of misalignment between ultrasound piezoelectric transducers on transcutaneous energy transfer [8688-38] C. Mo, S. Hudson, Washington State Univ. (United States); L. J. Radziemski, Piezo Energy Technologies, LLC (United States)     |
| SESSION 10 | AIRCRAFT, MAV/UAV AND MORPHING SYSTEMS   |
| 8688 15    | Experimental testing of spanwise morphing trailing edge concept [8688-39] A. Pankonien, D. J. Inman, Univ. of Michigan (United States)   |
| 8688 18    | Characterization of multifunctional skin-material for morphing leading-edge applications [8688-42] S. Geier, M. Kintscher, T. Mahrholz, P. Wierach, HP. Monner, M. Wiedemann, German Aerospace Ctr. (DLR) (Germany)                            |
| SESSION 11 | MAGNETO RHEOLOGICAL SYSTEMS II   |
| 8688 19    | A magneto-rheological fluid-based torque sensor for smart torque wrench application [8688-44] F. Ahmadkhanlou, G. N. Washington, Univ. of California, Irvine (United States)   |

| 8688 1 A                     | Simulation of adaptive semi-active magnetorheological seat damper for vehicle occupant blast protection [8688-45] JH. Yoo, M. Murugan, U.S. Army Research Lab. (United States); N. M. Wereley, Univ. of Maryland (United States)   |
|------------------------------|--|
| 8688 1B                      | Design and control of MR haptic master/slave robot system for minimally invasive surgery [8688-46] CH. Uhm, PB. Nguyen, SB. Choi, Inha Univ. (Korea, Republic of)  |
| 8688 1C                      | An improved polynomial dynamic model of a magnetorheological fluid damper under impact loadings [8688-47]  Z. Li, Nanjing Forestry Univ. (China) and Nanjing Univ. of Science and Technology (China);  J. Zheng, Nanjing Univ. of Science and Technology (China); J. H. Koo, Miami Univ. (United States); J. Wang, Nanjing Univ. of Science and Technology (China)   |
| 8688 1D                      | Energy-efficient MRF clutch avoiding no-load losses [8688-48] D. Güth, M. Schamoni, J. Maas, Hochschule Ostwestfalen-Lippe Univ. of Applied Sciences (Germany)   |
| 8688 1E                      | Design of the magnetorheological mount with high damping force for medium speed diesel generators [8688-49] OH. Kang, WH. Kim, W. H. Joo, Hyundai Heavy Industries Co., Ltd. (Korea, Republic of);   |
|                              | JH. Park, Inha Univ. (Korea, Republic of)  |
| SESSION 12                   | ENERGY HARVESTING AND SCAVENGING: GENERAL III  |
| <b>SESSION 12</b><br>8688 1F |  |
|                              | ENERGY HARVESTING AND SCAVENGING: GENERAL III  Vibration energy harvesting using Galfenol-based transducer [8688-50]   |
| 8688 1F                      | ENERGY HARVESTING AND SCAVENGING: GENERAL III  Vibration energy harvesting using Galfenol-based transducer [8688-50]  V. Berbyuk, Chalmers Univ. of Technology (Sweden)  Enhance piezoelectric energy harvesting by stiffness compensation using magnetic effect [8688-52]   |
| 8688 1F<br>8688 1H           | Vibration energy harvesting using Galfenol-based transducer [8688-50] V. Berbyuk, Chalmers Univ. of Technology (Sweden)  Enhance piezoelectric energy harvesting by stiffness compensation using magnetic effect [8688-52] J. Xu, J. Tang, Univ. of Connecticut (United States)  A hybrid electromagnetic energy harvesting device for low frequency vibration [8688-53] HJ. Jung, IH. Kim, D. Min, KAIST (Korea, Republic of); SH. Sim, Ulsan National Institute of |

| SESSION 13 | MODELING OF ENERGY HARVESTING SYSTEMS I   |
|------------|---|
| 8688 1N    | Investigation of bistable piezo-composite plates for broadband energy harvesting [8688-58] D. N. Betts, C. R. Bowen, H. A. Kim, N. Gathercole, C. T. Clarke, Univ. of Bath (United Kingdom); D. J. Inman, Univ. of Michigan (United States)   |
| 8688 10    | Mechanical and thermal energy transduction utilizing phase transformations in 32 mode relaxor-ferroelectric single crystals [8688-59] W. D. Dong, Univ. of California, Los Angeles (United States); P. Finkel, Naval Undersea Warfare Ctr. Newport (United States); C. S. Lynch, Univ. of California, Los Angeles (United States) |
| SESSION 14 | MODELING OF ENERGY HARVESTING SYSTEMS II  |
| 8688 1P    | Electromechanical and statistical modeling of turbulence-induced vibration for energy harvesting [8688-101] J. D. Hobeck, D. J. Inman, Univ. of Michigan (United States)  |
| 8688 1Q    | Energy harvesting from harmonic and noise excitation of multilayer piezoelectric stacks: modeling and experiment [8688-61] S. Zhao, A. Erturk, The George W. Woodruff School of Mechanical Engineering (United States)  |
| 8688 1R    | Shear mode energy harvesting of piezoelectric sandwich beam [8688-62] M. H. Malakooti, H. A. Sodano, Univ. of Florida (United States)   |
| 8688 1S    | Power-generation prediction for piezoelectric composite plates by modal analysis [8688-63]<br>YF. Chou, CH. Cheng, National Taiwan Univ. (Taiwan)   |
| SESSION 15 | ADAPTIVE SYSTEMS AND STRATEGIES   |
| 8688 1T    | Effect of loading rate on the superelastic behavior of SMAs under multi-axial loading conditions; analytical modeling and experiment [8688-64] M. Taheri Andani, M. Elahinia, R. Rahmanian, The Univ. of Toledo (United States)   |
| 8688 1U    | An active control logic to improve the fatigue strength of smart flexible structures [8688-66] P. Ambrosio, F. Braghin, F. Resta, F. Ripamonti, Politecnico di Milano (Italy)   |
| 8688 1V    | On ultrasonic squeeze film levitation: modeling and feedback control of ultrasonic bearing systems [8688-67] S. Mojrzisch, J. Twiefel, Leibniz Univ. Hannover (Germany)   |
| 8688 1W    | Power fluctuation reduction methodology for the grid-connected renewable power systems [8688-68] F. T. Aula, S. C. Lee, The Univ. of Oklahoma (United States)   |

#### SESSION 16 PASSIVE AND ACTIVE VIBRATION ISOLATION SYSTEMS II

8688 1X Experimental characterization of a bi-dimensional array of negative capacitance piezo-patches for vibroacoustic control [8688-69]

F. Tateo, M. Collet, M. Ouisse, FEMTO-ST (France); M. N. Ichchou, Lab. de Tribologie et Dynamique des Systèmes, Ecole Centrale de Lyon (France); K. A. Cunefare, The George W. Woodruff School of Mechanical Engineering (United States)

8688 20 Approximate pole-placement controller using inverse plant dynamics for floor vibration control [8688-72]

D. S. Nyawako, The Univ. of Sheffield (United Kingdom); P. Reynolds, The Univ. of Sheffield (United Kingdom) and Full Scale Dynamics Ltd. (United Kingdom); M. J. Hudson, The Univ. of Sheffield (United Kingdom)

Passive and hybrid piezoelectric circuits to reduce induced-atmospheric turbulence vibration of a plate-like wing [8688-73]

T. M. P. Silva, C. De Marqui, Univ. of Sao Paulo (Brazil)

#### SESSION 17 PASSIVE AND ACTIVE VIBRATION ISOLATION SYSTEMS III

8688 22 Simulation study of semi-active control of stay cable using MR damper under wind loads [8688-74]

J. Liu, Tongji Univ. (China); H. Huang, L. Sun, State Key Lab. for Disaster Reduction in Civil Engineering (China)

8688 23 A comparison between the IMSC and the DMSC for vibration suppression of smart flexible structures [8688-75]

M. Serra, F. Resta, F. Ripamonti, Politecnico di Milano (Italy)

#### **POSTER SESSION**

8688 26 Damping properties of stay cable-passive damper system with effects of cable sag and damper stiffness [8688-78]

M. Liu, G. Zhang, Harbin Institute of Technology (China)

8688 28 A bio-inspired test system for bionic above-knee prosthetic knees [8688-80]

D.-H. Wang, L. Xu, Q. Fu, G. Yuan, Chongqing Univ. (China)

8688 29 Theory and experiment research of two-dimension acoustic metamaterial [8688-81]

H. Sun, Jiangsu Automation Research Institute (China) and Nanjing Univ. of Science and Technology (China); J. Li, Z. Li, Jiangsu Automation Research Institute (China); Y. Li, Nanjing Univ. of Science and Technology (China)

Analysis and modeling of a piezoelectric energy harvester for powering a wireless sensor

M. Bassetti, F. Braghin, D. Milani, F. Ripamonti, G. Tomasini, Politecnico di Milano (Italy)

| 8688 2B | Modeling and comparison of cantilevered piezoelectric energy harvester with segmented and continuous electrode configurations [8688-83] H. Wang, Harbin Institute of Technology (China) and Qiqihar Univ. (China); L. Tang, Nanyang Technological Univ. (Singapore); X. Shan, T. Xie, Harbin Institute of Technology (China); Y. Yang, Nanyang Technological Univ. (Singapore) |
|---------|--|
| 8688 2C | Experimental test of MR fluid based tactile device for minimally invasive surgery [8688-84] JS. Oh, JK. Kim, SB. Choi, Inha Univ. (Korea, Republic of)   |
| 8688 2G | Fuzzy logic control of the building structure with CLEMR dampers [8688-89] XC. Zhang, ZD. Xu, XH. Huang, JT. Zhu, Southeast Univ. (China)  |
| 8688 2H | Enhancement of piezoelectric energy harvesting with multi-stable nonlinear vibrations [8688-90]  |
|         | P. V. Avvari, L. Tang, Y. Yang, C. K. Soh, Nanyang Technological Univ. (Singapore)   |
| 8688 2J | An adaptive non-model-based control strategy for smart structures vibration suppression [8688-92]  |
|         | M. Morlacchi, F. Resta, F. Ripamonti, G. Tomasini, Politecnico di Milano (Italy)   |
| 8688 2N | Electroaeroelastic modeling and analysis of a hybrid piezoelectric-inductive flow energy harvester [8688-96] J. A. C. Dias, C. De Marqui Jr., Univ. of Sao Paulo (Brazil); A. Erturk, The George W. Woodruff School of Mechanical Engineering (United States)  |
| 8688 20 | Application of a passive/active autoparametric cantilever beam absorber with PZT actuator for Duffing systems [8688-97] G. Silva-Navarro, H. F. Abundis-Fong, Ctr. de Investigación y de Estudios Avanzados del Instituto Politécnico Nacional (Mexico); B. Vazquez-Gonzalez, Univ. Autónoma Metropolitana (Mexico)  |
| 8688 2P | A fuzzy-logic based dual-purpose adaptive circuit for vibration control and energy harvesting using piezoelectric transducer [8688-98] Z. P. Liu, Q. Li, Univ. of New Haven (United States)  |
| 8688 2Q | Smart integrated energy monitoring and management system for standalone photovoltaic systems [8688-99]  A. Abou-Elnour, F. S. Murad, I. S. Al-Tayasna, O. Abo-Elnor, Ajman Univ. of Science and Technology (United Arab Emirates)  |

Х

Author Index

#### **Conference Committee**

#### Symposium Chairs

**Norbert Meyendorf**, Fraunhofer-Institut für Zerstörungsfreie Prüfverfahren (Germany) and University of Dayton (United States) **Norman Wereley**, University of Maryland, College Park (United States)

#### Symposium Cochairs

Victor Giurgiutiu, University of South Carolina (United States)
Christopher S. Lynch, University of California, Los Angeles
(United States)

#### Conference Chair

**Henry A. Sodano**, University of Florida (United States)

#### Conference Cochairs

Wei-Hsin Liao, The Chinese University of Hong Kong (Hong Kong, China)Gyuhae Park, Chonnam National University (Korea, Republic of)

#### Conference Program Committee

Gregory S. Agnes, Jet Propulsion Laboratory (United States)

Mehdi Ahmadian, Virginia Polytechnic Institute and State University
(United States)

Eric H. Anderson, CSA Engineering, Inc. (United States)

Hiroshi Asanuma, Chiba University (Japan)

Amr M. Baz, University of Maryland, College Park (United States)

**Diann E. Brei**, University of Michigan (United States)

**Gregory P. Carman**, University of California, Los Angeles (United States)

**Seung-Bok Choi**, Inha University (Korea, Republic of)

William W. Clark, University of Pittsburgh (United States)

Alison B. Flatau, University of Maryland, College Park (United States)

Farhan Gandhi, The Pennsylvania State University (United States)

**Ephrahim Garcia**, Cornell University (United States)

**Mehrdad N. Ghasemi-Nejhad**, University of Hawai'i at Manoa (United States)

Victor Giurgiutiu, University of South Carolina (United States)

Faramarz Gordaninejad, University of Nevada, Reno (United States)

Nakhiah C. Goulbourne, University of Michigan (United States)

**Tristram Tupper Hyde**, NASA Goddard Space Flight Center (United States)

**Daniel J. Inman**, University of Michigan (United States)

Conor D. Johnson, CSA Engineering, Inc. (United States)

Hyung-Jo Jung, KAIST (Korea, Republic of)

Seung Jo Kim, Seoul National University (Korea, Republic of)

Jeong-Hoi Koo, Miami University (United States)

**Wei-Hsin Liao**, The Chinese University of Hong Kong (Hong Kong, China)

Roger Ohayon, Conservatoire National des Arts et Métiers (France)Mohammad Rastgaar Aagaah, Massachusetts Institute of Technology (United States)

Norbert Schwesinger, Technische Universität München (Germany)

Yi-Chung Shu, National Taiwan University (Taiwan)

**Steve Southward**, Virginia Polytechnic Institute and State University (United States)

**Roger Stanway**, The University of Sheffield (United Kingdom)

Kon-Well Wang, University of Michigan (United States)

**Norman M. Wereley**, University of Maryland, College Park (United States)

#### Session Chairs

- Energy Harvesting and Scavenging: General I
   Henry A. Sodano, University of Florida (United States)
   Wei-Hsin Liao, The Chinese University of Hong Kong (Hong Kong, China)
- Energy Harvesting and Scavenging: Circuitry Ephrahim Garcia, Cornell University (United States) Lei Zuo, Stony Brook University (United States)
- 3 Energy Harvesting and Scavenging: Broadband Techniques Hyung-Jo Jung, KAIST (Korea, Republic of) Yaowen Yang, Nanyang Technological University (Singapore)
- Biological-inspired Systems and Bio-MEMS
   Andy Sarles, The University of Tennessee (United States)
   Robert K. Lenzen, Air Force Institute of Technology (Unite States)
- 5 Energy Harvesting and Scavenging: General II Gyuhae Park, Chonnam National University (Korea, Republic of) Amr M. Baz, University of Maryland, College Park (United States)

6 Modeling, Simulation, Optimization, Signal Processing, Control, and Design of Integration

**Mehrdad N. Ghasemi-Nejhad**, University of Hawai'i (United States) **Manuel Collet**, Université de Franche-Comté (France)

Passive and Active Vibration Isolation Systems I
 Paul Reynolds, The University of Sheffield (United Kingdom)

8 Magneto Rheological Systems I

**Norman M. Wereley**, University of Maryland, College Park (United States)

Seung-Bok Choi, Inha University (Korea, Republic of)

9 SMA- and Piezo-Based Materials and Systems Yirong Lin, The University of Texas at El Paso (United States) Diann E. Brei, University of Michigan (United States)

10 Aircraft, MAV/UAV and Morphing Systems Daniel J. Inman, University of Michigan (United States) Nakhiah C. Goulbourne, University of Michigan (United States)

11 Magneto Rheological Systems II

**Mehdi Ahmadian**, Virginia Polytechnic Institute and State University (United States)

**Henry A. Sodano**, University of Florida (United States)

12 Energy Harvesting and Scavenging: General III

William W. Clark, University of Pittsburgh (United States)

**Steve Southward**, Virginia Polytechnic Institute and State University (United States)

Yi-Chung Shu, National Taiwan University (Taiwan)

Norbert Schwesinger, Technische Universität München (Germany)

13 Modeling of Energy Harvesting Systems IYa D. Wang, University of Michigan (United States)

14 Modeling of Energy Harvesting Systems II

Alper Erturk, Georgia Institute of Technology (United States)

Ya D. Wang, University of Michigan (United States)

15 Adaptive Systems and Strategies

**Alison B. Flatau**, University of Maryland, College Park (United States) **Victor Giurgiutiu**, University of South Carolina (United States)

Passive and Active Vibration Isolation Systems II
 Donald Nyawako, The University of Sheffield (United Kingdom)

17 Passive and Active Vibration Isolation Systems III Roger Ohayon, Conservatoire National des Arts et Métiers (France) Ji Su, NASA Langley Research Center (United States)