



2015

# SMART STRUCTURES NDE.

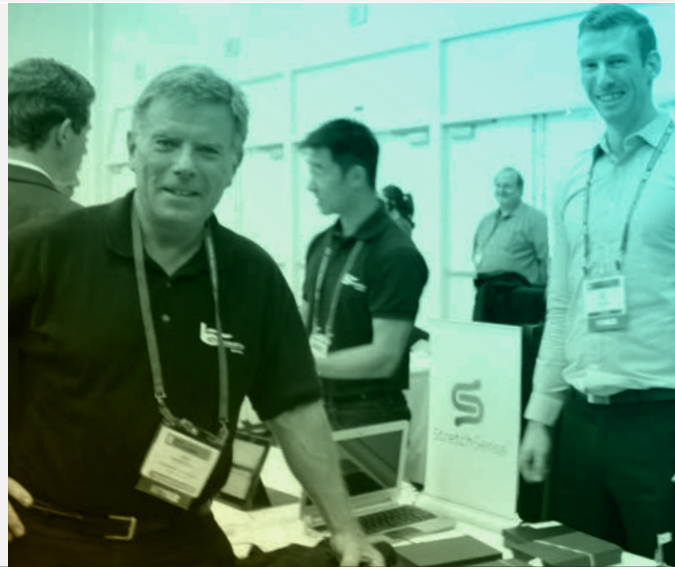
TECHNICAL  
PROGRAM

[WWW.SPIE.ORG/SSNDE](http://WWW.SPIE.ORG/SSNDE)

Conferences & Courses  
8-12 March 2015

Exhibition  
10-11 March 2015

Town & Country Resort and Convention Center  
San Diego, California, USA



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**SPIE.** SMART  
STRUCTURES  
NDE

TECHNICAL  
PROGRAM

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Applied technologies of advanced materials, smart sensor networks, and non-destructive evaluation tools.

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**LOCATION**

Town & Country Resort  
and Convention Center  
San Diego, California, USA

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**DATES**

Conferences & Course: 8-12 March 2015  
Exhibition: 10-11 March 2015

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Sponsored by  
**SPIE.**

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**American Society of  
Mechanical Engineers**

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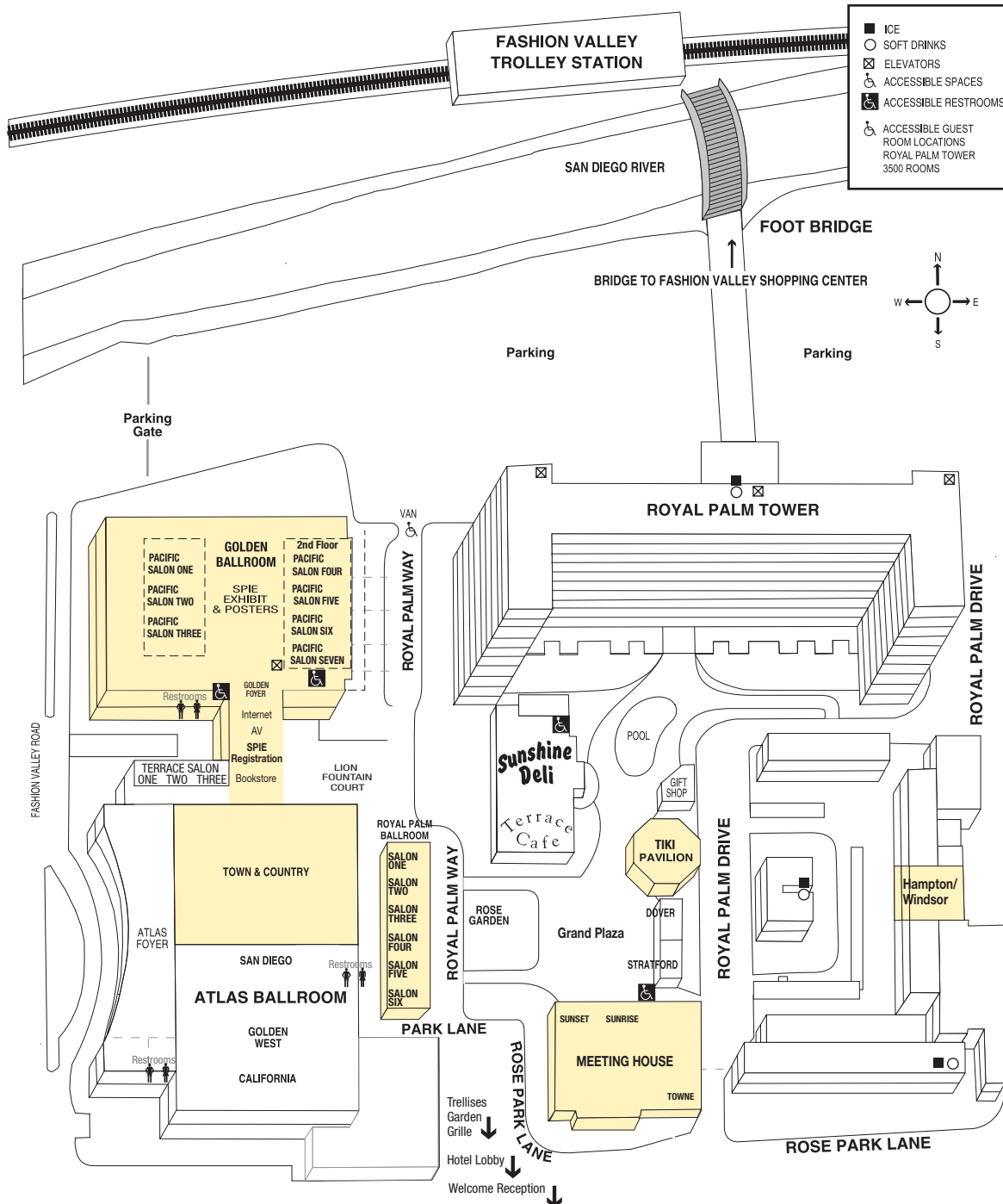
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## TECHNICAL CONFERENCES

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<b>9433 Industrial and Commercial Applications of Smart Structures Technologies 2015</b> <i>(Farinholt)</i> .....	18-34
<b>9434 Nanosensors, Biosensors, and Info-Tech Sensors and Systems 2015</b> <i>(Varadan)</i> .....	18-45
<b>9435 Sensors and Smart Structures Technologies for Civil, Mechanical, and Aerospace Systems 2015</b> <i>(Lynch)</i> .....	19-55
<b>9436 Smart Sensor Phenomena, Technology, Networks, and Systems Integration 2015</b> <i>(Peters)</i> .....	19-33
<b>9437 Structural Health Monitoring and Inspection of Advanced Materials, Aerospace, and Civil Infrastructure 2015</b> <i>(Shull)</i> .....	19-55
<b>9438 Health Monitoring of Structural and Biological Systems 2015</b> <i>(Kundu)</i> .....	19-53
<b>NEW 9439 Smart Materials and Nondestructive Evaluation for Energy Systems 2015</b> <i>(Meyendorf)</i> .....	19-34

# TOWN & COUNTRY



## Join us in celebrating the International Year of Light

The International Year of Light is a global initiative highlighting to the citizens of the world the importance of light and light-based technologies in their lives, for their futures, and for the development of society.

We hope that the International Year of Light will increase global awareness of the central role of light in human activities and that the brightest young minds continue to be attracted to careers in this field.



INTERNATIONAL  
YEAR OF LIGHT  
2015



**SPIE.**

For more information on how you and your organization can participate, visit [www.spie.org/IYL](http://www.spie.org/IYL)

# DAILY SCHEDULE

Sunday 8 March

Monday 9 March

Tuesday 10 March

Wednesday 11 March

Thursday 12 March

## SPECIAL EVENTS

<p><b>SSM Lifetime Achievement Award Presentation and NDE Lifetime Achievement Award Presentation</b>, 8:10 to 8:30 am, p. 7</p>	<p><b>Smart Structures Product Implementation Award Presentation and SPIE Fellow Recognition</b>, 8:10 to 8:25 am, p. 4</p>	<p><b>ASME Best Paper Award Presentations and ASME Gary Anderson Early Achievement Award Presentation</b>, 8:10 to 8:25 am, p. 7</p>	<p><b>SPIE/ASME Best Student Paper Award Presentation and Bioinspiration, Biomimetics, and Bioreplication Best Student Paper Award Presentation: In Memory of H. Don Wolpert</b>, 8:10 to 8:25 am, p. 7</p>
<p><i>Plenary Presentation: Potential and Challenges for the Application of Smart Advanced Ceramic Materials</i> (Michaelis) 8:30 to 9:15 am, p. 4</p>	<p><i>Plenary Presentation: Optical Fiber Based Structural Health and Process Monitoring of Advanced Composite Structures</i> (Takeda), 8:25 to 9:10 am, p. 4</p>	<p><i>Plenary Presentation: Guided Acoustic Wavefield Imaging for Damage Detection, Structural Characterization, and Transducer Design</i> (Ruzzene), 8:25 to 9:10 am, p. 5</p>	<p><i>Plenary Presentation: Smart Sensors and Actuators: From Concepts to Products</i> (Joshi), 8:25 to 9:10 am, p. 5</p>
<p><i>Plenary Presentation: Biomolecular Material Systems: Harnessing Nature's Smart Materials for Sensing, Actuation, and Energy Conversion</i> (Leo) 9:15 to 10:00 am, p. 4</p>	<p><b>Poster Viewing</b>, 10:00 am to 4:00 pm, p. 6</p>	<p><b>Poster Viewing</b>, 10:00 to 4:00 pm, p. 6</p>	<p><b>SPIE/ASME Best Student Paper Session</b>, 1:30 pm to 4:00 pm, p. 7</p>
<p><b>EAPAD Keynote Presentation: RoboSimian and the Advancement of Mobile Manipulation in Robotics</b> (Kennedy), 10:30 to 11:00 am, p. 6</p>	<p><b>Lunch with the Experts - A Student Networking Event</b>, 12:30 to 1:30 pm, p. 6</p>	<p><b>SPIE/ASME Best Student Paper Session</b>, 1:30 pm to 4:00 pm, p. 7</p>	<p><i>Panel Discussion: Biomimicry, Bioinspiration, and the San Diego Zoo</i>, 4:20 to 5:40 pm, p. 6</p>
<p><b>17th Annual EAP-in-Action Session and Demonstrations</b>, 4:30 to 5:45 pm, p. 12-13</p>	<p><b>EXHIBITION</b>, p. 11 10:00 am to 4:00 pm; 6:00 to 7:30 pm</p>		<p><b>EXHIBITION</b>, p. 11 10:00 am to 4:00 pm</p>
<p><b>All Symposium Welcome Reception</b>, 6:00 to 7:30 pm, p. 6</p>			

## CONFERENCES

<p>Conf. 9429 <b>Bioinspiration, Biomimetics, and Bioreplication V</b> (<i>Lakhtakia</i>), p. 18-46</p>	
<p>Conf. 9430 <b>Electroactive Polymer Actuators and Devices (EAPAD) XVII</b> (<i>Bar-Cohen</i>), p. 18-54</p>	
<p>Conf. 9431 <b>Active and Passive Smart Structures and Integrated Systems IX</b> (<i>Liao</i>), p. 18-54</p>	
<p>Conf. 9432 <b>Behavior and Mechanics of Multifunctional Materials and Composites IX</b> (<i>Goulbourne</i>), p. 18-43</p>	
<p>Conf. 9433 <b>Industrial and Commercial Applications of Smart Structures Technologies IX</b> (<i>Farinholt</i>), p. 18-34</p>	
<p>Conf. 9434 <b>Nano-, Bio-, Info-Tech Sensors and Systems</b> (<i>Varadan</i>), p. 18-45</p>	
<p>Conf. 9435 <b>Sensors and Smart Structures Technologies for Civil, Mechanical, and Aerospace Systems</b> (<i>Lynch</i>), p. 19-55</p>	
<p>Conf. 9436 <b>Smart Sensor Phenomena, Technology, Networks, and Systems Integration VIII</b> (<i>Peters</i>), p. 19-33</p>	
<p>Conf. 9437 <b>Structural Health Monitoring and Inspection of Advanced Materials, Aerospace, and Civil Infrastructure IX</b> (<i>Shull</i>), p. 19-55</p>	
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<p><b>NEW</b> Conf. 9439 <b>Smart Materials and Nondestructive Evaluation for Energy Systems</b> (<i>Meyendorf</i>), p. 19-34</p>	

## COURSE

SC634 **Electroactive Polymer Actuators and Devices**, 1:30 am to 5:30 pm, p. 8



# Plenary Sessions

Monday 9 March · 8:15 to 10:00 am  
Location: Town & Country Ballroom

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8:10 to 8:30 am:

## AWARDS

- **SSM Lifetime Achievement Award Presentation** presented to **Gregory P. Carman**, Univ. of California, Los Angeles (USA)
- **NDE Lifetime Achievement Award Presentation** presented to **Peter B. Nagy**, Univ. of Cincinnati (USA)
- **Commemoration for Prof. Ephraim Garcia** presented by **Daniel J. Inman**, Univ. of Michigan (USA)

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8:30 to 9:15 am

## POTENTIAL AND CHALLENGES FOR THE APPLICATION OF SMART ADVANCED CERAMIC MATERIALS



**Alexander Michaelis**

Fraunhofer-IKTS (Germany)

*Abstract:* Advanced ceramic materials offer enormous potential for innovations in the fields of efficient energy conversion and storage, sensor technology as well as environmental technology.

The joint application of structural and functional ceramic technology allows for unique combination of electronic, ionic (electrochemical) and mechanical properties enabling the development of new, highly integrated systems. However, due to the brittle failure mechanism of ceramic materials the production of ceramic components requires nondestructive in-line testing. This is illustrated with specific examples for development for Fuel Cell, batteries and ceramic membranes.

*Biography:* Professor **Alexander Michaelis** studied physics and received his doctorate in the field of electrochemistry. In 1996 he accepted a position at Siemens AG working in the field of microelectronics amongst others at the DRAM Development Alliance in East Fishkill, New York. In 2000, he began to work for Bayer

AG in Leverkusen changing subsequently to H.C. Starck GmbH, a Bayer subsidiary, where he was head of the Electroceramics and the New Business Development department. Furthermore, he was the managing director of InDEC B.V. working in the field of solid oxide fuel cells and finished his state doctorate at University of Düsseldorf. Since 2004, he has been director of the Fraunhofer Institute for Ceramic Technologies and Systems IKTS and has been holding the chair of Inorganic Nonmetallic Materials at TU Dresden. He has more than 40 patent families in materials science, microelectronics, and electronics and provided more than 100 publications. In 2012 Prof. Alexander Michaelis was awarded the ACeRS Bridge Building Award for his contribution in the field of energy and environmental technology.

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9:15 to 10:00 am

## BIOMOLECULAR MATERIAL SYSTEMS: HARNESSING NATURE'S SMART MATERIALS FOR SENSING, ACTUATION, AND ENERGY CONVERSION



**Donald J. Leo**

The Univ. of Georgia (USA)

*Abstract:* Nature has created a vast array of biomolecules that enable living systems to interact with their environment and respond to external stimuli. One such class of biomolecule — stimuli-responsive ion channels — evolved early in our

evolutionary history to enable passive cell membranes to become 'active', thus allowing organisms to survive environmental stress. Today we are utilizing these same biomolecules to make new types of sensors, actuators, and energy conversion devices that respond to mechanical stress, light, chemical gradients, and electrical gradients. We will discuss recent progress in the use of ion channels and transduction elements for smart materials, as well as several of the challenges that remain in fully harnessing these materials for engineering applications.

*Biography:* **Donald Leo** is currently the Dean of the College of Engineering at the University of Georgia. His research interests are in the modeling, analysis, and control of smart material systems, with a particular emphasis on polymeric materials and biomolecular materials. Prior to his appointment at the University of Georgia, he was a faculty member at Virginia Tech in the Center for Intelligent Material Systems and Structures.

Tuesday 10 March · 8:10 to 9:10 am

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8:10 to 8:25 am:

## AWARDS

- **Smart Structures Product Implementation Award**
- **SPIE Fellow Recognition**  
*presented to*  
**Kyo D. Song**, Norfolk State Univ. (USA)  
**Ming L. Wang**, Northeastern Univ. (USA)

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8:25 to 9:10 am

## OPTICAL FIBER BASED STRUCTURAL HEALTH AND PROCESS MONITORING OF ADVANCED COMPOSITE STRUCTURES



**Nobuo Takeda**

The Univ. of Tokyo (Japan)

*Abstract:* Optical fiber sensors are very useful to monitor the internal strain and temperature during manufacturing as well as in practical operations exposed to external loads. The authors have been using both multi-point and distributed strain

monitoring techniques to characterize the structural integrity and quality control of advanced composite structures. This presentation first covers optical fiber based structural health monitoring (SHM) technologies for aircraft composite structures being conducted these ten years in Japan as national and international projects. Then, some recent developments on process and life-cycle monitoring (LCM) are presented as a promising method for intrinsic quality control of advanced composite structures with embedded optical fiber sensor systems.

*Biography:* Professor **Nobuo Takeda** graduated from the University of Florida with PhD as well as from the University of Tokyo with a doctoral degree in Engineering. He is currently Dean and Professor, Graduate School of Frontier Sciences, the University of Tokyo. He is also Asian Editor of Composites Part A and Senior Vice President of International Committee on Composite Materials (ICCM). He has been leading several Japanese national projects on SHM and LCM for aircraft composite structures.

Wednesday 11 March · 8:10 to 9:10 am

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8:10 to 8:25 am:

## AWARDS

- ASME Best Paper Awards
- ASME Gary Anderson Early Achievement Award

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8:25 to 9:10 am

## GUIDED ACOUSTIC WAVEFIELD IMAGING FOR DAMAGE DETECTION, STRUCTURAL CHARACTERIZATION, AND TRANSDUCER DESIGN



**Massimo Ruzzene**

Georgia Institute of Technology (USA)

*Abstract:* The application of wave-based inspection methods for the analysis of the state of health of structural components has received significant attention in recent years. The propagation and GUV, together with the application of Scanning Laser

Vibrometry for full wavefield measurement enables the introduction of novel damage detection techniques which are based on the application of filtering techniques in the frequency/wavenumber space. The goal of these techniques is to separate the contribution of damage from the overall response of the structure, thus highlighting its presence and location. This presentation will provide an overview of techniques developed for the analysis of guided wavefield and their application for damage detection, structural characterization, and for the design of novel transducers for Structural Health Monitoring. These transducers feature patterns that enable wave steering through the selection of the excitation frequency, and the measurement of multiple strain components for surface acoustic wave-based sensing of strain.

*Biography:* **Massimo Ruzzene** is a Professor of Aerospace and Mechanical Engineering at Georgia Tech, and he is currently the Program Director for the Sensors, Dynamics and Control Program of CMMI at NSF. Dr. Ruzzene is author of 2 books, 130 journal papers and about 170 conference papers, and has participated to projects funded by the AFOSR, ARO, ONR, NASA, US Army, US Navy, DARPA, and NSF, as well as numerous companies. His work focuses on solid mechanics, structural dynamics and wave propagation with application to structural health monitoring, metamaterials, and vibration and noise control. M. Ruzzene is a Fellow of ASME, an Associate Fellow of AIAA, and a member of AHS, and ASA.

Thursday 12 March · 8:10 to 9:10 am

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8:10 to 8:25 am:

## AWARDS

- SPIE/ASME Best Student Paper Award
- Bioinspiration, Biomimetics, and Bioreplication Best Student Paper Award: In Memory of H. Don Wolpert

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8:25 to 9:10 am

## SMART SENSORS AND ACTUATORS: FROM CONCEPTS TO PRODUCTS



**Shiv Joshi**

NextGen Aeronautics, Inc. (USA)

*Abstract:* Sensors and actuators are the basic building blocks of smart structures. In the smart sensors portion of the presentation, examples of wireless sensing, thin-film flexible multiplexed sensor arrays, and printed sensors development will be emphasized. As an example of actuator development, a piezohydraulic actuator will also be included in the presentation. Through these examples, the difference between system level requirements or base technologies push driven development will be discussed. The technology development portion will include academic research as well as industrial development. The emphasis will be on taking a concept to prototype. The talk will be concluded by reflecting on challenges and opportunities for a small company like NextGen Aeronautics in developing a commercially viable product.

*Biography:* **Dr. Shiv Joshi** spent 17 years at the University of Arizona and the University of Texas at Arlington (UTA) before moving to NextGen Aeronautics as a founding partner and Chief Technology Officer in 2003. He has developed research and development programs in multifunctional materials and structures, sensors and actuators, structural health monitoring, and complex systems at NextGen Aeronautics. He is an associate fellow of AIAA and chairs the ASME Nondestructive Evaluation, Diagnosis and Prognosis Division (NDPD). He received the SPIE Life Time Achievement Award for sustained contribution to the field of adaptive structures and materials in 2013.

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**Monday-Thursday daily sessions will consist of opening remarks, award presentations, and plenary presentations.**

# Special and Technical Events

## EAPAD Keynote Presentation

Monday 9 March · 10:30 to 11:00 am  
Location: Town & Country Ballroom

### RoboSimian and the Advancement of Mobile Manipulation in Robotics



**Brett Kennedy**, Jet Propulsion Lab. (USA)

*Abstract:* As robotic systems that get themselves from place to place become more common in the world, the frontier of mobile manipulation systems has opened. RoboSimian is the Jet Propulsion Laboratory's entry into the DARPA Robotics Challenge, a contest that explicitly demands robots that can both go and do in an abstracted disaster response environment. By incorporating four

identical limbs on a human-scale body, RoboSimian represents a unique approach to the Challenge by deliberately combining the requirements mobility and manipulation, which provides an increased operational flexibility and range over other designs. This talk will describe the particular hurdles of designing a limbed robot inspired by simians (and other animals) within the constraints of current human technology. We will also discuss the practical issues of developing a robotic system that will be fieldable in the near term due to its amenability to manufacturing and maintenance. Finally, we will look at what system and component technology advances would most directly improve the execution of the vision of a highly mobile and dexterous robot system in the future.

*Biography:* **Brett Kennedy** is currently the Supervisor of the Robotic Vehicles and Manipulators Group at JPL. His areas of expertise include space robotics, bio-inspired robotics, novel mobility systems, robotic manipulators, and underactuated grippers. He graduated from University of California, Berkeley in 1996 with his B.S. in mechanical engineering with an emphasis in controls and robotics. As an undergraduate, he was involved in research covering the

design of composite material parts, the design of human amplification mechanisms, and the finite-element modeling of bones. In 1997, he received his M.S. in Mechanical Engineering from Stanford University concentrating on mechatronics and robotics. At JPL he has divided his time between research and space flight robotics. On the research front, he conceived and led the development of the bio-inspired Lemur series of robots as well as acting as the lead mechanical engineer a number of other robotic systems. He has also acted as the lead robotic engineer on several DARPA studies of subjects such as orbital telescopes and humanoid robotic mobility. On the flight side, his major role has been as the Cognizant Engineer of the Robotic Arm for the Mars Science Laboratory (MSL), for which he was responsible for the design, fabrication, and testing. Previously, he had also been responsible for two elements of the Mars Exploration Rover (MER) chassis. Currently, he is leading the development of the RoboSimian robot for DARPA's Robotic Challenge.

## 17th Annual EAP-in-Action Session and Demonstrations

Monday 9 March · 4:30 to 5:45 pm  
Location: Town & Country Ballroom

See the full program and descriptions of EAP presentations on pages 12-13.

## All Symposium Welcome Reception

Monday 9 March · 6:00 to 7:30 pm  
Location: Tiki Pavilion

All attendees are invited to relax, socialize, and enjoy refreshments. Please remember to wear your conference registration badges. Dress is casual.

## Lunch with the Experts - A Student Networking Event

Tuesday 10 March · 12:30 to 1:30 pm  
Location: Windsor

Open to Student Attendees. Seating is limited. Enjoy a casual meal with colleagues at this engaging networking opportunity. Hosted by SPIE Student Services, this event features experts willing to share their experience and wisdom on career paths in optics and photonics. Seating is limited and will be granted on a first-come, first-served basis.

## Poster Exhibition/Reception

Tuesday 10 March · 6:00 to 7:30 pm  
Location: Golden Ballroom

Conference attendees are invited to attend the poster session on Tuesday evening. Come view the posters, ask questions, and enjoy the refreshments. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions. Posters will also be available for viewing on Wednesday during exhibition hours.

## Poster Viewing

Tuesday 10 March · 10:00 am to 4:00 pm  
Location: Golden Ballroom

Wednesday 11 March · 10:00 am to 4:00 pm  
Location: Golden Ballroom

## SPIE/ASME Best Student Paper Session

Wednesday 11 March · 1:30 pm to 4:00 pm  
Location: Sunset

Finalists for the SPIE/ASME Best Student Paper Award will present their papers in this special session.

## Panel Discussion: Biomimicry, Bioinspiration, and the San Diego Zoo

Wednesday 11 March · 4:20 to 5:40 pm  
Location: Sunrise

SPIE and the SS/NDE symposium have partnered with the San Diego Zoo to promote the value of biomimicry as a paradigm for engineering research and practice. A representative from the San Diego Zoo will introduce the audience to an 'animal ambassador' and explain some of the remarkable features that can provide inspiration for the work of engineers and scientists. Panelists will discuss the current state of bioinspiration in the research lab, design challenges, and future solutions. This panel is open for all attendees and will focus on all aspects of engineered biomimicry, including education, awareness, applications, research, and funding sources.

*Panelists include:* **Diana C. Skigin**, Univ. de Buenos Aires (Argentina); **Franziska Schenk**, Birmingham City Univ. (United Kingdom); **Elmar Kroner**, Leibniz-Institut für Neue Materialien gGmbH (Germany); **Jaavan Chahl**, Defence Science and Technology Organisation (Australia); **David Kisailus**, Univ. of California, Riverside (USA).

For more information about the San Diego Zoo's Biomimicry project, please visit our website: [www.spie.org/SDZOO](http://www.spie.org/SDZOO)



# Awards

Location: Town & Country Ballroom

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Monday 9 March · 8:15 to 8:30 am

## 2015 SSM Lifetime Achievement Award

presented to



**Gregory P. Carman**, Univ. of California, Los Angeles (USA)

*Biography:* Professor **Gregory P. Carman** joined the Mechanical & Aerospace Engineering Department at the University of California, Los Angeles in 1991. He is presently the Director of a new NSF Engineering Research Center entitled Translational Applications of Nanoscale Multiferroic Materials TANMS and is Executive Engineering Director of the Center for

Advanced Surgical and Interventional Technology in the Department of Surgery at UCLA. Professor Carman has served as chairman for the Adaptive Structures and Material Systems of the ASME (2000-2002), holds a position as Associate Editor for the Journal of Intelligent Material Systems Structures, as well as the journal of Smart Materials and Structures. He was awarded the Northrop Grumman Young Faculty in 1995 and three best paper awards from the ASME in 1996, 2001, and 2007. In 2003 he was elected to the grade of Fellow in ASME and awarded the ASME Adaptive Structures and Material Systems Prize honoring his contributions to smart materials and structures in 2004. Presently his research interests focus on analytical modeling, fabricating, and testing nanoscale multiferroic (magnetolectric) materials and developing devices for medical application.

## 2015 NDE Lifetime Achievement Award

presented to



**Peter B. Nagy**, Univ. of Cincinnati (USA)

*Biography:* **Peter B. Nagy** received his BS degree in Electrical Engineering and PhD degree in Acoustics from the Technical University of Budapest, Hungary, in 1976 and 1980, respectively. He worked as a Research Scientist in the Nondestructive Evaluation Program of The Ohio State University between

1985 and 1994 and also served as a Visiting Scientist in the Metals, Ceramics, and NDE Division of the Air Force Research Laboratory for more than ten years. He joined the University of Cincinnati in

1994, where he is now the Herman Schneider Professor of Aerospace Engineering and Engineering Mechanics. Since 2006, he has been also working as a Visiting Professor in the UK Research Centre in Nondestructive Evaluation at Imperial College London. Dr. Nagy specializes in ultrasonic, electromagnetic, and thermoelectric materials characterization and has published about 270 research papers on these subjects, coauthored a book entitled Physical Ultrasonics of Composites, and contributed numerous book chapters on various topics of NDE. Dr. Nagy is an elected Fellow of the Acoustical Society of America and the recipient of the 2008 Roy Sharpe Award of the British Institute of Nondestructive Testing. He served on the Editorial Board of Ultrasonics between 2001 and 2011 and is currently serving as the Editor-in-Chief of Journal of Nondestructive Evaluation.

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Tuesday 10 March · 8:10 to 8:25 am

## SPIE Fellow Recognition

presented to

**Kyo D. Song**, Norfolk State Univ. (USA), and  
**Ming L. Wang**, Northeastern Univ. (USA)

## Smart Structures Product Implementation Award

This award is intended to recognize those individuals or companies who have taken the critical step of transitioning smart structures technologies into viable industrial and commercial products. These visionaries are required for this important field of science and engineering to be recognized and accepted in the world at large.

A panel of independent experts selects the best product based on its importance, uniqueness, and usefulness to defense or commercial industries. We are looking for the most innovative—but realistic—products using smart structures and materials technologies. System integration aspects are very important criterion as well.

The award will be presented during SPIE Smart Structures/NDE in front of a group of peers and potential customers. SPIE will publish news items that will be sent to appropriate trade journals. In addition, the winning company will be able to use the recognition associated with this award in any of its subsequent marketing and promotional endeavors.

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Wednesday 11 March · 8:10 to 8:25 am

## ASME Gary Anderson Early Achievement Award

This award is given for notable contributions to the field of Adaptive Structures and Material Systems.

## ASME Best Paper Awards

The ASME Technical Committee presents two awards annually: Best Paper in Structures and Best Paper in Materials.

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Thursday 13 March · 8:10 to 8:25 am

## SPIE/ASME Best Student Paper Award

SPIE and the ASME Adaptive Structures and Material Technical Committee are sponsoring the best student paper contest. Papers will be presented in a special session on Wednesday afternoon. Entrants will be judged by a committee of the ASME Adaptive Structures and Materials Technical Committee. The committee will then vote to determine the top three finalists. The top three finalist student authors and/or student co-authors will receive certificates.

## Bioinspiration, Biomimetics, and Bioreplication Best Student Paper Award: In Memory of H. Don Wolpert

The Bioinspiration, Biomimetics, and Bioreplication V conference chairs will present the Best Student Paper Award from their conference.

*This award is sponsored by*



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## Electroactive Polymer Actuators and Devices

### SC634

Course Level: Introductory  
CEU: 0.35 \$360 Members | \$410 Non-Members USD  
Sunday 1:30 pm to 5:30 pm

This course will provide an overview of the field of EAP covering the state of the art, challenges and potential. Two general classes of polymer materials are described, namely those that involve ionic mechanisms (Ionic EAP), and field activated materials (Electronic EAP). In addition new thermally actuated carbon nanotube, metal and nylon actuators will be discussed. The basic mechanisms responsible for the electroactive behavior of EAP materials will be covered and compared with natural muscles. Analytical models, fabrication processes and methods of characterizing these materials will be described. Moreover, the currently considered applications will be reviewed including actuators, robotics, animatronics, energy harvesting, medical, and biologically inspired mechanisms, so called biomimetics.

The course begins with an overview of the field, current capabilities, potential and challenges. The course follows with a description of the currently available EAP materials and principles of operating them as actuators and artificial muscles. The course ends with a review of the future prospect of EAP as actuators in systems, mechanisms and smart structures for space, industrial and medical applications.

### LEARNING OUTCOMES

This course will enable you to:

- identify EAP based available and emerging actuators
- learn the fundamentals of electroactive behavior in leading EAP materials
- describe the capabilities, limitations and benefits of electroactive polymers
- become familiar with fabrication processes
- review mechanical analysis and design principles associated with EAP

- assess the applicability of current EAP actuators while accounting for their limitations
- describe the future prospects of EAP materials as actuators and their applications

### INTENDED AUDIENCE

Engineers, scientists and managers who need to understand the basic concepts of EAP, or are interested in learning, applying or engineering mechanisms or devices using EAP materials. Also those who wish to discover the excitement of research and development in EAP materials and their applications - present and future.

### INSTRUCTOR

**Yoseph Bar-Cohen** is Senior Research Scientist and Supervisor, Advanced Technologies Group, at JPL. He is a leading expert in advanced actuators using electroactive polymers and ceramic materials. Dr. Bar-Cohen is a Fellow of SPIE and ASNT. He is the author/coauthor of numerous publications, has many registered patents and is the recipient of many awards and honors. Further information on: <http://ndeaa.jpl.nasa.gov/nasa-nde/yosi/yosi.htm>

**John Madden** is a Professor of Electrical & Computer Engineering at the University of British Columbia, Vancouver, Canada. His research areas include the application of EAP materials in active catheters, as well as the development and characterization of molecular, carbon nanotube and anisotropically thermally expanding polymer actuators. <http://www.mina.ubc.ca/jmadden>

**Gibing Pei** is professor of materials science and engineering at the University of California, Los Angeles. His research interests cover a wide range of soft materials and span from polymer synthesis, processing, to fabrication of functional devices which include flexible polymer electronics, dielectric elastomer artificial muscles, and Braille electronic readers. <http://www.ms.ucla.edu/people/bios/pei>

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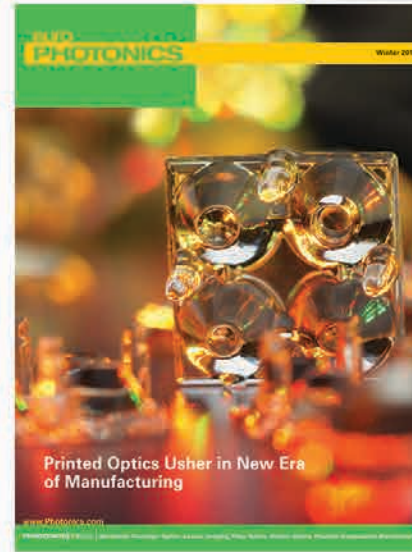
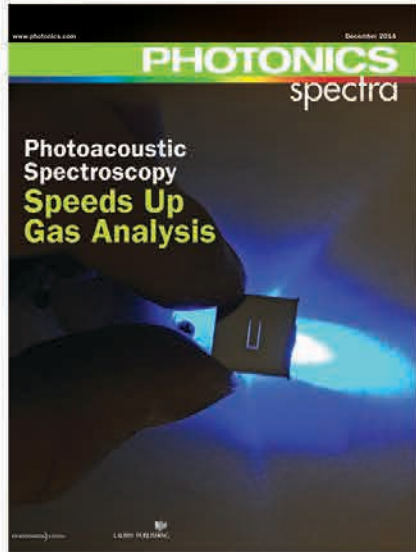
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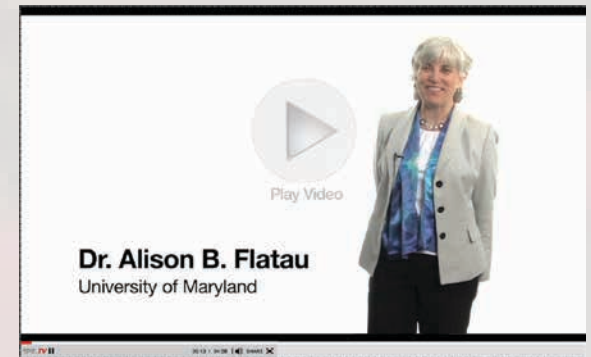


# Biomimicry, Bioinspiration, and the San Diego Zoo Panel Discussion



**SPIE.**

Wednesday 11 March · 4:20 to 5:40 pm • Location: Sunrise



SPIE and the SS/NDE symposium have partnered with the San Diego Zoo to promote the value of biomimicry as a paradigm for engineering research and practice. A representative from the San Diego Zoo will introduce the audience to an 'animal ambassador' and explain some of the remarkable features that can provide inspiration for the work of engineers and scientists. Panelists will discuss the current state of bioinspiration in the research lab, design challenges, and future solutions.

This panel is open for all attendees and will focus on all aspects of engineered biomimicry, including education, awareness, applications, research, and funding sources.

**Panel Moderators:** **Mato Knez**, CIC nanoGUNE Consolider (Spain); **Akhlesh Lakhtakia**, The Pennsylvania State Univ. (USA)

**Panelists:** **Diana C. Skigin**, Univ. de Buenos Aires (Argentina); **Franziska Schenk**, Birmingham City Univ. (United Kingdom); **Elmar Kroner**, Leibniz-Institut für Neue Materialien gGmbH (Germany); **Jaavan Chahl**, Defence Science and Technology Organisation (Australia); **David Kisailus**, Univ. of California, Riverside (USA)



**Alison Flatau**, Prof. of Aerospace Engineering, at the Univ. of Maryland, is a long-standing supporter of SS/NDE. She has served as a conference chair, as well as a symposium chair. Alison has been a plenary speaker, and she was also the recipient of the 2010 SPIE Smart Structures and Materials Lifetime Achievement Award. She speaks here about the 'new' movement that surrounds bioinspired design.

To view this and other videos, please visit: [www.spie.org/SDZOO](http://www.spie.org/SDZOO)

2011 Featured a presentation about an alligator named 'Laveau'. 2012 featured 'Shaman' a Great Horned Owl whose serrated feathers allow silent flight for nighttime predation. 2013 featured a bald python named 'Monte'. 2014 featured an anteater named 'Tipu'.

# E.

EXHIBITION



## Attend the Exhibition at SPIE Smart Structures/NDE

**EXHIBITION**  
**10-11 March 2015**

Tuesday 10:00 am to 4:00 pm;  
6:00 to 7:30 pm (Posters/Exhibition Reception)  
Wednesday 10:00 am to 4:00 pm

### SEE PRODUCTS IN

- sensor systems
- health monitoring
- smart materials
- actuation
- damping
- safety and reliability of structures
- smart sensor networks
- testing equipment
- structural monitoring using nondestructive evaluation
- damage detection

### MEET VENDORS WORKING ON SOLUTIONS RELEVANT TO YOUR WORK.

- Smart Structures and Materials
- Automotive and Aerospace Applications
- Actuators and Damping
- Structural Health Monitoring
- Nanotechnology
- Civil Infrastructure Systems
- Modeling, Control, and Optimization
- Energy Harvesting/Energy Systems
- Bio-inspired and Robotic Systems
- Electroactive Polymers
- Shape Memory Alloys
- MR Fluids and Elastomers
- Piezoelectric Materials
- Embedded and Self-diagnostic Sensors
- Optical Fiber Sensors
- Sensor Networks
- Real-Time NDE

*“Smart Structures/NDE is where a diverse community representing all facets of the field come together to talk about relevant work and interface with colleagues and vendors.”*

— Attendee

Register to attend this smaller venue that provides one-on-one interactions with a unique multi-disciplinary mix of audience and end product. Registration is free.

[www.spie.org/ssnde](http://www.spie.org/ssnde)



# 17th Annual EAP-in-Action Session and Demonstrations

Monday 9 March · 4:30 to 5:45 pm · Location: Town & Country Ballroom



*Moderator:*  
**Yoseph Bar-Cohen**  
Jet Propulsion Lab.

This Session highlights some of the latest capabilities and applications of Electroactive Polymers (EAP) materials where the attendees are shown demonstrations of these materials in action. Also, the attendees interact directly with technology developers and given “hands-on” experience with this emerging technology. The first Human/EAP-Robot Armwrestling Contest was held during this session of the 2005 EAPAD conference.

## Tentative EAP Demonstrations

### Conducting polymer and nylon-based sensors and actuators

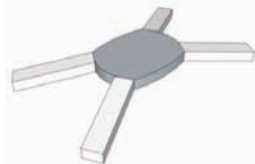
**Mirza Saquib Sarwar, Ettore Glitz, Soheil Kianzad, Ali Rafiee, Milind Pandit, Johnathan D. Lewis, Alexander R. Berlinger, Meisam Farajollahi, Saeedeh Ebrahimi Takaloo, Yuta Dobashi, Shahrar Mirabbasi, Edmond Cretu and John D.W. Madden,** Univ. of British Columbia (Canada)



The demonstration will feature ionic EAP sensor membranes, miniature trilayer actuators, and large force nylon linear actuators. The nylon thermal actuators, which are helical in form, can be woven into fabrics.

### Soft crawling robot based on dielectric elastomer

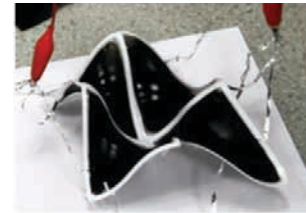
**Jinsong Leng, Jinrong Li and Liwu Liu,** Harbin Institute of Technology (China)



A simple crawling robot based on dielectric elastomer will be demonstrated. This robot is quadrupedal and each foot is a dielectric elastomer based spring-roll actuator having the appropriate deformation and response time. The power supply and control are tethered through wires. The speed of crawling robot can be changed by changing the amplitude and frequency of control signal.

### Soft robot using dielectric elastomers

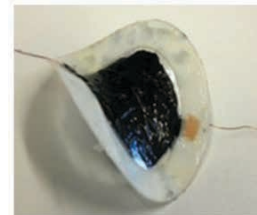
**Tiefeng Li, Chi Li, Yuhan Xie, and Xuxu Yang,** Zhejiang Univ., Institute of Applied Mechanics (China)



Inspired by the natural invertebrates like worms and starfish, a novel soft robot is being developed using a flexible elastomer as the body and driven by dielectric elastomer as the muscle. This configuration makes the robot run fast and resilient to extreme mechanical condition.

### Minimum energy structures from dielectric elastomers

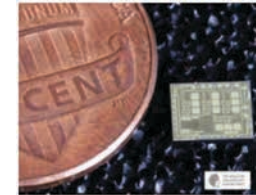
**Rahimullah Sarban,** LEAP Technology (USA) and **Anne Ladegaard Skov,** Technical Univ. of Denmark (Denmark)



An optimized minimum energy structure will be demonstrated using dielectric elastomers with optimized performance. The figure shows an example of a minimum energy structure.

### Reduced size electronics for controlling DEA

**Holger Mößinger, Henry Haus, Muhammad Bilal Saif, Klaus Hofmann, and Helmut F. Schlaak,** Technische Univ. Darmstadt (Germany)



As DEA move closer to the market providing suitable driving and sensing electronics becomes a crucial task. In the ongoing effort to develop small and efficient electronics Technische Universität Darmstadt presents the first version of their custom designed application-specific integrated circuit (ASIC) for driving up to four DE-actuators at voltages as high as 700 Volts. In a total chip size of 20 mm<sup>2</sup>, the chip contains four signal generation units capable of generating switching signals in the kHz range, configurable by a serial digital interface. (Photo: Four channel ASIC for driving DEA compared to the size of a US penny.)

### Thermo responsive shape recovery soft actuator

**M. Hasnat Kabir, Jin Gong, Masato Makino, and Hidemitsu Furukawa,** Yamagata Univ. (Japan)



A free-forming deformed shape of polymeric gel can recover its original shape and size. The gel shows the functionality with temperature. The shape memory effect can be observed both in hot water and in hot

air. The material is suitable for soft actuator, which might be applicable in biomedical science. A human mimic of this gel will be demonstrated along with its shape memory function.

## Applications of dielectric elastomers

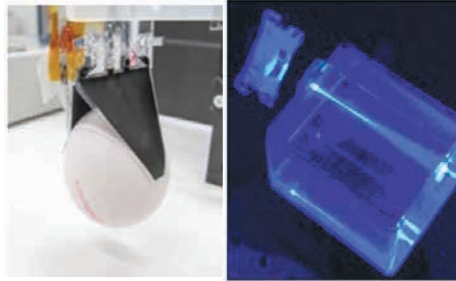
**Iain Anderson, Daniel Xu, and Alan Veale,** Auckland Bioengineering Institute (New Zealand)



The Biomimetics Lab and its spinout StretchSense Ltd. will demonstrate advances leading to exciting wearable and portable energy harvesters and soft sensor technologies. The demos will include (1) An intuitive motion capture controller to play DOOM. This is one of the first computer games featuring 3D graphics and first-person perspective. This novel game controller will be made from soft wearable sensor technology allowing a design that is more intuitive and simple to use. (2) Artificial Muscle Power - An energy harvester using dielectric elastomer generators will be present in the new version of the Artificial Muscle Power (AMP) device. (3) Measuring human body motion can provide valuable feedback for sports, medical, video and game applications. The latest soft sensor for this purpose will be presented.

## High-speed silicone DEAs

**S. Rosset, S. Araromi, A. Poulin, L. Maffli, J. Shintake, D. Floreano and H. Shea,** École polytechnique fédérale de Lausanne (Switzerland)



Precise patterning of robust and wear-resistant electrodes on silicone membranes allows for the fabrication of high-speed dielectric elastomer actuators with a long lifetime. At EPFL-LMTS, a broad range of fabrication processes were developed for the fabrication of high quality silicone membranes and the patterning of compliant electrodes presenting strong adhesion to the dielectric membrane. Several devices are going to be shown to illustrate the related activities. These include tunable lens with a settling time below 200  $\mu\text{m}$ , a soft and compliant 1-g gripper capable of holding an egg, and capacitive sensing devices with miniaturized sub-mm electrodes.

## New EAP materials and actuators

**Zhi Ren, David McCoul, Wei Hu, and Qibing Pei,** Univ. of California, Los Angeles (USA)

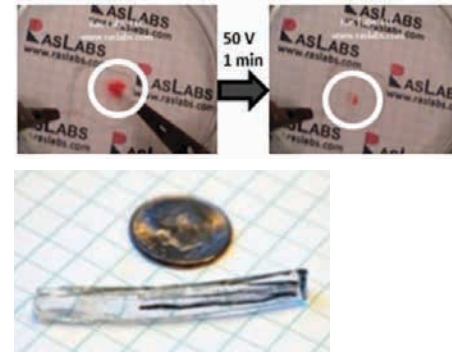


Bistable electroactive polymers (BSEP) combine electrically induced large-strain actuation with a shape memory effect to present a unique opportunity for refreshable, repeated actuation. A new BSEP material will be presented that achieves prolonged cycle lifetimes. This refreshable rigid-to-

rigid actuation simultaneously provides large-strain actuation and large load support. Other innovative forms of actuators will also be presented. One such device is a biomimetic pump fabricated from tubular dielectric elastomer actuators. (Photos: Actuation of dot actuator on the hotplate at elevated temperature)

## Synthetic Muscle™: shape-morphing EAP based materials and actuators

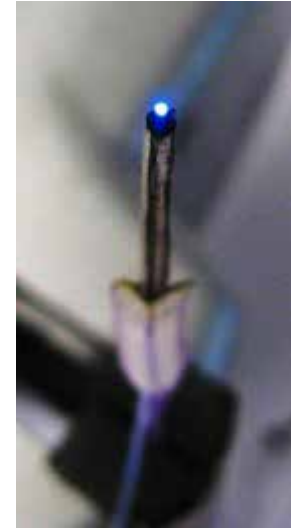
**Lenore Rasmussen and Eric Sandberg,** Ras Labs. (USA)



EAP will be demonstrated contracting and expanding. A thin shape-morphing film of the material in the expansion mode produces raised surface zones in desired shapes. Actuation can be performed using suitable elastomeric coatings, and in 2015 selected synthetic muscle samples are going to be tested for radiation resistance on the International Space Station. (Photos: Contracting EAP dyed red so easy to see, Carbon fiber infused EAP)

## Advanced IPMC actuators and sensors

**Qi Shen, Tyler Stalbaum, Shelby E. Nelson, Sara Trabia, Jameson Lee, Viljar Palmre, and Kwang J. Kim,** Univ. of Nevada (USA)



Conventional IPMC is produced in a strip form. In this EAP-in-Action, advanced IPMC actuators and sensors in a variety of different forms (cylinder, tube, square, fiber, etc.) will be presented.

# CONFERENCE SESSION SCHEDULE

	<b>CONFERENCE 9429</b> Bioinspiration, Biomimetics, and Bioreplication V	<b>CONFERENCE 9430</b> Electroactive Polymer Actuators and Devices (EAPAD) XVII	<b>CONFERENCE 9431</b> Active and Passive Smart Structures and Integrated Systems IX	<b>CONFERENCE 9432</b> Behavior and Mechanics of Multifunctional Materials and Composites IX	<b>CONFERENCE 9433</b> Industrial and Commercial Applications of Smart Structures Technologies IX	<b>CONFERENCE 9434</b> Nano-, Bio-, Info-Tech Sensors and Systems
Monday 9 March	<b>SESSION 1</b> Mon 10:30 am to 11:50 am Biomaterials I <i>(Lakhtakia)</i>	<b>SESSION 1</b> Mon 10:30 am to 12:10 pm EAP as Emerging Actuators <i>(Bar-Cohen, deBotton)</i>	<b>SESSION 1</b> Mon 10:30 am to 12:10 pm Energy Harvesting and Scavenging: Waves/Acoustics <i>(Liao, Park)</i>	<b>SESSION 1</b> Mon 10:30 am to 11:50 am Mechanics of Active Polymers <i>(Goulbourne, Naguib)</i>	<b>SESSION 1</b> Mon 10:30 am to 11:50 am Use of Piezoelectrics in Smart Structures <i>(Park)</i>	<b>Mon 10:30 am to 11:10 am</b> <b>Keynote Session I</b> <i>(Varadan)</i> <b>SESSION 1</b> Mon 11:10 am to 12:10 pm Nanosensors and Systems I <i>(Varadan)</i>
	<b>SESSION 2</b> Mon 1:10 pm to 3:00 pm Optics and Photonics I <i>(Autumn)</i> <b>SESSION 3</b> Mon 3:30 pm to 4:30 pm Adhesion <i>(Dry)</i> <b>SESSION 4</b> Mon 4:30 pm to 5:30 pm Biomaterials II <i>(Saito)</i>	<b>SESSION 2</b> Mon 1:20 pm to 3:00 pm Power Generation and Energy Harvesting <i>(Kennedy, Anderson)</i> <b>Mon 4:30 pm to 5:45 pm</b> EAP-in-Action Demonstration Session <i>(Bar-Cohen)</i>	<b>SESSION 2</b> Mon 1:40 pm to 3:00 pm Magneto Rheological Systems I <i>(Wereley, Gordaninejad)</i> <b>SESSION 3</b> Mon 3:30 pm to 5:30 pm Energy Harvesting and Scavenging: Fluid-Structure Interaction <i>(Erturk, Sodano)</i>	<b>SESSION 2</b> Mon 1:20 pm to 3:00 pm Piezoelectric and Electrostrictive Materials <i>(Smith, Oates)</i> <b>SESSION 3</b> Mon 3:30 pm to 5:10 pm Constitutive Behavior of Piezoelectric and Active Materials <i>(Ounaies, Geier)</i>	<b>SESSION 2</b> Mon 1:20 pm to 3:00 pm Aerospace Applications of Smart Structures <i>(Griffin)</i> <b>SESSION 3</b> Mon 3:30 pm to 4:10 pm Energy Harvesting <i>(Farinholt)</i> <b>SESSION 4</b> Mon 4:10 pm to 5:30 pm Technologies for Vibration Control <i>(Browne)</i>	<b>Mon 1:30 pm to 2:10 pm</b> <b>Keynote Session II</b> <i>(Choi)</i> <b>SESSION 2</b> Mon 2:10 pm to 3:20 pm Nanosensors and Systems II <i>(Yoon)</i> <b>SESSION 3</b> Mon 3:40 pm to 5:00 pm Nano-and Micro-systems in Medicine and Healthcare <i>(Kim)</i>
Tuesday 10 March	<b>SESSION 5</b> Tue 9:20 am to 10:00 am Visual and Acoustic Sensing <i>(Chahl)</i> <b>SESSION 6</b> Tue 10:30 am to 11:50 am Flight <i>(Porfiri)</i>	<b>SESSION 3</b> Tue 9:20 am to 12:10 pm Dielectric EAP Materials and Actuators I <i>(Pei, Zhang)</i>	<b>SESSION 4</b> Tue 9:20 am to 10:20 am Biological-inspired Systems and Bio-MEMS <i>(Bryant)</i> <b>SESSION 5</b> Tue 10:50 am to 12:10 pm Energy Harvesting and Scavenging: Broadband/Nonlinear I <i>(Baz, Shu)</i>	<b>SESSION 4</b> Tue 9:20 am to 10:00 am CNTs and Nanostructured Materials <i>(Dapino, Amirkhizi)</i> <b>SESSION 5</b> Tue 10:30 am to 11:50 am Material Development and Characterization <i>(Sundaresan, Leng)</i>	<b>SESSION 5</b> Tue 9:20 am to 10:00 am Applications of Shape Memory Alloys <i>(Farinholt)</i> <b>SESSION 6</b> Tue 10:30 am to 11:45 am Commercially Viable Smart Structure Technologies <i>(Browne)</i>	<b>Tue 9:20 am to 10:20 am</b> <b>Keynote Session III</b> <i>(Song)</i> <b>SESSION 4</b> Tue 10:30 am to 12:20 pm Special Invited Session in honor of Vasundara Varadan I <i>(Brantley)</i>
	<b>SESSION 7</b> Tue 1:20 pm to 3:00 pm Robotics I <i>(Abaid)</i> <b>SESSION 8</b> Tue 3:30 pm to 4:30 pm Robotics II <i>(Shafer)</i> <b>Tue 4:30 pm to 5:30 pm</b> POSTER POPS <i>(Martín-Palma)</i>	<b>SESSION 4</b> Tue 1:20 pm to 3:00 pm Ionic EAP I <i>(Madden, Rosset)</i> <b>SESSION 5</b> Tue 3:30 pm to 5:10 pm Dielectric EAP Materials and Actuators II <i>(Anderson, Choi)</i>	<b>SESSION 6</b> Tue 1:40 pm to 3:00 pm Energy Harvesting and Scavenging: Broadband/Nonlinear II <i>(Wang, Arafa)</i> <b>SESSION 7</b> Tue 3:30 pm to 5:30 pm Aircraft, MAV/UAV, and Morphing Systems <i>(Flatau, Goo)</i>	<b>SESSION 6</b> Tue 1:20 pm to 3:00 pm Shape Memory Polymer Behavior <i>(Kim, Furukawa)</i> <b>SESSION 7</b> Tue 3:30 pm to 4:50 pm Experimental Characterization of Multifunctional Composites I <i>(Sodano, Vertechy)</i>	<b>SESSION 7</b> Tue 1:10 pm to 3:00 pm In Memory of Ephraim Garcia I <i>(Leo)</i> <b>SESSION 8</b> Tue 3:30 pm to 5:30 pm In Memory of Ephraim Garcia II <i>(Inman)</i>	<b>SESSION 5</b> Tue 1:30 pm to 3:10 pm Special Invited Session in honor of Vasundara Varadan II <i>(Varadan, Kim, Chang)</i> <b>SESSION 6</b> Tue 3:40 pm to 5:20 pm Nanosensor and Nanocomposite <i>(Edwards)</i>

# CONFERENCE SESSION SCHEDULE

<b>CONFERENCE 9435</b> Sensors and Smart Structures Technologies for Civil, Mechanical, and Aerospace Systems	<b>CONFERENCE 9436</b> Smart Sensor Phenomena, Technology, Networks, and Systems Integration VIII	<b>CONFERENCE 9437</b> Structural Health Monitoring and Inspection of Advanced Materials, Aerospace, and Civil Infrastructure IX	<b>CONFERENCE 9438</b> Health Monitoring of Structural and Biological Systems IX	<b>CONFERENCE 9439</b> Smart Materials and Nondestructive Evaluation for Energy Systems
Mon 10:30 am to 11:50 am <b>Keynote Session</b> <i>(Sohn, Wang)</i>	<b>SESSION 1</b> Mon 10:30 am to 11:50 am New Sensor Technologies I <i>(Peters, Sulejmani)</i>	Mon 10:30 am to 11:10 am <b>Keynote Session I</b> <i>(Shull)</i> <b>SESSION 1</b> Mon 11:10 am to 11:50 am SHM/NDE for Composite Materials I <i>(Laflamme, Lau)</i>	<b>SESSION 1</b> Mon 10:30 am to 12:10 pm Guided Waves for Pipe Inspection <i>(Kundu, Grill)</i>	Mon 10:30 am to 11:10 am <b>Keynote Session I</b> <i>(Meyendorf)</i> <b>SESSION 1</b> Mon 11:10 am to 11:50 am NDE for Nuclear Energy <i>(Bond)</i>
<b>SESSION 1</b> Mon 1:20 pm to 3:00 pm Novel Approaches to Energy Harvesting <i>(Park, Huang)</i> <b>SESSION 2</b> Mon 3:30 pm to 5:10 pm Vibrations and SHM of Bridge Structures <i>(Noh, Loh)</i>	<b>SESSION 2</b> Mon 1:20 pm to 3:00 pm Applications of New Sensor Technologies I <i>(Iliopoulos)</i> <b>SESSION 3</b> Mon 3:30 pm to 5:50 pm Guided Wave Sensing <i>(Matikas, Abdul-Aziz)</i>	<b>SESSION 2</b> Mon 1:20 pm to 3:00 pm SHM/NDE for Composite Materials II <i>(Laflamme, Lau)</i> <b>SESSION 3</b> Mon 3:30 pm to 5:50 pm SHM/NDE for Composite Materials III <i>(Laflamme, Lau)</i>	<b>SESSION 2</b> Mon 1:30 pm to 3:10 pm Noncontact Guided Wave Techniques <i>(Sohn, Lanza di Scalea)</i> <b>SESSION 3</b> Mon 3:40 pm to 6:00 pm Nonlinear Techniques I <i>(Giurgiutiu, Staszewski)</i>	<b>SESSION 2</b> Mon 1:20 pm to 3:00 pm Green, Conventional, and Nuclear Energy <i>(Bond, Han)</i> <b>SESSION 3</b> Mon 3:30 pm to 5:30 pm Wind and Solar Energy <i>(Yoon, Heilmann)</i>
<b>SESSION 3</b> Tue 9:20 am to 10:00 am Spatial Sensing by Tomographic Methods <i>(Loh, Sohn)</i> <b>SESSION 4</b> Tue 10:30 am to 11:50 am Nanoengineered Thin Film Sensors I <i>(Lynch, Burton)</i>	<b>SESSION 4</b> Tue 9:20 am to 10:00 am Applications of New Sensor Technologies II <i>(Ecke, Dalla)</i> <b>SESSION 5</b> Tue 10:30 am to 11:50 am New Sensor Technologies II <i>(Ecke)</i>	Tue 9:20 am to 10:00 am <b>Keynote Session II</b> <i>(Shull, Yu)</i> <b>SESSION 4</b> Tue 10:30 am to 11:50 am Bridge Inspection and Monitoring Using SHM/NDE Techniques I <i>(Chen, Yu)</i>	<b>SESSION 4</b> Tue 9:20 am to 10:00 am Distributed Sensors <i>(Lanza di Scalea, Zagrai)</i> <b>SESSION 5</b> Tue 10:30 am to 11:50 am Guided Waves for Composite Monitoring: Modeling Aspects <i>(Staszewski, Fromme)</i>	Tue 9:20 am to 10:00 am <b>Keynote Session II</b> <i>(Meyendorf)</i> <b>SESSION 4</b> Tue 10:30 am to 11:50 am Batteries and Fuel Cells <i>(Michaelis)</i>
<b>SESSION 5</b> Tue 1:20 pm to 3:00 pm Advanced Ultrasonic Methods for SHM I <i>(Hong, Semperlotti)</i> <b>SESSION 6</b> Tue 3:30 pm to 5:30 pm Novel System Identification and Damage Detection Strategies <i>(Wang, Wakin)</i>	<b>SESSION 6</b> Tue 1:20 pm to 2:40 pm Spectral Gap Sensors <i>(Pсаробas, Matikas)</i>	<b>SESSION 5</b> Tue 1:20 pm to 3:00 pm Bridge Inspection and Monitoring Using SHM/NDE Techniques II <i>(Chen, Yu)</i> <b>SESSION 6</b> Tue 3:30 pm to 5:30 pm Piezoelectric Sensing SHM/NDE Technologies I <i>(Lau, Xia)</i>	<b>SESSION 6</b> Tue 1:20 pm to 3:00 pm Guided Waves for Composite Monitoring: Experimental Investigation <i>(Fromme, Ostachowicz)</i> <b>SESSION 7</b> Tue 3:30 pm to 6:30 pm Metamaterial and Periodic Structures I <i>(Huang, Pai)</i>	<b>SESSION 5</b> Tue 1:20 pm to 3:00 pm Monitoring and Energy Conversion <i>(Matikas, Dalichow)</i> <b>SESSION 6</b> Tue 3:30 pm to 5:30 pm Energy Conversion and Harvesting <i>(Kroening, Heuer)</i> Tue 5:30 pm to 6:30 pm <b>Panel Discussion: Challenges for Materials, Smart Structures, and NDE to Provide Energy for a Growing Ecologic Economy and a Better Quality of Life</b>



# CONFERENCE SESSION SCHEDULE

	CONFERENCE 9429 Bioinspiration, Biomimetics, and Bioreplication V	CONFERENCE 9430 Electroactive Polymer Actuators and Devices (EAPAD) XVII	CONFERENCE 9431 Active and Passive Smart Structures and Integrated Systems IX	CONFERENCE 9432 Behavior and Mechanics of Multifunctional Materials and Composites IX	CONFERENCE 9434 Nano-, Bio-, Info-Tech Sensors and Systems		
Wednesday 11 March	<p><b>SESSION 9</b> Wed 9:20 am to 10:00 am Optics and Photonics II (Debiasi)</p> <p><b>SESSION 10</b> Wed 10:30 am to 12:00 pm Optics and Photonics III (Arwin)</p> <p><b>SESSION 11</b> Wed 1:10 pm to 3:10 pm Systems and Devices (Anderson)</p> <p><b>SESSION 12</b> Wed 3:40 pm to 4:20 pm Biomaterials III (Shimomura)</p> <p>PANEL DISCUSSION Wed 4:20 pm to 5:40 pm Biomimicry, Bioinspiration, and the San Diego Zoo (Knez, Lakhtakia)</p>	<p><b>SESSION 6A</b> Wed 9:20 am to 12:10 pm Ionic EAP II (Chen, van Kessel)</p> <p><b>SESSION 7A</b> Wed 1:20 pm to 3:00 pm Dielectric EAP Materials and Actuators III (Bauer, Li)</p> <p><b>SESSION 8A</b> Wed 3:30 pm to 5:50 pm New EAP Materials, Processes, and Fabrication Techniques (Plesse, Bar-Cohen)</p>	<p><b>SESSION 6B</b> Wed 9:20 am to 12:10 pm Nano-Tech and CNT EAP (Vertechy, Kovacs)</p> <p><b>SESSION 7B</b> Wed 1:20 pm to 3:00 pm Conducting EAP Materials (Knoop, Xu)</p> <p><b>SESSION 8B</b> Wed 3:30 pm to 5:50 pm Analytical Modeling and Simulations of EAP Mechanisms (Su, Jager)</p>	<p><b>SESSION 8A</b> Wed 9:20 am to 10:20 am Energy Harvesting and Scavenging: Piezoelectrics/Electrects (Liang)</p> <p><b>SESSION 9A</b> Wed 10:50 am to 12:10 pm SMA-Based Materials and Systems I (Lagoudas, Brei)</p> <p><b>SESSION 10A</b> Wed 1:40 pm to 3:00 pm Energy Harvesting and Scavenging: General Piezoelectrics (Schwesinger, Lee)</p> <p><b>SESSION 11A</b> Wed 3:30 pm to 5:30 pm Magneto Rheological Systems II (Choi, Behrooz)</p>	<p><b>SESSION 8B</b> Wed 9:20 am to 10:20 am Micro- and Nano- Integrated Systems (Carman)</p> <p><b>SESSION 9B</b> Wed 10:50 am to 12:10 pm Passive and Active Vibration Isolation Systems I (Arrieta, Bai)</p> <p><b>SESSION 10B</b> Wed 1:40 pm to 3:00 pm Modeling, Optimization, Signal Processing, Sensing, Control, and Design of Integrated Systems I (Ohayon, Gandhi)</p> <p><b>SESSION 11B</b> Wed 3:30 pm to 5:30 pm Piezo-based Materials and Systems (Tang)</p>	<p><b>SESSION 8</b> Wed 9:20 am to 10:00 am Experimental Characterization of Multifunctional Composites II (Hartl)</p> <p><b>SESSION 9</b> Wed 10:30 am to 11:50 am Ionic Polymers and Gels (Sodano, Ciocanel)</p>	<p>Wed 9:20 am to 10:30 am Keynote <b>SESSION IV: RF and Wireless</b> (Choi)</p> <p><b>SESSION 7</b> Wed 10:40 am to 12:20 pm Fabrication and Characterization I (Kim)</p> <p><b>SESSION 8</b> Wed 1:30 pm to 3:10 pm Fabrication and Characterization II (Choi)</p>
Thursday 12 March		<p><b>SESSION 9A</b> Thu 9:20 am to 12:10 pm Applications of EAP Materials I (deBotton, Khoshkava)</p> <p><b>SESSION 10A</b> Thu 1:20 pm to 3:00 pm Applications of EAP Materials II (Akle, Wallmersperger)</p> <p><b>SESSION 11A</b> Thu 3:30 pm to 4:50 pm Applications of EAP Materials III (Bluemke, Kruusamäe)</p>	<p><b>SESSION 9B</b> Thu 9:20 am to 10:00 am SMP and Other EAP Materials (Mirvakili, Wallmersperger)</p> <p><b>SESSION 9C</b> Thu 10:30 am to 12:10 pm New EAP Actuators and Applications of EAP Materials (Bar-Cohen)</p> <p><b>SESSION 10B</b> Thu 1:20 pm to 3:00 pm Haptic, Tactile, and Other Sensors I (Böse, Shian)</p> <p><b>SESSION 11B</b> Thu 3:30 pm to 4:50 pm Haptic, Tactile, and Other Sensors II (Böse, Shian)</p>	<p><b>SESSION 12A</b> Thu 9:20 am to 10:20 am Modeling, Optimization, Signal Processing, Sensing, Control, and Design of Integrated Systems II (Ripamonti)</p> <p><b>SESSION 13A</b> Thu 10:50 am to 12:10 pm Energy Harvesting and Scavenging: Applications (Harne, Tang)</p> <p><b>SESSION 14A</b> Thu 1:40 pm to 3:00 pm Energy Harvesting and Scavenging: General (Zuo, Kauffman)</p> <p><b>SESSION 15A</b> Thu 3:30 pm to 5:30 pm SMA-Based Materials and Systems II (Leng, Ikeda)</p>	<p><b>SESSION 12B</b> Thu 9:20 am to 10:20 am Passive and Active Vibration Isolation Systems II (Anton)</p> <p><b>SESSION 13B</b> Thu 10:50 am to 12:10 pm Passive and Active Vibration Isolation Systems III (Asanuma)</p> <p><b>SESSION 14B</b> Thu 1:40 pm to 3:00 pm Modeling, Optimization, Signal Processing, Sensing, Control, and Design of Integrated Systems III (Papalou)</p> <p><b>SESSION 15B</b> Thu 3:30 pm to 5:10 pm Passive and Active Vibration Isolation Systems IV (Wang, Yoon)</p>		



# CONFERENCE SESSION SCHEDULE

CONFERENCE 9435 Sensors and Smart Structures Technologies for Civil, Mechanical, and Aerospace Systems		CONFERENCE 9437 Structural Health Monitoring and Inspection of Advanced Materials, Aerospace, and Civil Infrastructure IX		CONFERENCE 9438 Health Monitoring of Structural and Biological Systems IX	
<p><b>SESSION 7A</b> Wed 9:20 am to 10:00 am Big Data and Data Analytics for SHM (Chen, Ryu)</p> <p><b>SESSION 8A</b> Wed 10:30 am to 11:50 am Actuation and Feedback Control Technologies (Swartz)</p>	<p><b>SESSION 7B</b> Wed 9:20 am to 10:00 am Sensing Systems for Flight Control (Laflamme, Song)</p> <p><b>SESSION 8B</b> Wed 10:30 am to 11:50 am Nonlinear Ultrasonics for Damage Detection (Oppenheim, Sohn)</p>	<p><b>SESSION 7</b> Wed 9:20 am to 10:00 am Modeling and Simulation Techniques For SHM/NDE I (Omenzetter, Ozevin)</p> <p><b>SESSION 8</b> Wed 10:30 am to 11:50 am Modeling and Simulation Techniques For SHM/NDE II (Omenzetter, Lau)</p>	<p><b>SESSION 8</b> Wed 9:20 am to 10:00 am Emerging and Futuristic Techniques (Zentai, Panetta)</p> <p><b>SESSION 9</b> Wed 10:30 am to 11:50 am Bridge Monitoring (Reis, Zentai)</p>		
<p><b>SESSION 9A</b> Wed 1:20 pm to 3:00 pm SHM of Concrete Structures (Hoult, Li)</p> <p><b>SESSION 10A</b> Wed 3:30 pm to 5:30 pm Nanoengineered Thin Film Sensors II (Loyola, Lynch)</p>	<p><b>SESSION 9B</b> Wed 1:20 pm to 3:00 pm Advances in Wireless Sensors for SHM (Gordaninejad, Lynch)</p> <p><b>SESSION 10B</b> Wed 3:30 pm to 5:30 pm Advanced Ultrasonic Methods for SHM II (Ostachowicz, di Scalea)</p>	<p><b>SESSION 9</b> Wed 1:20 pm to 3:00 pm Modeling and Simulation Techniques For SHM/NDE III (Gyekenyesi, Shull)</p> <p><b>SESSION 10</b> Wed 3:30 pm to 5:50 pm Vibration-Based SHM/NDE I (Sasamoto, Ozevin)</p>	<p><b>SESSION 10</b> Wed 1:20 pm to 3:00 pm Civil Structure Monitoring: Building, Bridge, and Tower (Niezrecki, Reis)</p> <p><b>SESSION 11</b> Wed 3:30 pm to 5:50 pm Metamaterial and Periodic Structures II (Huang, Uhl)</p>		
<p><b>SESSION 11A</b> Thu 9:20 am to 10:00 am Human and Humanoid Sensing and Actuation (Chen, Ryu)</p> <p><b>SESSION 12A</b> Thu 10:30 am to 11:50 am Fiber Optic Sensing Technology (Huang, Glisic)</p>	<p><b>SESSION 11B</b> Thu 9:20 am to 10:00 am Control of Wind Turbines (Laflamme, Song)</p> <p><b>SESSION 12B</b> Thu 10:30 am to 11:50 am Vision-based Sensing Technologies (Chang, Zonta)</p>	<p><b>SESSION 11A</b> Thu 9:20 am to 10:00 am Panel Discussion: Challenges and Opportunities for Infrastructure Inspection, Monitoring, and Repair (Yu, Huston)</p> <p><b>SESSION 12A</b> Thu 10:30 am to 11:50 am SHM/NDE for Civil Infrastructure I (Huang, Dai)</p>	<p><b>SESSION 11B</b> Thu 9:20 am to 10:00 am Guided Wave I (Gucunski, Huston)</p> <p><b>SESSION 12B</b> Thu 10:30 am to 11:50 am Guided Wave II (Gucunski, Huston)</p>	<p><b>SESSION 12A</b> Thu 9:20 am to 10:00 am Vibration-Based SHM (Krishnaswamy, Yu)</p> <p><b>SESSION 13A</b> Thu 10:30 am to 11:50 am Guided Wave-Based SHM I (Su, Rizzo)</p> <p><b>SESSION 14A</b> Thu 1:20 pm to 3:00 pm Guided Wave-Based SHM II (Fromme, Todd)</p>	<p><b>SESSION 12B</b> Thu 9:20 am to 10:00 am Composite Monitoring (Ostachowicz, Su)</p> <p><b>SESSION 13B</b> Thu 10:30 am to 11:50 am Nonlinear Techniques II (Grill, Banerjee)</p> <p><b>SESSION 14B</b> Thu 1:20 pm to 3:00 pm Biomedical Applications: Organ and Implant Monitoring (Jiang, Banerjee)</p>
<p><b>SESSION 13A</b> Thu 1:40 pm to 3:00 pm Applications of Smart Structure Technologies (Jang, Sohn)</p> <p><b>SESSION 14A</b> Thu 3:30 pm to 5:30 pm Advanced Composite Structural Systems (Mascarenas, Loyola)</p>	<p><b>SESSION 13B</b> Thu 1:20 pm to 3:00 pm Next-Generation Sensors for Smart Structures (Kurata, Ozevin)</p> <p><b>SESSION 14B</b> Thu 3:30 pm to 5:30 pm Modeling Techniques for Smart Structures (Pakzad, Jahanshahi)</p>	<p><b>SESSION 13A</b> Thu 1:20 pm to 3:00 pm SHM/NDE for Civil Infrastructure II (Huang, Dai)</p> <p><b>SESSION 14A</b> Thu 3:30 pm to 5:10 pm Roadway and Pavement Inspection and Monitoring: SHM/NDE Technologies (Wang, Su)</p>	<p><b>SESSION 13B</b> Thu 1:20 pm to 3:00 pm Guided Wave III (Wang, Jiang)</p> <p><b>SESSION 14B</b> Thu 3:30 pm to 4:50 pm Radar and Microwave NDE Technologies (Yu, Huston)</p>		

## TECHNICAL CONFERENCES

### CONFERENCE 9429

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## Bioinspiration, Biomimetics, and Bioreplication V

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### CONFERENCE 9430

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## Electroactive Polymer Actuators and Devices (EAPAD) XVII

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### CONFERENCE 9431

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## Active and Passive Smart Structures and Integrated Systems IX

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### CONFERENCE 9432

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## Behavior and Mechanics of Multifunctional Materials and Composites IX

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### CONFERENCE 9433

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## Industrial and Commercial Applications of Smart Structures Technologies IX

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### CONFERENCE 9434

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## Nano-, Bio-, Info- Tech Sensors and Systems

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**CONFERENCE 9435**

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

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**CONFERENCE 9436**

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**Smart Sensor Phenomena, Technology, Networks, and Systems Integration VIII**

*Conference Chair:* **Kara J. Peters**, North Carolina State Univ. (USA)

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**CONFERENCE 9437**

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**Structural Health Monitoring and Inspection of Advanced Materials, Aerospace, and Civil Infrastructure IX**

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**CONFERENCE 9438**

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**Health Monitoring of Structural and Biological Systems IX**

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*Conference Co-Chair:* **Wolfgang Grill**, Univ. Leipzig (Germany)

*Program Committee:* **Sourav Banerjee**, Univ. of South Carolina (USA); **Yoseph Bar-Cohen**, Jet Propulsion Lab. (USA); **Fu-Kuo Chang**, Stanford Univ. (USA); **Anthony J. Croxford**, Univ. of Bristol (United Kingdom); **Paul Fromme**, Univ. College London (United Kingdom); **Victor Giurgiutiu**, Univ. of South Carolina (USA); **Daniel J. Guyomar**, Institut National des Sciences Appliquées de Lyon (France); **Guoliang Huang**, Univ. of Arkansas at Little Rock (USA); **Xiaoning Jiang**, North Carolina State Univ. (USA); **Sridhar Krishnaswamy**, Northwestern Univ. (USA); **Francesco Lanza di Scalea**, Univ. of California, San Diego (USA); **Jerome P. Lynch**, Univ. of Michigan (USA); **Jennifer E. Michaels**, Georgia Institute of Technology (USA); **Won-Bae Na**, Pukyong National Univ. (Korea, Republic of); **Christopher Niezrecki**, Univ. of Massachusetts Lowell (USA); **Wieslaw M. Ostachowicz**, The Szwalski Institute of Fluid-Flow Machinery (Poland); **Paul D. Panetta**, Applied Research Associates, Inc. (USA); **Pergjin F. Pai**, Univ. of Missouri-Columbia (USA); **Xinlin Qing**, Commercial Aircraft Corp. of China, Ltd. (China); **Henrique L. Reis**, Univ. of Illinois at Urbana-Champaign (USA); **Piervincenzo Rizzo**, Univ. of Pittsburgh (USA); **Hoon Sohn**, KAIST (Korea, Republic of); **Wieslaw J. Staszewski**, AGH Univ. of Science and Technology (Poland); **Zhongqing Su**, The Hong Kong Polytechnic Univ. (Hong Kong, China); **Nobuo Takeda**, The Univ. of Tokyo (Japan); **Michael D. Todd**, Univ. of California, San Diego (USA);

*continues*

**CONFERENCE 9439**

Monday–Tuesday  
9–10 March 2015  
Proceedings of SPIE  
Vol. 9439

**Smart Materials and Nondestructive Evaluation for Energy Systems**

*Conference Chair:* **Norbert G. Meyendorf**, Fraunhofer IKTS-MD (Germany), Univ. of Dayton (USA)

*Conference Co-Chair:* **Theodoros E. Matikas**, Univ. of Ioannina (Greece)

*Program Committee:* **Ali Abdul-Aziz**, NASA Glenn Research Ctr. (USA); **George Y. Baaklini**, NASA Glenn Research Ctr. (USA); **Leonard Bond**, Iowa State Univ. (USA); **Michael Dalichow**, Quality Network Inc. (USA); **Tae-Young Han**, Yonsei-Fraunhofer Joint Medical Device Lab. (Korea, Republic of); **Peter Heilmann**, arxes-tolina GmbH (Germany); **Manfred Johannes**, South African Institute for Non-Destructive Testing (South Africa); **Michael Kroening**, Pontificia Univ. Católica do Rio de Janeiro (Brazil); **Jinhong Liu**, China General Nuclear Power Corp. (China); **Alexander Michaelis**, Fraunhofer-Institut für Elektronische Nanosysteme (Germany); **Dong-Jin Yoon**, Korea Research Institute of Standards and Science (Korea, Republic of)



## TECHNICAL CONFERENCES

### CONFERENCE 9429

### CONFERENCE 9430

**Qibing Pei**, Univ. of California, Los Angeles (USA); **Valentin Radu**, Omicron Plus S.R.L. (Romania); **Mehdi Razzaghi-Kashani**, Tarbiat Modares Univ. (Iran, Islamic Republic of); **Jonathan M. Rossiter**, Univ. of Bristol (United Kingdom); **Anuvat Sirivat**, Chulalongkorn Univ. (Thailand); **Anne Ladegaard Skov**, Technical Univ. of Denmark (Denmark); **Elisabeth Smela**, Univ. of Maryland, College Park (USA); **Ji Su**, NASA Langley Research Ctr. (USA); **Minoru Taya**, Univ. of Washington (USA); **Gordon G. Wallace**, Univ. of Wollongong (Australia); **Thomas Wallmersperger**, Technische Univ. Dresden (Germany); **Qiming M. Zhang**, The Pennsylvania State Univ. (USA); **Pawel Zylka**, Wroclaw Univ. of Technology (Poland)

### CONFERENCE 9431

**Hyung-Jo Jung**, KAIST (Korea, Republic of); **David L. Mascareñas**, Los Alamos National Lab. (USA); **Roger Ohayon**, Conservatoire National des Arts et Métiers (France); **Mohammad Rastgaar Aagaah**, Massachusetts Institute of Technology (USA); **Norbert Schwesinger**, Technische Univ. München (Germany); **Yi-Chung Shu**, National Taiwan Univ. (Taiwan); **Henry A. Sodano**, Univ. of Florida (USA); **Steve Southward**, Virginia Polytechnic Institute and State Univ. (USA); **Roger Stanway**, The Univ. of Sheffield (United Kingdom); **Jiong Tang**, Univ. of Connecticut (USA); **Dai-Hua Wang**, Chongqing Univ. (China); **Kon-Well Wang**, Univ. of Michigan (USA); **Norman M. Wereley**, Univ. of Maryland, College Park (USA); **Hwan-Sik Yoon**, The Univ. of Alabama (USA); **Lei Zuo**, Virginia Polytechnic Institute and State Univ. (USA)

### CONFERENCE 9432

**Zoubeida Ounaies**, The Pennsylvania State Univ. (USA); **Etienne Patoor**, Univ. Metz (France); **Ralph C. Smith**, North Carolina State Univ. (USA); **Jonghwan Suhr**, Univ. of Delaware (USA); **Vishnu Baba Sundaresan**, The Ohio State Univ. (USA)

### CONFERENCE 9433

**Gyuhae Park**, Chonnam National Univ. (Korea, Republic of); **Marc E. Regelbrugge**, Rhombus Consultants Group (USA); **W. Lance Richards**, NASA Dryden Flight Research Ctr. (USA); **Janet M. Sater**, Institute for Defense Analyses (USA); **Henry A. Sodano**, Univ. of Florida (USA); **Wieslaw J. Staszewski**, AGH Univ. of Science and Technology (Poland); **Edward V. White**, The Boeing Co. (USA)

### CONFERENCE 9434

**Wei-Chih Wang**, Univ. of Washington (USA); **Richard K. Watt**, Brigham Young Univ. (USA); **T. C. Yih**, California State Univ., Long Beach (USA); **Hargsoon Yoon**, Norfolk State Univ. (USA); **Ming Zhou**, Suzhou Institute of Nano-tech and Nano-bionics (China)

## Monday 9 March

### Monday Plenary Session

MON 8:10 AM TO 10:00 AM  
LOCATION: TOWN AND COUNTRY BALLROOM

8:10 TO 8:30 AM:

- **SSM Lifetime Achievement Award Presentation**
- **NDE Lifetime Achievement Award Presentation**
- **Commemoration for Prof. Ephraim Garcia** presented by **Daniel J. Inman**, Univ. of Michigan (USA)



**Potential and Challenges for the Application of Smart Advanced Ceramic Materials** (*Plenary*), Alexander Michaelis, Fraunhofer-IKTS (Germany). . . [9429-500]



**Biomolecular Material Systems: Harnessing Nature's Smart Materials for Sensing, Actuation, and Energy Conversion** (*Plenary*), Donald J. Leo, The Univ. of Georgia (USA) . . . [9429-501]

**CONFERENCE 9435**

**Sami F. Masri**, The Univ. of Southern California (USA); **Akira Mita**, Keio Univ. (Japan); **Tomonori Nagayama**, The Univ. of Tokyo (Japan); **Yiqing Ni**, The Hong Kong Polytechnic Univ. (Hong Kong, China); **Hae Young Noh**, Carnegie Mellon Univ. (USA); **Irving J. Oppenheim**, Carnegie Mellon Univ. (USA); **Wieslaw M. Ostachowicz**, The Szewalski Institute of Fluid-Flow Machinery (Poland); **Jinping Ou**, Dalian Univ. of Technology (China); **Shamim N. Pakzad**, Lehigh Univ. (USA); **Seunghee Park**, Sungkyunkwan Univ. (Korea, Republic of); **Jin-Song Pei**, The Univ. of Oklahoma (USA); **Michael K. Philen**, Virginia Polytechnic Institute and State Univ. (USA); **Paul Reynolds**, Univ. of Exeter (United Kingdom); **Massimo Ruzzene**, Georgia Institute of Technology (USA); **Liming W. Salvino**, Office of Naval Research Global (USA); **Jeffrey T. Scruggs**, Univ. of Michigan (USA); **Fabio Semperlotti**, Univ. of Notre Dame (USA); **Sung-Han Sim**, Ulsan National Institute of Science and Technology (Korea, Republic of); **Billie F. Spencer Jr.**, Univ. of Illinois at Urbana-Champaign (USA); **Wieslaw J. Staszewski**, AGH Univ. of Science and Technology (Poland); **Lizhi Sun**, Univ. of California, Irvine (USA); **R. Andrew Swartz**, Michigan Technological Univ. (USA); **Masayoshi Tomizuka**, Univ. of California, Berkeley (USA); **Ming L. Wang**, Northeastern Univ. (USA); **Xingwei Wang**, Univ. of Massachusetts Lowell (USA); **Yang Wang**, Georgia Institute of Technology (USA); **Chung-Bang Yun**, Ulsan National Institute of Science and Technology (Korea, Republic of); **Yunfeng Zhang**, Univ. of Maryland, College Park (USA); **Li Zhou**, Nanjing Univ. of Aeronautics and Astronautics (China); **Daniele Zonta**, Univ. degli Studi di Trento (Italy)

**CONFERENCE 9436**

**CONFERENCE 9437**

**Ming L. Wang**, Northeastern Univ. (USA); **Xingwei Wang**, Univ. of Massachusetts Lowell (USA); **Yang Wang**, Georgia Institute of Technology (USA); **Fan Wu**, Shanghai Jiao Tong Univ. (China); **Tian Xia**, The Univ. of Vermont (USA); **Lingyu Yu**, Univ. of South Carolina (USA); **Fuh-Gwo Yuan**, North Carolina State Univ. (USA); **Paul H. Ziehl**, Univ. of South Carolina (USA)

**CONFERENCE 9438**

**Tadeusz Uhl**, AGH Univ. of Science and Technology (Poland); **Wei-Chih Wang**, Univ. of Washington (USA); **Lingyu Yu**, Univ. of South Carolina (USA); **Andrei N. Zagrai**, New Mexico Institute of Mining and Technology (USA); **George Zentai**, Varian Medical Systems, Inc. (USA)

**CONFERENCE 9439**

**Monday 9 March**

**Monday Plenary Session**

**MON 8:10 AM TO 10:00 AM**  
**LOCATION: TOWN AND COUNTRY BALLROOM**

**8:10 TO 8:30 AM:**

- **SSM Lifetime Achievement Award Presentation**
- **NDE Lifetime Achievement Award Presentation**
- **Commemoration for Prof. Ephrahim Garcia** presented by **Daniel J. Inman**, Univ. of Michigan (USA)



**Potential and Challenges for the Application of Smart Advanced Ceramic Materials** (*Plenary*), Alexander Michaelis, Fraunhofer-IKTS (Germany). . . [9429-500]



**Biomolecular Material Systems: Harnessing Nature's Smart Materials for Sensing, Actuation, and Energy Conversion** (*Plenary*), Donald J. Leo, The Univ. of Georgia (USA) . . . [9429-501]



**CONFERENCE 9429**

Bioinspiration, Biomimetics, and Bioreplication V

**SESSION 1**

**LOCATION: SUNRISE  
MON 10:30 AM TO 11:50 AM**

**Biomaterials I**

Session Chair: **Akhlesh Lakhtakia**, The Pennsylvania State Univ. (USA)

10:30 am: **Paradigm for design of biomimetic adaptive structures** (*Keynote Presentation*), Carolyn Dry, Natural Process Design, Inc. (USA) . . . . . [9429-1]

11:20 am: **Investigation of biological and biomimetic composites** (*Invited Paper*), David Kisailus, Univ. of California, Riverside (USA) . . . . . [9429-2]

Lunch Break. Mon 11:50 am to 1:10 pm

**CONFERENCE 9430**

Electroactive Polymer Actuators and Devices (EAPAD) XVII

**SESSION 1**

**LOCATION: TOWN AND COUNTRY BALLROOM  
MON 10:30 AM TO 12:10 PM**

**EAP as Emerging Actuators**

Session Chairs: **Yoseph Bar-Cohen**, Jet Propulsion Lab. (USA); **Gal deBotton**, Ben-Gurion Univ. of the Negev (Israel)

10:30 am: **RoboSimian and the advancement of mobile manipulation in robotics** (*Keynote Presentation*), Brett A. Kennedy, Jet Propulsion Lab. (USA) . . . . . [9430-1]

11:10 am: **Multifunctional electroactive polymers and nanocomposites: fascinating properties and novel applications** (*Invited Paper*), Qiming M. Zhang, The Pennsylvania State Univ. (USA) . . . . . [9430-2]

11:50 am: **Reducing laser speckle with electroactive polymer actuators** (*Invited Paper*), Chauncey Graetzel, David Stadler, Marcel Suter, David A. Niederer, Optotune AG (Switzerland) . . . . . [9430-3]

Lunch Break Mon 12:10 to 1:20 pm

**CONFERENCE 9431**

Active and Passive Smart Structures and Integrated Systems IX

**SESSION 1**

**LOCATION: ROYAL PALM FIVE  
MON 10:30 AM TO 12:10 PM**

**Energy Harvesting and Scavenging: Waves/Acoustics**

Session Chairs: **Wei-Hsin Liao**, The Chinese Univ. of Hong Kong (Hong Kong, China); **Gyuhae Park**, Chonnam National Univ. (Korea, Republic of)

10:30 am: **Broadband performance of a patterned piezoelectric energy harvester integrated with a continuous elastoacoustic mirror**, Matteo Carrara, Stephen M. Leadenham, Jason A. Kulpe, Michael J. Leamy, Alper Erturk, Georgia Institute of Technology (USA)[9431-1]

10:50 am: **On the use of nonlinear solitary waves for energy harvesting**, Kaiyuan Li, Piervincenzo Rizzo, Univ. of Pittsburgh (USA) . . . . . [9431-2]

11:10 am: **Hydraulic pressure energy harvester enhanced by Helmholtz resonator**, Ellen A. Skow, Zachary Koontz, Kenneth A. Cunefare, Alper Erturk, Georgia Institute of Technology (USA) . . . . . [9431-3]

11:30 am: **An experimentally validated contactless acoustic energy transfer model with resistive-reactive electrical loading**, Shima Shahab, Michael Gray, Alper Erturk, Georgia Institute of Technology (USA) . . . . . [9431-4]

11:50 am: **Energy scavenging from acousto-elastic metamaterial using local resonance phenomenon**, Riaz Ahmed, Univ. of South Carolina (USA); Afifa Adiba, The Ohio State Univ. (USA); Sourav Banerjee, Univ. of South Carolina (USA) . . . . . [9431-5]

Lunch Break . Mon 12:10 to 1:40 pm

**CONFERENCE 9432**

Behavior and Mechanics of Multifunctional Materials and Composites IX

**SESSION 1**

**LOCATION: SUNSET  
MON 10:30 AM TO 11:50 AM**

**Mechanics of Active Polymers**

Session Chairs: **Nakhiah C. Goulbourne**, Univ. of Michigan (USA); **Hani E. Naguib**, Univ. of Toronto (Canada)

10:30 am: **Unifying relations in polymer photomechanics**, Jonghoon Bin, William S. Oates, Florida State Univ. (USA) . . [9432-1]

10:50 am: **Thermoplastic polyurethane as a mechanochromic strain sensor**, Filippo Cellini, New York Univ. (USA); Sachin Khapli, New York Univ. Abu Dhabi (United Arab Emirates); Sean D. Peterson, Univ. of Waterloo (Canada); Maurizio Porfiri, New York Univ. (USA) . . . . . [9432-2]

11:10 am: **Mechanical, thermal, and photo-mechanical properties of a novel light activated shape memory polymer**, Yingtao Y. Liu, The Univ. of Oklahoma (USA)[9432-3]

11:30 am: **Chemorheological behavior of thermoset shape memory polymers: experiments and modeling**, Kannan Dasharathi, John A. Shaw, Alan Wineman, Univ. of Michigan (USA) . . . . . [9432-4]

Lunch Break . Mon 11:50 am to 1:20 pm

**CONFERENCE 9433**

Industrial and Commercial Applications of Smart Structures Technologies IX

**SESSION 1**

**LOCATION: ROYAL PALM ONE  
MON 10:30 AM TO 11:50 AM**

**Use of Piezoelectrics in Smart Structures**

Session Chair: **Gyuhae Park**, Chonnam National Univ. (Korea, Republic of)

10:30 am: **Actuators using piezoelectric stacks and displacement enhancers**, Yoseph Bar-Cohen, Stewart Sherrit, Xiaohui Bao, Mircea Badescu, Hyeong Jae Lee, Phillip E. Walkemeyer, Derek A. Lewis, Grayson Adams, Kevin Christensen, Jet Propulsion Lab. (USA) . . . . . [9433-1]

10:50 am: **Optimally tuned resonant negative capacitance for piezoelectric shunt damping based on measured electromechanical impedance**, Rogério Salloum, Oliver Heuss, Fraunhofer-Institut für Betriebsfestigkeit und Systemzuverlässigkeit (Germany); Benedict Götz, Technische Univ. Darmstadt (Germany); Dirk Mayer, Fraunhofer-Institut für Betriebsfestigkeit und Systemzuverlässigkeit (Germany) . . . . . [9433-2]

11:10 am: **Mapping of power consumption and friction reduction in piezoelectrically-assisted ultrasonic lubrication**, Sheng Dong, Marcelo J. Dapino, The Ohio State Univ. (USA) . . . [9433-3]

11:30 am: **Geometry adaptive control of a composite reflector using PZT actuators**, Houfei Fang, Y. Song, Y. Hou, S. Jiang, Shanghai YS Information Technology Co., Ltd. (China) . . . . . [9433-4]

Lunch Break. Mon 11:50 am to 1:20 pm

**CONFERENCE 9434**

Nano-, Bio-, Info-Tech Sensors and Systems

**LOCATION:**

**ROYAL PALM THREE  
MON 10:30 AM TO 11:10 AM**

**Keynote Session I**

Session Chair: **Vijay K. Varadan**, The Pennsylvania State Univ. (USA)

10:30 am: **Nano devices and concepts for condition-based maintenance of military systems** (*Keynote Presentation*), Eugene Edwards, Christina L. Brantley, U.S. Army Research, Development and Engineering Command (USA); Paul B. Ruffin, Alabama A&M Univ. (USA); Sihon H. Crutcher, U.S. Army Research, Development and Engineering Command (USA) . . . . . [9434-1]

**SESSION 1**

**LOCATION: ROYAL PALM THREE  
MON 11:10 AM TO 12:10 PM**

**Nanosensors and Systems I**

Session Chair: **Vijay K. Varadan**, The Pennsylvania State Univ. (USA)

11:10 am: **A tactile sensor made of graphene-cellulose nanocomposite** (*Invited Paper*), Kishor Kumar Sadasivuni, Abdullahlil Kafy, Seongcheol Mun, Jaehwan Kim, Inha Univ. (Korea, Republic of) . . . . . [9434-2]

11:40 am: **Sensor system for vapor trace detection of different molecules** (*Invited Paper*), Drago Strle, Univ. of Ljubljana (Slovenia) . . . . . [9434-3]

Lunch Break Mon 12:10 to 1:30 pm

**CONFERENCE 9435**

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

LOCATION: PACIFIC SALON SIX  
MON 10:30 AM TO 11:50 AM

**Keynote Session**

Session Chairs: **Hoon Sohn**, KAIST (Korea, Republic of); **Kon-Well Wang**, Univ. of Michigan (USA)

10:30 am: **New trends in non-destructive assessment of aerospace structures** (*Keynote Presentation*), Wieslaw M. Ostachowicz, The Szwalski Institute of Fluid-Flow Machinery (Poland) and Warsaw Univ. of Technology (Poland); Pawel H. Malinowski, Tomasz Wandowski, The Szwalski Institute of Fluid-Flow Machinery (Poland) . . . . . [9435-1]

11:10 am: **Computational service infrastructure for structural health monitoring** (*Keynote Presentation*), Kincho H. Law, Stanford Univ. (USA) . . . . . [9435-2]

Lunch Break . . . Mon 11:50 am to 1:20 pm

**CONFERENCE 9436**

Smart Sensor Phenomena, Technology, Networks, and Systems Integration VIII

**SESSION 1**

LOCATION: TOWNE  
MON 10:30 AM TO 11:50 AM

**New Sensor Technologies I**

Session Chairs: **Kara J. Peters**, North Carolina State Univ. (USA); **Sanne Sulejmani**, Vrije Univ. Brussel (Belgium)

10:30 am: **Ultra-thin sensor array for curvature sensing**, Eugen Koch, Florian Wilsdorf, Andreas H. Dietzel, Technische Univ. Braunschweig (Germany) . . . [9436-1]

10:50 am: **Monitoring the fracture behaviour of metal matrix composites by combined NDE methodologies**, Evangelos Z. Kordatos, Sheffield Hallam Univ. (United Kingdom) and Univ. of Ioannina (Greece); Dimitrios A. Exarchos, Theodore E. Matikas, Univ. of Ioannina (Greece) . . . . . [9436-31]

11:10 am: **Delamination monitoring in composite materials using dedicated microstructured optical fiber Bragg grating sensors**, Sanne Sulejmani, Vrije Univ. Brussel (Belgium); Geert Luyckx, Univ. Gent (Belgium); Thomas Geernaert, Vrije Univ. Brussel (Belgium); Pawel Mergo, Marie Curie-Sklodowska Univ. (Poland); Wacław Urbanczyk, Wrocław Univ. of Technology (Poland); Karima Chah, Univ. de Mons (Belgium); Hugo Thienpont, Francis Berghmans, Vrije Univ. Brussel (Belgium) . . . . . [9436-3]

11:30 am: **Correction factors for cross-correlation processing of FBG sensor network data**, William B. Stewart, North Carolina State Univ. (USA); Bram Van Hoe, North Carolina State Univ. (USA) and Univ. Gent (Belgium); Kara J. Peters, North Carolina State Univ. (USA); Stephen Schultz, Brigham Young Univ. (USA); Geert Steenberge, Univ. Gent (Belgium) . [9436-4]

Lunch Break . . . Mon 11:50 am to 1:20 pm

**CONFERENCE 9437**

Structural Health Monitoring and Inspection of Advanced Materials, Aerospace, and Civil Infrastructure IX

LOCATION: ROYAL PALM FOUR  
MON 10:30 AM TO 11:10 AM

**Keynote Session I**

Session Chair: **Peter J. Shull**, The Pennsylvania State Univ. (USA)

10:30 am: **Novel ultrasound sensors and transducers for non-destructive testing** (*Keynote Presentation*), Xiaoning Jiang, North Carolina State Univ. (USA) . [9437-1]

**SESSION 1**

LOCATION: ROYAL PALM FOUR  
MON 11:10 AM TO 11:50 AM

**SHM/NDE for Composite Materials I**

Session Chairs: **Simon Laflamme**, Iowa State Univ. (USA); **Dennis Lau**, City Univ. of Hong Kong (Hong Kong, China)

11:10 am: **Characterization of complex materials with elastic discontinuities using scanning acoustic microscopy**, Xin Li, Jeong Nyeon Kim, Richard L. Tutwiler, Judith A. Todd, The Pennsylvania State Univ. (USA); Ik-Keun Park, Seoul National Univ. of Science and Technology (Korea, Republic of) . . . . . [9437-2]

11:30 am: **FRP/steel composite damage monitoring and evaluation based on acoustic emission techniques**, Dongsheng Li, Dalian Univ. of Technology (China) . . . . . [9437-3]

Lunch Break . . . Mon 11:50 am to 1:20 pm

**CONFERENCE 9438**

Health Monitoring of Structural and Biological Systems IX

**SESSION 1**

LOCATION: ROYAL PALM SIX  
MON 10:30 AM TO 12:10 PM

**Guided Waves for Pipe Inspection**

Session Chairs: **Tribikram Kundu**, The Univ. of Arizona (USA); **Wolfgang Grill**, ASI Analog Speed Instruments GmbH (Germany)

10:30 am: **A closed form solution of the torsional wave scattered amplitude in a pipe by the reciprocity theorem** (*Invited Paper*), Younho Cho, Jaesun Lee, Pusan National Univ. (Korea, Republic of); Jan D. Achenbach, Northwestern Univ. (USA) . . . . . [9438-1]

11:10 am: **Multi-helical ultrasonic imaging MHUI for corrosion monitoring of cylindrical structures**, Ehsan Dehghan Niri, Salvatore Salamone, Univ. at Buffalo (USA) . . . . . [9438-2]

11:30 am: **Enhanced signal processing method for monitoring the height of condensed water in steam pipes**, Shyh-Shiuh Lih, Hyeong Jae Lee, Yoseph Bar-Cohen, Jet Propulsion Lab. (USA) . [9438-3]

11:50 am: **Guided wave technique for non-destructive testing of StiffPipe**, Umar Amjad, Susheel K. Yadav, Chi Hahn Nguyen, The Univ. of Arizona (USA); Mohammad R. Ehsani, QuakeWrap Inc. (USA); Tribikram Kundu, The Univ. of Arizona (USA) . [9438-4]

Lunch Break . . . Mon 12:10 pm to 1:50 pm

**CONFERENCE 9439**

Smart Materials and Nondestructive Evaluation for Energy Systems

LOCATION: ROYAL PALM TWO  
MON 10:30 AM TO 11:10 AM

**Keynote Session I**

Session Chair: **Norbert G. Meyendorf**, Fraunhofer IKTS-MD (Germany)

10:30 am: **Needs and opportunities: nondestructive evaluation for energy systems** (*Keynote Presentation*), Leonard J. Bond, Iowa State Univ. (USA) . . . . . [9439-1]

**SESSION 1**

LOCATION: ROYAL PALM TWO  
MON 11:10 AM TO 11:50 AM

**NDE for Nuclear Energy**

Session Chair: **Leonard J. Bond**, Iowa State Univ. (USA)

11:10 am: **Investigation of UT inspection approach for primary piping welds of Chinese evolutionary pressurized reactor nuclear power plant**, Weiqiang Wang, Huaidong Chen, Guanbing Ma, Maocheng Hong, Ming Li, Jinhong Liu, CGNPC Inspection Technology Co. Ltd. (China); Norbert G. Meyendorf, Fraunhofer IKTS-MD (Germany) . . . . . [9439-2]

11:30 am: **Phased array ultrasonic testing of dissimilar metal welds using geometric based referencing delay law technique**, Tae Young Han, Norbert G. Meyendorf, Kyoung Hee Kim, Frank Schubert, Martin Barth, Andreas Brusinsky, Fraunhofer IKTS-MD (Germany) . . . . . [9439-3]

Lunch Break . . . Mon 11:50 am to 1:20 pm

CONFERENCE 9429

SESSION 2

LOCATION: SUNRISE  
MON 1:10 PM TO 3:00 PM

Optics and  
Photonics I

Session Chair: **Kellar Autumn**,  
Lewis & Clark (USA)

- 1:10 pm: **Exploring polarization features in light reflection from beetles with structural colors** (*Invited Paper*), Hans Arwin, Roger Magnusson, Lia Fernández del Río, Jan Landin, Linköping Univ. (Sweden); Arturo Mendoza-Galván, Ctr. de Investigación y de Estudios Avanzados del Instituto Politécnico Nacional (Mexico); Kenneth Järendahl, Linköping Univ. (Sweden) . . . . . [9429-3]
- 1:40 pm: **InxAl1-xN chiral nanorods mimicking the polarization features of scarab beetles**, Roger Magnusson, Jens Birch, Ching-Lien Hsiao, Per Sandström, Hans Arwin, Kenneth Järendahl, Linköping Univ. (Sweden) . . . . . [9429-4]
- 2:00 pm: **Toward authentic replication of structural and optical features of beetle bodies**, Michael H. Bartl, The Univ. of Utah (USA); Akhlesh Lakhtakia, The Pennsylvania State Univ. (USA) . . . . . [9429-5]
- 2:20 pm: **Light emission from compound-eye cornea with conformal fluorescent coating**, Raúl J. Martín-Palma, Univ. Autónoma de Madrid (Spain) and The Pennsylvania State Univ. (USA); Amy E. Miller, Drew P. Pulsifer, Akhlesh Lakhtakia, The Pennsylvania State Univ. (USA) . . . . . [9429-6]
- 2:40 pm: **Electromagnetic response of the protective pellicle of Euglenoids: influence of the surface profile**, Marina E. Inchaussandague, Miriam L. Gigli, Diana C. Skigin, Analía Tolivia, Visitación Conforti, Univ. de Buenos Aires (Argentina) . . . . . [9429-7]
- Coffee Break . Mon 3:00 to 3:30 pm

CONFERENCE 9430

SESSION 2

LOCATION: TOWN AND  
COUNTRY BALLROOM  
MON 1:20 PM TO 3:00 PM

Power Generation  
and Energy  
Harvesting

Session Chairs: **Brett A. Kennedy**, Jet Propulsion Lab. (USA); **Iain A. Anderson**, The Univ. of Auckland (New Zealand)

- 1:20 pm: **Dielectric elastomers for wave energy harvesting: current status and future expectations** (*Invited Paper*), Rocco Vertechy, Marco Fontana, Scuola Superiore Sant'Anna (Italy) . . . . . [9430-4]
- 2:00 pm: **Analyses and comparison of an energy harvesting system for dielectric electro active polymer generators using a passive harvesting concept: the voltage-clamped multi-phase system**, Rick C. L. van Kessel, SBM Offshore (Monaco) and Technische Univ. Delft (Netherlands); Ambroise Wattez, SBM Offshore (Monaco); Pavol Bauer, Technische Univ. Delft (Netherlands) . . . . . [9430-5]
- 2:20 pm: **Comparison of bidirectional power electronics with unidirectional topologies using active discharging circuits for feeding DEAP transducer**, Thorben Hoffstadt, Jürgen Maas, Ostwestfalen-Lippe Univ. of Applied Sciences (Germany) . . . . . [9430-6]
- 2:40 pm: **Electronics drivers for high voltage dielectric electro active polymer (DEAP) applications**, Zhe Zhang, Michael A. E. Andersen, Technical Univ. of Denmark (Denmark) . . . . . [9430-7]
- Coffee Break . Mon 3:00 to 3:30 pm

CONFERENCE 9431

SESSION 2

LOCATION: ROYAL PALM FIVE  
MON 1:40 PM TO 3:00 PM

Magneto  
Rheological  
Systems I

Session Chairs: **Norman M. Wereley**, Univ. of Maryland, College Park (USA); **Faramarz Gordaninejad**, Univ. of Nevada, Reno (USA)

- 1:40 pm: **Fail-safe linear stroke magnetorheological energy absorber using hybrid active-passive electromagnetic circuits**, John Kunkel, Univ. of Maryland, College Park (USA); Xian-Xu Bai, Hefei Univ. of Technology (China); Wei Hu, Norman M. Wereley, Univ. of Maryland, College Park (USA) . . . . . [9431-6]
- 2:00 pm: **Design semi-active prosthetic knee using MR damper for above-knee amputees**, Jinhyuk Park, Seung-Bok Choi, Inha Univ. (Korea, Republic of) . . . . . [9431-7]
- 2:20 pm: **Behavior of a controllable fluid transport system**, Majid Behrooz, Faramarz Gordaninejad, Univ. of Nevada, Reno (USA) [9431-8]
- 2:40 pm: **Long-term stable MRF-brake for industrial use in wind turbines**, Dirk G. Güth, Jürgen Maas, Ostwestfalen-Lippe Univ. of Applied Sciences (Germany) . . . . . [9431-9]
- Coffee Break . Mon 3:00 to 3:30 pm

CONFERENCE 9432

SESSION 2

LOCATION: SUNSET  
MON 1:20 PM TO 3:00 PM

Piezoelectric and  
Electrostrictive  
Materials

Session Chairs: **Ralph C. Smith**, North Carolina State Univ. (USA); **William S. Oates**, Florida State Univ. (USA)

- 1:20 pm: **Electric field responsive origami structures using electrostriction-based active materials**, Saad Ahmed, Erika Arrojado, Nirmal Shankar Sigamani, Zoubeida Ounaies, The Pennsylvania State Univ. (USA) . . . . . [9432-5]
- 1:40 pm: **Characterization of lead zirconate titanate microwires using digital image correlation**, Mohammad H. Malakooti, Alexander T. Miller, Henry A. Sodano, Univ. of Florida (USA) . . . . . [9432-6]
- 2:00 pm: **Effect of carbon nanotubes on properties of cement-sand based piezoelectric composites**, Ping Zhao, Emmanuel U. Enemuoh, Sunjung Kim, Univ. of Minnesota, Duluth (USA) . . . . . [9432-7]
- 2:20 pm: **Study of the thermoelectric performance of GNP/PVDF and MWCNT/PVDF composite fabricated through melt blending method**, Yu-Chen Sun, Yu Kai Wang, Hani E. Naguib, Univ. of Toronto (Canada) . . . . . [9432-8]
- 2:40 pm: **Strain and voltage analysis of a piezoelectric wafer bonded to thin plate in bending**, ZhongZhe Dong, Cassio T. Faria, Siemens Industry Software (Belgium) . . . . . [9432-9]
- Coffee Break . Mon 3:00 to 3:30 pm

CONFERENCE 9433

SESSION 2

LOCATION: ROYAL PALM ONE  
MON 1:20 PM TO 3:00 PM

Aerospace  
Applications of  
Smart Structures

Session Chair: **Steven F. Griffin**, Boeing LTS Inc. (USA)

- 1:20 pm: **Adhesive-bonded shape memory alloy strip joint for composite fan blade shape changing concept**, James B. Min, Tiffany S. Williams, Gary D. Roberts, Lee W. Kohlman, NASA Glenn Research Ctr. (USA) . . . . . [9433-5]
- 1:40 pm: **Parametric optimization of a flexure-based active gurney flap mechanism for minimum stress**, Jon Freire Gómez, Julian D. Booker, Phillip H. Mellor, Univ. of Bristol (United Kingdom) . . . . . [9433-6]
- 2:00 pm: **Fatigue damage monitoring of an UAV wing under extreme environments**, Jun Young Jeon, Hwee Kwon Jung, Gyuhae Park, Chonnam National Univ. (Korea, Republic of); Jaeseok Ha, Chan Yik Park, Agency for Defense Development (Korea, Republic of) . . . . . [9433-7]
- 2:20 pm: **Regenerative composites for drones**, Carolyn Dry, Natural Process Design, Inc. (USA) [9433-8]
- 2:40 pm: **Structural analysis of morphing airfoils for camber adaptive wing**, Ning Feng, Liwu Liu, Yanjiu Liu, Jinsong Leng, Harbin Institute of Technology (China) . . . . . [9433-9]
- Coffee Break . Mon 3:00 to 3:30 pm

CONFERENCE 9434

LOCATION: ROYAL PALM  
THREE  
MON 1:30 PM TO 2:10 PM

Keynote Session II

Session Chair: **Sang H. Choi**, NASA Langley Research Ctr. (USA)

- 1:30 pm: **Analysis of advanced thermoelectric materials and their functional limits** (*Keynote Presentation*), Hyun Jung Kim, National Institute of Aerospace (USA) . . . . . [9434-4]

SESSION 2

LOCATION: ROYAL PALM  
THREE  
MON 2:10 PM TO 3:20 PM

Nanosensors and  
Systems II

Session Chair: **Hargsoon Yoon**, Norfolk State Univ. (USA)

- 2:10 pm: **Flexible pressure sensors for burnt skin patient monitoring** (*Invited Paper*), GwangWook Hong, Sehun Kim, Joo-Hyung Kim, Inha Univ. (Korea, Republic of) . . . . . [9434-5]
- 2:40 pm: **PPG sensor and device for noninvasive mobile health monitoring**, Armen R. Poghosyan, Vahram Mouradian, Levon Hovhannisyanyan, Sensogram Technologies Inc. (USA) . . . . . [9434-6]
- 3:00 pm: **Wireless nanosensors for monitoring concussion of football players**, Vijay K. Varadan, The Pennsylvania State Univ. (USA) . . . . . [9434-7]
- Coffee Break . . Mon 3:20 to 3:40 pm



**CONFERENCE 9435**

**SESSION 1**

**LOCATION: PACIFIC SALON SIX  
MON 1:20 PM TO 3:00 PM**

**Novel Approaches to Energy Harvesting**

Session Chairs: **Seunghee Park**, Sungkyunkwan Univ. (Korea, Republic of); **Ying Huang**, North Dakota State Univ. (USA)

1:20 pm: **New insights into vibration-based energy harvesting**, Hui Zhang, Univ. of Hawai'i at Manoa (USA); David T. Ma, Univ. of Hawai'i (USA). . . . . [9435-3]

1:40 pm: **A frequency study of a clamped-clamped pipe immersed in a viscous fluid conveying internal steady flow for use in energy harvester development as applied to hydrocarbon production wells**, Eric J. Kjolsing, Michael D. Todd, Univ. of California, San Diego (USA) . . . . . [9435-4]

2:00 pm: **Design, modelling, and road rest of speed bump energy harvester**, Lei Zuo, Virginia Polytechnic Institute and State Univ. (USA); Lirong Wang, Stony Brook Univ. (USA); Prakhar Todaria, Virginia Polytechnic Institute and State Univ. (USA); Abhishek Pandey, Stony Brook Univ. (USA) . . [9435-5]

2:20 pm: **Fluid flow energy nozzle harvesters**, Stewart Sherrit, Hyeong Jae Lee, Phil E. Walkemeyer, Jet Propulsion Lab. (USA); Luis Philippe Tosi, Tim Colonius, California Institute of Technology (USA) . . . . . [9435-6]

2:40 pm: **Energy harvesting of two cantilever beams structure: interfacing circuit discussion**, Yu-Yin Chen, National Taiwan Univ. (Taiwan) and Ecole Normale Supérieure de Cachan (France); Dejan Vasic, Ecole Normale Supérieure de Cachan (France) . . . . . [9435-7]

Coffee Break . . . . . Mon 3:00 pm to 3:30 pm

**CONFERENCE 9436**

**SESSION 2**

**LOCATION: TOWNE  
MON 1:20 PM TO 3:00 PM**

**Applications of New Sensor Technologies I**

Session Chair: **Sokratis N. Iliopoulos**, Vrije Univ. Brussel (Belgium)

1:20 pm: **Effective combination of DIC, AE, and UPV nondestructive techniques on a scaled model of the Belgian nuclear waste container**, Sokratis N. Iliopoulos, Vrije Univ. Brussel (Belgium); Lou Areias, Vrije Univ. Brussel (Belgium) and EURIDICE GIE (Belgium) and SCK/CEN (Belgium); Lincy Pyl, Vrije Univ. Brussel (Belgium); John Vantomme, Vrije Univ. Brussel (Belgium) and Royal Military Academy (Belgium); Philippe Van Marcke, Erik Coppens, NIRAS Allerød (Belgium); Dimitrios G. Aggelis, Vrije Univ. Brussel (Belgium) . . . . . [9436-5]

1:40 pm: **Implementation and validation of a multi-modal mobile sensor system for surface and subsurface assessment of roadways**, Ming Wang, Ralf Birken, Salar Shahini Shamsabadi, Northeastern Univ. (USA) . . . . . [9436-6]

2:00 pm: **A Bayesian optimization approach for wind farm power maximization**, Jinkyoo Park, Kincho H. Law, Stanford Univ. (USA) . . . . . [9436-7]

2:20 pm: **Environmental barrier coating (EBC) durability test validation using combined digital image correlation and NDE**, Ali Abdul-Aziz, Adam C. Wroblewski, Ramakrishna T. Bhatt, Martha H. Jaskowiak, Danial Gorican, Richard W. Rauser, NASA Glenn Research Ctr. (USA) . . . . . [9436-8]

2:40 pm: **Engine rotor health monitoring: an experimental approach to fault detection and durability assessment**, Ali Abdul-Aziz, Mark R. Woike, Michelle M. Clem, George Y. Baaklini, NASA Glenn Research Ctr. (USA) . . . . . [9436-9]

Coffee Break . . . . . Mon 3:00 pm to 3:30 pm

**CONFERENCE 9437**

**SESSION 2**

**LOCATION: ROYAL PALM FOUR  
MON 1:20 PM TO 3:00 PM**

**SHM/NDE for Composite Materials II**

Session Chairs: **Simon Laflamme**, Iowa State Univ. (USA); **Denvid Lau**, City Univ. of Hong Kong (Hong Kong, China)

1:20 pm: **Experimental evaluation on the effectiveness of acoustic-laser technique towards the FRP-bonded concrete system**, Qiwen Qiu, Denvid Lau, City Univ. of Hong Kong (Hong Kong, China) . . . [9437-4]

1:40 pm: **Non destructive testing techniques based on non-linear methods for assessment of debonding in single lap joints**, Gennaro Scarselli, Univ. del Salento (Italy); Francesco Ciampa, Dmitri Ginzburg, Michele Meo, Univ. of Bath (United Kingdom) . . . . . [9437-5]

2:00 pm: **Selection of sensors based on their damage detection capabilities in aero structures**, Frank Abdi, Harsh K. Baid, Farid Taleghani, Ernie Cochran, AlphaSTAR Corp. (USA); Andre Luz, Glexys (Portugal); Ali Nobari, Kamran Nikbin, Imperial College London (United Kingdom) . . . . . [9437-6]

2:20 pm: **Characterization of the multi-modal sensing properties of photoactive structural coatings**, Donghyeon Ryu, New Mexico Institute of Mining and Technology (USA); Arick Jones, Kenneth J. Loh, Univ. of California, Davis (USA) . . . . . [9437-7]

2:40 pm: **Modelling of thermal wave propagation in damaged composites with internal source**, Francesco Ciampa, Stefano Angioni, Fulvio Pinto, Univ. of Bath (United Kingdom); Gennaro Scarselli, Univ. del Salento (Italy); Darryl P. Almond, Michele Meo, Univ. of Bath (United Kingdom)[9437-8]

Coffee Break . . . . . Mon 3:00 pm to 3:30 pm

**CONFERENCE 9438**

**SESSION 2**

**LOCATION: ROYAL PALM SIX  
MON 1:50 PM TO 3:10 PM**

**Noncontact Guided Wave Techniques**

Session Chairs: **Hoon Sohn**, KAIST (Korea, Republic of); **Francesco Lanza di Scalea**, Univ. of California, San Diego (USA)

1:50 pm: **Development of an electromagnetic acoustic transducer (EMAT) for the noncontact excitation of guided ultrasonic waves**, Paul Fromme, Univ. College London (United Kingdom) . . . . . [9438-5]

2:10 pm: **Wavenumber study of guided waves in aluminum honeycomb sandwich structures**, Zhenhua Tian, Lingyu Yu, Univ. of South Carolina (USA); Guoliang Huang, Univ. of Arkansas at Little Rock (USA); Michel J. L. Van Tooren, Will Mitchell, Univ. of South Carolina (USA) . . . . . [9438-6]

2:30 pm: **On the combination of outlier analysis and ANN for the inspection of underwater plates**, Abdollah Bagheri, Elisabetta Pistone, Piervincenzo Rizzo, Univ. of Pittsburgh (USA) . . . . . [9438-7]

2:50 pm: **Laser ultrasonic evaluation of bonding layer in thermal barrier coating**, Yang Zhao, Shandong Academy of Sciences (China); Yinian Zhu, Sridhar Krishnaswamy, Northwestern Univ. (USA) . . . . . [9438-9]

Coffee Break . . . . . Mon 3:10 pm to 3:40 pm

**CONFERENCE 9439**

**SESSION 2**

**LOCATION: ROYAL PALM TWO  
MON 1:20 PM TO 3:00 PM**

**Green, Conventional, and Nuclear Energy**

Session Chairs: **Leonard J. Bond**, Iowa State Univ. (USA); **Tae Young Han**, Fraunhofer IKTS-MD (Germany)

1:20 pm: **Nondestructive evaluation of thick concrete structures**, Dwight A. Clayton, Oak Ridge National Lab. (USA) . . . . . [9439-4]

1:40 pm: **Impact damage assessment of high pressure cylindrical composite structures by energy based acoustic emission analysis**, Dong-Jin Yoon, Byeong-Hee Han, Il-Sik Kim, Choon-Su Park, Il-Bum Kwon, Korea Research Institute of Standards and Science (Korea, Republic of) . . [9439-5]

2:00 pm: **Effect of spatial frequency components of surface roughness on ultrasonic reflection**, Wonjae Choi, Korea Research Institute of Standards and Science (Korea, Republic of); Fan Shi, Elizabeth A. Skelton, Mike J. S. Lowe, Richard V. Craster, Imperial College London (United Kingdom) . . . . . [9439-6]

2:20 pm: **The investigation about the ultrasonic inspection of RPV safe end dissimilar metal weld**, Tianming Lv, Ming Li, Jinhong Liu, Huaidong Chen, Zhe Yu, Chenxu Hu, CGNPC Inspection Technology Co. Ltd. (China); Norbert G. Meyendorf, Fraunhofer IKTS-MD (Germany) . . [9439-7]

2:40 pm: **Residual stresses evaluation in the inner and outer surface of a dissimilar welded pipe by using finite element and ultrasonic method**, Yashar Javadi, Islamic Azad Univ. (Iran, Islamic Republic of); Ghazaleh Javadi, Univ. of Applied Science & Technology (Iran, Islamic Republic of) . . . . . [9439-8]

Coffee Break . . . . . Mon 3:00 pm to 3:30 pm



CONFERENCE 9429

SESSION 3

LOCATION: SUNRISE  
MON 3:30 PM TO 4:30 PM

Adhesion

Session Chair: **Carolyn Dry**, Natural Process Design, Inc. (USA)

3:30 pm: **Mechanisms of gecko adhesion and their application in gecko-like synthetic adhesives (GSAs)** (*Invited Paper*), Kellar Autumn, Lewis & Clark (USA) [9429-8]

4:00 pm: **Switchable bioinspired adhesives** (*Invited Paper*), Elmar Kroner, Mareike Frensemeier, Julia Purto, Leibniz-Institut für Neue Materialien gGmbH (Germany) ..... [9429-9]

SESSION 4

LOCATION: SUNRISE  
MON 4:30 PM TO 5:30 PM

Biomaterials II

Session Chair: **Akira Saito**, Osaka Univ. (Japan)

4:30 pm: **Bio-inspired preparation of polymer based hydrophilic ultrafiltration membrane using graphene oxide as a hydrophilic anti-bio fouling layer**, Taeseon Hwang, Woosoon Yim, Kwang Jin Kim, Univ. of Nevada, Las Vegas (USA) ..... [9429-10]

4:50 pm: **Phase separated polymer microparticles as pollen biomimetics**, Olaf Karthaus, Chitose Institute of Science and Technology (Japan) ..... [9429-11]

5:10 pm: **Fabrications of durable micro wrinkle structures by using self-organized honeycomb structures**, Yuji Hirai, Chitose Institute of Science and Technology (Japan); Takuya Ohzono, Kosuke Suzuki, National Institute of Advanced Industrial Science and Technology (Japan); Masatsugu Shimomura, Chitose Institute of Science and Technology (Japan) ..... [9429-12]

CONFERENCE 9430

LOCATION: TOWN AND COUNTRY BALLROOM  
4:30 PM TO 5:45 PM

EAP-in-Action Demonstration Session

Moderator : **Yoseph Bar-Cohen**, Jet Propulsion Lab. (USA)

This session highlights some of the latest capabilities and applications of Electroactive Polymers (EAP) materials where the attendees are shown demonstrations of these materials in action. Also, the attendees interact directly with technology developers and given "hands-on" experience with this emerging technology. The first Human/EAP Robot Armwrestling Contest was held during this session of the 2005 EAPAD conference.

See the full program and descriptions of EAP presentations on page 12–13.

CONFERENCE 9431

SESSION 3

LOCATION: ROYAL PALM FIVE  
MON 3:30 PM TO 5:30 PM

Energy Harvesting and Scavenging: Fluid-Structure Interaction

Session Chairs: **Alper Erturk**, Georgia Institute of Technology (USA); **Henry A. Sodano**, Univ. of Florida (USA)

3:30 pm: **Underwater energy harvesting from vibrations of annular ionic polymer metal composites**, Youngsu Cha, Shervin Abdolhamidi, Maurizio Porfiri, New York Univ. (USA) ..... [9431-10]

3:50 pm: **Unified electrohydroelastic investigation of underwater energy harvesting and dynamic actuation by incorporating Morison's equation**, Shima Shahab, Alper Erturk, Georgia Institute of Technology (USA) ..... [9431-11]

4:10 pm: **Integrated structures for hybrid wind and solar energy harvesting**, Punnag Chatterjee, Matthew J. Bryant, North Carolina State Univ. (USA) ..... [9431-12]

4:30 pm: **Enhancement of galloping-based wind energy harvesting by synchronized switching interface circuits**, Liya Zhao, Nanyang Technological Univ. (Singapore); Junrui Liang, ShanghaiTech Univ. (China); Lihua Tang, The Univ. of Auckland (New Zealand); Yaowen Yang, Nanyang Technological Univ. (Singapore); Haiii Liu, ShanghaiTech Univ. (China) ..... [9431-13]

4:50 pm: **A hydrostatic pressure-cycle energy harvester**, Michael W. Shafer, Gregory Hahn, Eric R. Morgan, Northern Arizona Univ. (USA) ..... [9431-14]

5:10 pm: **A new energy harvester for fluids in motion**, Corrado Boragno, Gregorio Boccacero, Univ. degli Studi di Genova (Italy) [9431-15]

CONFERENCE 9432

SESSION 3

LOCATION: SUNSET  
MON 3:30 PM TO 5:10 PM

Constitutive Behavior of Piezoelectric and Active Materials

Session Chairs: **Zoubeida Ounaies**, The Pennsylvania State Univ. (USA); **Sebastian M. Geier**, Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany)

3:30 pm: **Characterization and modeling time dependent behavior in PZT fibers and active fiber composites**, Mohamed Aziz Dridi, Hassene Ben Atitallah, Zoubeida Ounaies, The Pennsylvania State Univ. (USA); Anastasia Muliiana, Texas A&M Univ. (USA) .. [9432-10]

3:50 pm: **Uncertainty quantification in quantum informed ferroelectric phase field modeling**, Justin Collins, William S. Oates, Florida State Univ. (USA) ..... [9432-11]

4:10 pm: **Bayesian techniques to quantify parameter and model uncertainty in nonlinear distributed smart material systems**, Ralph C. Smith, North Carolina State Univ. (USA) ..... [9432-12]

4:30 pm: **Electromechanical analysis of tapered piezoelectric bimorph at high electric field**, Nilanjan Chattaraj, Ranjan Ganguli, Indian Institute of Science (India) ..... [9432-13]

4:50 pm: **Modeling and experimental characterization on fatigue behaviour of 1-3 piezocomposites**, Y. Mohan, R. Jayendiran, A. Arockiarajan, Indian Institute of Technology Madras (India) ..... [9432-14]

CONFERENCE 9433

SESSION 3

LOCATION: ROYAL PALM ONE  
MON 3:30 PM TO 4:10 PM

Energy Harvesting

Session Chair: **Kevin M. Farinholt**, Luna Innovations Inc. (USA)

3:30 pm: **Multiphysics modeling and design of Gallenol-based unimorph harvesters**, Zhangxian Deng, Marcelo J. Dapino, The Ohio State Univ. (USA) ..... [9433-10]

3:50 pm: **Magnetostrictive vibration damper and energy harvester for rotating machinery**, Zhangxian Deng, The Ohio State Univ. (USA); Vivake M. Asnani, NASA Glenn Research Ctr. (USA); Marcelo J. Dapino, The Ohio State Univ. (USA) ..... [9433-11]

SESSION 4

LOCATION: ROYAL PALM ONE  
MON 4:10 PM TO 5:30 PM

Technologies for Vibration Control

Session Chair: **Alan L. Browne**, General Motors Corp. (USA)

4:10 pm: **Variable stiffness structures using integrated electroadhesive elements**, Callum J. C. Heath, Ian P. Bond, Univ. of Bristol (United Kingdom) ..... [9433-12]

4:30 pm: **Adaptive-passive vibration control systems for industrial applications**, Dirk Mayer, Tobias Melz, Fraunhofer-Institut für Betriebsfestigkeit und Systemzuverlässigkeit (Germany) ..... [9433-13]

4:50 pm: **Design and testing of a dynamically-tuned magnetostrictive spring with electrically-controlled stiffness**, Justin J. Scheidler, Marcelo J. Dapino, The Ohio State Univ. (USA) ..... [9433-14]

5:10 pm: **Approach to prevent locking in a spring-damper system by adaptive load redistribution in auxiliary kinematic guidance elements**, Christopher M. Gehb, Technische Univ. Darmstadt (Germany); Roland Platz, Fraunhofer-Institut für Betriebsfestigkeit und Systemzuverlässigkeit (Germany); Tobias Melz, Technische Univ. Darmstadt (Germany) .... [9433-15]

CONFERENCE 9434

SESSION 3

LOCATION: ROYAL PALM THREE  
MON 3:40 PM TO 5:00 PM

Nano-and Micro-systems in Medicine and Healthcare

Session Chair: **Hyun Jung Kim**, National Institute of Aerospace (USA)

3:40 pm: **Probe-pin device for optical neurotransmitter sensing in the brain** (*Invited Paper*), Min Hyuck Kim, Kyo D. Song, Hargsoon Yoon, Norfolk State Univ. (USA); Yeonjoon Park, Sang H. Choi, NASA Langley Research Ctr. (USA); Dae-Sung Lee, Kyu Sik Shin, Hak-In Hwang, Korea Electronics Technology Institute (Korea, Republic of) ..... [9434-8]

4:00 pm: **Nanosensor system for monitoring brain activity and drowsiness**, M. Ramasamy, Vijay K. Varadan, The Pennsylvania State Univ. (USA) ..... [9434-9]

4:20 pm: **Miniaturized neural sensing and optogenetic stimulation system for behavioral studies in the rat**, Min Hyuck Kim, Ilho Nam, Norfolk State Univ. (USA); Youngki Ryu, Sun Moon Univ. (Korea, Republic of); Laurie L. Wellman, Larry D. Sanford, Eastern Virginia Medical School (USA); Hargsoon Yoon, Norfolk State Univ. (USA) ..... [9434-10]

4:40 pm: **Effect of temperature and UV light on charge transport mechanism in DNA**, Aleah Golkar Narenji, Noah Goshi, Chris Bui, John Mokili, Sam Kassegne, San Diego State Univ. (USA) ..... [9434-45]

## CONFERENCE 9435

## SESSION 2

LOCATION: PACIFIC SALON SIX  
MON 3:30 PM TO 5:10 PM

### Vibrations and SHM of Bridge Structures

Session Chairs: **Hae Young Noh**, Carnegie Mellon Univ. (USA); **Chin-Hsiung Loh**, National Taiwan Univ. (Taiwan)

3:30 pm: **Mitigating the effect of variable speed on drive-by infrastructure inspection**, Andrew Thorsen, George H. Lederman, Zihao Wang, Carnegie Mellon Univ. (USA); Yoshinobu Oshima, Kyoto Univ. (Japan); Jacobo Bielak, Hae Young Noh, Carnegie Mellon Univ. (USA) . . . . . [9435-8]

3:50 pm: **Intelligent tires for identifying coefficient of friction of tire/road contact surfaces**, Ryosuke Matsuzaki, Kazuto Kamai, Tokyo Univ. of Science (Japan); Akira Todoroki, Tokyo Institute of Technology (Japan) . . . . . [9435-9]

4:10 pm: **Recovering bridge deflections from collocated acceleration and strain measurements**, David T. Ma, Univ. of Hawai'i (USA); Michael S. Bell, Univ. of Hawaii at Manoa (USA) . . . . . [9435-10]

4:30 pm: **Analysis of traffic-induced vibration and damage detection by blind source separation with application to bridge monitoring**, Chin-Hsiung Loh, Sheng-Fu Chen, National Taiwan Univ. (Taiwan) . . . . . [9435-11]

4:50 pm: **A multiresolution signal processing method for extracting frequencies of interest from the interaction of a vehicle-bridge system**, Zihao Wang, Jacobo Bielak, Hae Young Noh, Carnegie Mellon Univ. (USA) . . . . . [9435-12]

## CONFERENCE 9436

## SESSION 3

LOCATION: TOWNE  
MON 3:30 PM TO 5:50 PM

### Guided Wave Sensing

Session Chairs: **Theodore E. Matikas**, Univ. of Ioannina (Greece); **Ali Abdul-Aziz**, NASA Glenn Research Ctr. (USA)

3:30 pm: **Modeling, optimization, and experimental validation of a resonant piezo-optical ring sensor for enhanced active and passive structural health monitoring**, Erik L. Frankforter, Jingjing Bao, Bin Lin, Victor Giurgiutiu, Univ. of South Carolina (USA) . . . . . [9436-10]

3:50 pm: **New non-local lattice models for the description of wave dispersion in concrete**, Sokratis N. Iliopoulos, Vrije Univ. Brussel (Belgium); Demosthenes Polyzos, Univ. of Patras (Greece); Dimitrios G. Aggelis, Vrije Univ. Brussel (Belgium) . . . . . [9436-11]

4:10 pm: **Alternate solution for the cylindrical Helmholtz vector equation applied to elastic helical guided waves in pipes**, Haraprasad Kannajosyula, Giovanni F. Nino, Qi2 (USA) . . . . . [9436-12]

4:30 pm: **The effect of CNTs reinforcement, on thermal and electrical properties, of cement-based materials**, Dimitrios A. Exarchos, Panagiota T. Dalla, Theodore E. Matikas, Univ. of Ioannina (Greece) . . . . . [9436-13]

4:50 pm: **Nondestructive evaluation of the mechanical behavior of cement based nanocomposites under bending**, Ilias K. Tragazikis, Dimitrios A. Exarchos, Konstantinos G. Dassios, Theodore E. Matikas, Univ. of Ioannina (Greece)[9436-28]

5:10 pm: **Acoustic emission activity during fracture of human femur bone**, Dimitrios G. Aggelis, Maria Strantza, Vrije Univ. Brussel (Belgium); Olivia Louis, Univ. Ziekenhuis Brussel (Belgium); Frans Boulpaep, Vrije Univ. Brussel (Belgium); Demosthenes Polyzos, Univ. of Patras (Greece); Danny Van Hemelrijck, Vrije Univ. Brussel (Belgium) . . . . . [9436-15]

5:30 pm: **An intelligent algorithm of impact source localization with embedded sensors array in the CFRP plate**, Tao Fu, Yanju Liu, Jinsong Leng, Harbin Institute of Technology (China) . . . . . [9436-16]

## CONFERENCE 9437

## SESSION 3

LOCATION: ROYAL PALM FOUR  
MON 3:30 PM TO 5:30 PM

### SHM/NDE for Composite Materials III

Session Chairs: **Simon Laflamme**, Iowa State Univ. (USA); **Dennis Lau**, City Univ. of Hong Kong (Hong Kong, China)

3:30 pm: **The exploration study of fire-damaged concrete specimen using x-ray computed tomography**, Yu-Min Su, National Kaohsiung Univ. of Applied Sciences (Taiwan) . . . . . [9437-9]

3:50 pm: **Development of a health monitoring method for solid rocket propellant**, Craig Lopatin, Technion-Israel Institute of Technology (Israel); Dan Grinstein, Israel Ministry of Defense (Israel) . . [9437-10]

4:10 pm: **Damage criticality and inspection concerns of composite: metallic aircraft structures under high energy blunt impact**, Duo Zou, Peter W. Bishop, Abraham Bezabeh, Bishop GmbH (Germany)[9437-11]

4:30 pm: **Design, application, and validation of embedded ultrasonic sensors within composite structures**, Jamie S. Chilles, Univ. of Bristol (United Kingdom) . . . . . [9437-12]

4:50 pm: **Damage classification in composite structures using statistical analysis**, Yingtao Y. Liu, The Univ. of Oklahoma (USA) . . . . . [9437-14]

5:10 pm: **Quantitative characterization of composite materials using thermographic signal reconstruction (TSR)**, Steven M. Shepard, Maria Frenberg Beemer, Thermal Wave Imaging, Inc. (USA) . . . . . [9437-15]

## CONFERENCE 9438

## SESSION 3

LOCATION: ROYAL PALM SIX  
MON 3:40 PM TO 6:00 PM

### Nonlinear Techniques I

Session Chairs: **Victor Giurgiutiu**, Univ. of South Carolina (USA); **Wieslaw Jerzy Staszewski**, AGH Univ. of Science and Technology (Poland)

3:40 pm: **Nonlinear guided waves in composite laminates and application to detection of cyclic loading-induced damage in composites**, Ming Hong, The Hong Kong Polytechnic Univ. (Hong Kong, China); Michael D. Todd, Univ. of California, San Diego (USA); Zhongqing Su, The Hong Kong Polytechnic Univ. (Hong Kong, China); Xinlin Qing, Beijing Aeronautical Science and Technology Research Institute of COMAC (China) . . . . . [9438-10]

4:00 pm: **Fatigue crack visualization using noncontact laser ultrasonics and state space geometrical changes**, Peipei Liu, Hoon Sohn, KAIST (Korea, Republic of) . . . . . [9438-11]

4:20 pm: **Enhanced nonlinear crack-wave interactions for structural damage detection based on Lamb waves**, Kajetan Dziejch, Lukasz J. Pieczonka, Piotr Kijanka, Wieslaw J. Staszewski, AGH Univ. of Science and Technology (Poland) . . . . . [9438-12]

4:40 pm: **Monitoring accelerated carbonation on standard portland cement mortar by nonlinear resonance acoustic test**, Jesus N. Eiras, Univ. Politècnica de València (Spain); Tribikram Kundu, The Univ. of Arizona (USA); John S. Popovics, Univ. of Illinois at Urbana-Champaign (USA); José Monzó, Victoria Borrachero, Jordi Payá, Univ. Politècnica de València (Spain) . . . . . [9438-13]

5:00 pm: **Damage imaging in nonlinear vibro-acoustic modulation tests**, Lukasz J. Pieczonka, Andrzej Klepka, Tadeusz Uhl, Wieslaw J. Staszewski, AGH Univ. of Science and Technology (Poland). [9438-14]

5:20 pm: **Vibration-based health monitoring of rotordynamic system with breathing cracks**, Jie Zhao, Schlumberger Ltd. (USA); Hans DeSmidt, The Univ. of Tennessee Knoxville (USA) . . . . . [9438-15]

5:40 pm: **Wavelet based simulation of a piecewise linear SDOF oscillatory system**, Mira Mitra, Soumendu Bagchi, Dhanashri M. Joglekar, Indian Institute of Technology Bombay (India) . . . . . [9438-16]

## CONFERENCE 9439

## SESSION 3

LOCATION: ROYAL PALM TWO  
MON 3:30 PM TO 5:30 PM

### Wind and Solar Energy

Session Chairs: **Dong-Jin Yoon**, Korea Research Institute of Standards and Science (Korea, Republic of); **Peter Heilmann**, arxes-tolina GmbH (Germany)

3:30 pm: **MEMS inertial sensors for load monitoring of wind turbine blades**, Aubryn M. Cooperman, Marcias J. Martinez, Technische Univ. Delft (Netherlands)[9439-9]

3:50 pm: **Structural damage localization in wind turbine blades based on time series representations**, Simon Hoell, Yen-Ting Chen, Piotr Omenzetter, Univ. of Aberdeen (United Kingdom) . . . . . [9439-10]

4:10 pm: **Acoustic emission monitoring of wind turbine blades**, Jeremy E. Van Dam, Leonard J. Bond, Iowa State Univ. (USA) . . . . . [9439-11]

4:30 pm: **HF eddy current imaging for electrical characterization of solar cells**, Henning Heuer, Fraunhofer IKT5-MD (Germany) . . . . . [9439-12]

4:50 pm: **Pyro-pyrotelectricity: a new effect in heterogeneous material architectures**, Huai-An Chin, Princeton Univ. (USA); Sheng Mao, Univ. of Pennsylvania (USA); Bhadrinarayana L. Visweswaran, Kwaku Ohemeng, Sigurd Wagner, Princeton Univ. (USA); Prashant K. Purohit, Univ. of Pennsylvania (USA); Michael C. McAlpine, Princeton Univ. (USA) . . . . . [9439-13]

5:10 pm: **Electrospinning of strontium titanate incorporated with nickel oxide nanoparticles for improved photocatalytic performances**, Abulaziz Alharbi, Ibrahim M. Alarifi, Waseem S. Khan, Ramazan Asmatulu, Wichita State Univ. (USA) . . . . . [9439-35]

**CONFERENCE 9429**

Bioinspiration, Biomimetics, and Bioreplication V

**CONFERENCE 9430**

Electroactive Polymer Actuators and Devices (EAPAD) XVII

**CONFERENCE 9431**

Active and Passive Smart Structures and Integrated Systems IX

**CONFERENCE 9432**

Behavior and Mechanics of Multifunctional Materials and Composites IX

**CONFERENCE 9433**

Industrial and Commercial Applications of Smart Structures Technologies IX

**CONFERENCE 9434**

Nano-, Bio-, Info-Tech Sensors and Systems

**Tuesday Plenary Session**

**TUE 8:10 AM TO 9:10 AM**  
**LOCATION: TOWN AND COUNTRY BALLROOM**

**8:10 TO 8:25 AM:**

- Smart Structures Product Implementation Award
- SPIE Fellow Recognition



**Optical Fiber Based Structural Health and Process Monitoring of Advanced Composite Structures** (*Plenary*), Nobuo Takeda, The Univ. of Tokyo (Japan) . . . [9429-502]

**SESSION 5**

**LOCATION: SUNRISE**  
**TUE 9:20 AM TO 10:00 AM**

**Visual and Acoustic Sensing**

Session Chair: **Javaan S. Chahl**, Univ. of South Australia (Australia)

9:20 am: **Acoustic characteristic of a bat inspired membrane wing with adaptive compliances**, Zhenbo Lu, Yongdong Cui, Marco Debiasi, National Univ. of Singapore (Singapore) . . . . . [9429-54]

9:40 am: **A predictive model for bio-inspired mechanical band-pass filter**, Riaz Ahmed, Univ. of South Carolina (USA); Afifa Adiba, The Ohio State Univ. (USA); Sourav Banerjee, Univ. of South Carolina (USA) . . . . . [9429-14]

Coffee Break Tue 10:00 to 10:30 am

**SESSION 3**

**LOCATION: TOWN AND COUNTRY BALLROOM**  
**TUE 9:20 AM TO 12:10 PM**

**Dielectric EAP Materials and Actuators I**

Session Chairs: **Qibing Pei**, Univ. of California, Los Angeles (USA); **Qiming M. Zhang**, The Pennsylvania State Univ. (USA)

9:20 am: **Towards fast, reliable, and manufacturable DEAs** (*Invited Paper*), Samuel Rosset, Herbert R. Shea, Ecole Polytechnique Fédérale de Lausanne (Switzerland) [9430-8]

Coffee Break Tue 10:00 to 10:30 am

**SESSION 4**

**LOCATION: ROYAL PALM FIVE**  
**TUE 9:20 AM TO 10:20 AM**

**Biological-inspired Systems and Bio-MEMS**

Session Chair: **Matthew J. Bryant**, North Carolina State Univ. (USA)

9:20 am: **Fluidic origami: combining the plant nastic motion and paper folding art**, Suyi Li, Kon-Well Wang, Univ. of Michigan (USA) . . . . . [9431-16]

9:40 am: **Meso-hydraulic actuation for small legged robots**, Edward Chapman, Marc MacLeod, Matthew J. Bryant, North Carolina State Univ. (USA) . . . . . [9431-17]

10:00 am: **Nylon muscle actuated robotic hand**, Lianjun Wu, Monica Jung de Andrade, Richard S. Rome, Yonas T. Tadesse, Ray H. Baughman, The Univ. of Texas at Dallas (USA) . . . . . [9431-18]

Coffee Break Tue 10:20 to 10:50 am

**SESSION 4**

**LOCATION: SUNSET**  
**TUE 9:20 AM TO 10:00 AM**

**CNTs and Nanostructured Materials**

Session Chairs: **Marcelo J. Dapino**, The Ohio State Univ. (USA); **Alireza Vakil Amirkhizi**, Univ. of Massachusetts Lowell (USA)

9:20 am: **Molecular mechanics methods for individual carbon nanotubes and nanotube assemblies**, Oliver Eberhardt, Thomas Wallmersperger, Technische Univ. Dresden (Germany) [9432-15]

9:40 am: **Action-mechanisms of CNT-bucky papers and CNT-arrays**, Sebastian M. Geier, Thorsten Mahrholz, Peter Wierach, Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany); Michael Sinapius, Technische Univ. Braunschweig (Germany) . . . . . [9432-16]

Coffee Break Tue 10:00 to 10:30 am

**SESSION 5**

**LOCATION: ROYAL PALM ONE**  
**TUE 9:20 AM TO 10:00 AM**

**Applications of Shape Memory Alloys**

Session Chair: **Kevin M. Farinholt**, Luna Innovations Inc. (USA)

9:20 am: **Computational design optimization of a SMA-based active steerable needle**, Bardia Konh, Parsaoran Hutapea, Temple Univ. (USA) . . . . . [9433-16]

9:40 am: **Intelligent driving assistance system using shape memory alloy as variable impedance actuator**, Josephine Selvarani Ruth D., Kaliyaperumal Dhanalakshmi, Sunjai Nakshatharan S., National Institute of Technology, Tiruchirappalli (India) . . . . [9433-17]

Coffee Break Tue 10:00 to 10:30 am

**LOCATION: ROYAL PALM THREE**  
**TUE 9:20 AM TO 10:20 AM**

**Keynote Sesssion III**

Session Chair: **Kyo D. Song**, Norfolk State Univ. (USA)

9:20 am: **Nanomaterials and naotechnology for numerous applications: biotechnology to energy** (*Keynote Presentation*), Aswini K. Pradhan, Norfolk State Univ. (USA) . . . . . [9434-12]

10:00 am: **Properties of RNA nanotubes and their applications**, Roderick V. Melnik, Shyam Badu, Wilfrid Laurier Univ. (Canada) . . . . . [9434-13]

Coffee Break Tue 10:20 to 10:30 am



**CONFERENCE 9435**

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

**CONFERENCE 9436**

Smart Sensor Phenomena, Technology, Networks, and Systems Integration VIII

**CONFERENCE 9437**

Structural Health Monitoring and Inspection of Advanced Materials, Aerospace, and Civil Infrastructure IX

**CONFERENCE 9438**

Health Monitoring of Structural and Biological Systems IX

**CONFERENCE 9439**

Smart Materials and Nondestructive Evaluation for Energy Systems

**Tuesday Plenary Session**

**TUE 8:10 AM TO 9:10 AM**  
**LOCATION: TOWN AND COUNTRY BALLROOM**

**8:10 TO 8:25 AM:**

- Smart Structures Product Implementation Award
- SPIE Fellow Recognition



**Optical Fiber Based Structural Health and Process Monitoring of Advanced Composite Structures** (Plenary), Nobuo Takeda, The Univ. of Tokyo (Japan) . . . [9429-502]

**SESSION 3**

**LOCATION: PACIFIC SALON SIX**  
**TUE 9:20 AM TO 10:00 AM**

**Spatial Sensing by Tomographic Methods**

Session Chairs: **Kenneth J. Loh**, Univ. of California, Davis (USA); **Hoon Sohn**, KAIST (Korea, Republic of)

9:20 am: **Real-time spatial sensing using a portable electrical impedance tomography data acquisition system**, Shieh-Kung Huang, National Taiwan Univ. (Taiwan); Kenneth J. Loh, Univ. of California, Davis (USA) . . . . . [9435-13]

9:40 am: **Structural damage detection via impediographic tomography**, Liuxian Zhao, Jie Yang, Univ. of Notre Dame (USA); Kon-Well Wang, Univ. of Michigan (USA); Fabio Semperlotti, Univ. of Notre Dame (USA) . . . . . [9435-130]

Coffee Break . . . Tue 10:00 am to 10:30 am

**SESSION 4**

**LOCATION: TOWNE**  
**TUE 9:20 AM TO 10:00 AM**

**Applications of New Sensor Technologies II**

Session Chairs: **Wolfgang Ecke**, Leibniz-Institut für Photonische Technologien e.V. (Germany); **Panagiota T. Dalla**, Univ. of Ioannina (Greece)

9:20 am: **Rapid chloride permeability test for durability study of carbon nanoreinforced mortar**, Panagiota T. Dalla, Panagiota Alafogianni, Ilias K. Tragazikis, Nektaria-M. Barkoula, Theodore E. Matikas, Univ. of Ioannina (Greece) . . . . . [9436-17]

9:40 am: **A novel downhole fiber optical flowmeter using Fabry-Perot sensor**, Hongtao Zhang, Harbin Institute of Technology (China) . . . . . [9436-18]

Coffee Break . . . Tue 10:00 am to 10:30 am

**LOCATION: ROYAL PALM FOUR**  
**TUE 9:20 AM TO 10:00 AM**

**Keynote Session II**

Session Chairs: **Peter J. Shull**, The Pennsylvania State Univ. (USA); **Tzu Yang Yu**, Univ. of Massachusetts Lowell (USA)

9:20 am: **Transforming SHM research to practice in bridge maintenance** (Keynote Presentation), Genda Chen, Missouri Univ. of Science and Technology (USA) . . . [9437-16]

Coffee Break . . . Tue 10:00 am to 10:30 am

**SESSION 4**

**LOCATION: ROYAL PALM SIX**  
**TUE 9:20 AM TO 10:00 AM**

**Distributed Sensors**

Session Chairs: **Francesco Lanza di Scalea**, Univ. of California, San Diego (USA); **Andrei N. Zagrai**, New Mexico Institute of Mining and Technology (USA)

9:20 am: **Applications of matched field processing to damage detection in composite wind turbine blades**, Jeffery D. Tippmann, Francesco Lanza di Scalea, Univ. of California, San Diego (USA) . . . [9438-17]

9:40 am: **State sensing and awareness for the next generation of autonomous fly-by-feel UAVs**, Fotios Kopsaftopoulos, Raphael Nardari, Yu-Hung Li, Fu-Kuo Chang, Stanford Univ. (USA) . . . . . [9438-18]

Coffee Break . . . Tue 10:00 am to 10:30 am

**LOCATION: ROYAL PALM TWO**  
**TUE 9:20 AM TO 10:00 AM**

**Keynote Session II**

Session Chair: **Norbert G. Meyendorf**, Fraunhofer IKTS-MD (Germany)

9:20 am: **Advanced ceramics for energy for energy systems** (Keynote Presentation), Alexander Michaelis, Fraunhofer-IKTS CMD (Germany) . . . . . [9439-14]

Coffee Break . . . Tue 10:00 am to 10:30 am



CONFERENCE 9429

SESSION 6

LOCATION: SUNRISE  
TUE 10:30 AM TO 11:50 AM

Flight

Session Chair: **Maurizio Porfiri**,  
New York Univ. (USA)

10:30 am: **A low-cost simulation platform for flapping wing MAVs**, Javaan S. Chahl, Univ. of South Australia (Australia) . . . . . [9429-15]

10:50 am: **A three dimensional unsteady iterative panel method with vortex particle wakes and boundary layer model for bio-inspired multi-body wings**, Akash V. Dhruv, Christopher J. Blower, Adam M. Wickenheiser, The George Washington Univ. (USA) . [9429-16]

11:10 am: **Aerodynamic analysis of bioinspired corrugated aerofoils using a parametric shape perturbation approach**, Matteo Giacobello, Defence Science and Technology Organisation (Australia); Manas S. Khurana, RMIT Univ. (Australia); Javaan S. Chahl, Univ. of South Australia (Australia) [9429-17]

11:30 am: **Dynamic response of a piezoelectric flapping wing**, Alok Kumar, Gaurang Khandwekar, S. Venkatesh, D. Roy Mahapatra, Indian Institute of Science (India); Soma Dutta, National Aerospace Labs. (India) . . . . . [9429-58]

Lunch/Exhibition  
Break . . . Tue 11:50 am to 1:20 pm

CONFERENCE 9430

SESSION 3  
CONTINUED

10:30 am: **Dielectric materials, chemistry, and design** (*Invited Paper*), Jose Enrico Q. Quinsaat, Simon Dunki, Yee Song Ko, EMPA (Switzerland) and Ecole Polytechnique Fédérale de Lausanne (Switzerland); Mihaela Alexandru, EMPA (Switzerland) and Ecole Polytechnique Fédérale de Lausanne (Switzerland) and Petru Poni Institute of Macromolecular Chemistry (Romania); Carmen Racles, Petru Poni Institute of Macromolecular Chemistry (Romania); Frank A. Nüesch, EMPA (Switzerland) and Ecole Polytechnique Fédérale de Lausanne (Switzerland); Dorina M. Opris, EMPA (Switzerland) [9430-9]

11:10 am: **Electro-active polymer thin films and flexible electrodes for artificial muscle sphincters**, Vanessa Y. F. Leung, Bekim Osmani, Tino Töpfer, Florian M. Weiss, Marco D. Dominietto, Bert Müller, Univ. Basel (Switzerland) . [9430-9]

11:30 am: **Influence of electrode material and geometry on the actuation and sensing performance of dielectric electro-active polymers (DEAP)**, Steffen Hau, Battina Fasolt, Alexander York, Univ. des Saarlandes (Germany); L. Catherine Brinson, Northwestern Univ. (USA); Stefan S. Seelecke, Univ. des Saarlandes (Germany) . . . . . [9430-11]

11:50 am: **Characterization of the dielectric breakdown field strength of PDMS thin films: thickness dependence and electrode geometry**, Florentine Foerster, Tanja Grotepass, Helmut F. Schlaak, Technische Univ. Darmstadt (Germany) . . . . . [9430-12]

Lunch/Exhibition  
Break . . . Tue 12:10 pm to 1:20 pm

CONFERENCE 9431

SESSION 5

LOCATION: ROYAL PALM FIVE  
TUE 10:50 AM TO 12:10 PM

Energy Harvesting  
and Scavenging:  
Broadband/  
Nonlinear I

Session Chairs: **Amr M. Baz**, Univ. of Maryland, College Park (USA); **Yi-Chung Shu**, National Taiwan Univ. (Taiwan)

10:50 am: **Vibration energy harvesting using nonlinear dynamic principles inspired by trees**, Ryan L. Harné, Anqi Sun, Kon-Well Wang, Univ. of Michigan (USA) . . . . . [9431-19]

11:10 am: **Piezoelectric cantilever-based energy harvesting with internal resonance**, Jiawen Xu, Jiong Tang, Univ. of Connecticut (USA) . . . . . [9431-20]

11:30 am: **Array of piezoelectric oscillators with an SECE circuit**, Ping-Hsien Wu, Yi-Chung Shu, National Taiwan Univ. (Taiwan) . . . . . [9431-21]

11:50 am: **Chaotic control of a piezomagnetoelastic beam for improved energy harvesting**, Daniel Geiyer, Jeffrey L. Kauffman, Univ. of Central Florida (USA) . . . . . [9431-22]

Lunch/Exhibition  
Break . . . Tue 12:10 pm to 1:40 pm

CONFERENCE 9432

SESSION 5

LOCATION: SUNSET  
TUE 10:30 AM TO 11:50 AM

Material  
Development and  
Characterization

Session Chairs: **Vishnu Baba Sundaresan**, The Ohio State Univ. (USA); **Jinsong Leng**, Harbin Institute of Technology (China)

10:30 am: **Nonlinear modeling of ferroelectric-ferromagnetic composites based on condensed and finite element approaches**, Andreas Ricoeur, Stephan Lange, Artjom Avakian, Univ. Kassel (Germany) . . . . . [9432-17]

10:50 am: **Dynamic characterization of Galfenol**, Justin J. Scheidler, Marcelo J. Dapino, The Ohio State Univ. (USA) . . [9432-18]

11:10 am: **Modeling of thermo-mechanical fatigue and damage in shape memory alloy axial actuators**, Robert Wheeler, Dimitris C. Lagoudas, Darren J. Hartl, Texas A&M Univ. (USA); Yves Chemisky, Ecole Nationale Supérieure d'Arts et Métiers (France) . . . . . [9432-19]

11:30 am: **Investigation of crystal structures of one-way shape memory Nitinol wire actuators for active steerable needle**, Mohammad Honarvar, Bardia Konh, Parsaoran Hutapea, Temple Univ. (USA) . . . . . [9432-20]

Lunch/Exhibition  
Break . . . Tue 11:50 am to 1:20 pm

CONFERENCE 9433

SESSION 6

LOCATION: ROYAL PALM ONE  
TUE 10:30 AM TO 11:45 AM

Commercially  
Viable Smart  
Structure  
Technologies

Session Chair: **Alan L. Browne**,  
General Motors Corp. (USA)

10:30 am: **SMA actuators: a viable practical technology** (*Invited Paper*), Alan L. Browne, Consultant, Retired (USA); Jeffrey Brown, Dynalloy, Inc. (USA); Darel E. Hodgson, Nitinol Technology, Inc. (USA) . . [9433-18]

10:55 am: **Large-strain bistable actuation: BSEP polymer materials, actuators, and applications** (*Invited Paper*), Qibing Pei, Univ. of California, Los Angeles (USA) . . . . . [9433-19]

11:20 am: **Magnetorheological energy absorbers and applications to occupant protection systems** (*Invited Paper*), Norman M. Wereley, Univ. of Maryland, College Park (USA); Gregory J. Hiemenz, InnoVital Systems, Inc. (USA) . . . . . [9433-20]

Lunch/Exhibition  
Break . . . Tue 11:45 am to 1:10 pm

CONFERENCE 9434

SESSION 4

LOCATION:  
ROYAL PALM THREE  
TUE 10:30 AM TO 12:20 PM

Special Invited  
Session in honor  
of Vasundara  
Varadan I

Session Chair: **Christina L. Brantley**, U.S. Army Research, Development and Engineering Command (USA)

10:30 am: **Ultrasonic matrix transducer for real time volumetric cardiac imaging** (*Invited Paper*), Yongrae Roh, Yeonsue Park, Haejune Park, Hyunki Kim, Kyungpook National Univ. (Korea, Republic of) . . . . . [9434-14]

11:00 am: **Cellulose nanocrystals, nanofibers, and their composites as renewable smart materials**, Jaehwan Kim, Lindong Zhai, Seongcheol Mun, Hyun-U Ko, Young-Min Yun, Eun Byul Jo, Inha Univ. (Korea, Republic of) [9434-15]

11:20 am: **Implementation and characterization of meta-resonator antennas** (*Invited Paper*), In Kwang Kim, Nextivity, Inc. (USA) and Univ. of Arkansas (USA); Vasundara V. Varadan, Univ. of Arkansas (USA) . . . . . [9434-16]

11:40 am: **Efficient light scattering in plasmonic light trapping designs for thin film solar cells**, Liming Ji, Vasundara V. Varadan, Univ. of Arkansas (USA) . . . . . [9434-17]

12:00 pm: **Piezocomposites for unmanned underwater vehicle application**, Woosuk A. Chang, National Univ. of Singapore (Singapore) . . . . . [9434-18]

Lunch/Exhibition  
Break . . . Tue 12:20 pm to 1:30 pm

**CONFERENCE 9435**

**SESSION 4**

**LOCATION: PACIFIC SALON SIX  
TUE 10:30 AM TO 11:50 AM**

**Nanoengineered Thin Film Sensors I**

Session Chairs: **Jerome P. Lynch**, Univ. of Michigan (USA); **Andrew R. Burton**, Univ. of Michigan (USA)

10:30 am: **Sensing sheets based on large area electronics for fatigue crack detection**, Yao Yao, Branko Glisic, Princeton Univ. (USA) ..... [9435-15]

10:50 am: **Characterization of patterned nanoengineered sensing skins for applications in structural sensing**, Andrew R. Burton, Jerome P. Lynch, Univ. of Michigan (USA) ..... [9435-16]

11:10 am: **Peridynamics for wave propagation modelling in graphene nanoribbons**, Adam Martowicz, Wieslaw J. Staszewski, AGH Univ. of Science and Technology (Poland); Massimo Ruzzene, Georgia Institute of Technology (USA); Tadeusz Uhl, AGH Univ. of Science and Technology (Poland) ..... [9435-17]

11:30 am: **Design and fabrication of mechanochromic photonic crystals as strain sensor**, Andrea Chiappini, Consiglio Nazionale Delle Ricerche (Italy) and Univ. degli Studi di Trento (Italy); Anna K. Piotrowska, Univ. degli Studi di Trento (Italy) and Univ. degli Studi di Trento (Italy); Marian Marciniak, National Institute of Telecommunications (Poland); Maurizio Ferrari, CNR-Istituto di Fotonica e Nanotecnologie (Italy) and Univ. degli Studi di Trento (Italy); Daniele Zonta, Univ. degli Studi di Trento (Italy) and Univ. degli Studi di Trento (Italy) ..... [9435-18]

Lunch/Exhibition  
Break ..... Tue 11:50 am to 1:20 pm

**CONFERENCE 9436**

**SESSION 5**

**LOCATION: TOWNE  
TUE 10:30 AM TO 11:50 AM**

**New Sensor Technologies II**

Session Chair: **Wolfgang Ecke**, Leibniz-Institut für Photonische Technologien e.V. (Germany)

10:30 am: **Target-free dynamic displacement measurement using computer vision**, Hyungchul Yoon, Hazem Elanwar, Hajin Choi, Billie F. Spencer Jr., Univ. of Illinois at Urbana-Champaign (USA) ..... [9436-19]

10:50 am: **Optical excitation and detection of a quartz crystal resonator**, Nan Wu, Univ. of Massachusetts Lowell (USA); Lijun Yang, Haifeng Zhang, Univ. of North Texas (USA); Xingwei Wang, Univ. of Massachusetts Lowell (USA) . . . . [9436-20]

11:10 am: **Temperature compensation in CNT-composite distributed strain sensors**, D. Roy Mahapatra, Vivek T. Rathod, S. Venkatesh, Indian Institute of Science (India) ..... [9436-21]

11:30 am: **Strain sensors based on pencil-drawn stacked graphite sheets on paper substrate at percolation threshold zone**, Jinbao Jiang, Harbin Institute of Technology (China) ..... [9436-22]

Lunch/Exhibition  
Break ..... Tue 11:50 am to 1:20 pm

**CONFERENCE 9437**

**SESSION 4**

**LOCATION: ROYAL PALM FOUR  
TUE 10:30 AM TO 11:50 AM**

**Bridge Inspection and Monitoring Using SHM/ NDE Techniques I**

Session Chairs: **Genda Chen**, Missouri Univ. of Science and Technology (USA); **Lingyu Yu**, Univ. of South Carolina (USA)

10:30 am: **Strain distribution in thin concrete pavement panels under three-point loading to failure with pre-pulse-pump Brillouin optical time domain analysis**, Yi Bao, John Cain, Yizheng Chen, Missouri Univ. of Science and Technology (USA); Ying Huang, North Dakota State Univ. (USA); Genda Chen, Missouri Univ. of Science and Technology (USA); Leonard Palek, Minnesota Dept. of Transportation (USA) ..... [9437-17]

10:50 am: **Detection of delaminations in concrete slabs combining infrared thermography and impact echo techniques**, Fuad H. Khan, Drexel Univ. (USA); Matteo Mazzotti, Univ. degli Studi di Bologna (USA); Ivan Bartoli, Drexel Univ. (USA) ..... [9437-18]

11:10 am: **Boundary condition identification for a grid model by experimental and numerical dynamic analysis**, Qiang Mao, Mustafa Furkan, Drexel Univ. (USA); Matteo Mazzotti, Univ. degli Studi di Bologna (USA); Ivan Bartoli, Ahmet E. Aktan, Drexel Univ. (USA) . . . . [9437-19]

11:30 am: **Development and evaluation of a long range image-based monitoring system for civil engineering structures**, Matthias Ehrhart, Werner Lienhart, Technische Univ. Graz (Austria) . . [9437-20]

Lunch/Exhibition  
Break ..... Tue 11:50 am to 1:20 pm

**CONFERENCE 9438**

**SESSION 5**

**LOCATION: ROYAL PALM SIX  
TUE 10:30 AM TO 11:50 AM**

**Guided Waves for Composite Monitoring: Modeling Aspects**

Session Chairs: **Wieslaw Jerzy Staszewski**, AGH Univ. of Science and Technology (Poland); **Paul Fromme**, Univ. College London (United Kingdom)

10:30 am: **Hybrid local FEM/global LISA modeling of guided wave propagation and interaction with damage in composite structures**, Yanfeng Shen, Carlos E. S. Cesnik, Univ. of Michigan (USA) . . [9438-19]

10:50 am: **Advanced analytical modelling of guided waves generation on composite structures using circular piezoceramics**, Pierre-Claude Ostiguy, Nicolas Quaegebeur, Patrice Masson, Univ. de Sherbrooke (Canada) ..... [9438-20]

11:10 am: **Dispersion of guided waves in composite laminates and sandwich panels**, Christoph Schaal, Ajit K. Mal, Univ. of California, Los Angeles (USA) . . [9438-21]

11:30 am: **Guided waves based SHM systems for composites structural elements: statistical analyses finalised at probability of detection definition and assessment**, Ernesto Monaco, Vittorio Memmolo, Fabrizio Ricci, Natalino D. Boffa, Leandro Maio, Univ. degli Studi di Napoli Federico II (Italy) ..... [9438-22]

Lunch/Exhibition  
Break ..... Tue 11:50 am to 1:20 pm

**CONFERENCE 9439**

**SESSION 4**

**LOCATION: ROYAL PALM TWO  
TUE 10:30 AM TO 11:30 AM**

**Batteries and Fuel Cells**

Session Chair: **Alexander Michaelis**, Fraunhofer-IKTS CMD (Germany)

10:30 am: **High-performance porous carbon/CeO<sub>2</sub> nanoparticles hybrid super-capacitors for energy storage**, Mohammad Arif I. Shuvo, Hasanul Karim, Gerardo Rodriguez, The Univ. of Texas at El Paso (USA); Manjula I. Nandasiri, Ashleigh M. Schwarz, Arun Devraj, Pacific Northwest National Lab. (USA); Yirong Lin, The Univ. of Texas at El Paso (USA); Murugesan Vijayakumar, Pacific Northwest National Lab. (USA) ..... [9439-15]

10:50 am: **Porous carbon/CeO<sub>2</sub> composites for Li-ion battery application**, Hasanul Karim, Mohammad Arif I. Shuvo, Gerardo Rodriguez, Yirong Lin, The Univ. of Texas at El Paso (USA); Manjula I. Nandasiri, Ashleigh M. Schwarz, Arun Devaraj, Murugesan Vijayakumar, Pacific Northwest National Lab. (USA) ..... [9439-16]

11:10 am: **Applications of nano and smart materials in renewable energy production and storage devices**, Mehrdad N. Ghasemi-Nejhad, Univ. of Hawai'i (USA) . . . [9439-17]

Lunch/Exhibition  
Break ..... Tue 11:30 am to 1:20 pm

**CONFERENCE 9429**

**SESSION 7**

**LOCATION: SUNRISE  
TUE 1:20 PM TO 3:00 PM**

**Robotics I**

Session Chair: **Nicole Abaid**, Virginia Polytechnic Institute and State Univ. (USA)

1:20 pm: **Fin propulsion on a human-powered submarine**, Iain A. Anderson, Ben Pocock, Antoni Harbuz, Ryan Chao, Daniel Vochezer, Cam Algie, The Univ. of Auckland (New Zealand) . [9429-19]

1:40 pm: **Biologically-inspired robots elicit a robust fear response in zebrafish**, Fabrizio Ladu, Tiziana Bartolini, New York Univ. (USA); Sarah G. Panitz, New York Univ. (USA) and Brooklyn Technical High School (USA); Sachit Butail, Indraprastha Institute of Information Technology (India); Simone Macri, New York Univ. (USA) and Istituto Superiore di Sanità (Italy); Maurizio Porfiri, New York Univ. (USA) . . . . . [9429-20]

2:00 pm: **Artificial heart for humanoid robot using coiled SMA actuators**, Akshay Potnuru, Yonas T. Tadesse, The Univ. of Texas at Dallas (USA) . . . . . [9429-21]

2:20 pm: **Modeling of the energy savings of variable recruitment McKibben muscle bundles**, Michael A. Meller, Ephraim Garcia, Cornell Univ. (USA) . . . . . [9429-22]

2:40 pm: **Design and fabrication of a three-finger prosthetic hand using SMA muscle wires**, Filomena Simone, Zentrum für Mikrosystemtechnik Berlin (Germany) and Saarland Univ. (Germany); Alexander York, Zentrum für Mikrosystemtechnik Berlin (Germany) and Univ. des Saarlandes (Germany); Stefan S. Seelecke, Univ. des Saarlandes (Germany) and Zentrum für Mikrosystemtechnik Berlin (Germany) . . . . . [9429-23]

Coffee Break . . Tue 3:00 to 3:30 pm

**CONFERENCE 9430**

**SESSION 4**

**LOCATION: TOWN AND COUNTRY BALLROOM  
TUE 1:20 PM TO 3:00 PM**

**Ionic EAP I**

Session Chairs: **John D. W. Madden**, The Univ. of British Columbia (Canada); **Samuel Rosset**, Ecole Polytechnique Fédérale de Lausanne (Switzerland)

1:20 pm: **Thermal behavior of ionic electroactive polymer actuators**, Andres Punning, Indrek Must, Urmas Johanson, Alvo Aabloo, Univ. of Tartu (Estonia) . . . . . [9430-13]

1:40 pm: **Modeling of the time-dependent strain response of electroactive NCC-PEO and PVDF composites**, Patrick S. Bass, Lauchlin Blue, Lin Zhang, Auburn Univ. (USA) and Materials Research and Education Ctr. (USA); Mi Li, Maobing Tu, Auburn Univ. (USA) and Forest Products Lab. and Ctr. for Bioenergy and Bioproducts (USA); ZhongYang Cheng, Auburn Univ. (USA) and Materials Research and Education Ctr. (USA) . . . . [9430-14]

2:00 pm: **A physics-based model for actuation and sensing of ionic polymer metal composites**, Youngsu Cha, Maurizio Porfiri, New York Univ. (USA) . . . . . [9430-15]

2:20 pm: **Development and characterization of an IPMC hair-like transducer**, Barbar J. Akle, Elio Challita, Nady Khairallah, Lebanese American Univ. (Lebanon) [9430-16]

2:40 pm: **Development of a micro-scale circuit for low-current tethering applications of cylindrical IPMC actuators**, Jameson Lee, Woosoon Yim, Kwang Jin Kim, Univ. of Nevada, Las Vegas (USA) . . . . . [9430-17]

Coffee Break . . Tue 3:00 to 3:30 pm

**CONFERENCE 9431**

**SESSION 6**

**LOCATION: ROYAL PALM FIVE  
TUE 1:40 PM TO 3:00 PM**

**Energy Harvesting and Scavenging: Broadband/ Nonlinear II**

Session Chairs: **Kon-Weil Wang**, Univ. of Michigan (USA); **Mustafa H. Arafa**, The American Univ. in Cairo (Egypt)

1:40 pm: **Vibration energy harvesting from a nonlinear standing beam-mass system using a two-mode approximation**, S. Amir M. Lajimi, Simon Fraser Univ. (Canada); Michael I. Friswell, Swansea Univ. (United Kingdom) . . . . . [9431-23]

2:00 pm: **A diamagnetically stabilized horizontally levitated electromagnetic vibration energy harvester**, Sri Vikram Palagummi, Fuh-Gwo Yuan, North Carolina State Univ. (USA) . . . . . [9431-24]

2:20 pm: **Piezoelectric energy harvesting with a nonlinear energy sink**, Yu Zhang, Kefu Liu, Lakehead Univ. (Canada); Lihua Tang, The Univ. of Auckland (New Zealand) . . . . . [9431-25]

2:40 pm: **Tunable bistable devices for harvesting energy from spinning wheels**, Mohamed Elhadidi, Higher Technological Institute (Egypt); Mohammed Helal, American Univ. in Cairo (Egypt); Omar Nassar, Ain Shams Univ. (Egypt); Yasser Zeyada, Cairo Univ. (Egypt); Mustafa H. Arafa, The American Univ. in Cairo (Egypt) . . . . . [9431-26]

Coffee Break . . Tue 3:00 to 3:30 pm

**CONFERENCE 9432**

**SESSION 6**

**LOCATION: SUNSET  
TUE 1:20 PM TO 3:00 PM**

**Shape Memory Polymer Behavior**

Session Chairs: **Kwang Jin Kim**, Univ. of Nevada, Las Vegas (USA); **Hidemitsu Furukawa**, Yamagata Univ. (Japan)

1:20 pm: **Shape-memory polymers for active optical devices: continuously tunable organic semiconductor distributed feedback lasers**, Senta Schauer, Xin Liu, Norbert Schneider, Matthias Worgull, Uli Lemmer, Hendrik Hölscher, Karlsruhe Institut für Technologie (Germany) . . [9432-21]

1:40 pm: **Shape memory polymer with multistage stimulus and two-way reversible actuation**, Wenbing Li, Yanjiu Liu, Jinsong Leng, Harbin Institute of Technology (China) . . . . . [9432-22]

2:00 pm: **Shape memory PCL/CNT composite foams and their microwave activated behaviors**, Fenghua Zhang, Tianyang Zhou, Zhichun Zhang, Yanjiu Liu, Jinsong Leng, Harbin Institute of Technology (China) . . . . . [9432-23]

2:20 pm: **Experimental characterization of actuators based on coiled polymeric-wire**, Marco Fontana, Rocco Vertechy, Antonello Cherubini, Giacomo Moretti, Scuola Superiore Sant'Anna (Italy) . . . . . [9432-24]

2:40 pm: **The effect of cross linker concentration in the physical properties of shape memory gel**, Md. Hasnat Kabir, Kumkum Ahmed, Jin Gong, Hidemitsu Furukawa, Yamagata Univ. (Japan) . [9432-25]

Coffee Break . . Tue 3:00 to 3:30 pm

**CONFERENCE 9433**

**SESSION 7**

**LOCATION: ROYAL PALM ONE  
TUE 1:10 PM TO 3:00 PM**

**In Memory of Ephraim Garcia I**

Session Chair: **Donald J. Leo**, The Univ. of Georgia (USA)

1:10 pm: **Ephraim Garcia: student and postdoc (Invited Paper)**, Daniel J. Inman, Univ. of Michigan (USA) . . . . . [9433-21]

1:40 pm: **From ASMS to TANMS: what I learned from Ephraim (Invited Paper)**, Gregory P. Carman, Univ. of California, Los Angeles (USA) . . . . . [9433-22]

2:00 pm: **Sparking innovation in defense research: Ephraim Garcia's contributions to smart structures and materials (Invited Paper)**, Jayanth N. Kudva, NextGen Aeronautics, Inc. (USA) . . [9433-23]

2:20 pm: **Actuation fatigue induced damage and fracture of SMAs (Invited Paper)**, Dimitris C. Lagoudas, Texas A&M Univ. (USA) . . [9433-24]

2:40 pm: **On the use of smart materials for self sensing (Invited Paper)**, Alison B. Flatau, Univ. of Maryland, College Park (USA) . . . . . [9433-25]

Coffee Break . . Tue 3:00 to 3:30 pm

**CONFERENCE 9434**

**SESSION 5**

**LOCATION: ROYAL PALM THREE  
TUE 1:30 PM TO 3:10 PM**

**Special Invited Session in honor of Vasundara Varadan II**

Session Chairs: **Vijay K. Varadan**, The Pennsylvania State Univ. (USA); **In Kwang Kim**, Consultant (USA); **Woosuk Albert Chang**, LIG Nex1 Co., Ltd. (Korea, Republic of)

1:30 pm: **Cellulose/PDMS hybrid material for actuating lens (Invited Paper)**, Kishor Kumar Sadasivuni, Xiaoyuan Gao, Eun Byul Jo, Asma Akther, Jaehwan Kim, Inha Univ. (Korea, Republic of) . . . . [9434-19]

2:10 pm: **Novel design of honeycombs using a seamless combination of auxetic and conventional cores toward phononic band gap engineering (Invited Paper)**, Sushovan Mukherjee, Indian Institute of Science (India); Fabrizio Scarpa, Univ. of Bristol (United Kingdom); Srinivasan Gopalakrishnan, Indian Institute of Science (India) . . . . . [9434-20]

2:40 pm: **Dynamics of plasmon in graphene oxide (Invited Paper)**, Brahmanandam Javvaji, D. Roy Mahapatra, Indian Institute of Science (India) . . . . . [9434-21]

Coffee Break . . Tue 3:10 to 3:40 pm



**CONFERENCE 9435**

**SESSION 5**

**LOCATION: PACIFIC SALON SIX  
TUE 1:20 PM TO 3:00 PM**

**Advanced Ultrasonic Methods for SHM I**

Session Chairs: **Jung-Wuk Hong**, KAIST (Korea, Republic of); **Fabio Semperlotti**, Univ. of Notre Dame (USA)

1:20 pm: **Design of embedded acoustic lenses in plate-like structures based on periodic acoustic black holes**, Hongfei Zhu, Fabio Semperlotti, Univ. of Notre Dame (USA) . . . . . [9435-19]

1:40 pm: **Granular chains for the assessment of thermal stress in slender structures**, Abdollah Bagheri, Emma La Malfa Ribolla, Piervincenzo Rizzo, Univ. of Pittsburgh (USA); Leith Al-Nazer, Federal Railroad Administration (USA) . . . . [9435-20]

2:00 pm: **Frequency-wavenumber design of spiral micro fiber composite directional actuators**, Matteo Carrara, Massimo Ruzzene, Georgia Institute of Technology (USA) . . . . . [9435-21]

2:20 pm: **Modulation scheme of nonlinear waves for effective crack detection**, Sang Eon Lee, Jung-Wuk Hong, KAIST (Korea, Republic of) . . . . . [9435-22]

2:40 pm: **Thermal effect on E/M impedance spectroscopy (EMIS) of piezoelectric wafer active sensors**, Tuncay Kamas, Victor Giurgiutiu, Lucy (Lingyu) Yu, Bin Lin, Erik L. Frankforter, Univ. of South Carolina (USA) . . . . . [9435-23]

Coffee Break . . . . . Tue 3:00 pm to 3:30 pm

**CONFERENCE 9436**

**SESSION 6**

**LOCATION: TOWNE  
TUE 1:20 PM TO 3:20 PM**

**Spectral Gap Sensors**

Session Chairs: **Ioannis E. Psarobas**, National and Kapodistrian Univ. of Athens (Greece); **Theodore E. Matikas**, Univ. of Ioannina (Greece)

1:20 pm: **Phonon-based scalable quantum computing and sensing**, Ihab El-Kady, Sandia National Labs. (USA) . . . . . [9436-23]

1:40 pm: **Unidirectional dual spectral gaps of low symmetry phoxonic assemblies**, Vassilios Yannopoulos, Univ. of Patras (Greece); Ioannis E. Psarobas, Univ. of Ioannina (Greece) . . . . . [9436-24]

2:00 pm: **Chiral phononic structures**, Ioannis E. Psarobas, Univ. of Ioannina (Greece); Dimitrios A. Exarchos, Theodore E. Matikas, Univ. of Ioannina (Greece) [9436-25]

2:20 pm: **High-frequency phononic crystal structures based on metallic pillars on piezoelectric membranes**, Reza Pourabolghasem, Ali A. Eftekhar, Saeed Mohammadi, Ali Adibi, Georgia Institute of Technology (USA) . . . . . [9436-26]

2:40 pm: **Standardization in fiber-optic sensing for structural safety: activities in the ISHMII and IEC (Invited Paper)**, Wolfgang R. Habel, Katerina Kriebber, Werner Daum, Bundesanstalt für Materialforschung und -prüfung (Germany) . . . . . [9436-33]

Conference End.

**CONFERENCE 9437**

**SESSION 5**

**LOCATION: ROYAL PALM FOUR  
TUE 1:20 PM TO 3:00 PM**

**Bridge Inspection and Monitoring Using SHM/ NDE Techniques II**

Session Chairs: **Genda Chen**, Missouri Univ. of Science and Technology (USA); **Lingyu Yu**, Univ. of South Carolina (USA)

1:20 pm: **Research of a health monitoring system of a prestressed concrete box-girder bridge**, Lei Wang, Pengfei Wei, Shifeng Huang, Xin Cheng, Univ. of Jinan (China) . . . . . [9437-21]

1:40 pm: **Non-contact main cable NDE technique for suspension bridge using magnetic flux-based B-H loop measurements**, Seunghee Park, Ju-Won Kim, Sungkyunkwan Univ. (Korea, Republic of); Dae-Joong Moon, Eitech (Korea, Republic of) . . . . . [9437-22]

2:00 pm: **Data analysis for decision making: a long-term wireless monitoring demonstration of the Telegraph Road bridge**, Sean M. O'Connor, Yilan Zhang, Jerome P. Lynch, Univ. of Michigan (USA) . . . . . [9437-23]

2:20 pm: **Monitoring of transverse displacement of reinforced concrete beams under flexural loading with embedded arrays of optical fibers**, Sergei Khotiantsev, Juan E. González-Tinoco, Héctor Guzmán-Olguín, Univ. Nacional Autónoma de México (Mexico) . . . [9437-24]

2:40 pm: **Concrete bridge deck early problem detection and mitigation using robotics**, Nenad Gucunski, Jingang Yi, Basily B. Basily, Hooman Parvardeh, Jinyuon Kim, Trung Duong, Rutgers, The State Univ. of New Jersey (USA); Hung M. La, Univ. of Nevada, Reno (USA); Ali Maher, Rutgers, The State Univ. of New Jersey (USA) . . . . . [9437-25]

Coffee Break . . . . . Tue 3:00 pm to 3:30 pm

**CONFERENCE 9438**

**SESSION 6**

**LOCATION: ROYAL PALM SIX  
TUE 1:20 PM TO 3:00 PM**

**Guided Waves for Composite Monitoring: Experimental Investigation**

Session Chairs: **Paul Fromme**, Univ. College London (United Kingdom); **Wieslaw M. Ostachowicz**, The Szwedzki Institute of Fluid-Flow Machinery (Poland)

1:20 pm: **Design of intelligent composites with life-cycle health management capabilities**, Colleen Rosania, Cecilia Larrosa, Fu-Kuo Chang, Stanford Univ. (USA) . . . . . [9438-23]

1:40 pm: **Analysis of Lamb wave dispersion curve sensitivity to material elastic constants in composites**, Lukasz J. Pieczonka, Lukasz Ambrozinski, Alberto Gallina, Pawel Packo, AGH Univ. of Science and Technology (Poland); Piotr Nazarko, Rzeszów Univ. of Technology (Poland); Tadeusz Uhl, Wieslaw J. Staszewski, AGH Univ. of Science and Technology (Poland); Zenon Waszczyszyn, Cracow Univ. of Technology (Poland) . . . . . [9438-24]

2:00 pm: **Guided waves for detection of delamination and disbonding in stiffened composite panels**, Fabrizio Ricci, Ernesto Monaco, Leonardo Lecce, Univ. degli Studi di Napoli Federico II (Italy); Ajit K. Mal, Univ. of California, Los Angeles (USA) . . [9438-25]

2:20 pm: **Analysis of guided wave propagation in a tapered composite panel**, Tomasz Wandowski, Pawel H. Malinowski, The Szwedzki Institute of Fluid-Flow Machinery (Poland); Jochen Moll, Johann Wolfgang Goethe-Univ. Frankfurt am Main (Germany); Maciej Radzienski, The Szwedzki Institute of Fluid-Flow Machinery (Poland); Wieslaw M. Ostachowicz, The Szwedzki Institute of Fluid-Flow Machinery (Poland) and Warsaw Univ. of Technology (Poland) . . . . . [9438-26]

2:40 pm: **Identification of disbond in a honeycomb composite sandwich structure using ultrasonic guided wave and embedded PWT sensors**, Shirsendu Sikdar, Indian Institute of Technology Bombay (India) . . . . . [9438-27]

Coffee Break . . . . . Tue 3:00 pm to 3:30 pm

**CONFERENCE 9439**

**SESSION 5**

**LOCATION: ROYAL PALM TWO  
TUE 1:20 PM TO 3:00 PM**

**Monitoring and Energy Conversion**

Session Chairs: **Theodore E. Matikas**, Univ. of Ioannina (Greece); **Michael Dalichow**, Quality Network Inc. (USA)

1:20 pm: **Using aeroelastic structures with nonlinear switching electronics to increase potential energy yield in airflow**, Malika Grayson, Ephraim Garcia, Alexander Mihalca, Jonathan Drosinos, Cornell Univ. (USA) . . . . . [9439-19]

1:40 pm: **Acoustic signatures of different damage modes in plain and repaired marble and granite specimens**, Anastasios C. Mpalaskas, Theodore E. Matikas, Univ. of Ioannina (Greece); Danny Van Hemelrijck, Dimitrios G. Aggelis, Vrije Univ. Brussel (Belgium) . . . . . [9439-20]

2:00 pm: **Statistical approach to quantify structural health monitoring thickness measurement accuracy for internal pipe corrosion**, Thomas J. Eason, Iowa State Univ. (USA) and BP America Inc. (USA); Leonard J. Bond, Iowa State Univ. (USA); Mark G. Lozev, BP America Inc. (USA) . . . . . [9439-21]

2:20 pm: **Developing a structural health monitoring system for nuclear dry cask storage canister**, Lingyu Yu, Bin Lin, Jingjing Bao, Victor Giurgiutiu, Travis W. Knight, Univ. of South Carolina (USA); Poh-Sang Lam, Savannah River National Lab. (USA) . . . . . [9439-22]

2:40 pm: **Robust ultrasonic waveguide based distributed temperature sensing**, Suresh Periyannan, Krishnan Balasubramanian, Indian Institute of Technology Madras (India) . . . . . [9439-23]

Coffee Break . . . . . Tue 3:00 pm to 3:30 pm



**CONFERENCE 9429**

**SESSION 8**

**LOCATION: SUNRISE  
TUE 3:30 PM TO 4:30 PM**

**Robotics II**

Session Chair: **Michael W. Shafer**, Northern Arizona Univ. (USA)

3:30 pm: **An insect-inspired flapping wing micro air vehicle with double wing clap-fling effects and capability of sustained hovering**, Quoc-Viet Nguyen, Woei Leong Chan, Marco Debiasi, National Univ. of Singapore (Singapore) . . . . . [9429-24]

3:50 pm: **Soap film flow visualization investigations of oscillating wing energy harvesters**, Benjamin Kirschmeier, Matthew J. Bryant, North Carolina State Univ. (USA) . . . . . [9429-25]

4:10 pm: **The environment blending dynamics of biomimetic low observable platforms**, Theodore B. Terry, Patrice M. Smith, Walden Univ. (USA) . . . . . [9429-26]

**LOCATION: SUNRISE  
4:30 PM TO 5:30 PM**

**Poster Pops**

Session Chair: **Raúl J. Martín-Palma**, Univ. Autónoma de Madrid (Spain)

In addition to their poster presentations, the poster authors will provide 3-minute oral presentations during the conference.

**CONFERENCE 9430**

**SESSION 5**

**LOCATION: TOWN AND COUNTRY BALLROOM  
TUE 3:30 PM TO 5:10 PM**

**Dielectric EAP Materials and Actuators II**

Session Chairs: **Iain A. Anderson**, The Univ. of Auckland (New Zealand); **Hyouk Ryeol Choi**, Sungkyunkwan Univ. (Korea, Republic of)

3:30 pm: **Robust position control for a DEAP stack-actuator**, Thorben Hoffstadt, Jürgen Maas, Ostwestfalen-Lippe Univ. of Applied Sciences (Germany) . . . . . [9430-18]

3:50 pm: **Electromechanical characterization of a new synthetic rubber membrane for dielectric elastomer transducers**, Rocco Vertechy, Marco Fontana, Scuola Superiore Sant'Anna (Italy)[9430-19]

4:10 pm: **Silicone films with high stiffness and increasing permittivity through dipole-grafting**, Martin Blümke, Michael Wegener, Hartmut Krüger, Fraunhofer-Institut für Angewandte Polymerforschung (Germany) . . . . . [9430-20]

4:30 pm: **Large-strain, high-stress tubular dielectric elastomer actuator with oil encapsulation**, Gih-Keong Lau, Desmond D. T. Tan, Thanh-Giang La, Nanyang Technological Univ. (Singapore) . . . . . [9430-21]

4:50 pm: **Thermodynamics and instability of dielectric elastomers**, Liwu Liu, Yanju Liu, Jinsong Leng, Harbin Institute of Technology (China) . . . . . [9430-22]

**CONFERENCE 9431**

**SESSION 7**

**LOCATION: ROYAL PALM FIVE  
TUE 3:30 PM TO 5:30 PM**

**Aircraft, MAV/ UAV, and Morphing Systems**

Session Chairs: **Alison B. Flatau**, Univ. of Maryland, College Park (USA); **Nam Seo Goo**, Konkuk Univ. (Korea, Republic of)

3:30 pm: **Spanwise morphing trailing edge on a finite wing**, Alexander M. Pankonien, Daniel J. Inman, Univ. of Michigan (USA) . . . . . [9431-27]

3:50 pm: **Modeling and development of a twisting wing using inductively heated shape memory alloy actuators**, Robert Saunders, James G. Boyd IV, Darren J. Hartl, Dimitris C. Lagoudas, Texas A&M Univ. (USA) . . . . . [9431-28]

4:10 pm: **Multimodal sensing strategies for detecting transparent barriers indoors from a mobile platform**, David D. L. Mascareñas, Los Alamos National Lab. (USA); **Isaiah Acevedo**, New Mexico Institute of Mining and Technology (USA); **Kaleb Kleine**, Rose-Hulman Institute of Technology (USA); **Dustan Kraus**, Brigham Young Univ. (USA) . . . . . [9431-29]

4:30 pm: **Morphing wingtips based on inflatable honeycomb structures**, Jian Sun, Harbin Institute of Technology (China); **Fabrizio Scarpa**, Univ. of Bristol (United Kingdom); **Yanju Liu**, Jinsong Leng, Harbin Institute of Technology (China) . . . . . [9431-30]

4:50 pm: **A robust two-way switching control system for remote piloting and stabilization of low-cost quadrotor UAVs**, Francesco Ripamonti, Ferruccio Resta, Andrea Vivani, Politecnico di Milano (Italy) . . . . . [9431-31]

5:10 pm: **Planform, aero-structural, and flight control optimization for tailless morphing aircraft**, Giulio Molinari, Andres F. Arrieta, Paolo Ermanni, ETH Zürich (Switzerland) . . . . . [9431-32]

**CONFERENCE 9432**

**SESSION 7**

**LOCATION: SUNSET  
TUE 3:30 PM TO 5:10 PM**

**Experimental Characterization of Multifunctional Composites I**

Session Chairs: **Henry A. Sodano**, Univ. of Florida (USA); **Rocco Vertechy**, Scuola Superiore Sant'Anna (Italy)

3:30 pm: **Effect of particle size on the properties of polyurea-based composites**, Jing Qiao, Harbin Institute of Technology (China) and Univ. of California, San Diego (USA); **Alireza V. Amirkhizi**, Univ. of Massachusetts Lowell (USA); **Siavouche Nemat-Nasser**, Univ. of California, San Diego (USA); **Gaohui Wu**, Harbin Institute of Technology (China) . . . . . [9432-26]

3:50 pm: **Multi-functional composite material base on carbon nanotube paper using for deicing, flame retardancy, thermal insulation and lightning strike protection**, Hetao Chu, Jinsong Leng, Zhichun Zhang, Yanjiu Liu, Harbin Institute of Technology (China) . . . . . [9432-27]

4:10 pm: **3D gel printer for creating order-made meals**, Jin Gong, Ryo Serizawa, Chika Sasaki, Masato Makino, Hidemitsu Furukawa, Yamagata Univ. (Japan) . . . . . [9432-28]

4:30 pm: **Fabrication and characterization of polyaniline-based nanocomposite electrodes for lightweight, flexible, high performance hybrid supercapacitor applications**, HaoTian H. Shi, Hani E. Naguib, Univ. of Toronto (Canada) [9432-36]

4:50 pm: **Effects of interface treatment on the fatigue behaviour of shape memory alloy reinforced polymer composites**, Shashishekarayya R. Hiremath, Indian Institute of Science (India); **K. Harish**, M. M. Benal, Visvesvaraya National Institute of Technology (India); **D. Roy Mahapatra**, Indian Institute of Science (India) [9432-40]

**CONFERENCE 9433**

**SESSION 8**

**LOCATION: ROYAL PALM ONE  
TUE 3:30 PM TO 5:30 PM**

**In Memory of Ephraim Garcia II**

Session Chair: **Daniel J. Inman**, Univ. of Michigan (USA)

The final 20 minutes of this session will be an open Questions/Comments period in which attendees are welcome to share memories of Ephraim Garcia.

3:30 pm: **Ephraim Garica: a visionary, a leader, and a friend (Invited Paper)**, Brian Sanders, Embry Riddle Aeronautical Univ. (USA) . . . . . [9433-26]

3:50 pm: **To slew or not to slew: Ephraim's influence on my career (Invited Paper)**, Donald J. Leo, The Univ. of Georgia (USA) . . . . . [9433-27]

4:10 pm: **Top 10 Ephraim-isms (Invited Paper)**, Diann E. Brei, Univ. of Michigan (USA) . . . . . [9433-28]

4:30 pm: **Bioinspired artificial muscle actuators for robotics and aerospace applications (Invited Paper)**, Norman M. Wereley, Univ. of Maryland, College Park (USA) . . . . . [9433-29]

4:50 pm: **Diode-less rectification technique for energy harvesting (Invited Paper)**, Rashi Tiwari, The Dow Chemical Co. (USA); **Alex D. Schlichting**, The MITRE Corp. (USA) . . . . . [9433-30]

Conference End.

**CONFERENCE 9434**

**SESSION 6**

**LOCATION: ROYAL PALM THREE  
TUE 3:40 PM TO 5:30 PM**

**Nanosensor and Nanocomposite**

Session Chair: **Eugene Edwards**, U.S. Army Research, Development and Engineering Command (USA)

3:40 pm: **A novel intraocular pressure microsensor based on a resonant nanocavity (Invited Paper)**, Tianlong Li, Longqiu Li, Jiaxin Li, Harbin Institute of Technology (China); **Xinrong Zhou**, The Second Affiliated Hospital of Harbin Medical Univ. (China); **Guangyu Zhang**, Harbin Institute of Technology (China) . . . . . [9434-22]

4:10 pm: **Non-invasive glucose determination by saliva**, Rogerio F. Andrade, Iron Bit (Brazil) and CEPAM (Brazil); **Helber Holland**, Instituto de Pesquisas Energéticas e Nucleares (Brazil); **Flavia D. Motta**, Iron Bit (Brazil); **Maria J. De Oliveira**, Instituto de Pesquisas Energéticas e Nucleares (Brazil) . . . . . [9434-23]

4:30 pm: **AC magnetic field-assisted method to develop porous carbon nanotube/ conducting polymer composites for application in thermoelectric materials**, Chun-Yu Chuang, Shu-Chian Yang, Su-Hua Chang, Ta-I Yang, Chung Yuan Christian Univ. (Taiwan) . . . . . [9434-24]

4:50 pm: **Wideband, thin, and flexible graphene-nanotube-iron nanostructure filled PEDOT:PSS film for EMI shielding**, Sihwa Lee, Kiwoo Jun, Ilkwon Oh, KAIST (Korea, Republic of) . . . . . [9434-25]

5:10 pm: **Vibration response of magnetic field affected double single-walled carbon nanotube systems using modified couple stress theory (Invited Paper)**, Vijay Kumar Gupta, Swati Agrawal Jaiswal, Pavan Kumar Kankar, PDM IITDM Jabalpur (India) . . . . . [9434-26]

**CONFERENCE 9435**

**SESSION 6**

**LOCATION: PACIFIC SALON SIX  
TUE 3:30 PM TO 5:30 PM**

**Novel System Identification and Damage Detection Strategies**

Session Chairs: **Yang Wang**, Georgia Institute of Technology (USA); **Michael B. Wakin**, Colorado School of Mines (USA)

3:30 pm: **A cloud based data management infrastructure for bridge monitoring**, Seongwoon Jeong, Stanford Univ. (USA); Jaewook Byun, Daeyoung Kim, Hoon Sohn, KAIST (Korea, Republic of); Kincho Henry Law, Stanford Univ. (USA) . . . . . [9435-24]

3:50 pm: **Uncertainty calculation for modal parameters used with stochastic subspace identification: an application to a bridge structure**, Chin-Hsiung Loh, Wei-Ting Hsu, National Taiwan Univ. (Taiwan); Shu-Hsien Chao, National Ctr. for Research on Earthquake Engineering (Taiwan) . . . . . [9435-25]

4:10 pm: **Substructure location and size effects on decentralized model updating**, Xinjun Dong, Dapeng Zhu, Yang Wang, Georgia Institute of Technology (USA) . . . . . [9435-26]

4:30 pm: **Sequential damage detection and localization based on the continuous wavelet transform: a graphical model approach**, Yizheng Liao, Konstantinos Balafas, Ram Rajagopal, Anne S. Kiremidjian, Stanford Univ. (USA) . . . . . [9435-27]

4:50 pm: **Stochastic filtering for damage identification through nonlinear structural finite element model updating**, Rodrigo Astroza, Hamed Ebrahimian, Joel P. Conte, Univ. of California, San Diego (USA) [9435-28]

5:10 pm: **Sampling considerations for modal analysis with damping**, Jae Young Park, Univ. of Michigan (USA); Michael B. Wakin, Colorado School of Mines (USA); Anna C. Gilbert, Univ. of Michigan (USA) . . . . . [9435-29]

**CONFERENCE 9437**

**SESSION 6**

**LOCATION: ROYAL PALM FOUR  
TUE 3:30 PM TO 5:30 PM**

**Piezoelectric Sensing SHM/NDE Technologies I**

Session Chairs: **Denvid Lau**, City Univ. of Hong Kong (Hong Kong, China); **Tian Xia**, The Univ. of Vermont (USA)

3:30 pm: **Bearing fault component identification using information gain and machine learning algorithms**, Vakharia Vinay, Gupta Vijay Kumar, Kankar Pavan Kumar, PDPM Indian Institute of Information Technology, Design & Manufacturing Jabalpur (India) . . . . . [9437-96]

3:50 pm: **High piezoelectric properties of cement piezoelectric composites containing Kaolin**, Huang Hsing Pan, National Kaohsiung Univ. of Applied Sciences (Taiwan) . . . . . [9437-27]

4:10 pm: **Adhesive disbond detection using piezoelectric wafer active sensors**, William Roth, Victor Giurgiutiu, Univ. of South Carolina (USA) . . . . . [9437-28]

4:30 pm: **Ultrasonic measurement and monitoring of loads in bolts used in structural joints**, Ajay M. Koshti, NASA Johnson Space Ctr. (USA) . . . . . [9437-29]

4:50 pm: **Nonlinear acoustics for practical applications**, To Kang, Korea Atomic Energy Research Institute (Korea, Republic of) and Sungkyunkwan Univ. (Korea, Republic of); Jeong Na, Wyle Labs. (USA); Sung-Jin Song, Sungkyunkwan Univ. (Korea, Republic of); Jin-Ho Park, Korea Atomic Energy Research Institute (Korea, Republic of) . . . . . [9437-30]

5:10 pm: **Fibre optic sensors for load-displacement measurements and its comparisons to piezo sensor based electromechanical admittance signatures**, Muneesh Maheshwari, Venu Gopal Madhav Annamdas, John H. L. Pang, Anand K. Asundi, Swee Chuan Tjin, Nanyang Technological Univ. (Singapore) . . [9437-47]

**CONFERENCE 9438**

**SESSION 7**

**LOCATION: ROYAL PALM SIX  
TUE 3:30 PM TO 6:30 PM**

**Metamaterial and Periodic Structures I**

Session Chairs: **Guoliang Huang**, Univ. of Arkansas at Little Rock (USA); **Perngjin F. Pai**, Univ. of Missouri-Columbia (USA)

3:30 pm: **Design optimization of layered periodic composites for desired elastodynamic response**, Hossein Sadeghi, Siavouche Nemat-Nasser, Univ. of California, San Diego (USA) . . . . . [9438-28]

3:50 pm: **Sound insulation and energy harvesting based on acoustic metamaterial plate**, Badreddine Assouar, Mourad Oudich, Xiaoming Zhou, Univ. de Lorraine (France) . . . . . [9438-29]

4:10 pm: **Active control of flexural waves in a plate using elastic metamaterials**, Yangyang Chen, Guoliang Huang, Univ. of Missouri-Columbia (USA) . . . . . [9438-30]

4:30 pm: **Band gap control in an active elastic metamaterial with negative capacitance piezoelectric shunting**, Guoliang Huang, Yangyang Chen, Univ. of Missouri-Columbia (USA) . . . . . [9438-31]

4:50 pm: **Design of multi-stopband metamaterial plates for absorption of broadband elastic waves and vibration**, Perngjin F. Pai, Univ. of Missouri-Columbia (USA); Hao Peng, Univ. of Missouri, Columbia (USA) . . . . . [9438-32]

5:10 pm: **Tunable directivity in phononic crystals with piezoelectric microstructures**, Paolo Celli, Stefano Gonella, Univ. of Minnesota, Twin Cities (USA) . . . . . [9438-33]

5:30 pm: **Parameter-dependence of the acoustic rotation effect of a metamaterial-based field rotator**, Xue Jiang, JianChun Cheng, Bin Liang, Nanjing Univ. (China) . . . . . [9438-34]

5:50 pm: **A wrinkly phononic crystal**, Alireza Bayat, Faramarz Gordaninejad, Univ. of Nevada, Reno (USA) . . . . . [9438-35]

6:10 pm: **Microstructural realization of acoustic cloak with pentamode material**, Yi Chen, Xiaoning Liu, Gengkai Hu, Beijing Institute of Technology (China) . . [9438-36]

**CONFERENCE 9439**

**SESSION 6**

**LOCATION: ROYAL PALM TWO  
TUE 3:30 PM TO 5:30 PM**

**Energy Conversion and Harvesting**

Session Chairs: **Michael Kroening**, Pontificia Univ. Católica do Rio de Janeiro (Brazil); **Henning Heuer**, Fraunhofer IKTS-MD (Germany)

3:30 pm: **Performance quantification of piezoelectric energy harvesting devices**, Miso Kim, Korea Research Institute of Standards and Science (Korea, Republic of); Brian L. Wardle, John Dugundji, Massachusetts Institute of Technology (USA) . . . . . [9439-24]

3:50 pm: **Robust design optimization for nonlinear vibration energy harvesters**, Sumin Seong, Soobum Lee, Univ. of Maryland, Baltimore County (USA); Chao Hu, Medtronic, Inc. (USA) . . . . . [9439-25]

4:10 pm: **Rotating beam flexural vibrations in perpendicular directions as a wide-band piezoelectric energy harvester**, Lijun Yang, Haifeng Zhang, Univ. of North Texas (USA) . . . . . [9439-26]

4:30 pm: **An experimentally validated parametrically excited vibration energy harvester with time-varying stiffness**, Bahareh Zaghari, Emiliano Rustighi, Maryam Ghandchi-Tehrani, Univ. of Southampton (United Kingdom) . . . . . [9439-27]

4:50 pm: **Self-assembled graphene films based self-heating slab and its electro-thermal performance in deicing applications**, Qiangqiang Zhang, Harbin Institute of Technology (China) . . . [9439-28]

5:10 pm: **Experimental investigation of fatigue in a cantilever energy harvesting beam**, Panduranga V. Avvari, Yaowen Yang, Chee Kiong Soh, Peiwen Liu, Nanyang Technological Univ. (Singapore) . . [9439-29]

**PANEL DISCUSSION**

**LOCATION: ROYAL PALM TWO  
5:30 PM TO 6:30 PM**

**Challenges for Materials, Smart Structures, and NDE to Provide Energy for a Growing Ecologic Economy and a Better Quality of Life**

Conference End.



**CONFERENCE 9429**

**Bioinspiration, Biomimetics, and Bioreplication V**

**Preparation of hybrid materials from spider silk and conducting polymers**, Kazuki Miyaura, Chitose Institute of Science and Technology (Japan) . . . . . [9429-40]

**Precipitative self-healing of creep damage in steels: studies by mechanokinetic coupled modeling method**, Eduard Karpov, Mansoor Ariyan, Univ. of Illinois at Chicago (USA) . . . . . [9429-41]

**Cell-free photosynthetic system fabricated by layer-by-layer assembly**, Hongseop Hwang, Inha Univ. (Korea, Republic of) [9429-42]

**Motion generation of peristaltic mobile robot with swarm optimization algorithm**, Takahiro Homma, Norihiro Kamamichi, Tokyo Denki Univ. (Japan) . . . . . [9429-44]

**The effects of cap dimension on dry adhesion of bioinspired mushroom-shaped surfaces**, Jinyou Shao, Yue Wang, Xi'an Jiaotong Univ. (China) . . . [9429-45]

**Electrowetting of liquid polymer on petal-mimetic microbowl-array surfaces for formation of microlens array with varying focus on a single substrate**, Xiangmeng Li, Jinyou Shao, Yucheng Ding, Hongmiao Tian, Xiangming Li, Xi'an Jiaotong Univ. (China) . . . [9429-46]

**A study on the durability of gecko-like PDMS micro-structures by metal coatings**, GyuHe Kim, Hui Yun Hwang, Andong National Univ. (Korea, Republic of) . . . . . [9429-47]

**Multifunctional clay-cellulose nanocomposites by mimicking structures of nacre**, Daseul Jang, Bong Sup Shim, Inha Univ. (Korea, Republic of) . . . . . [9429-49]

**Bistability and thermal coupling in elastic metamaterials with negative compressibility**, Eduard Karpov, Michelle Chen, Univ. of Illinois at Chicago (USA) . [9429-50]

**Biomimetic nanofur for drag reduction and oil-water separation**, Hendrik Hölscher, Maryna N. Kavalenka, Claudia Zeiger, Matthias Mail, Marc Schneider, Stefan Walheim, Thomas Schimmel, Matthias Worgull, Karlsruher Institut für Technologie (Germany) . . [9429-53]

**The effect of the abdomen deformation on the longitudinal stability of flying insects**, Sang-Yeon Choi, Joong-Kwan Kim, Jong-Seob Han, Jae-Hung Han, KAIST (Korea, Republic of) . . . . [9429-55]

**Exploration of electric properties of bone compared to cement: streaming potential and piezoelectric properties**, Carolyn Dry, Natural Process Design, Inc. (USA) . . . . . [9429-56]

**Improving energy efficiency in robot limbs through hydraulic dangle**, Julian S. Whitman, Michael A. Meller, Ephraim Garcia, Cornell Univ. (USA) . . . . . [9429-57]

**CONFERENCE 9430**

**Electroactive Polymer Actuators and Devices (EAPAD) XVII**

**Performance analysis of the polymeric structures applied for flexible solar cells**, Jyh-Jier J. Ho, National Taiwan Ocean Univ. (Taiwan) . . . . . [9430-88]

**Electromechanical and electrostrictive behavior of polyurethane: effects of urethane type**, Karat Petcharoen, Anuvat Sirivat, The Petroleum and Petrochemical College (Thailand) . . . . . [9430-89]

**Electroactive ionic fibers for cilia-based underwater robotic systems**, Viljar Palmre, Kwang Jin Kim, Univ. of Nevada, Las Vegas (USA) . . . . . [9430-90]

**Comprehensive modeling of ionic polymer-metal composite actuators based upon variable surface resistance and underlying physics of the polymer**, Qi Shen, Viljar Palmre, Tyler P. Stalbaum, Kwang Jin Kim, Univ. of Nevada, Las Vegas (USA) . . . . . [9430-91]

**Comparison of custom manufacturing methods of Nafion to commercially available Nafion for the purpose of ionic polymer-metal composite (IPMC) applications**, Shelby Nelson, Viljar Palmre, Kwang Jin Kim, Univ. of Nevada, Las Vegas (USA) [9430-92]

**Actuation behavior of flexible sulfonated polyaniline-polyimide films**, I-Hsiang Tseng, Feng Chia Univ. (Taiwan); Jheng-Jia Li, National Chin-Yi Univ. of Technology (Taiwan); Po-Ya Chang, Feng Chia Univ. (Taiwan); Mei-Hui Tsai, National Chin-Yi Univ. of Technology (Taiwan) . . . . . [9430-93]

**Prediction of rate dependent deformation of dielectric elastomer using artificial neural network**, Raj Kumar Sahu, National Institute of Technology Raipur (India); Karali Patra, Indian Institute of Technology Patna (India) [9430-94]

**A novel approach of fabricating dielectric elastomer actuator with interpenetrating double network**, Ji Hyeon Lee, Bismark Mensah, Gi-Bbeum Lee, Yujin So, Changwoon Nah, Chonbuk National Univ. (Korea, Republic of) . . . . . [9430-95]

**Large-area manufacturing method of dielectric elastomer stack transducers (DESTs) made from pre-fabricated dielectric films**, Tanja Grotepaß, Florentine Förster, Holger Moessinger, Helmut F. Schlaak, Technische Univ. Darmstadt (Germany) . . . [9430-96]

**Energy harvesting based on dielectric elastomers: maximum converted energy, dissipation, and wave power generator**, Xiongfei Lv, Liwu Liu, Yanju Liu, Jinsong Leng, Harbin Institute of Technology (China) . . . . . [9430-97]

**Facile hydrophobicity/hydrophilicity modification of SMP surface based on metal constrained cracking**, Yu Han, Peng Li, Wenxin Wang, Jinsong Leng, Peng Jin, Harbin Institute of Technology (China) . . . . [9430-98]

**Development of a soft robot using self-sensing IPMC integrated with Gallium-Indium alloy**, Sarah Trabia, Viljar Palmre, Kwang Jin Kim, Woosoon Yim, Univ. of Nevada, Las Vegas (USA) . . . . . [9430-99]

**Ionic polymer-metal composite based on anionic functionalized polysulfone membrane**, Viljar Palmre, Univ. of Nevada, Las Vegas (USA); Angela D. Mohanty, Chulsung Bae, Rensselaer Polytechnic Institute (USA); Kwang Jin Kim, Univ. of Nevada, Las Vegas (USA) [9430-100]

**Design and fabrication of compliant proximity-tactile sensor using carbon micro coils**, Hyouk Ryeol Choi, Junwoo Park, Tien Dat Nguyen, Uikeyum Kim, Donghyuk Lee, Canh Toan Nguyen, Hoa Phung, Jae-Do Nam, Ja Choon Koo, Hyungpil Moon, Sungkyunkwan Univ. (Korea, Republic of) . . . . . [9430-101]

**Poleable nanoparticles as fillers towards non-linear optically active actuators**, Yee Song Ko, Frank A. Nüesch, Dorina M. Opris, EMPA (Switzerland) . . . . . [9430-102]

**Fabrication of natural melanin composites for electroceuticals**, Tae Sik Eom, Inha Univ. (Korea, Republic of) . . . . . [9430-103]

**Property modification of Nafion via polymer blending**, Jungsoo Nam, Dong-Chan Lee, Viljar Palmre, Kwang Jin Kim, Univ. of Nevada, Las Vegas (USA) . . . . . [9430-104]

**Fabrication and characterization of aligned electroactive conducting polymer nanotubes and nanofibers for neural application**, Mohammad Reza Abidian, Ning Ye, The Pennsylvania State Univ. (USA) . . . . . [9430-105]

**Cylindrical conducting polymer-based trilayer actuator for catheter application**, Meisam Farajollahi, The Univ. of British Columbia (Canada); Vincent Woehling, Cédric Plesse, Frédéric Vidal, Univ. de Cergy-Pontoise (France); Victor X. D. Yang M.D., Sunnybrook Health Sciences Ctr. (Canada); Farrokh Sassani, John D. W. Madden, The Univ. of British Columbia (Canada) . . . . [9430-106]

**Variable stiffness structure using nylon actuators arranged in a pennate muscle configuration**, Soheil Kianzad, Milind Pandit, Johnathan D. Lewis, Alexander R. Berlinger, John D. W. Madden, The Univ. of British Columbia (Canada) . . . . . [9430-107]

**A multi-segment soft actuator for biomedical applications based on IPMCs**, Dongxu Zhao, Yanjie Wang, Jiayu Liu, Hualing Chen, Dichen Li, Xi'an Jiaotong Univ. (China) . . . . . [9430-108]

**Novel composite piezoelectric material for energy harvesting applications**, Giedrius Janusas, Asta Guobiene, Arvydas Palevicius, Igoris Prosycevas, Sigita Ponelyte, Valentinas Baltrusaitis, Rokas Sakalys, Kaunas Univ. of Technology (Lithuania) . . . . . [9430-109]

**Electrical properties of nanoscale metallic thin film coatings on dielectric elastomer**, Md. Shahnewaz Sabit Faisal, Zhihang Ye, Zheng Chen, Ramazan Asmatulu, Wichita State Univ. (USA) [9430-110]

**Electrospun nanofibers for improved electrical and thermal conductivities of fiber-reinforced composites**, Ibrahim M. Alarifi, Abdulaziz Alharbi, S. Khan, Ramazan Asmatulu, Wichita State Univ. (USA) . . . . . [9430-111]

**Inkjet-printed MWCNT electrodes for dielectric elastomer actuators**, Gabor M. Kovacs, EMPA (Switzerland) . . . . . [9430-112]

**CONFERENCE 9431**

**Active and Passive Smart Structures and Integrated Systems IX**

**Design of a bidirectional piezoelectric hybrid actuator**, Xiao Long Jin, Ngoc-San Ha, Nam Seo Goo, Konkuk Univ. (Korea, Republic of); Tae Heun Kim, Byung Woon Bae, Firstec Co. (Korea, Republic of); Chang Seop Lee, Agency for Defense Development (Korea, Republic of) . . . . . [9431-62]

**Creation of smart discrete-nanostructures using soft materials-derived lithography**, Jae Hong Park, National Nanofab Ctr. (Korea, Republic of) . . . . [9431-100]

**A spring-roll EAP actuator applied as end-effector of a hyper-redundant robot**, Francesco Ripamonti, Gianmarco Errico, Victor Fava, Ferruccio Resta, Politecnico di Milano (Italy) . . . . . [9431-101]

**Design and experimental tests of an innovative magnetostrictive patch actuator**, Simone Cinquemani, Francesco Castelli-Dezza, Hermes Giberti, Politecnico di Milano (Italy) . . . . . [9431-102]

**Low frequency inertial control strategy for seismic attenuation with multi-stage mechanical suspensions**, Fabrizio Barone, Fausto Acemese, Gerardo Giordano, Rocco Romano, Univ. degli Studi di Salerno (Italy); Rosario De Rosa, Univ. degli Studi di Napoli Federico II (Italy) . . . . . [9431-103]

**A novel resonant based viscometer for magnetorheological fluid**, Suresh Kaluvan, Seung-Bok Choi, Jong Seok Oh, Jinhuk Park, Pyunghwa Kim, Inha Univ. (Korea, Republic of) . . . . . [9431-104]

**Passive vibration control in a building-like structure using a tuned-mass-damper and an autoparametric cantilever beam absorber**, Josue Enriquez-Zarate, Hugo F. Abundis-Fong, Gerardo Silva-Navarro, Ctr. de Investigación y de Estudios Avanzados del Instituto Politécnico Nacional (Mexico) . . . . . [9431-105]



Conference attendees are invited to attend the joint poster session/exhibition reception to network, enjoy light refreshments, and view the poster papers. Attendees are required to wear their conference registration badge. Authors of poster papers will be present to answer questions concerning their papers. Poster authors must set up their poster between 10 am and 4 pm on Tuesday 10 March.

**Design and analysis of an innovative by-pass MR mount,** Quoc Hung Nguyen, Thang Lang Van, Industrial Univ. of Hochiminh City (Viet Nam); Seung-Bok Choi, Inha Univ. (Korea, Republic of) . . . . . [9431-106]

**Morphological enhancement of poly(3,4-ethylenedioxythiophene) in alginate hydrogel for electrically controlled drug release,** Nophawan Paradee, Anuvat Sirivat, Chulalongkorn Univ. (Thailand) . . . . . [9431-107]

**Hysteresis modeling and experimental validation of a magnetorheological damper,** Xian-Xu Bai, Peng Chen, Li-Jun Qian, An-Ding Zhu, Hefei Univ. of Technology (China) . . . . . [9431-108]

**Design of MR brake featuring tapered inner magnetic core,** Jung Woo Sohn, Kumoh National Institute of Technology (Korea, Republic of); Jong-Soek Oh, Seung-Bok Choi, Inha Univ. (Korea, Republic of) . . . . . [9431-109]

**A novel morphing skin integrating shape memory polymer with anisotropic corrugated laminates,** Xiaobo Gong, Liwu Liu, Yanju Liu, Jinsong Leng, Harbin Institute of Technology (China) . . . . . [9431-110]

**Circuit driver for robotic hand,** Debalina Ghosh, Poojan D. Khanpara, Yonas T. Tadesse, The Univ. of Texas at Dallas (USA) . . . . . [9431-111]

**Trajectory tracking and vibration control in a space frame flexible structure with a PZT stack actuator,** Gerardo Silva-Navarro, Oscar A. Garcia-Perez, Juan F. Peza-Solis, Luis G. Trujillo-Franco, Ctr. de Investigación y de Estudios Avanzados del Instituto Politécnico Nacional (Mexico) . . . . . [9431-112]

**Wideband piezoelectric energy harvester for low-frequency application with plucking mechanism,** Yasuhiro Hiraki, Arata Masuda, Naoto Ikeda, Takeru Sato, Kyoto Institute of Technology (Japan) . . . . . [9431-113]

**Sensor-less parameter estimation of electromagnetic transducer and experimental verification,** Toru Ikegame, Kentaro Takagi, Tsuyoshi Inoue, Ichiro Jikuya, Nagoya Univ. (Japan) . . . . . [9431-114]

**Enhanced piezoelectric energy harvesting of a bistable oscillator with an elastic magnifier,** Guangqing Wang, Zhejiang Gongshang Univ. (China); Wei-Hsin Liao, The Chinese Univ. of Hong Kong (Hong Kong, China)[9431-115]

**Structural health assessment in cryogenic temperatures using piezoelectric transducers,** HyeJin Jo, Hwee Kwon Jung, WanChul Kim, Gyuhae Park, Chonnam National Univ. (Korea, Republic of)[9431-116]

**Off-road motorcycle performance analysis using a rear semi-active suspension,** Damian Cervantes-Munoz, Tecnológico de Monterrey (Mexico); Jorge de Jesús Lozoya-Santos, Univ. de Monterrey (Mexico); Ricardo Ramírez Mendoza, Tecnológico de Monterrey (Mexico) . . . . . [9431-119]

**Comparisons of the dynamic characteristics of magnetorheological and hydraulic dampers,** Yi Zhang, The Univ. of Manchester (United Kingdom) . . . . . [9431-120]

**Aerosol deposited PZT actuated 2D scanner system,** Wei-Chih Wang, Univ. of Washington (USA) . . . . . [9431-121]

## CONFERENCE 9432

### Behavior and Mechanics of Multifunctional Materials and Composites IX

**Effects of interface morphology and TGO thickness on residual stress of EB-PVD thermal barrier coatings,** Yang Zhao, Jianwei Chen, Jian Ma, Shandong Academy of Sciences (China) . . . . . [9432-35]

**The friction measurement of functional gel mechanical materials using mechanical fixation,** Masato Wada, Hidemitsu Furukawa, Yamagata Univ. (Japan) . . . . . [9432-37]

**Study of emissivity dependence upon concentration in CdTe quantum dots,** Benjamin S. Rinehart, Matthieu Martin, Caroline G. L. Cao, Wright State Univ. (USA) . . . . . [9432-38]

**Stress relaxation behavior in the effect of electric field and degree of crosslinking on gelatin hydrogels: time-electric field superposition,** Thawatchai Tungkavet, Anuvat Sirivat, The Petroleum and Petrochemical College (Thailand) . . . . . [9432-39]

**Mussel-inspired catecholamine polymers as new sizing agents for fiber-reinforced composites,** Wonoh Lee, Jea Uk Lee, Joon-Hyung Byun, Korea Institute of Materials Science (Korea, Republic of) . . . . . [9432-41]

## CONFERENCE 9433

### Industrial and Commercial Applications of Smart Structures Technologies IX

**Energy harvesting to power embedded condition monitoring hardware,** Kevin M. Farinholt, Luna Innovations Inc. (USA) . . . . . [9433-31]

**Free forming of the gel by 3D gel printer SWIM-ER,** Koji Okada, Hidemitsu Furukawa, Masaru Kawakami, Jin Gong, Masato Makino, Azusa Saitou, Yamagata Univ. (Japan) . . . . . [9433-32]

**A smart guidewire for smooth navigation in interventional radiology,** Yanfei Chen, Matthew M. Barry, Mahdis Shayan, Univ. of Pittsburgh (USA); Brian T. Jankowitz, UPMC (USA); Xinjie Duan, Anne M. Robertson, Youngjae Chun, Univ. of Pittsburgh (USA) . . . . . [9433-33]

**In-service demonstration of electromagnetic vibration energy harvesting technologies for heavy haul rail applications,** Chandarin Ung, Monash Univ. (Australia); Scott D. Moss, Owen R. Payne, Luke A. Vandewater, Steve C. Galea, Defence Science and Technology Organisation (Australia); Wing K. Chiu, Monash Univ. (Australia); Greg Crew, BHPBilinton Iron Ore (Australia) . . . . . [9433-34]

**Evaluation of conductive concrete for anti-static flooring applications,** Sherif Yehia, Nasser Qaddoumi, Mohamed Hassan, American Univ. of Sharjah (United Arab Emirates) . . . . . [9433-35]

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### Nano-, Bio-, Info-Tech Sensors and Systems

**Study on dynamic characteristics of smart composite laminates with partially debonded piezoelectric actuator,** Bin Huang, Heung Soo Kim, Dongguk Univ. (Korea, Republic of); Gil Ho Yoon, Hanyang Univ. (Korea, Republic of) . . . . . [9434-39]

**Synthesis of polydiphenylamine nanoparticles: effect of surfactant type and concentration,** Tharaporn Permpool, Anuvat Sirivat, The Petroleum and Petrochemical College (Thailand); Darunee Aussawasathien, National Metal and Materials Technology Ctr. (Thailand) and National Science and Technology Development Agency (Thailand) . . . . . [9434-40]

**Enhanced the interaction of dPPP/Zeolite Y composites towards Ketone vapors: effect of transition metals,** Jirarat Kamonsawas, Anuvat Sirivat, The Petroleum and Petrochemical College (Thailand) . . . . . [9434-41]

**Thin film of sol-gel deposited in photonic crystal fiber for cholesterol detection,** Daniel A. Razo Medina, Edgar Alvarado-Méndez, Mónica Trejo-Durán, Univ. de Guanajuato (Mexico) . . . . . [9434-42]

**Simulation and experimental verification of flexible cellulose acetate haptic array actuator,** Asma Akther, Md Mohiuddin, Seung-Ki Min, Inha Univ. (Korea, Republic of); Sang-Youn Kim, Korea Univ. of Technology and Education (Korea, Republic of); Jaehwan Kim, Inha Univ. (Korea, Republic of) [9434-43]

**Electrospinning biodegradable shape memory Chitosan/polyethylene oxide nanofibrous membranes,** Hongqiu Wei, Fenghua Zhang, Yanju Liu, Jingsong Leng, Harbin Institute of Technology (China) . . . . . [9434-44]

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

**Some aspects of electro-mechanical impedance application for SHM,** Vitalijs Pavelko, Riga Technical Univ. (Latvia) . . . . . [9435-96]

**Low frequency seismic characterization of underground sites with tunable mechanical monolithic sensors,** Fabrizio Barone, Fausto Acernese, Gerardo Giordano, Univ. degli Studi di Salerno (Italy); Rosario De Rosa, Univ. degli Studi di Napoli Federico II (Italy); Rocco Romano, Univ. degli Studi di Salerno (Italy) . . . . . [9435-97]

**Nap environment control considering respiration rate and music tempo by using sensor agent robot,** Sayaka Nakaso, Akira Mita, Keio Univ. (Japan) [9435-100]

**Lighting control system in luminance and color reflecting personal preference,** Risa Ueda, Akira Mita, Keio Univ. (Japan) . . . . . [9435-101]

**Software design and implementation of ship heave motion monitoring system based on MBD method,** Yan Yu, Yuhuan Li, Dalian Univ. of Technology (China); Chunwei Zhang, Won Hee Kang, The Univ. of Western Sydney (Australia); Jinping Ou, Dalian Univ of Technology (China) . . . . . [9435-102]

**Statistical analysis of nature frequencies of hemispherical resonator gyroscope based on probability theory,** Yu Xudong, Long Xingwu, Wei Guo, Li Geng, Qu Tianliang, National Univ. of Defense Technology (China) . . . . . [9435-103]

**Inductive wireless sensor-actuator node for structural health monitoring of fiber reinforced polymers by means of Lamb-waves,** Mariugenia Salas, Friedrich Wilhelm Bessel Institute (Germany); Oliver Focke, Faserinstitut Bremen e.V. (Germany); Walter Lang, Univ. Bremen (Germany) and Friedrich Wilhelm Bessel Institut (Germany); Axel S. Herrmann, Faserinstitut Bremen e.V. (Germany) and Univ. Bremen (Germany) . . . . . [9435-104]

**In-situ strain sensing with fiber optic sensors embedded into stainless steel 316,** Dirk Havermann, William N. MacPherson, Robert R. J. Maier, Duncan P. Hand, Heriot-Watt Univ. (United Kingdom) . . . . . [9435-105]

**Innovative insulations for spacecraft on-surface monitoring system in harsh environments,** Ying Huang, Fardad Azarmi, Mehdi S. Jazi, North Dakota State Univ. (USA) . . . . . [9435-106]

**Liquid polyimide as a substrate for aeronautical sensor systems,** Martin Schwerter, Lars Hecht, Monika Leester-Schädel, Stephanus Büttgenbach, Andreas H. Dietzel, Technische Univ. Braunschweig (Germany) . . . . . [9435-107]

**Damage detection of plane frame structure based on a novel reduced model,** Dongyu Zhang, Harbin Institute of Technology (China) . . . . . [9435-108]

**Research on slope instability displacement monitoring technique based on laser spot video identification method**, Xi Xu, China Univ. of Geosciences (China); Hao Liu, Xuefeng Zhao, Dalian Univ. of Technology (China) . . . [9435-109]

**Emotion identification by face color using kinect**, Shinya Kita, Akira Mita, Keio Univ. (Japan) . . . . . [9435-110]

**Bio-inspired symbiotic structural control and structural health monitoring system**, Zhaoshuo Jiang, San Francisco State Univ. (USA) . . . . . [9435-111]

**Simultaneous shear and pressure sensing based on patch antenna**, Hao Jiang, Haiying Huang, The Univ. of Texas at Arlington (USA) . . . . . [9435-112]

**Dielectric and electro-mechanical properties of (Na<sub>0.5</sub>K<sub>0.5</sub>)NbO<sub>3</sub> based thin films prepared by pulsed laser deposition**, Kazuhiko Tonoooka, Naoto Kikuchi, National Institute of Advanced Industrial Science and Technology (Japan) . . . . [9435-113]

**Influence of surface processing on the fracture strength of structurally integrated PZT fibers in shaped sheet metal parts**, Marek Schmidt, Volker Wittstock, Michael Müller, Technische Univ. Chemnitz (Germany) . . . . . [9435-114]

**Dynamic pressure sensor calibration techniques offering expanded bandwidth with increased resolution**, David Wisniewski, Meggitt Sensing Systems (USA) . . . . . [9435-115]

**Foot pressure sensing system using low-cost microstrip patch antenna**, Jun Yao, Haiying Huang, Saibun Tjuatja, The Univ. of Texas at Arlington (USA) . . . . . [9435-116]

**Damage identification via asymmetric active magnetic bearing acceleration feedback control**, Jie Zhao, Schlumberger Ltd. (USA); Hans DeSmid, The Univ. of Tennessee Knoxville (USA) . . . . . [9435-117]

**The effect of calibration approach on the predictive performance of a general two dimensional constitutive model for magnetic shape memory alloys**, Jason Dikes, Heidi P. Feigenbaum, Constantin Ciocanel, Northern Arizona Univ. (USA) . . . . . [9435-118]

**Damage detection system for in-service highway under operational and environmental variability**, Chenhao Jin, Jingcheng Li, Shinae Jang, Richard Christenson, Univ. of Connecticut (USA) . . . . [9435-119]

**Method for generating dynamic fiber optic Bragg grating sensor array in a single sigle-mode fiber**, Cui Zhang, Lixin Wang, Yu-Tang Dai, Weibing Gan, Wuhan Univ. of Technology (China) . . . . [9435-120]

**Numerical investigations on metal wire based variant of EMI technique for structural health monitoring**, Suresh Bhalla, Susmita Naskar, Indian Institute of Technology Delhi (India) [9435-121]

**Flexible patch composed of PZT thin-film on stainless steel foil for energy harvesting from low-frequency human motions**, Yin-Jie Wang, Chao-Ting Chen, Chun-Liang Kuo, Shou-Peng Yeh, Wen-Jong Wu, National Taiwan Univ. (Taiwan) . . . . . [9435-122]

**Effect of sensor fault on the performance and stability of active control logics with large sensor arrays**, Gabriele Cazzulani, Simone Cinquemani, Francesco Ripamonti, Politecnico di Milano (Italy) . . . . . [9435-123]

**Fault detection in small diameter pipes using ultrasonic guided wave technology**, Rahul Shabahnani, Bahareh Zaghari, Mohammed Moshrefi-Torbati, Victor Humphrey, Univ. of Southampton (United Kingdom) . . . . . [9435-124]

**Design and simulation of multi-resonance sonic transducer using Terfenol-D**, Mohammad Reza Sheykholeslami, Yousef Hojjat, Tarbiat Modares Univ. (Iran, Islamic Republic of); Simone Cinquemani, Politecnico di Milano (Italy); Mojtaba Ghodsi, Tarbiat Modares Univ. (Iran, Islamic Republic of) . . . . [9435-125]

**Comparative discussion between first and second modes of Terfenol-D transducer**, Mohammad Reza Sheykholeslami, Yousef Hojjat, Mojtaba Ghodsi, Tarbiat Modares Univ. (Iran, Islamic Republic of); Simone Cinquemani, Politecnico di Milano (Italy) . . . . . [9435-126]

**Characterization of a soft elastomeric capacitive strain sensor for fatigue crack monitoring**, Xiangxiong Kong, Jian Li, The Univ. of Kansas (USA); Simon Laflamme, Sari Kharroub, Iowa State Univ. (USA); Caroline R. Bennett, The Univ. of Kansas (USA); Adolfo B. Matamoros, The Univ. of Texas at San Antonio (USA) . . . . [9435-127]

**Statistical analysis of modal properties of a cable-stayed bridge through long-term structural health monitoring with wireless smart sensor networks**, Jian Li, Parisa Asadollahi, The Univ. of Kansas (USA) . . . . . [9435-128]

**Regenerative magnetorheological dampers for vehicle suspensions**, Chao Chen, Li Zou, Wei-Hsin Liao, The Chinese Univ. of Hong Kong (Hong Kong, China) . . . . [9435-129]

**Fundamental study on the performance of modified microcombustors with porous media inserts**, K. J. Chua, W. M. Yang, N. Aqdas, Y. Tong, National Univ. of Singapore (Singapore); Terence K. L. Goh, National Univ. of Singapore (Singapore) and SIM Univ. (Singapore) . . . . . [9435-131]

## CONFERENCE 9436

### Smart Sensor Phenomena, Technology, Networks, and Systems Integration VIII

**Nondestructive characterization of phononic heterostructures**, Ioannis E. Psarobas, Dimitrios A. Exarchos, Theodore E. Matikas, Univ. of Ioannina (Greece) . . . . . [9436-2]

**Acoustic emission monitoring of recycled aggregate concrete under bending**, Anna A. Tsoumani, Nektaria-M. Barkoula, Theodoros E. Matikas, Univ. of Ioannina (Greece) . . . . . [9436-14]

**A novel processing route for carbon nanotube reinforced glass-ceramic matrix composites**, Konstantinos G. Dassios, Univ. of Ioannina (Greece); Guillaume Bonnefont, Gilbert Fantozzi, Institut National des Sciences Appliquées de Lyon (France); Theodore E. Matikas, Univ. of Ioannina (Greece) [9436-27]

**The effect of different surfactants/plastisizers on the electrical behavior of CNT nano-modified cement mortars**, Panagiota T. Dalla, Panagiota Alafogianni, Ilias K. Tragazikis, Dimitrios A. Exarchos, Nektaria-M. Barkoula, Konstantinos G. Dassios, Theodore E. Matikas, Univ. of Ioannina (Greece) [9436-29]

**Determination of the dynamic elastic constants of recycled aggregate concrete**, Anna A. Tsoumani, Nektaria-M. Barkoula, Theodoros E. Matikas, Univ. of Ioannina (Greece) . . . . . [9436-30]

**Parallel multi-join query optimization algorithm for distributed sensor network in the internet of things**, Yan Zheng, Heilongjiang Institute of Technology (China) . . . . . [9436-32]

## CONFERENCE 9437

### Structural Health Monitoring and Inspection of Advanced Materials, Aerospace, and Civil Infrastructure IX

**Monitoring the integrity of massive aluminum structures using PZT transducers and the technique of impedance**, Rosalba Costa, Joaquim M. Maia, Amauri A. Assef, Sergio F. Pichorim, Univ. Tecnológica Federal do Paraná (Brazil); Eduardo T. Costa, Vera Lucia da Silveira Nantes Button, Univ. Estadual de Campinas (Brazil) . . . . . [9437-26]

**Foam metal metamaterial panel for mechanical waves isolation**, Hongwei Sun, Jiangsu Automation Research Institute (China); Guochang Lin, Harbin Institute of Technology (China) . . . . . [9437-79]

**Quick seismic intensity map investigation and evaluation based on cloud monitoring method using smart mobile phone**, Xuefeng Zhao, Deli Peng, Weitong Hu, Quanhua Guan, Qinghua Zhu, Yan Yu, Mingchu Li, Jinping Ou, Dalian Univ. of Technology (China) . . . [9437-81]

**Rapid condition assessment of structural condition after a blast using state-space identification**, Edward Eskew, Shinae Jang, Univ. of Connecticut (USA) . . . . . [9437-82]

**Acoustic metamaterial panels based on multi frequency vibration absorbers**, Hongwei Sun, Jiangsu Automation Research Institute (China); Guochang lin, Harbin Institute of Technology (China); Xiaolei Hu, Jiangsu Automation Research Institute (China) [9437-83]

**Thermal protection system monitoring with linear and nonlinear elastic waveguides**, Dryver R. Huston, Stephen H. Pearson, Jonathan Razinger, The Univ. of Vermont (USA) . . [9437-84]

**Physics driven pitting corrosion modeling in 2024-T3 aluminum alloys**, Lingyu Yu, Univ. of South Carolina (USA); Kumar V. Jata, Air Force Research Lab. (USA) [9437-85]

**Damage detection of plate-like structures using computational intelligence concepts**, Ramin Ghiasi, Shahid Bahonar Univ. of Kerman (Iran, Islamic Republic of); Mohammad N. Noori, California Polytechnic State Univ., San Luis Obispo (USA); Hamed Fathnejat, Kerman Graduate Univ. of Advanced Technology (Iran, Islamic Republic of); Peyman Torkzadeh, Shahid Bahonar Univ. of Kerman (Iran, Islamic Republic of) . . . . . [9437-86]

**Multi-physics modeling and simulation of a frequency doubling antenna sensor for passive wireless strain sensing**, Chun Hee Cho, Yang Wang, Georgia Institute of Technology (USA) . . . . . [9437-87]

**Considerations for ultrasonic testing application for on-orbit NDE**, Ajay M. Koshti, NASA Johnson Space Ctr. (USA) . . . . . [9437-88]

**Evaluation of sub-surface residual stresses in a dissimilar welded plate by using finite element and ultrasonic method**, Yashar Javadi, Islamic Azad Univ. (Iran, Islamic Republic of); Ghazaleh Javadi, Univ. of Applied Science & Technology (Iran, Islamic Republic of) [9437-89]

**The study of compressive sampling in ultrasonic computerized tomography**, Wentao Wang, Chonghe Wang, Yuequan Bao, Hui Li, Harbin Institute of Technology (China) . . . . . [9437-90]

**Crack visualization of metallic structures in wide area using time-domain reflectometry with two-dimensional microstrip lines**, Masahiro Kawasaki, Ryosuke Matsuzaki, Tokyo Univ. of Science (Japan); Akira Todoroki, Tokyo Institute of Technology (Japan) . . . . . [9437-91]

**Damage detection and quantification in a structural model under seismic excitation using time-frequency analysis**, Chin-Hsiung Loh, Chun-Kai Chan, National Taiwan Univ. (Taiwan) . . . . . [9437-92]



Authors of poster papers will be present to answer questions concerning their papers. Poster authors must set up their poster between 10 am and 4 pm on Tuesday 10 March.

**Structural health monitoring and assessment aided by building information modeling techniques,** Dryver R. Huston, Dylan Burns, Mandar Dewoolkar, The Univ. of Vermont (USA). . . . . [9437-93]

**Vibrational energy harvesting structure health monitoring of critical interdependent infrastructure systems,** Marcus P. Rutner, Mark Conticchio, Stevens Institute of Technology (USA). . . . . [9437-94]

**Artificial intelligence and signal processing for infrastructure assessment,** Khaled Assaleh, Tamer Shanableh, Sherif Yehia, American Univ. of Sharjah (United Arab Emirates). . . . . [9437-95]

**Disbond detection using guided wave Pzt excitation in honeycomb composite sandwich structure,** Chandrakant B. Pol, Indian Institute of Technology Bombay (India). . . . . [9437-97]

## CONFERENCE 9438

### Health Monitoring of Structural and Biological Systems IX

**Health assessment of bolted joints in a steel planar frame structure: An experimental study,** Joy Pal, Sauvik Banerjee, Indian Institute of Technology Bombay (India)[9438-77]

**A novel low-profile wireless flow sensor to monitor hemodynamic changes in cerebral aneurysm,** Yanfei Chen, Sung Kwon Cho, Univ. of Pittsburgh (USA); Brian T. Jankowitz, UPMC (USA); Youngjae Chun, Univ. of Pittsburgh (USA). . . . . [9438-78]

**ANN-based persistent SHM technique for wind-induced response of tall buildings,** Jinwoo Hwang, Byung Kwan Oh, Yonsei Univ. (Korea, Republic of) and Ctr. for Structural Health Care Technology in Building (Korea, Republic of); Yousok Kim, Tongjun Cho, Ctr. for Structural Health Care Technology in Building (Korea, Republic of); Hyo Seon Park, Yonsei Univ. (Korea, Republic of) and Ctr. for Structural Health Care Technology in Building (Korea, Republic of). . . . . [9438-79]

**Comparative efficacy of flaw detection in structures using piezo sensors in bonded and non-bonded configurations,** Shashank Srivastava, Indira Gandhi National Open Univ. (India); Suresh Bhalla, Alok Madan, Ashok Gupta, Indian Institute of Technology Delhi (India). . . . . [9438-80]

**Electromechanical impedance monitoring of joints in space structures,** Matthew Campisi, Mary Anderson, Rebecca C. Clemens, Andrei N. Zagrai, New Mexico Institute of Mining and Technology (USA). . . . . [9438-81]

**Towards a micromechanics based understanding of ultrasonic higher harmonic generation,** Vamshi Krishna Chillara, Cliff J. Lissenden, The Pennsylvania State Univ. (USA). . . . . [9438-83]

**Medical CT image reconstruction accuracy and industrial non-destructive image quality measures using x-rays up to 1.75 MeV from a newly developed x-band linear accelerator system and an optimized flat panel imager,** James E. Clayton, Varian Medical Systems, Inc. (USA). . . . . [9438-84]

## CONFERENCE 9439

### Smart Materials and Nondestructive Evaluation for Energy Systems

**Ultrasonic assessment of tension shear strength in resistance spot welding,** Abbas Moghanizadeh, Islamic Azad Univ. (Iran, Islamic Republic of). . . . . [9439-30]

**Fabrication, microstructure, and high-temperature thermoelectric properties of  $\text{Ca}_{0.8}\text{Y}_{0.2}\text{-xDyxMn}_{0.8-\delta}$ ,** Kyeongsoon Park, J. W. Seo, C. M. Kim, Sejong Univ. (Korea, Republic of). . . . . [9439-31]

**Investigation of eddy current examination on OD fatigue crack for steam generator tubes,** Yuying Kong, Boyuan Ding, Ming Li, Jinhong Liu, Huaidong Chen, CGNPC Inspection Technology Co. Ltd. (China); Norbert G. Meyendorf, Fraunhofer IKTS-MD (Germany). . . . . [9439-32]

**The eddy current inspection and evaluation for the bottom mounted instrument of reactor pressure vessel,** Yayao Bei, Yi He, Ming Li, Tao Song, Ge Lin, Huaidong Chen, Jinhong Liu, CGNPC Inspection Technology Co. Ltd. (China); Norbert G. Meyendorf, Fraunhofer IKTS-MD (Germany). . . . . [9439-33]

**Electrospun  $\text{TiO}_2$  nanofibers incorporated with conductive nanoscale inclusions for energy conversion,** Ramazan Asmatulu, Manish A. Shinde, James Ho, Wichita State Univ. (USA) [9439-34]



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**CONFERENCE 9429**

Bioinspiration,  
Biomimetics, and  
Bioreplication V

**CONFERENCE 9430**

Electroactive Polymer Actuators and Devices  
(EAPAD) XVII

**CONFERENCE 9431**

Active and Passive Smart Structures and  
Integrated Systems IX

**Wednesday Plenary Session**

**WED 8:10 AM TO 9:10 AM**  
**LOCATION: TOWN AND COUNTRY BALLROOM**

**8:10 TO 8:25 AM:**

- ASME Best Paper Awards
- ASME Gary Anderson Early Achievement Award



**Guided Acoustic Wavefield Imaging for Damage Detection, Structural Characterization, and Transducer Design (Plenary)**, Massimo Ruzzene, Georgia Institute of Technology (USA) . . . [9429-503]

**SESSION 9**

**LOCATION: SUNRISE**  
**WED 9:20 AM TO 10:00 AM**

**Optics and Photonics II**

Session Chair: **Marco Debiasi**, Temasek Labs. (Singapore)

9:20 am: **Characterization of natural photonic structures by means of optimization strategies**, Demetrio Macías, Alexandre Vial, Univ. de Technologie Troyes (France); Ana E. Luna, Diana C. Skigin, Marina E. Inchaussandague, Univ. de Buenos Aires (Argentina) . . . . . [9429-27]

9:40 am: **Transparency by randomness: omnidirectional anti-reflection properties of the glasswing butterfly (Greta oto)**, Hendrik Hölscher, Radwanul H. Siddique, Karlsruhe Institut für Technologie (Germany) [9429-28]

Coffee Break . . . . . Wed 10:00 to 10:30 am

Sessions 6A and 6B run concurrently.

**SESSION 6A**

**LOCATION: TOWN AND COUNTRY BALLROOM**  
**WED 9:20 AM TO 12:10 PM**

**Ionic EAP II**

Session Chairs: **Wei Chen**, Suzhou Institute of Nano-tech and Nano-bionics (China); **Rick C. L. van Kessel**, SBM Offshore (Monaco)

9:20 am: **KHz electromechanical response of ionic microactuators (Invited Paper)**, Cédric Plesse, Univ. de Cergy-Pontoise (France); Ali Maziz, Univ. de Cergy-Pontoise (France) and IEMN CNRS UMR-8520 (France); Caroline Soyer, Eric Cattan, Univ. de Valenciennes et du Hainaut-Cambrésis (France); Frédéric Vidal, Univ. de Cergy-Pontoise (France) . . . . . [9430-23]

Coffee Break . . . . . Wed 10:00 to 10:30 am

**SESSION 6B**

**LOCATION: TOWNE**  
**WED 9:20 AM TO 12:10 PM**

**Nano-Tech and CNT EAP**

Session Chairs: **Rocco Vertechy**, Scuola Superiore Sant'Anna (Italy); **Gabor M. Kovacs**, EMPA (Switzerland)

9:20 am: **Nanoscale engineering of functional materials for high performance electrochemical actuator (Invited Paper)**, Wei Chen, Suzhou Institute of Nano-tech and Nano-bionics (China) . . . . . [9430-29]

Coffee Break . . . . . Wed 10:00 to 10:30 am

Sessions 8A and 8B run concurrently.

**SESSION 8A**

**LOCATION: ROYAL PALM FIVE**  
**WED 9:20 AM TO 10:20 AM**

**Energy Harvesting and Scavenging: Piezoelectrics/Electrets**

Session Chair: **Junrui Liang**, ShanghaiTech Univ. (China)

9:20 am: **A review of piezoelectric-based electrical energy harvesting methods and devices for munitions**, Jahangir Rastegar, Omnitek Partners, LLC (USA); Carlos M. Pereira, U.S. Army Armament Research, Development and Engineering Ctr. (USA); Dake Feng, Omnitek Partners, LLC (USA) . . . . . [9431-33]

9:40 am: **Bimorph disk piezoelectric energy harvester under base excitation: electroelastic modeling and experimental validation**, Amirebrahim Darabi, Shima Shahab, Michael J. Leamy, Alper Erturk, Georgia Institute of Technology (USA) . . . . . [9431-34]

10:00 am: **An evaluation of piezoelectret foam in a multilayer stack configuration for low-level vibration energy harvesting application**, Chase A. Ray, Steven R. Anton, Tennessee Technological Univ. (USA) . . . . . [9431-35]

Coffee Break . . . . . Wed 10:20 to 10:50 am

**SESSION 8B**

**LOCATION: ROYAL PALM ONE**  
**WED 9:20 AM TO 10:20 AM**

**Micro- and Nano-Integrated Systems**

Session Chair: **Gregory P. Carman**, Univ. of California, Los Angeles (USA)

9:20 am: **Force-compensated hydrogel-based pH sensor**, Kangfa Deng, Gerald Gerlach, Margarita Guenther, Technische Univ. Dresden (Germany) . . . . . [9431-36]

9:40 am: **Integration of fluidic jet actuators in composite structures**, Martin Schueller, Mathias Lipowski, Fraunhofer-Institut für Elektronische Nanosysteme (Germany); Eckart Schirmer, Marco Walther, Technische Univ. Chemnitz (Germany); Thomas Otto, Thomas Gessner, Fraunhofer-Institut für Elektronische Nanosysteme (Germany) . . . . . [9431-37]

10:00 am: **Design of a high performance T/R switch for 2.4 GHz RF wireless transceiver in 0.13 μm CMOS technology**, Mohammad Arif Sobhan Bhuiyan, National Univ. of Malaysia (Malaysia); Md Mamun Bin Ibne Reaz, Univ. Kebangsaan Malaysia (Malaysia) . . . . . [9431-38]

Coffee Break . . . . . Wed 10:20 to 10:50 am

**CONFERENCE 9432**

Behavior and Mechanics of Multifunctional Materials and Composites IX

**CONFERENCE 9434**

Nano-, Bio-, Info-Tech Sensors and Systems

**CONFERENCE 9435**

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

**CONFERENCE 9437**

Structural Health Monitoring and Inspection of Advanced Materials, Aerospace, and Civil Infrastructure IX

**CONFERENCE 9438**

Health Monitoring of Structural and Biological Systems IX

**Wednesday Plenary Session**

**WED 8:10 AM TO 9:10 AM**

**LOCATION: TOWN AND COUNTRY BALLROOM**

**8:10 TO 8:25 AM:**

- ASME Best Paper Awards
- ASME Gary Anderson Early Achievement Award



**Guided Acoustic Wavefield Imaging for Damage Detection, Structural Characterization, and Transducer Design (Plenary)**, Massimo Ruzzene, Georgia Institute of Technology (USA) . . . [9429-503]

**SESSION 8**

**LOCATION: SUNSET  
WED 9:20 AM TO 10:00 AM**

**Experimental Characterization of Multifunctional Composites II**

Session Chair: **Darren J. Hartl**, Texas A&M Univ. (USA)

9:20 am: **Power generation from base excitation of a ZnO nanorods**, Mohammad H. Malakooti, Hyun-Sik Hwang, Henry A. Sodano, Univ. of Florida (USA) . . . . . [9432-29]

9:40 am: **Study of the electro-mechanical properties of a power storage composite material during long term electro-mechanical loading**, Constantin Ciocanel, Cindy Browder, Katherine Carroll, Northern Arizona Univ. (USA) . . . . . [9432-30]

Coffee Break Wed 10:00 to 10:30 am

**LOCATION: ROYAL PALM THREE  
WED 9:20 AM TO 10:30 AM**

**Keynote Session IV: RF and Wireless**

Session Chair: **Sang H. Choi**, NASA Langley Research Ctr. (USA)

9:20 am: **RF to millimeter wave integration and module technologies (Keynote Presentation)**, Tauno Vaha-Heikkila, VTT Technical Research Ctr. of Finland (Finland) . . . . . [9434-27]

10:00 am: **Review of radio wave for power transmission with safety (Invited Paper)**, Kyo D. Song, John Day, Demetris L. Geddis, Hargsoon Yoon, Norfolk State Univ. (USA); Jaehwan Kim, Inha Univ. (Korea, Republic of); Sang H. Choi, NASA Langley Research Ctr. (USA) . . . . . [9434-28]

Coffee Break . Wed 10:30 to 10:40 am

Sessions 7A and 7B run concurrently.

**SESSION 7A**

**LOCATION: PACIFIC SALON SIX  
WED 9:20 AM TO 10:00 AM**

**Big Data and Data Analytics for SHM**

Session Chairs: **Genda Chen**, Missouri Univ. of Science and Technology (USA); **Donghyeon Ryu**, New Mexico Institute of Mining and Technology (USA)

9:20 am: **Big data extraction with adaptive wavelet analysis**, Hongya Qu, Genda Chen, Missouri Univ. of Science and Technology (USA); Yiqing Ni, The Hong Kong Polytechnic Univ. (China) [9435-30]

9:40 am: **Portable database system for biofield building**, Kohta Matsuura, Akira Mita, Keio Univ. (Japan) . . . . . [9435-31]

Coffee Break . Wed 10:00 to 10:30 am

**SESSION 7B**

**LOCATION: PACIFIC SALON FOUR  
WED 9:20 AM TO 10:00 AM**

**Sensing Systems for Flight Control**

Session Chairs: **Simon Laflamme**, Iowa State Univ. (USA); **Wei Song**, The Univ. of Alabama (USA)

9:20 am: **Gust alleviation of highly flexible UAVs with artificial hair sensors**, Weihua Su, The Univ. of Alabama (USA); Gregory W. Reich, Air Force Research Lab. (USA) . . . . . [9435-32]

9:40 am: **Low frequency motion measurement and control of spacecrafts and satellites**, Fabrizio Barone, Fausto Acemese, Gerardo Giordano, Rocco Romano, Univ. degli Studi di Salerno (Italy)[9435-33]

Coffee Break . Wed 10:00 to 10:30 am

**SESSION 7**

**LOCATION: ROYAL PALM FOUR  
WED 9:20 AM TO 10:00 AM**

**Modeling and Simulation Techniques For SHM/NDE I**

Session Chairs: **Piotr Omenzetter**, Univ. of Aberdeen (United Kingdom); **Didem Ozevin**, Univ. of Illinois at Chicago (USA)

9:20 am: **Simulating the x-ray image contrast to set-up techniques with desired flaw detectability**, Ajay M. Koshti, NASA Johnson Space Ctr. (USA) [9437-31]

9:40 am: **Infrared contrast data analysis method for quantitative measurement and monitoring in flash infrared thermography**, Ajay M. Koshti, NASA Johnson Space Ctr. (USA) . . . . . [9437-32]

Coffee Break . Wed 10:00 to 10:30 am

**SESSION 8**

**LOCATION: ROYAL PALM SIX  
WED 9:20 AM TO 10:00 AM**

**Emerging and Futuristic Techniques**

Session Chairs: **George Zentai**, Varian Medical Systems, Inc. (USA); **Paul D. Panetta**, Applied Research Associates, Inc. (USA)

9:20 am: **What can phase contrast do for you in applications for SHM involving ultrasonic microscopy?**, Wolfgang Grill, Gerhard Birkelbach, ASI Analog Speed Instruments GmbH (Germany) . . . . . [9438-37]

9:40 am: **Pixelated MV detector for radiotherapy and NDE applications**, George Zentai, Josh M. Star-Lack, Daniel Shedlock, James E. Clayton, Varian Medical Systems, Inc. (USA); Rebecca Fahrig, Stanford School of Medicine (USA); Gary Virshup, Varian Medical Systems, Inc. (USA) . . . . . [9438-38]

Coffee Break . Wed 10:00 to 10:30 am

CONFERENCE 9429

SESSION 10

LOCATION: SUNRISE  
WED 10:30 AM TO 12:00 PM

**Optics and Photonics III**

Session Chair: **Hans Arwin**, Linköping Univ. (Sweden)

10:30 am: **Biomimetics, color, and the arts** (*Invited Paper*), Franziska Schenk, Birmingham City Univ. (United Kingdom) . . . . . [9429-29]

11:00 am: **Fabrication of broadband, antireflection surfaces inspired by the black butterfly** (*Pachliopta aristolochiae*), Radwanul H. Siddique, Guillaume Gomard, Norbert Schneider, Yidenekachew Donie, Uli Lemmer, Matthias Worgull, Hendrik Hölscher, Karlsruher Institut für Technologie (Germany) . . . . . [9429-30]

11:20 am: **Large-scale replication of the blue Morpho's hierarchical photonic nanostructures utilizing shape memory polymers**, Norbert Schneider, Senta Schauer, Alexander Kolew, Marc Schneider, Karlsruher Institut für Technologie (Germany); Juerg Leuthold, ETH Zürich (Switzerland); Hendrik Hölscher, Matthias Worgull, Karlsruher Institut für Technologie (Germany) . . . . . [9429-31]

11:40 am: **Simple mass-production method of the flexible Morpho-colored thin film for wide applications**, Akira Saito, Osaka Univ. (Japan) and RIKEN (Japan); Kosei Ishibashi, Junpei Ohga, Megumi Akai-Kasaya, Yuji Kuwahara, Osaka Univ. (Japan) . . . . . [9429-32]

Lunch/Exhibition  
Break . . . . . Wed 12:00 pm to 1:10 pm

CONFERENCE 9430

Sessions 6A and 6B run concurrently.

SESSION 6A  
CONTINUED

10:30 am: **Measuring blocking force to interpret ionic mechanisms within bucky-gel actuators**, Karl Kruusamäe, Takushi Sugino, Kinji Asaka, National Institute of Advanced Industrial Science and Technology (Japan) . . . . . [9430-24]

10:50 am: **A power-autonomous self-rolling wheel using ionic and capacitive actuators**, Indrek Must, Toomas Kaasik, Inna Baranova, Urmas Johanson, Andres Punning, Alvo Aabloo, Univ. of Tartu (Estonia) . . . . . [9430-25]

11:10 am: **Long-term response of ionic electroactive polymer actuators in variable ambient conditions**, Veiko Vunder, Andres Punning, Alvo Aabloo, Univ. of Tartu (Estonia) . . . . . [9430-26]

11:30 am: **Long-term degradation of the ionic electroactive polymer actuators**, Andres Punning, Indrek Must, Inga Põldsalu, Veiko Vunder, Friedrich Kaasik, Alvo Aabloo, Univ. of Tartu (Estonia) . . . . . [9430-27]

11:50 am: **High energy density interpenetrating networks from ionic networks and silicone**, Liyun Yu, Søren Hvilsted, Technical Univ. of Denmark (Denmark); Anne L. Skov, Technical Univ. of Denmark (Dominica) . . . . . [9430-28]

Lunch/Exhibition  
Break . . . . . Wed 12:10 pm to 1:20 pm

SESSION 6B  
CONTINUED

10:30 am: **Cross-linked carbon nanotubes buckygel actuators: an in-depth study**, David Gendron, Luca Ceseracciu, Alberto Ansaldo, Davide Ricci, Istituto Italiano di Tecnologia (Italy) . . . . . [9430-30]

10:50 am: **Parylene coated carbon nanotube actuators for tactile stimulation**, Grzegorz Bubak, Alberto Ansaldo, David Gendron, Luca Ceseracciu, Davide Ricci, Istituto Italiano di Tecnologia (Italy) [9430-31]

11:10 am: **Development of 3D knitted CNT fabric as smart textiles**, Syamak Farajikhah, Javad Foroughi, Gordon G. Wallace, Univ. of Wollongong (Australia); Ray H. Baughman, The Univ. of Texas at Dallas (USA) [9430-32]

11:30 am: **Electrical actuation properties of epoxy shape memory polymers/flexible carbon nanotubes paper composite**, Wenxin Wang, Yanju Liu, Harbin Institute of Technology (China); Yongyi Zhang, Suzhou Institute of Nano-tech and Nano-bionics (China); Jinsong Leng, Harbin Institute of Technology (China) . . . . . [9430-33]

11:50 am: **CNT: polymer composite membrane as active device**, Y. K. Vijay, Vivekananda Global Univ. (India) . . [9430-34]

Lunch/Exhibition  
Break . . . . . Wed 12:10 pm to 1:20 pm

CONFERENCE 9431

Sessions 9A and 9B run concurrently.

SESSION 9A

LOCATION: ROYAL PALM FIVE  
WED 10:50 AM TO 12:10 PM

**SMA-Based Materials and Systems I**

Session Chairs: **Dimitris C. Lagoudas**, Texas A&M Univ. (USA); **Diann E. Brei**, Univ. of Michigan (USA)

10:50 am: **Experimental investigation of bond in concrete members reinforced with shape memory alloy bars**, Sherif Daghash, Muhammad Sherif, Osman E. Ozbulut, Univ. of Virginia (USA) . . . [9431-39]

11:10 am: **Adaptive and energy-efficient SMA-based vacuum gripper system**, Paul Motzki, ZeMA gGmbH (Germany); Alexander York, Univ. des Saarlandes (Germany); Stefan S. Seelecke, Univ. des Saarlandes (Germany) and ZeMA gGmbH (Germany) . . . . . [9431-40]

11:30 am: **Shape-retainment control using an antagonistic shape memory alloy system**, Tadashige Ikeda, Kazuya Sawamura, Atsuhiko Senba, Nagoya Univ. (Japan); Masato Tamayama, Japan Aerospace Exploration Agency (Japan) . . . . . [9431-41]

11:50 am: **Self tuning parts in an Erhu instrument using shape memory alloys**, Huihui Wang, Stephen Cowan, Williams B. Lane, John Leong, Devin Pappas, Jacksonville Univ. (USA) . . . . . [9431-42]

Lunch/Exhibition  
Break . . . . . Wed 12:10 pm to 1:40 pm

SESSION 9B

LOCATION: ROYAL PALM ONE  
WED 10:50 AM TO 12:10 PM

**Passive and Active Vibration Isolation Systems I**

Session Chairs: **Andres F. Arrieta**, ETH Zürich (Switzerland); **Xian-Xu Bai**, Hefei Univ. of Technology (China)

10:50 am: **Magnetoelastic metastructures for passive broadband vibration suppression**, Jared D. Hobeck, Daniel J. Inman, Univ. of Michigan (USA) . . . [9431-43]

11:10 am: **Multimodal vibration damping through a periodic array of piezoelectric patches connected to a passive network**, Boris Lossouarn, Mathieu Aucejo, Jean-Francois Deu, Conservatoire National des Arts et Métiers (France) . . . . . [9431-44]

11:30 am: **Static and quasi-static behavior of an adaptive system to compensate path errors for smart fiber placement**, Marcus Perner, Hans Peter Monner, Christian Kromholz, Felix Kruse, Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany) . . . . . [9431-45]

11:50 am: **Adaptive passive control of structure-borne noise of rotating machinery using a pair of shunted inertial actuators**, Guoying Zhao, Neven Alujevic, Katholieke Univ. Leuven (Belgium); Gregory Pinte, Bruno Depraetere, Flanders' Mechatronics Technology Ctr. (Belgium); Paul Sas, Katholieke Univ. Leuven (Belgium) . . . . . [9431-46]

Lunch/Exhibition  
Break . . . . . Wed 12:10 pm to 1:40 pm



**CONFERENCE 9432**

**SESSION 9**

**LOCATION: SUNSET  
WED 10:30 AM TO 11:50 AM**

**Ionic Polymers and Gels**

Session Chairs: **Henry A. Sodano**, Univ. of Florida (USA); **Constantin Ciocanel**, Northern Arizona Univ. (USA)

10:30 am: **Aggregation of ionic clusters in thermoplastic ionomers under electrostatic fields**, Vishnu Baba Sundaresan, The Ohio State Univ. (USA) ..... [9432-31]

10:50 am: **Theoretical investigation of ionic effects in actuation and sensing of IPMCs of various geometries**, Tyler P. Stalbaum, Kwang Jin Kim, Univ. of Nevada, Las Vegas (USA) ..... [9432-32]

11:10 am: **Ionic liquid based multifunctional double network gel**, Kumkum Ahmed, Tomoya Higashihara, Yamagata Univ. (Japan); Takashi Morinaga, Takaya Sato, National Institute of Technology, Tsuruoka College (Japan); Hidemitsu Furukawa, Yamagata Univ. (Japan) ..... [9432-33]

11:30 am: **Observation of the characteristic properties in soft and wet friction of gel engineering materials**, Naoya Yamada, Hidemitsu Furukawa, Yamagata Univ. (Japan) ..... [9432-34]

Conference End.

**CONFERENCE 9434**

**SESSION 7**

**LOCATION: ROYAL PALM THREE  
WED 10:40 AM TO 12:20 PM**

**Fabrication and Characterization I**

Session Chair: **Jaehwan Kim**, Inha Univ. (Korea, Republic of)

10:40 am: **Enhanced electromechanical behaviors of cellulose ZnO hybrid nanocomposite**, Seongcheol Mun, Seung-Ki Min, Hyunchan Kim, Jongbeom Im, Jaehwan Kim, Inha Univ. (Korea, Republic of) [9434-29]

11:00 am: **3D gel printing for soft-matter systems innovation**, Hidemitsu Furukawa, Masaru Kawakami, Jin Gong, Masato Makino, Md. H. Kabir, Azusa Saito, Yamagata Univ. (Japan) . [9434-30]

11:20 am: **The effects of width reduction on cantilever type piezoelectric energy harvesters**, Jongbeom Im, Lindong Zhai, Inha Univ. (Korea, Republic of); Jedol Dayou, Univ. Malaysia Sabah (Malaysia); Jeongwoong Kim, Jaehwan Kim, Inha Univ. (Korea, Republic of) ..... [9434-31]

11:40 am: **Effect of microneedle shape on pumping phenomenon in micropumps**, Vijay Kumar Gupta, Rakesh Kumar Haldkar, Tanuja Sheorey, PDPM IITDM Jabalpur (India) ..... [9434-32]

12:00 pm: **Array vibrotactile actuator made with cellulose acetate for flight simulator**, Hyun-U Ko, Hyunchan Kim, Abdullahil Kafy, Inha Univ. (Korea, Republic of); Sang-Youn Kim, Korea Univ. of Technology and Education (Korea, Republic of); Jaehwan Kim, Inha Univ. (Korea, Republic of) [9434-33]

Lunch/Exhibition  
Break . . . Wed 12:20 pm to 1:30 pm

**CONFERENCE 9435**

Sessions 8A and 8B run concurrently.

**SESSION 8A**

**LOCATION: PACIFIC SALON SIX  
WED 10:30 AM TO 11:50 AM**

**Actuation and Feedback Control Technologies**

Session Chair: **R. Andrew Swartz**, Michigan Technological Univ. (USA)

10:30 am: **Sparse feedback structures for wireless control of civil systems**, Reuben Verdoljak, Lauren Linderman, Univ. of Minnesota, Twin Cities (USA) ..... [9435-34]

10:50 am: **A driven active mass damper by using output of a neural oscillator: effects of position control system changes on vibration mitigation performance**, Junichi Hongu, Daiuske Iba, Takayuki Sasaki, Kyoto Institute of Technology (Japan) ..... [9435-35]

11:10 am: **Low-force magnetorheological damper design for small-scale structural control experimentation**, Benjamin D. Winter, Antonio H. Velazquez, R. Andrew Swartz, Michigan Technological Univ. (USA) [9435-36]

11:30 am: **Development and application of a vibration isolation system with adaptive stiffness considering potential energy**, Tzu Kang Lin, National Chiao Tung Univ. (Taiwan); Chii-Jen Chen, National Chung Cheng Univ. (Taiwan) ..... [9435-37]

Lunch/Exhibition  
Break . . . Wed 11:50 am to 1:20 pm

**SESSION 8B**

**LOCATION: PACIFIC SALON FOUR  
WED 10:30 AM TO 11:50 AM**

**Nonlinear Ultrasonics for Damage Detection**

Session Chairs: **Irving J. Oppenheim**, Carnegie Mellon Univ. (USA); **Hoon Sohn**, KAIST (Korea, Republic of)

10:30 am: **Detection and localization of fatigue crack on a rotating steel shaft using air-coupled nonlinear ultrasonic modulation**, Byeongju Song, Byeongjin Park, Hoon Sohn, KAIST (Korea, Republic of); Cheol-Woo Lim, Jae-Roung Park, KIA Motors Hwasung Plant (Korea, Republic of) ..... [9435-38]

10:50 am: **Circumferentially propagating ultrasonic waves generated by an inductively coupled transducer in a thick-walled aluminum tube**, Peng Gong, Carnegie Mellon Univ. (USA); Thomas R. Hay, TechKnowServ Corp. (USA); David W. Greve, Irving J. Oppenheim, Carnegie Mellon Univ. (USA) ..... [9435-39]

11:10 am: **Protection of sandwich composite panels from local buckling phenomena using non-linear wave modulation methodology**, Nikos A. Chrysochoidis, Eugenio Gutiérrez, European Commission Joint Research Ctr. (Italy) ..... [9435-40]

11:30 am: **Nonlinear ultrasonic fatigue crack detection using a single piezoelectric transducer**, Yun-kyu An, Southeast Univ. (China) ..... [9435-41]

Lunch/Exhibition  
Break . . . Wed 11:50 am to 1:20 pm

**CONFERENCE 9437**

**SESSION 8**

**LOCATION: ROYAL PALM FOUR  
WED 10:30 AM TO 11:50 AM**

**Modeling and Simulation Techniques For SHM/NDE II**

Session Chairs: **Piotr Omenzetter**, Univ. of Aberdeen (United Kingdom); **Dennis Lau**, City Univ. of Hong Kong (Hong Kong, China)

10:30 am: **Application of firefly algorithm to dynamic model updating problem**, Faisal Shabbir, Univ. of Engineering and Technology, Taxila (Pakistan); Piotr Omenzetter, Univ. of Aberdeen (United Kingdom) ..... [9437-33]

10:50 am: **Verification of recursive probabilistic integration method for probabilistic fatigue life management using non-destructive inspection techniques**, Tzikang Chen, Michael Shiao, U.S. Army Research Lab. (USA)[9437-34]

11:10 am: **Damage localization for multi-story buildings focusing on shift in the center of rigidity using an adaptive extended Kalman filter**, Tsubasa Takeuchi, Akira Mita, Keio Univ. (Japan) ..... [9437-35]

11:30 am: **Finite element analysis for the damage detection of light pole structures**, Qixiang Tang, Univ. of Massachusetts Lowell (USA); Mark Jen, Parsons Corp. (USA); Tzu Yang Yu, Univ. of Massachusetts Lowell (USA) ..... [9437-36]

Lunch/Exhibition  
Break . . . Wed 11:50 am to 1:20 pm

**CONFERENCE 9438**

**SESSION 9**

**LOCATION: ROYAL PALM SIX  
WED 10:30 AM TO 11:50 AM**

**Bridge Monitoring**

Session Chairs: **Henrique L. Reis**, Univ. of Illinois at Urbana-Champaign (USA); **George Zentai**, Varian Medical Systems, Inc. (USA)

10:30 am: **Determination of mode shapes using long-gage fiber optic sensors**, Kaitlyn Kliewer, Branko Glisic, Princeton Univ. (USA) ..... [9438-39]

10:50 am: **Monitoring viscosity in asphalt binders using an ultrasonic guided waves**, Henrique L. Reis, Alexandra E. Haser, Megan E. McGovern, Behzad Behnia, William G. Buttler, Univ. of Illinois at Urbana-Champaign (USA) [9438-40]

11:10 am: **Nondestructive evaluation of piers**, Ionica Negru, Gilbert-Rainer Gillich, Zeno-Iosif Praisach, Marius Tufoi, Univ. "Eftimie Murgu" Resita (Romania); Edwald-Viktor Gillich, Politehnica Univ. of Timisoara (Romania) . . . . [9438-41]

11:30 am: **Damage identification in rectangular plates using spectral strain energy distribution**, Marius Tufoi, Gilbert-Rainer Gillich, Vasile Iancu, Ionica Negru, Univ. "Eftimie Murgu" Resita (Romania) [9438-42]

Lunch/Exhibition  
Break . . . Wed 11:50 am to 1:20 pm

CONFERENCE 9429

SESSION 11

LOCATION: SUNRISE  
WED 1:10 PM TO 3:10 PM

Systems and Devices

Session Chair: **Iain A. Anderson**, The Univ. of Auckland (New Zealand)

1:10 pm: **The role of active sensing in multi-agent systems inspired by echolocating bat swarms** (*Invited Paper*), Nicole Abaid, Virginia Polytechnic Institute and State Univ. (USA) . . . . . [9429-33]

1:40 pm: **Biomimetic water transportation device learning from Wharf Roach Ligia exotica** (*Invited Paper*), Masatsugu Shimomura, Chitose Institute of Science and Technology (Japan) . . . . . [9429-34]

2:10 pm: **A synthetic leaf: the biomimetic potential of graphene oxide**, Marilla Lamb, George W. Koch, Eric R. Morgan, Michael W. Shafer, Northern Arizona Univ. (USA) . . . . . [9429-35]

2:30 pm: **Efficiency testing of hydraulic artificial muscles with variable recruitment using a linear dynamometer**, Jordan B. Chipka, Cornell Univ. (USA) . . . . . [9429-36]

2:50 pm: **Variable deflection response of sensitive CNT-on-fiber artificial hair sensors**, Keith Slinker, Air Force Research Lab. (USA) and Universal Technology Corp. (USA); Matthew R. Maschmann, Air Force Research Lab. (USA) and Universal Technology Corp. (USA) and Univ. of Missouri (USA); Corey Kondash, Air Force Research Lab. (USA) and Universal Technology Corp. (USA); Benjamin Severin, Federal Republic of Germany Liaison Office for Defense Material USA/Canada (USA) and Air Force Research Lab. (USA); David Phillips, Air Force Research Lab. (USA) and Universal Technology Corp. (USA); Weihua Su, The Univ. of Alabama (USA) and Air Force Research Lab. (USA); Benjamin T. Dickinson, Gregory W. Reich, Jeffery W. Baur, Air Force Research Lab. (USA) . . . . . [9429-37]

Coffee Break . . . . Wed 3:10 pm to 3:40 pm

CONFERENCE 9430

Sessions 7A and 7B run concurrently.

SESSION 7A

LOCATION: TOWN AND COUNTRY  
BALLROOM  
WED 1:20 PM TO 3:00 PM

Dielectric EAP Materials and Actuators III

Session Chairs: **Siegfried G. Bauer**, Johannes Kepler Univ. Linz (Austria); **Tiefeng Li**, Zhejiang Univ. (China)

1:20 pm: **Interfacing dielectric elastomer actuators with liquids**, Alexandre Poulin, Luc Maffii, Samuel Rosset, Herbert R. Shea, Ecole Polytechnique Fédérale de Lausanne (Switzerland) . . . . . [9430-35]

1:40 pm: **Silicone elastomers with high dielectric permittivity and high dielectric breakdown strength based on tuneable functionalised copolymers**, Frederikke B. Madsen, Liyun Yu, Anders E. Daugaard, Søren Hvilsted, Anne L. Skov, Technical Univ. of Denmark (Denmark) . . . . . [9430-36]

2:00 pm: **Elastomer modulus and dielectric strength scaling with sample thickness**, Kent Larson, Dow Corning Corp. (USA) . . . . . [9430-37]

2:20 pm: **Dielectric elastomer actuators as self-sensing devices: a new method of superimposing actuating and sensing signals**, Maximilian Landgraf, Ulrich Zorell, Sebastian Reitelshöfer, In Seong Yoo, Jörg Franke, Lehrstuhl für Fertigungsautomatisierung und Produktionssystematik (Germany) [9430-38]

2:40 pm: **Leakage current and stability of acrylic elastomer subjected to high DC voltage**, Saber Hammami, G2Elab (France) and Univ. Tunis El-Manar (Tunisia); Claire Jean-Mistral, Institut National des Sciences Appliquées de Lyon (France) and Univ. de Lyon (France) and CNRS (France); Fathi Jomni, Univ. Tunis El-Manar (Tunisia); Olivier Gallot-Lavallee, Pascal Rain, G2Elab (France) and Univ. Grenoble Alpes (France) and CNRS (France); Béchir Yangui, Univ. Tunis El Manar (Tunisia); Alain Sylvestre, G2Elab (France) and Univ. Grenoble Alpes (France) and CNRS (France) . . . . . [9430-39]

Coffee Break . . . . Wed 3:00 pm to 3:30 pm

SESSION 7B

LOCATION: TOWNE  
WED 1:20 PM TO 3:00 PM

Conducting EAP Materials

Session Chairs: **Lars E. Knoop**, Univ. of Bristol (United Kingdom); **Daniel Xu**, The Univ. of Auckland (New Zealand)

1:20 pm: **Soft linear electroactive polymers actuators based on polypyrrole**, Ali Maziz, Linköping Univ. (Sweden); Nils-Krister Persson, Univ. of Borås (Sweden); Edwin W. H. Jager, Linköping Univ. (Sweden) . . . . . [9430-40]

1:40 pm: **Bioteplated conducting polymer membrane supercapacitor**, Vishnu Baba Sundaresan, Robert Northcutt, The Ohio State Univ. (USA) . . . . . [9430-41]

2:00 pm: **Sequential growth for lifetime extension in biomimetic polypyrrole actuator systems**, John C. Sarrazin, Stephen A. Mascaró, The Univ. of Utah (USA) . . . . . [9430-42]

2:20 pm: **Fabrication of ion-conducting carbon polymer composite electrodes by spin coating**, Inga Põldsalu, Sven-Erik Mändmaa, Anna-Liisa Peikolainen, Arko Keskküla, Alvo Aabloo, Univ. of Tartu (Estonia) . . . . . [9430-43]

2:40 pm: **Stacking trilayers to increase force generation**, Meisam Farajollahi, Saeede Ebrahimi Takallo, The Univ. of British Columbia (Canada); Adelyne Fannir, Univ. de Cergy-Pontoise (France); Maan Almarghalani, Edmond Cretu, The Univ. of British Columbia (Canada); Giao T. M. Nguyen, Cédric Plesse, Frédéric Vidal, Univ. de Cergy-Pontoise (France); Farrokh Sassani, John D. W. Madden, The Univ. of British Columbia (Canada) . . . . . [9430-44]

Coffee Break . . . . Wed 3:00 pm to 3:30 pm

CONFERENCE 9431

Sessions 10A and 10B run concurrently.

SESSION 10A

LOCATION: ROYAL PALM FIVE  
WED 1:40 PM TO 3:00 PM

Energy Harvesting and Scavenging: General Piezoelectrics

Session Chairs: **Norbert Schwesinger**, Technische Univ. München (Germany); **Soobum Lee**, Univ. of Maryland, Baltimore County (USA)

1:40 pm: **Validating the predictive capability of a stochastic analytical model for a piezoelectric energy harvester under non-stationary random vibration**, Heonjun Yoon, Seoul National Univ. (Korea, Republic of); Miso Kim, Choon-Su Park, Korea Research Institute of Standards and Science (Korea, Republic of); Byung D. Youn, Seoul National Univ. (Korea, Republic of) [9431-47]

2:00 pm: **Embedded piezoelectrics for sensing and energy harvesting in total knee replacement units**, Brooke E. Wilson, Tennessee Technological Univ. (USA); Michael Meneghini, IU Health (USA); Steven R. Anton, Tennessee Technological Univ. (USA) . . . . . [9431-48]

2:20 pm: **Cell-structured wideband piezoelectric energy harvester for low-frequency application with synthesized force-displacement characteristics**, Arata Masuda, Yasuhiro Hiraki, Naoto Ikeda, Takeru Sato, Kyoto Institute of Technology (Japan) . . . . . [9431-49]

2:40 pm: **A mechanical solution of the self-powered SSHI interface for piezoelectric energy harvesting systems**, Haili Liu, Juanjuan Zhu, Junrui Liang, ShanghaiTech Univ. (China) . . . . . [9431-50]

Coffee Break . . . . Wed 3:00 pm to 3:30 pm

SESSION 10B

LOCATION: ROYAL PALM ONE  
WED 1:40 PM TO 3:00 PM

Modeling, Optimization, Signal Processing, Sensing, Control, and Design of Integrated Systems I

Session Chairs: **Roger Ohayon**, Conservatoire National des Arts et Métiers (France); **Farhan S. Gandhi**, Rensselaer Polytechnic Institute (USA)

1:40 pm: **Harnessing intrinsic localized mode behaviors as indicators of damage**, Manoj Thota, Ryan L. Harné, Kon-Well Wang, Univ. of Michigan (USA) . . . . . [9431-51]

2:00 pm: **Modeling and identification of nonlinear electroelastic and dissipative parameters for PZT-5A and PZT-5H bimorphs: a dynamical systems approach**, Stephen M. Leadham, Brian Ferri, Alper Erturk, Georgia Institute of Technology (USA) . . . . . [9431-52]

2:20 pm: **Design optimization of a magnetorheological brake in powered knee orthosis**, Hao Ma, Wei-Hsin Liao, The Chinese Univ. of Hong Kong (Hong Kong, China) . . . . . [9431-53]

2:40 pm: **Bistability, autowaves, and dissipative structures in semiconductor fibers with anomalous electrical properties**, Eduard Karpov, Michelle Chen, Univ. of Illinois at Chicago (USA) . . [9431-54]

Coffee Break . . . . Wed 3:00 pm to 3:30 pm

CONFERENCE 9434

SESSION 8

LOCATION: ROYAL PALM THREE  
WED 1:30 PM TO 3:10 PM

**Fabrication and Characterization II**

Session Chair: **Sang H. Choi**, NASA Langley Research Ctr. (USA)

1:30 pm: **Mechanoluminescent torque transducer integrated with cost-effective luminescent sensor and UV diode**, Gi-Woo Kim, Kyungpook National Univ. (Korea, Republic of) . . . . . [9434-34]

1:50 pm: **Synthesis of hybrid cellulose nanocomposite bonded with dopamine-SiO<sub>2</sub>/TiO<sub>2</sub> and its antimicrobial activity**, Siva Ramesh, Jaehwan Kim, Joo-Hyung Kim, Inha Univ. (Korea, Republic of) . . . [9434-35]

2:10 pm: **Synthesis and characterization of iron oxide-cellulose nanocomposite and its anti-microbial test**, Seongcheol Mun, Mithilesh Yadav, Joo-Hyung Kim, Jaehwan Kim, Inha Univ. (Korea, Republic of)[9434-36]

2:30 pm: **Towards rhombohedral SiGe epitaxy on 6" c-plane sapphire substrates**, Adam J. Duzik, National Institute of Aerospace (USA); Sang H. Choi, NASA Langley Research Ctr. (USA); Yeonjoon Park, National Institute of Aerospace (USA); Glen C. King, NASA Langley Research Ctr. (USA) . . . . . [9434-37]

2:50 pm: **Bismuth-induced surface structure and morphology in III-V semiconductors**, Adam J. Duzik, National Institute of Aerospace (USA) . . . . . [9434-38]

Conference End.

CONFERENCE 9435

Sessions 9A and 9B run concurrently.

SESSION 9A

LOCATION: PACIFIC SALON SIX  
WED 1:20 PM TO 3:00 PM

**SHM of Concrete Structures**

Session Chairs: **Neil A. Hoult**, Queen's Univ. (Canada); **Hui Li**, Harbin Institute of Technology (China)

1:20 pm: **FE model updating of a full-scale five-story reinforced concrete building tested on NEES-UCSD shake table**, Rodrigo Astroza, Hamed Ebrahimiyan, Joel P. Conte, Univ. of California, San Diego (USA) . . . . . [9435-42]

1:40 pm: **Development of a relationship between external measurements and reinforcement stress**, Neil A. Hoult, Andre Brault, Queen's Univ. (Canada); Janet M. Lees, Univ. of Cambridge (United Kingdom) . . . . . [9435-43]

2:00 pm: **Multifractal analysis of two-dimensional images for damage assessment of reinforced concrete structures**, Arvin Ebrahimkhanlou, Alireza Farhidzadeh, Salvatore Salamone, Univ. at Buffalo (USA) . . . . . [9435-44]

2:20 pm: **The qualitative identification of void at interface of concrete-filled steel tube by the acceleration sensors monitoring information**, Shengshan Pan, Hailiang Zhao, Jian Mao, Dalian Univ. of Technology (China) . . . . . [9435-45]

2:40 pm: **Electromechanical admittance-based damage monitoring of concrete structures using wirelessly connected PZT sensors**, Costas P. Providakis, E. Kampianakis, Maristella Voutetaki, John Tsompanakis, Maria Stavroulaki, John Agadakos, Technical Univ. of Crete (Greece); George Pentas, Technological Educational Institute of Crete (Greece); Stavros Tsistrakis, Technical Univ. of Crete (Greece) . [9435-46]

Coffee Break . . . . Wed 3:00 pm to 3:30 pm

SESSION 9B

LOCATION: PACIFIC SALON FOUR  
WED 1:20 PM TO 3:00 PM

**Advances in Wireless Sensors for SHM**

Session Chairs: **Faramarz Gordaninejad**, Univ. of Nevada, Reno (USA); **Jerome P. Lynch**, Univ. of Michigan (USA)

1:20 pm: **Development of Arduino based wireless control system**, Zhuoxiong Sun, Shirley J. Dyke, Francisco Pena, Alana Wilbee, Purdue Univ. (USA) . . . . . [9435-47]

1:40 pm: **A wireless magnetorheological elastomer sensor system**, Nima Ghafoorianfar, David Mar, Nelson G. Publicover, Faramarz Gordaninejad, Univ. of Nevada, Reno (USA) . . . . . [9435-48]

2:00 pm: **Wireless ultrasound pitch-catch sensor powered by microwave energy**, Farshad Zahedi, Jun Yao, Haiying Huang, The Univ. of Texas at Arlington (USA) . . . . . [9435-49]

2:20 pm: **Packet loss compensation of Wi-Fi-based wireless sensor networks**, Yan Yu, Feng Han, Dalian Univ. of Technology (China); Yuequan Bao, Harbin Institute of Technology (China); Jinping Ou, Dalian Univ. of Technology (China) . . . . . [9435-50]

2:40 pm: **Cable force monitoring system of cable stayed bridges using accelerometers inside mobile smart phone**, Xuefeng Zhao, Yan Yu, Weitong Hu, Dong Jiao, Ruicong Han, Xingquan Mao, Mingchu Li, Dalian Univ. of Technology (China); Jinping Ou, Dalian Univ. of Technology (China) and Harbin Institute of Technology (China) . . . . . [9435-51]

Coffee Break . . . . Wed 3:00 pm to 3:30 pm

CONFERENCE 9437

SESSION 9

LOCATION: ROYAL PALM FOUR  
WED 1:20 PM TO 3:00 PM

**Modeling and Simulation Techniques for SHM/NDE III**

Session Chairs: **Andrew L. Gyekenyesi**, Ohio Aerospace Institute (USA); **Peter J. Shull**, The Pennsylvania State Univ. (USA)

1:20 pm: **A signal-to-noise weighted neural network approach to structural health monitoring under uncertainty**, Hessamodin Teimouri, Abbas S. Milani, Rudolf J. Seethaler, The Univ. of British Columbia (Canada) . . . . . [9437-37]

1:40 pm: **Using a general purpose finite element approach to attain higher fidelity rotordynamic analyses**, Andrew L. Gyekenyesi, Ohio Aerospace Institute (USA) and NASA Glenn Research Ctr. (USA); Adam C. Wroblewski, Cleveland State Univ. (USA) . . . . . [9437-38]

2:00 pm: **Nonlinear dynamics and health monitoring of 6-DOF breathing cracked Jeffcott rotor**, Jie Zhao, Schlumberger Ltd. (USA); Hans DeSmidt, The Univ. of Tennessee Knoxville (USA) . . . . . [9437-39]

2:20 pm: **Finite element modeling, numerical calculation, and experimental researches for evaluating the seismic stability of the power units of Ukrainian nuclear power plants**, Volodymyr V. Skliarov, National Scientific Ctr. "Institute of Metrology" (Ukraine) . . . . . [9437-40]

2:40 pm: **Nonlinear structural finite element model updating and uncertainty quantification**, Hamed Ebrahimiyan, Rodrigo Astroza, Joel P. Conte, Univ. of California, San Diego (USA) . . . . . [9437-41]

Coffee Break . . . . Wed 3:00 pm to 3:30 pm

CONFERENCE 9438

SESSION 10

LOCATION: ROYAL PALM SIX  
WED 1:20 PM TO 3:00 PM

**Civil Structure Monitoring: Building, Bridge, and Tower**

Session Chairs: **Christopher Niezrecki**, Univ. of Massachusetts Lowell (USA); **Henrique L. Reis**, Univ. of Illinois at Urbana-Champaign (USA)

1:20 pm: **Output-only identification of civil structures using nonlinear finite element model updating**, Hamed Ebrahimiyan, Rodrigo Astroza, Joel P. Conte, Univ. of California, San Diego (USA) . . . . . [9438-43]

1:40 pm: **Linear and nonlinear characterization of weathering damage in limestone claddings**, Henrique L. Reis, Megan E. McGovern, Univ. of Illinois at Urbana-Champaign (USA) . . . . . [9438-44]

2:00 pm: **Kalman filter based data fusion for neutral axis tracking in wind turbine towers**, Rohan N. Soman, Polish Academy of Sciences (Poland); Pawel H. Malinowski, The Szwalski Institute of Fluid-Flow Machinery (Poland); Uwe Paulsen, Technical Univ. of Denmark (Denmark); Wieslaw M. Ostachowicz, The Szwalski Institute of Fluid-Flow Machinery (Poland) and Warsaw Univ. of Technology (Poland) . . . . [9438-45]

2:20 pm: **Quantitative evaluation of rejuvenator to restore embrittlement temperatures to oxidized asphalt concrete using acoustic emission**, Henrique L. Reis, Nicholas Farace, Lingqian Xie, Zhe Sun, Jacob W. Arnold, Behzad Behnia, William G. Buttlar, Univ. of Illinois at Urbana-Champaign (USA) . . . . . [9438-46]

2:40 pm: **Phase-shifted helical long-period grating-based temperature-insensitive optical fiber twist sensors**, Gao Ran, Jiang Yi, Beijing Institute of Technology (China); Yinian Zhu, Sridhar Krishnaswamy, Northwestern Univ. (USA) . . . . . [9438-47]

Coffee Break . . . . Wed 3:00 pm to 3:30 pm



CONFERENCE 9429

SESSION 12

LOCATION: SUNRISE  
WED 3:40 PM TO 4:20 PM

**Biomaterials III**

Session Chair: **Masatsugu Shimomura**, Chitose Institute of Science and Technology (Japan)

3:40 pm: **Mechanical reinforcement of (bio)organic materials with inorganics through vapor phase processing**, Mato Knez, Keith Gregorczyk, Ana Zuzuarregui, CIC nanoGUNE Consolider (Spain)[9429-38]

4:00 pm: **A bio-inspired spider web**, Lingyue Zheng, Alex Hertman, Majid Behrooz, Faramarz Gordaninejad, Univ. of Nevada, Reno (USA) . . . . . [9429-39]

PANEL DISCUSSION

LOCATION: SUNRISE  
4:20 PM TO 5:40 PM

**Biomimicry, Bioinspiration, and the San Diego Zoo**

Panel Moderator: **Mato Knez**, CIC nanoGUNE Consolider (Spain); **Akhlesh Lakhtakia**, The Pennsylvania State Univ. (USA)  
Panelists: **Diana C. Skigin**, Univ. de Buenos Aires (Argentina); **Franziska Schenk**, Birmingham City Univ. (United Kingdom); **Elmar Kroner**, Leibniz-Institut für Neue Materialien gGmbH (Germany); **Jaavan Chahl**, Defence Science and Technology Organisation (Australia); **David Kisailus**, Univ. of California, Riverside (USA)

SPIE and the SS/NDE symposium have partnered with the San Diego Zoo to promote the value of biomimicry as a paradigm for engineering research and practice. A representative from the San Diego Zoo will introduce the audience to an 'animal ambassador' and explain some of the remarkable features that can provide inspiration for the work of engineers and scientists. Panelists will discuss the current state of bioinspiration in the research lab, design challenges, and future solutions. This panel is open for all attendees and will focus on all aspects of engineered biomimicry, including education, awareness, applications, research, and funding sources. More information on page 10.

Conference End.

CONFERENCE 9430

Sessions 8A and 8B run concurrently.

SESSION 8A

LOCATION: TOWN AND COUNTRY BALLROOM

WED 3:30 PM TO 5:50 PM

**New EAP Materials, Processes, and Fabrication Techniques**

Session Chairs: **Cédric Plesse**, Univ. de Cergy-Pontoise (France); **Yoseph Bar-Cohen**, Jet Propulsion Lab. (USA)

3:30 pm: **Bistable, giant, and high-speed actuation with dielectric elastomers (Invited Paper)**, Siegfried G. Bauer, Johannes Kepler Univ. Linz (Austria) . . . . . [9430-45]

4:10 pm: **Solvent and electrolyte effects in PPyDBS free standing films**, Rudolf Kiefer, Univ. of Tartu (Estonia); Jose G. Martinez-Gil, Toribio Fernández Otero, Univ. Politécnica de Cartagena (Spain); Friedrich Kaasik, Matis Harjo, Alvo Aabloo, Univ. of Tartu (Estonia) . . . . . [9430-46]

4:30 pm: **Super soft silicone elastomers with high permittivity**, Frederikke B. Madsen, Liyun Yu, Anders E. Daugaard, Søren Hvilsted, Anne L. Skov, Technical Univ. of Denmark (Denmark) . . . . . [9430-47]

4:50 pm: **Simple casting based fabrication of PEDOT:PSS-PVDF-ionic liquid soft actuators**, Aiva Simate, LAAS-CNRS (France) and INSA-Toulouse (France); Bertrand Tondou, INSA-Toulouse (France) and LAAS-CNRS (France); Emeline Descamps, Philippe Soueres, Christian Bergaud, LAAS-CNRS (France) . . . . . [9430-48]

5:10 pm: **Three dimensional responsive structure of tough hydrogels**, Xuxu Yang, Xiaoqiang Huang, Chi Li, Yuhua Xie, Yongbin Jin, Junjie Liu, Tiefeng Li, Zhejiang Univ. (China) . . . . . [9430-49]

5:30 pm: **Improved actuation strain of PDMS-based DEA materials chemically modified with softening agents**, Martin Blümke, Miriam Biedermann, Michael Wegener, Hartmut Krüger, Fraunhofer-Institut für Angewandte Polymerforschung (Germany) . . . . . [9430-50]

SESSION 8B

LOCATION: TOWNE  
WED 3:30 PM TO 5:50 PM

**Analytical Modeling and Simulations of EAP Mechanisms**

Session Chairs: **Ji Su**, NASA Langley Research Ctr. (USA); **Edwin W.H. Jager**, Linköping Univ. (Sweden)

3:30 pm: **Molecular to continuum analysis of the coupling between mechanics and electrostatics in polymer chain networks**, Gal deBotton, Noy Cohen, Ben-Gurion Univ. of the Negev (Israel) . . . . . [9430-51]

3:50 pm: **Modeling and simulation of transport phenomena in ionic gels**, Peter Leichsenring, Thomas Wallmersperger, Technische Univ. Dresden (Germany) . . . . . [9430-52]

4:10 pm: **Maximizing strain in miniaturized dielectric elastomer actuators**, Samuel Rosset, Oluwaseun A. Araromi, Herbert R. Shea, Ecole Polytechnique Fédérale de Lausanne (Switzerland) . . . . . [9430-53]

4:30 pm: **Micro-mechanics of ionic electroactive polymer actuators**, Andres Punning, Inga Pöldsalu, Friedrich Kaasik, Veiko Vunder, Alvo Aabloo, Univ. of Tartu (Estonia) . . . . . [9430-54]

4:50 pm: **Optimized design of a multilayer DEAP stack-actuator based on a finite element model**, Dominik Tepel, Thorben Hoffstadt, Jürgen Maas, Ostwestfalen-Lippe Univ. of Applied Sciences (Germany) . . . . . [9430-55]

5:10 pm: **Numerical study on 3D composite morphing actuators**, Kazuma Oishi, Nabtesco Corp. (Japan) and Univ. of Washington (USA); Makoto Saito, Nabtesco Corp. (Japan); Minoru Taya, Univ. of Washington (USA) . . . . . [9430-56]

5:30 pm: **Thermo-electro-mechanical deformation of dielectric elastomer: experiment and theoretical model**, Bo Li, Lei Liu, Hualing Chen, Dichen LI, Xi'an Jiaotong Univ. (China) . . . . . [9430-57]

CONFERENCE 9431

Sessions 11A and 11B run concurrently.

SESSION 11A

LOCATION: ROYAL PALM FIVE  
WED 3:30 PM TO 5:30 PM

**Magneto Rheological Systems II**

Session Chairs: **Seung-Bok Choi**, Inha Univ. (Korea, Republic of); **Majid Behrooz**, Univ. of Nevada, Reno (USA)

3:30 pm: **Tactile device utilizing a single MR sponge to realize the sensation of human organs**, Soomin Kim, Seung-Bok Choi, Jong-Seok Oh, Inha Univ. (Korea, Republic of) . . . . . [9431-55]

3:50 pm: **Impact of viscous effects on the stroking load of magnetorheological energy absorbers**, Brian Powers, Norman M. Wereley, Univ. of Maryland, College Park (USA) . . . . . [9431-56]

4:10 pm: **Force modeling and haptic application for incision surgery into tissue**, Pyunghwa Kim, Jong-Seok Oh, Seung-Bok Choi, Inha Univ. (Korea, Republic of)[9431-57]

4:30 pm: **Optimization of new magnetorheological fluid mount for vibration control of start/stop engine mode**, Jye Ung Chung, Xuan Phu Do, Seung-Bok Choi, Inha Univ. (Korea, Republic of) . . . . . [9431-58]

4:50 pm: **Haptic cue control of an MR gear shifting assistance device via Preisach hysteresis linearization**, Young-Min Han, Ajou Motor College (Korea, Republic of); Seung-Bok Choi, Jye Ung Chung, Soomin Kim, Inha Univ. (Korea, Republic of)[9431-59]

5:10 pm: **Modeling and experimental verification of the prosthetic leg powered by MR fluid and SMA wires**, The M. Nguyen, Alan Suarez Garcia, California State Univ., Fresno (USA); Girish Barade, Schneider Electric (USA) . . . . . [9431-60]

SESSION 11B

LOCATION: ROYAL PALM ONE  
WED 3:30 PM TO 5:30 PM

**Piezo-based Materials and Systems**

Session Chair: **Jiong Tang**, Univ. of Connecticut (USA)

3:30 pm: **Large deformation of thin smart beams with piezoelectric patches under electro-mechanical actuations**, Vahid Tajeddini, Anastasia Muliana, Texas A&M Univ. (USA) . . . . . [9431-61]

3:50 pm: **Nonlinear vibration analysis of the high-efficiency compressive-mode piezoelectric energy harvester**, Zhengbao Yang, Jean Zu, Univ. of Toronto (Canada) . . . . . [9431-117]

4:10 pm: **Removing surface accretions with piezo-excited high-frequency structural waves**, Michal K. Kalkowski, Emiliano Rustighi, Timothy P. Waters, Univ. of Southampton (United Kingdom) [9431-63]

4:30 pm: **Hierarchical compact piezoelectric tripod manipulator**, Tae-Won Na, Ilkwon Oh, KAIST (Korea, Republic of); JunHo Choi, Korea Advanced Institute of Science (Korea, Republic of) . . . . . [9431-64]

4:50 pm: **Multiobjective optimization of piezoelectric bimorph actuator with rigid extension**, Nilanjan Chatteraj, Ranjan Ganguli, Indian Institute of Science (India) . . . . . [9431-65]

5:10 pm: **Effect of material uncertainties on dynamic analysis of piezoelectric fans**, Sujoy Mukherjee, PDPM Indian Institute of Information Technology, Design and Manufacturing Jabalpur (India); Swapnil Srivastava, Indian Institute of Information Technology (India); Shubham Kumar Yadav, Indian Institute of Information Technology, Design and Manufacturing Jabalpur (India) . . . . . [9431-66]

**CONFERENCE 9435**

Sessions 10A and 10B run concurrently.

**SESSION 10A**

**LOCATION: PACIFIC SALON SIX  
WED 3:30 PM TO 5:30 PM**

**Nanoengineered Thin  
Film Sensors II**

Session Chairs: **Bryan R. Loyola**, Sandia National Labs. (USA); **Jerome P. Lynch**, Univ. of Michigan (USA)

3:30 pm: **Characterization of the electrical properties of individual multi-walled carbon nanotubes**, Kevin Sahlín, Sandia National Labs. (USA) and Stanford Univ. (USA); Raymond Friddle, Karen L. Krafcik, Bryan R. Loyola, Sandia National Labs. (USA) . . . . . [9435-52]

3:50 pm: **Nanoscale optimization of ultrasonic dispersion of multi-walled carbon nanotubes in polyelectrolyte aqueous solution**, William Huang, Univ. of California, San Diego (USA) and Sandia National Labs. (USA); Raymond Friddle, Karen L. Krafcik, Bryan R. Loyola, Sandia National Labs. (USA) . . . . . [9435-53]

4:10 pm: **A remote-readable graphene-oxide (GO) based tamper-evident seal with self-reporting and self-authentication capabilities**, Alessandro Cattaneo, Jason A. Bossert, Gautam Gupta, Geraldine M. Purdy, Joseph H. Dumont, Aditya Mohite, Karen A. Miller, David D. L. Mascarenas, Los Alamos National Lab. (USA) . . . . . [9435-54]

4:30 pm: **Development and characterization of polyvinylidene fluoride-polyaniline films for supercapacitor applications**, Jayanth Kumar, Anjana Jain, National Aerospace Labs. (India) . . [9435-55]

4:50 pm: **Self-sensing properties of smart composite based on embedded buckypaper layer**, Zhichun Zhang, Hanqing Wei, Yanju Liu, Jinsong Leng, Harbin Institute of Technology (China) . . . . . [9435-56]

5:10 pm: **Algorithm for decomposition of additive strain from dense network of thin film sensors**, Austin R. J. Downey, Hussam S. Saleem, Simon Laflamme, Iowa State Univ. (USA) . . . . . [9435-57]

**SESSION 10B**

**LOCATION: PACIFIC SALON FOUR  
WED 3:30 PM TO 5:30 PM**

**Advanced Ultrasonic  
Methods for SHM II**

Session Chairs: **Wieslaw M. Ostachowicz**, The Szwedowski Institute of Fluid-Flow Machinery (Poland); **Francesco Lanza di Scalea**, Univ. of California, San Diego (USA)

3:30 pm: **Non-contact ultrasonic guided wave inspection of rails: field test results and updates**, Stefano Mariani, Thompson V. Nguyen, Francesco Lanza di Scalea, Univ. of California, San Diego (USA); Mahmood Fateh, Federal Railroad Administration (USA) . . . . . [9435-58]

3:50 pm: **Impact induced delamination detection and quantification with guided wavefield analysis**, Zhenhua Tian, Univ. of South Carolina (USA); Cara A. C. Leckey, NASA Langley Research Ctr. (USA); Lingyu Yu, Univ. of South Carolina (USA); Jeffrey P. Seebo, Analytical Mechanics Associates, Inc. (USA) . . . . . [9435-59]

4:10 pm: **Effects of structure thickness on ultrasound generation and sensing using bonded PWASs**, Md. Mazharul Islam, Haiying Huang, The Univ. of Texas at Arlington (USA) . . . . . [9435-60]

4:30 pm: **Structural damage identification using piezoelectric impedance and Bayesian inference**, Qi Shuai, Kai Zhou, Jiong Tang, Univ. of Connecticut (USA) . . . . . [9435-61]

4:50 pm: **Spira Mirabilis: a shaped piezoelectric sensor for impact localization**, Luca De Marchi, Nicola Testoni, Alessandro Marzani, Univ. degli Studi di Bologna (Italy) . . . . . [9435-62]

5:10 pm: **Influence of higher harmonics in time reversed Lamb wave generated and sensed using de-bonded piezoelectric wafers**, Bijudas C. R., Indian Institute of Space Science and Technology (India); Navaneetha K. J., Indian Institute of Space Science and Technology (India) . [9435-63]

**CONFERENCE 9437**

**SESSION 10**

**LOCATION: ROYAL PALM FOUR  
WED 3:30 PM TO 5:50 PM**

**Vibration-Based SHM/  
NDE I**

Session Chairs: **Akira Sasamoto**, National Institute of Advanced Industrial Science and Technology (Japan); **Didem Ozevin**, Univ. of Illinois at Chicago (USA)

3:30 pm: **A novel approach of damage detection using field measurement data of the Ironton-Russell bridge**, Fan Zhang, Mehdi Norouzi, Victor J. Hunt, Arthur Helmicki, Univ. of Cincinnati (USA) [9437-42]

3:50 pm: **Evaluation of bridges by recovered curvature data from responses due to moving truck loading**, Chih-Peng Yu, Chia-Chi Cheng, Chih-Hung Chiang, Ying-Tzu Ke, Keng-Tsang Hsu, Chaoyang Univ. of Technology (Taiwan) . . . [9437-43]

4:10 pm: **Health assessment of a multi-storey shear structure using modal curvature method and genetic algorithm**, S. K. Panigrahi, Ajay Chourasia, S. K. Bhattacharyya, Central Building Research Institute (India) . . . . . [9437-44]

4:30 pm: **Damage assessment of the Truss system with uncertainty using frequency response function based damage identification method**, Jie Zhao, Schlumberger Ltd. (USA); Hans DeSmidt, The Univ. of Tennessee Knoxville (USA) [9437-45]

4:50 pm: **Mass and stiffness estimation using mobile devices for structural health monitoring**, Viet Q. Le, Tzu Yang Yu, Univ. of Massachusetts Lowell (USA) . . . . [9437-46]

5:10 pm: **Time frequency analyses of vibrations of wind turbine towers**, Chih-Hung Chiang, Keng-Tsang Hsu, Chi-Lung Huang, Chia-Chi Cheng, Chih-Peng Yu, Chaoyang Univ. of Technology (Taiwan) . . . . . [9437-48]

5:30 pm: **Estimation of dynamic characteristics of artificial and natural approaches**, Minsun Kim, Byungkwan Oh, Tongjun Cho, Yousok Kim, Hyo Seon Park, Yonsei Univ. (Korea, Republic of) . [9437-49]

**CONFERENCE 9438**

**SESSION 11**

**LOCATION: ROYAL PALM SIX  
WED 3:30 PM TO 6:10 PM**

**Metamaterial and  
Periodic Structures II**

Session Chairs: **Guoliang Huang**, Univ. of Arkansas at Little Rock (USA); **Tadeusz Uhl**, AGH Univ. of Science and Technology (Poland)

3:30 pm: **Nonlinear wave propagation in origami-based mechanical metamaterials**, Hiromi Yasuda, Jinkyu Yang, Univ. of Washington (USA) . . . . . [9438-48]

3:50 pm: **GPU accelerated variational methods for fast phononic eigenvalue solutions**, Ankit Srivastava, Illinois Institute of Technology (USA) . . . . . [9438-49]

4:10 pm: **Dynamically tunable metamaterials based on helical photonic crystals**, Jinkyu Yang, Feng Li, Univ. of Washington (USA) . . . . . [9438-50]

4:30 pm: **Anisotropic mass density by three-dimensional elastic metamaterials**, Edahi A. Gutiérrez-Reyes, Ana L. González, Felipe Pérez-Rodríguez, Benemérita Univ. Autónoma de Puebla (Mexico) . . [9438-51]

4:50 pm: **Complete band gaps in an anti-symmetric piezoelectric phononic crystal slab**, Kwai Zou, Yuesheng Wang, Beijing Jiaotong Univ. (China) . . . . . [9438-52]

5:10 pm: **Nonlinear stress wave dispersion in elastic woodpile metamaterials**, Eunho Kim, Noel Y. H. Kim, Jinkyu Yang, Univ. of Washington (USA) . . . . . [9438-53]

5:30 pm: **Variational methods in phononics**, Yan Lu, Ankit Srivastava, Illinois Institute of Technology (USA) . . . [9438-54]

5:50 pm: **Design method for Hyper-elastic cloak with arbitrary configuration**, Dengke Guo, Gengkai Hu, Beijing Institute of Technology (China) . . . . . [9438-85]

**CONFERENCE 9430**

Electroactive Polymer Actuators and Devices (EAPAD) XVII

**CONFERENCE 9431**

Active and Passive Smart Structures and Integrated Systems IX

**CONFERENCE 9435**

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

**Thursday Plenary Session**

**THU 8:10 AM TO 9:10 AM**  
**LOCATION: TOWN AND COUNTRY BALLROOM**

**8:10 TO 8:25 AM:**

- SPIE/ASME Best Student Paper Award
- Bioinspiration, Biomimetics, and Bioreplication Best Student Paper Award: In Memory of H. Don Wolpert



**Smart Sensors and Actuators: From Concepts to Products (Plenary)**, Shiv Joshi, NextGen Aeronautics, Inc. (USA) . . . [9429-504]

Sessions 9A, 9B and 9C run concurrently.

Sessions 12A and 12B run concurrently.

Sessions 11A and 11B run concurrently.

**SESSION 9A**

**LOCATION: TOWN AND COUNTRY BALLROOM**  
**THU 9:20 AM TO 12:10 PM**

**Applications of EAP Materials I**

Session Chairs: **Gal deBotton**, Ben-Gurion Univ. of the Negev (Israel); **Vahid Khoshkava**, McGill Univ. (Canada)

9:20 am: **Applications of piezoelectric polymers in electrical power generation using ocean waves (Invited Paper)**, Ji Su, NASA Langley Research Ctr. (USA); Hiroshi Asanuma, Chiba Univ. (Japan) . . . [9430-58]

Coffee Break . . . Thu 10:00 am to 10:30 am

**SESSION 9B**

**LOCATION: TOWNE**  
**THU 9:20 AM TO 10:00 AM**

**SMP and Other EAP Materials**

Session Chairs: **Seyed Mohammad Mirvakili**, Massachusetts Institute of Technology (USA); **Thomas Wallmersperger**, Technische Univ. Dresden (Germany)

9:20 am: **A beam-power splitter membrane based on shape memory micropattern**, Peng Li, Yu Han, Wenxing Wang, Peng Jin, Yanju Liu, Jinsong Leng, Harbin Institute of Technology (China) . . . [9430-64]

9:40 am: **Low-voltage driven ionic polymer actuators composed of nanostructured block copolymers and ionic liquids**, Onnuri Kim, Moon Jeong Park, Pohang Univ. of Science and Technology (Korea, Republic of) . . . [9430-65]

Coffee Break . . . Thu 10:00 am to 10:30 am

**SESSION 12A**

**LOCATION: ROYAL PALM FIVE**  
**THU 9:20 AM TO 10:20 AM**

**Modeling, Optimization, Signal Processing, Sensing, Control, and Design of Integrated Systems II**

Session Chair: **Francesco Ripamonti**, Politecnico di Milano (Italy)

9:20 am: **Multifunctional magneto-plasmonic nano-transducers for advanced theranostics: synthesis, modeling and experiment**, Ya S. Wang, Masoud Masoumi, Stony Brook Univ. (USA) . . . [9431-122]

9:40 am: **Active noise control with fast delay-less convolution implemented on rapid control prototyping system**, Delf Sachau, Helmut-Schmidt Univ. (Germany) . . . [9431-68]

10:00 am: **A smart model of a long-span suspended bridge for wind tunnel tests**, Simone Cinquemani, Diana Giorgio, Lorenzo Fossati, Francesco Ripamonti, Politecnico di Milano (Italy) . . . [9431-69]

Coffee Break . . . Thu 10:20 am to 10:50 am

**SESSION 12B**

**LOCATION: ROYAL PALM ONE**  
**THU 9:20 AM TO 10:20 AM**

**Passive and Active Vibration Isolation Systems II**

Session Chair: **Steven R. Anton**, Tennessee Technological Univ. (USA)

9:20 am: **Electromagnetic damper design using a multiphysics approach**, Alessandro Stabile, Guglielmo S. Aglietti, Univ. of Surrey (United Kingdom) . . . [9431-70]

9:40 am: **Optimal resource allocation to multiple piezoelectric patches and inductors for SSDI vibration suppression**, Shigeru Shimose, Junjiro Onoda, Japan Aerospace Exploration Agency (Japan) . . . [9431-71]

10:00 am: **Vibration of cantilever piezolaminated beam with extension and shear mode piezo actuators**, Kamalkishor M. Bajoria, Rajan L. Wankhade, Indian Institute of Technology Bombay (India) . . . [9431-72]

Coffee Break . . . Thu 10:20 am to 10:50 am

**SESSION 11A**

**LOCATION: PACIFIC SALON SIX**  
**THU 9:20 AM TO 10:00 AM**

**Human and Humanoid Sensing and Actuation**

Session Chairs: **Genda Chen**, Missouri Univ. of Science and Technology (USA); **Donghyeon Ryu**, New Mexico Institute of Mining and Technology (USA)

9:20 am: **Recognition of human activities using depth images of Kinect for biofied building**, Ami Ogawa, Akira Mita, Keio Univ. (Japan) . . . [9435-64]

9:40 am: **The smart Peano fluidic muscle: a low profile flexible orthosis actuator that feels pain**, Allan J. Veale, The Univ. of Auckland (New Zealand) and Auckland Bioengineering Institute (New Zealand); Sheng Quan Xie, The Univ. of Auckland (New Zealand); Iain A. Anderson, Auckland Bioengineering Institute (New Zealand) and The Univ. of Auckland (New Zealand) and StretchSense (New Zealand) . . . [9435-65]

Coffee Break . . . Thu 10:00 am to 10:30 am



**CONFERENCE 9437**

Structural Health Monitoring and Inspection of Advanced Materials, Aerospace, and Civil Infrastructure IX

**CONFERENCE 9438**

Health Monitoring of Structural and Biological Systems IX

**Thursday Plenary Session**

**THU 8:10 AM TO 9:10 AM**  
**LOCATION: TOWN AND COUNTRY BALLROOM**

**8:10 TO 8:25 AM:**

- **SPIE/ASME Best Student Paper Award**
- **Bioinspiration, Biomimetics, and Bioreplication Best Student Paper Award: In Memory of H. Don Wolpert**



**Smart Sensors and Actuators: From Concepts to Products** (*Plenary*), Shiv Joshi, NextGen Aeronautics, Inc. (USA) . . . [9429-504]

Sessions 11A and 11B run concurrently.

Sessions 11A Panel Discussion and 11B run concurrently.

Sessions 12A and 12B run concurrently.

**SESSION 11B**

**LOCATION: PACIFIC SALON FOUR**  
**THU 9:20 AM TO 10:00 AM**

**Control of Wind Turbines**

Session Chairs: **Simon Laflamme**, Iowa State Univ. (USA); **Wei Song**, The Univ. of Alabama (USA)

9:20 am: **A wind turbine hybrid simulation framework considering aeroelastic effects**, Wei Song, Weihua Su, The Univ. of Alabama (USA) . . . . . [9435-66]

9:40 am: **Adaptive pitch control of wind turbines to mitigate loads**, Yuan Yuan, Jiong Tang, Univ. of Connecticut (USA) . . . . . [9435-67]

Coffee Break . . . Thu 10:00 am to 10:30 am

**SESSION 11A**

**PANEL DISCUSSION**

**LOCATION: ROYAL PALM FOUR**  
**THU 9:20 AM TO 10:00 AM**

**Challenges and Opportunities for Infrastructure Inspection, Monitoring, and Repair**

*Panel Moderators:* **Tzuyang Yu**, Univ. of Massachusetts at Lowell (USA) and **Dryver Huston**, Univ. of Vermont (USA)

Coffee Break . . . Thu 10:00 am to 10:30 am

**SESSION 11B**

**LOCATION: ROYAL PALM TWO**  
**THU 9:20 AM TO 10:00 AM**

**Guided Wave I**

Session Chairs: **Nenad Gucunski**, Rutgers, The State Univ. of New Jersey (USA); **Dryver R. Huston**, The Univ. of Vermont (USA)

9:20 am: **Separation of Lamb waves modes using polarization filter for the 3D wave motion signals**, Lukasz Ambrozinski, Tadeusz Stepinski, Tadeusz Uhl, AGH Univ. of Science and Technology (Poland) . . . . . [9437-50]

9:40 am: **Corrosion damage estimation in multi-wire steel strands using guided ultrasonic waves**, Salvatore Salamone, Alireza Farhidzadeh, Univ. at Buffalo (USA) . . . . . [9437-51]

Coffee Break . . . Thu 10:00 am to 10:30 am

**SESSION 12A**

**LOCATION: ROYAL PALM SIX**  
**THU 9:20 AM TO 10:00 AM**

**Vibration-Based SHM**

Session Chairs: **Sridhar Krishnaswamy**, Northwestern Univ. (USA); **Lingyu Yu**, Univ. of South Carolina (USA)

9:20 am: **Vibration response based structural damage detection using auto correlation function**, Muyu Zhang, Rüdiger Schmidt, RWTH Aachen Univ. (Germany) . . . . . [9438-55]

9:40 am: **Application of support vector machine in damage detection process of beams**, Satish B. Satpal, Anirban Guha, Sauvik Banerjee, Indian Institute of Technology Bombay (India) . . . . . [9438-56]

Coffee Break . . . Thu 10:00 am to 10:30 am

**SESSION 12B**

**LOCATION: ROYAL PALM THREE**  
**THU 9:20 AM TO 10:00 AM**

**Composite Monitoring**

Session Chairs: **Wieslaw M. Ostachowicz**, The Szwalski Institute of Fluid-Flow Machinery (Poland); **Zhongqing Su**, The Hong Kong Polytechnic Univ. (Hong Kong, China)

9:20 am: **SHM systems in composites structural elements: summary of the main achievements in SARISTU project and follow-up scenario for next future aircrafts implementation**, Ernesto Monaco, Univ. degli Studi di Napoli Federico II (Italy); Alfonso Apicella, Alenia Aermacchi (Italy); Ulrike Heckenberger, Airbus Group Innovations (Germany) . . . . . [9438-57]

9:40 am: **Heat induced damage detection in composite materials by terahertz radiation**, Maciej Radzienski, Magdalena Mieloszyk, The Szwalski Institute of Fluid-Flow Machinery (Poland); Ehsan Kabiri Rahani, Tribikram Kundu, The Univ. of Arizona (USA); Wieslaw M. Ostachowicz, The Szwalski Institute of Fluid-Flow Machinery (Poland) . . . . . [9438-58]

Coffee Break . . . Thu 10:00 am to 10:30 am

CONFERENCE 9430

Sessions 9A, 9B and 9C run concurrently.

SESSION 9A  
CONTINUED

10:30 am: **Fiber-constrained dielectric elastomer for soft robotic actuators**, Samuel Shian, Harvard Univ. (USA); Shijie Zhu, Harvard Univ. (USA) and Fukuoka Institute of Technology (Japan); Jiangshui Huang, David R. Clarke, Harvard Univ. (USA) . . . . . [9430-59]

10:50 am: **A passive autofocus system by using standard deviation of the image on a liquid lens**, Pejman Rasti, Univ. of Tartu (Estonia); Henry Haus, Helmut F. Schlaak, Technische Univ. Darmstadt (Germany); Harti Kiveste, Gholamreza Anbarjafari, Alvo Aabloo, Rudolf Kiefer, Univ. of Tartu (Estonia). . . . . [9430-60]

11:10 am: **Soft, flexible micromanipulators comprising polypyrrole trilayer microactuators**, Alexandre Khaldi, Linköping Univ. (Sweden); Gursel Alici, Geoffrey M. Spinks, Univ. of Wollongong (Australia); Edwin W. H. Jager, Linköping Univ. (Sweden) . . . . . [9430-61]

11:30 am: **DEA for soft robotics: 1-gram actuator picks-up a 60-gram egg**, Jun Shintake, Samuel Rosset, Bryan Schubert, Stefano Mintchev, Dario Floreano, Herbert R. Shea, Ecole Polytechnique Fédérale de Lausanne (Switzerland) . . . . . [9430-62]

11:50 am: **Electroactive polymer scaffolds for cardiac tissue engineering**, Amy Gelmi, Jiabin Zhang, Artur Cieslar-Pobuda, Marek J. Los, Mehrdad Rafat, Edwin W. H. Jager, Linköping Univ. (Sweden) . . . . . [9430-63]

Lunch Break . . . . Thu 12:10 pm to 1:20 pm

SESSION 9C

LOCATION: TOWNE  
THU 10:30 AM TO 12:10 PM

**New EAP Actuators and Applications of EAP Materials**

Session Chair: **Yoseph Bar-Cohen**, Jet Propulsion Lab. (USA)

10:30 am: **Dielectric elastomer soft machines: mechanics and bionics** (*Invited Paper*), Tiefeng Li, Yuhan Xie, Chi Li, Guoyong Mao, Shaoxing Qu, Zhejiang Univ. (China) . . . . . [9430-66]

11:10 am: **Fast torsional actuators**, Seyed Mohammad Mirvakili, Massachusetts Institute of Technology (USA); Soheil Kianzad, The Univ. of British Columbia (Canada); Ian W. Hunter, Massachusetts Institute of Technology (USA); John D. W. Madden, The Univ. of British Columbia (Canada) . . . . . [9430-67]

11:30 am: **Nylon actuator operating temperature range**, Soheil Kianzad, Milind Pandit, Ali Rafiee, John D. W. Madden, The Univ. of British Columbia (Canada) [9430-68]

11:50 am: **McKibben with a twist: high torque to mass pneumatic torsional and linear artificial muscle**, Seyed Mohammad Mirvakili, Massachusetts Institute of Technology (USA); Douglas Sim, The Univ. of British Columbia (Canada); Ian W. Hunter, Massachusetts Institute of Technology (USA); John D. W. Madden, The Univ. of British Columbia (Canada). . . . . [9430-69]

Lunch Break . . . . Thu 12:10 pm to 1:20 pm

CONFERENCE 9431

Sessions 13A and 13B run concurrently.

SESSION 13A

LOCATION: ROYAL PALM FIVE  
THU 10:50 AM TO 12:10 PM

**Energy Harvesting and Scavenging: Applications**

Session Chairs: **Ryan L. Harn**, Univ. of Michigan (USA); **Lihua Tang**, The Univ. of Auckland (New Zealand)

10:50 am: **Magnetoelastic energy harvester for structural health monitoring applications**, Brittany C. Essink, Jared D. Hobeck, Daniel J. Inman, Univ. of Michigan (USA) . . . . . [9431-73]

11:10 am: **Energy harvesting from building seismic isolation**, Mincan Cao, Lei Zuo, Virginia Polytechnic Institute and State Univ. (USA) . . . . . [9431-74]

11:30 am: **Wireless vibration monitoring system powered by piezocomposite vibration energy harvester for machine condition monitoring applications**, Ryota Shimizu, Masahiro Yamaguchi, Kazuhiko Adachi, Kobe Univ. (Japan) . . . . . [9431-75]

11:50 am: **Implementation of a robust hybrid rotary-translational vibration energy harvester for autonomous self-powered acceleration measurement**, Owen R. Payne, Scott D. Moss, Defence Science and Technology Organisation (Australia). . . . . [9431-76]

Lunch Break . . . . Thu 12:10 pm to 1:40 pm

SESSION 13B

LOCATION: ROYAL PALM ONE  
THU 10:50 AM TO 12:10 PM

**Passive and Active Vibration Isolation Systems III**

Session Chair: **Hiroshi Asanuma**, Chiba Univ. (Japan)

10:50 am: **Earthquake response reduction of mid-story isolated system due to semi-active control using magnetorheological rotary inertia mass damper**, Mai Ito, Shohei Yoshida, Hideo Fujitani, Kobe Univ. (Japan). . . . . [9431-77]

11:10 am: **Bistable oscillator for efficient target energy transfer**, Bing C. Chen, Teledyne Scientific Co. (USA) . . . . [9431-78]

11:30 am: **Gradient non-reflective layered media for isolation**, Alireza V. Amirkhizi, Univ. of Massachusetts, Lowell (USA) . . . . . [9431-79]

11:50 am: **Research on seismic performance of slotted RC shear walls with replaceable damper**, Jian Wang, Harbin Institute of Technology (China) . . . . . [9431-80]

Lunch Break . . . . Thu 12:10 pm to 1:40 pm

CONFERENCE 9435

Sessions 12A and 12B run concurrently.

SESSION 12A

LOCATION: PACIFIC SALON SIX  
THU 10:30 AM TO 11:50 AM

**Fiber Optic Sensing Technology**

Session Chairs: **Haiying Huang**, The Univ. of Texas at Arlington (USA); **Branko Glisic**, Princeton Univ. (USA)

10:30 am: **Seven-year-long crack detection monitoring by Brillouin-based fiber optic strain sensor**, Michio Imai, Kajima Technical Research Institute (Japan). . . . . [9435-68]

10:50 am: **Pipeline corrosion assessment using embedded Fiber Bragg grating sensors**, Liang Xiao, Ying Huang, Sahar A. Galedari, Fardad Azarmi, North Dakota State Univ. (USA) . . . . . [9435-69]

11:10 am: **Damage monitoring of CFRP retrofits using triboluminescent optical fiber sensors**, Kunal S. Joshi, High Performance Materials Institute (USA) and Florida State Univ. (USA); David O. Olawale, Florida State Univ. (USA) and High Performance Materials Institute (USA); Okenwa O. Okoli, Florida State Univ. (USA); Tarik J. Dickens, Florida State Univ. (USA) and High Performance Materials Institute (USA) . . . . . [9435-70]

11:30 am: **Evaluation of the use of fiber optic sensors in identification of fresco fracturing patterns**, Branko Glisic, Dorotea H. Sigurdardottir, David Dobkin, Princeton Univ. (USA) . . . . . [9435-71]

Lunch Break . . . . Thu 11:50 am to 1:20 pm

**CONFERENCE 9437**

Sessions 12A and 12B run concurrently.

**SESSION 12B**

**LOCATION: PACIFIC SALON FOUR  
THU 10:30 AM TO 11:50 AM**

**Vision-based Sensing Technologies**

Session Chairs: **Chih Chen Chang**, Hong Kong Univ. of Science and Technology (Hong Kong, China); **Daniele Zonta**, Univ. degli Studi di Trento (Italy)

10:30 am: **Hyperspectral imaging utility for transportation systems**, Raj Bridgelall, J. Bruce Rafert, Denver Tolliver, North Dakota State Univ. (USA)..... [9435-72]

10:50 am: **A digital sampling Moiré method for two-dimensional displacement measurement**, Xinxing Chen, Chih-Chen Chang, Hong Kong Univ. of Science and Technology (Hong Kong, China) .. [9435-73]

11:10 am: **Strain characterization of embedded aerospace smart materials using shearography**, Andrei G. Anisimov, Bernhard Müller, Jos Sinke, Roger M. Groves, Technische Univ. Delft (Netherlands)..... [9435-74]

11:30 am: **Stereovision-based method for the whole process of collapse measurement of a three-floor frame model under earthquake excitation**, Baohua Shan, Wenting Yuan, Harbin Institute of Technology (China) ... [9435-75]

Lunch Break . . . . Thu 11:50 am to 1:20 pm

**SESSION 12A**

**LOCATION: ROYAL PALM FOUR  
THU 10:30 AM TO 11:50 AM**

**SHM/NDE for Civil Infrastructure I**

Session Chairs: **Zhenhua Huang**, Univ. of North Texas (USA); **Kaoshan Dai**, Tongji Univ. (China)

10:30 am: **In situ monitoring of rail squats in three dimensions using ultrasonic technique**, Sakdirat Kaewunruen, Transport for NSW (Australia) ..... [9437-52]

10:50 am: **Field investigations for rail squat defect identification using rail magnetisation technology**, Sakdirat Kaewunruen, Transport for NSW (Australia)..... [9437-53]

11:10 am: **Development of a low-cost cableless geophone and its application in a micro-seismic survey at an abandoned underground coal mine**, Kaoshan Dai, Xiaofeng Li, Tongji Univ. (China); Chuan Lu, Qingyu You, Institute of Geology and Geophysics (China); Guotang Zhang, The 2nd Geo-engineering Investigation Institute of Jiangsun Province (China); Zhenhua Huang, H. Felix Wu, Univ. of North Texas (USA) ..... [9437-54]

11:30 am: **Fuzzy cluster analysis on the health monitoring measurements of shield tunnels**, Fa Zhou, Wei Zhang, Nanjing Univ. (China)..... [9437-55]

Lunch Break . . . . Thu 11:50 am to 1:20 pm

**SESSION 12B**

**LOCATION: ROYAL PALM TWO  
THU 10:30 AM TO 11:50 AM**

**Guided Wave II**

Session Chairs: **Nenad Gucunski**, Rutgers, The State Univ. of New Jersey (USA); **Dryver R. Huston**, The Univ. of Vermont (USA)

10:30 am: **Non-destructive evaluation of coating thickness using guided waves**, Pierre-Claude Ostiguy, Nicolas Quaegebeur, Patrice Masson, Univ. de Sherbrooke (Canada) ..... [9437-56]

10:50 am: **The study of damage identification based on compressive sampling**, Wentao Wang, Peng Wang, Wensong Zhou, Hui Li, Harbin Institute of Technology (China) ..... [9437-57]

11:10 am: **Numerical and experimental demonstration of shear stress measurement at thick steel plates using acoustoelasticity**, Zeynab Abbasi, Didem Ozevin, Univ. of Illinois at Chicago (USA) ..... [9437-58]

11:30 am: **Sparse representation of guided-waves for damage diagnosis in pipelines: investigating the effects of temperature**, Matineh Eybpoosh, Mario Bergés, Hae Young Noh, Carnegie Mellon Univ. (USA) ..... [9437-59]

Lunch Break . . . . Thu 11:50 am to 1:20 pm

**CONFERENCE 9438**

Sessions 13A and 13B run concurrently.

**SESSION 13A**

**LOCATION: ROYAL PALM SIX  
THU 10:30 AM TO 11:50 AM**

**Guided Wave-Based SHM I**

Session Chairs: **Zhongqing Su**, The Hong Kong Polytechnic Univ. (Hong Kong, China); **Piervincenzo Rizzo**, Univ. of Pittsburgh (USA)

10:30 am: **Monitoring of hidden fatigue crack growth in multi-layer aircraft structures using high frequency guided waves**, Henry Chan, Univ. College London (United Kingdom); Bernard Masserey, Univ. of Applied Sciences of Fribourg (Switzerland); Paul Fromme, Univ. College London (United Kingdom)..... [9438-59]

10:50 am: **On propagation of shock waves generated under hypervelocity impact (HVI) and application to characterizing orbital debris-induced damage in space vehicles**, Menglong Liu, Zhongqing Su, The Hong Kong Polytechnic Univ. (Hong Kong, China) ..... [9438-60]

11:10 am: **Data fusion for compensation of temperature variations in Lamb-wave based SHM systems**, Ziemowit Dworakowski, Lukasz Ambrozinski, Tadeusz Stepinski, AGH Univ. of Science and Technology (Poland) ..... [9438-61]

11:30 am: **A distance-domain based localization techniques for acoustic emission sources: a comparative study**, Pawel Packo, Krzysztof Grabowski, Mateusz Gawronski, Wieslaw J. Staszewski, Tadeusz Uhl, AGH Univ. of Science and Technology (Poland); Ireneusz Baran, Cracow Univ. of Technology (Poland); Wojciech L. Spychalski, Warsaw Univ. of Technology (Poland); Tribikram Kundu, The Univ. of Arizona (USA) ..... [9438-62]

Lunch Break . . . . Thu 11:50 am to 1:20 pm

**SESSION 13B**

**LOCATION: ROYAL PALM THREE  
THU 10:30 AM TO 11:50 AM**

**Nonlinear Techniques II**

Session Chairs: **Wolfgang Grill**, ASI Analog Speed Instruments GmbH (Germany); **Sourav Banerjee**, Univ. of South Carolina (USA)

10:30 am: **Non-classical dissipative model of nonlinear crack-wave interactions used for damage detection**, Piotr Kijanka, Pawel Packo, Wieslaw J. Staszewski, Kajetan Dziedzic, AGH Univ. of Science and Technology (Poland)..... [9438-63]

10:50 am: **Perturbation approach to dispersion curves calculation for nonlinear Lamb waves**, Pawel Packo, AGH Univ. of Science and Technology (Poland) and Georgia Institute of Technology (USA); Wieslaw J. Staszewski, Tadeusz Uhl, AGH Univ. of Science and Technology (Poland); Michael J. Leamy, Georgia Institute of Technology (USA) ..... [9438-64]

11:10 am: **Detection of structural micro-cracks from macro-scale response: a validation on 3D printed parts**, Sonjoy Das, Sourish Chakravarty, Chi Zhou, Univ. at Buffalo (USA)..... [9438-65]

11:30 am: **Ultrasonic structural health monitoring of brass**, Wolfgang Grill, Julian Grill, ASI Analog Speed Instruments GmbH (Germany) ..... [9438-66]

Lunch Break . . . . Thu 11:50 am to 1:40 pm



**CONFERENCE 9430**

Sessions 10A and 10B run concurrently.

**SESSION 10A**

**LOCATION: TOWN AND COUNTRY BALLROOM  
THU 1:20 PM TO 3:00 PM**

**Applications of EAP Materials II**

Session Chairs: **Barbar J. Akle**, Lebanese American Univ. (Lebanon); **Thomas Wallmersperger**, Technische Univ. Dresden (Germany)

1:20 pm: **Modeling of a corrugated dielectric elastomer actuator for artificial muscle applications**, Kevin Kadooka, Minoru Taya, Univ. of Washington (USA); Makoto Saito, Nabtesco Corp. (Japan) . . . . . [9430-70]

1:40 pm: **Novel dielectric elastomer structure of soft robot and wearable equipment**, Chi Li, Yuhan Xie, Xiaoqiang Huang, Junjie Liu, Tiefeng Li, Zhejiang Univ. (China) . . . . . [9430-71]

2:00 pm: **Optimization of tubular dielectric elastomer peristaltic pump**, Guoyong Mao, Tiefeng Li, Shaoxing Qu, Zhejiang Univ. (China) . . . . . [9430-72]

2:20 pm: **Kinematics and control of redundant robotic arm based on dielectric elastomer actuators**, Francesco Branz, Andrea Carron, Andrea Antonello, Alessandro Francesconi, Univ. degli Studi di Padova (Italy) . . . . . [9430-73]

2:40 pm: **Bio-inspired artificial muscle structure for integrated sensing and actuation**, Zhihang Ye, Md. Shahnewaz Sabit Faisal, Ramazan Asmatulu, Zheng Chen, Wichita State Univ. (USA) . . [9430-74]

Coffee Break . . . . . Thu 3:00 pm to 3:30 pm

**SESSION 10B**

**LOCATION: TOWNE  
THU 1:20 PM TO 3:00 PM**

**Haptic, Tactile, and Other Sensors I**

Session Chairs: **Holger Böse**, Fraunhofer-Institut für Silicatforschung (Germany); **Samuel Shian**, Harvard Univ. (USA)

Sessions 10A and 10B run concurrently.

1:20 pm: **A stretchable soft-touch musical keyboard**, Daniel Xu, The Univ. of Auckland (New Zealand); Benjamin M. O'Brien, Todd A. Gisby, StretchSense (New Zealand); Iain A. Anderson, The Univ. of Auckland (New Zealand) and StretchSense (New Zealand) . . . . . [9430-75]

1:40 pm: **Transparent and conformal touch sensor**, Mirza S. Sarwar, Ettore Glitz, Meisam Farajollahi, Shahriar Mirabbasi, John D. W. Madden, The Univ. of British Columbia (Canada) . . . . . [9430-76]

2:00 pm: **Follicular DEAs for two-way tactile communication**, Lars E. Knoop, Jonathan M. Rossiter, Univ. of Bristol (United Kingdom) and Bristol Robotics Lab. (United Kingdom); Tareq Assaf, Bristol Robotics Lab. (United Kingdom) . . . . . [9430-77]

2:20 pm: **Dielectric elastomer (DE) based sensors for SHM in composite structures**, Fulvio Pinto, Francesco Ciampa, Michele Meo, Univ. of Bath (United Kingdom) . . . . . [9430-78]

2:40 pm: **Influence of design and material properties on the performance of dielectric elastomer compression sensors**, Holger Böse, Fraunhofer-Institut für Silicatforschung (Germany) . . . . . [9430-79]

Coffee Break . . . . . Thu 3:00 pm to 3:30 pm

**CONFERENCE 9431**

Sessions 14A and 14B run concurrently.

**SESSION 14A**

**LOCATION: ROYAL PALM FIVE  
THU 1:40 PM TO 3:00 PM**

**Energy Harvesting and Scavenging: General**

Session Chairs: **Lei Zuo**, Virginia Polytechnic Institute and State Univ. (USA); **Jeffrey L. Kauffman**, Univ. of Central Florida (USA)

1:40 pm: **Harvesting under transient conditions: harvested energy as a proxy for vibration characteristics**, Taylor D. Hynds, Jeffrey L. Kauffman, Univ. of Central Florida (USA) . . . . . [9431-81]

2:00 pm: **Electromagnetic energy harvester using coupled oscillating system with 2-degree of freedom**, Chandarin Ung, Monash Univ. (Australia); Scott D. Moss, Defence Science and Technology Organisation (Australia); Wing K. Chiu, Monash Univ. (Australia) . . . [9431-82]

2:20 pm: **A single-DOF vibration energy harvester for integrating into the parallel mechanism**, Gang Yuan, Dai Hua Wang, Chongqing Univ. (China) . . . . . [9431-83]

2:40 pm: **A six-DOF vibration energy harvester based on the six-DOF parallel mechanism**, Gang Yuan, Dai-Hua Wang, Chongqing Univ. (China) . . . . . [9431-84]

Coffee Break . . . . . Thu 3:00 pm to 3:30 pm

**SESSION 14B**

**LOCATION: ROYAL PALM ONE  
THU 1:40 PM TO 3:00 PM**

**Modeling, Optimization, Signal Processing, Sensing, Control, and Design of Integrated Systems III**

Session Chair: **Angeliki Papalou**, Technological Educational Institute of Patras (Greece)

1:40 pm: **Simulating coupled thermal-mechanical interactions in morphing radiators**, Christopher L. Bertagne, John D. Whitcomb, Darren J. Hartl, Texas A&M Univ. (USA) . . . . . [9431-85]

2:00 pm: **A passive control methodology for seismic safety enhancement of monumental structures**, Angeliki Papalou, Denis Roubien, Technological Educational Institute of Patras (Greece); Thanasis Triantafyllou, Univ. of Patras (Greece); Elias Strepelias, Technological Educational Institute of Patras (Greece) and Univ. of Patras (Greece) . . . . . [9431-86]

2:20 pm: **On the use of Fiber Bragg gratings sensors to increase the reliability of feedback measurements in smart structures**, Simone Cinquemani, Gabriele Cazzulani, Francesco Ripamonti, Politecnico di Milano (Italy) . . . . . [9431-87]

2:40 pm: **Investigation on seismic resistance of high-rising buildings installed with viscoelastic-wall dampers**, Min Liu, Yang Wang, Harbin Institute of Technology (China) . . . . . [9431-88]

Coffee Break . . . . . Thu 3:00 pm to 3:30 pm

**CONFERENCE 9435**

Sessions 13A and 13B run concurrently.

**SESSION 13A**

**LOCATION: PACIFIC SALON SIX  
THU 1:20 PM TO 3:00 PM**

**Applications of Smart Structure Technologies**

Session Chairs: **Shinae Jang**, Univ. of Connecticut (USA); **Hoon Sohn**, KAIST (Korea, Republic of)

1:20 pm: **Investigation into phosphors for corrosion detection in aerospace and naval applications**, Vishnu Baba Sundaresan, Srivatsava Krishnan, The Ohio State Univ. (USA) . . . . . [9435-76]

1:40 pm: **Thermal analysis of brazing seal and sterilizing technique to break contamination path for Mars sample return**, Xiaoqi Bao, Mircea Badescu, Yoseph Bar-Cohen, Jet Propulsion Lab. (USA) . . . . . [9435-77]

2:00 pm: **Spiral passive electromagnetic sensor (SPES) for smart sensing and de-icing**, Michele Meo, Univ. of Bath (United Kingdom) . . . . . [9435-78]

2:20 pm: **Testing of tactile sensors for space applications**, Lisa Kogan, Timothy L. Weadon, Thomas Evans, David B. DeVallance, Edward M. Sabolsky, West Virginia Univ. (USA) . . . . . [9435-79]

2:40 pm: **Application of computed tomography techniques to heat transfer physics for use in damage detection**, Nephi R. Johnson, Jerome P. Lynch, Ann E. Jeffers, Univ. of Michigan (USA) . . [9435-14]

Coffee Break . . . . . Thu 3:00 pm to 3:30 pm

**CONFERENCE 9437**

Sessions 13A and 13B run concurrently.

**SESSION 13B**

**LOCATION: PACIFIC SALON FOUR  
THU 1:20 PM TO 3:00 PM**

**Next-Generation  
Sensors for Smart  
Structures**

Session Chairs: **Masahiro Kurata**, Kyoto Univ. (Japan); **Didem Ozevin**, Univ. of Illinois at Chicago (USA)

1:20 pm: **The design, characterization, and comparison of MEMS comb-drive acoustic emission transducers with the principles of area-change and gap-change**, Minoob Kabir, Hossain Saboonchi, Didem Ozevin, Univ. of Illinois at Chicago (USA) . . . . . [9435-80]

1:40 pm: **Developing a dual-beam gyroscope to measure rotation rate**, S. Amir Mousavi Lajimi, Simon Fraser Univ. (Canada) . . . . . [9435-81]

2:00 pm: **A coin size, 40mW, 20 grams sensor node for guided waves detection**, Nicola Testoni, Luca De Marchi, Alessandro Marzani, Univ. degli Studi di Bologna (Italy) . . . . . [9435-82]

2:20 pm: **Quantification of seismic damage in steel beam-column connection using PVDF strain sensors and model-updating technique**, Masahiro Kurata, Akiko Suzuki, Kyoto Univ. (Japan); Zenyung Tang, Beijing Univ. of Technology (China); Kaede Minegishi, Kyoto Univ. (Japan) . . . . [9435-83]

2:40 pm: **Experimental feasibility analysis of self-powered magnetic shape memory alloy based sensors**, Constantin Ciocanel, Jason Dikes, Edward Smaglik, Niranjan Venkatraman, Northern Arizona Univ. (USA) . . . . . [9435-84]

Coffee Break . . . . . Thu 3:00 pm to 3:30 pm

**SESSION 13A**

**LOCATION: ROYAL PALM FOUR  
THU 1:20 PM TO 3:00 PM**

**SHM/NDE for Civil  
Infrastructure II**

Session Chairs: **Zhenhua Huang**, Univ. of North Texas (USA); **Kaoshan Dai**, Tongji Univ. (China)

1:20 pm: **Extracting full-field dynamic strain response of a rotating wind turbine using photogrammetry**, Javad Baqersad, Peyman Poozesh, Christopher Niezrecki, Peter Avitabile, Univ. of Massachusetts Lowell (USA) . . . . . [9437-60]

1:40 pm: **Wind turbine blade health monitoring using acoustic array measurements**, Peyman Poozesh, Christopher Niezrecki, Kai Aizawa, Univ. of Massachusetts Lowell (USA) . . . . . [9437-61]

2:00 pm: **Deflection monitoring of pipelines using Fiber Bragg grating sensors**, Jin-Hyuk Lee, Heon-Young Kim, Seoul National Univ. of Science and Technology (Korea, Republic of); Dae Hyun Kim, Seoul National Univ. of Technology (Korea, Republic of) . . . . . [9437-62]

2:20 pm: **Mechanical strength of FBG sensors exposed to periodic thermal load in structural health monitoring**, Heon-Young Kim, Seoul National Univ. of Science and Technology (Korea, Republic of); Donghoon Kang, Korea Railroad Research Institute (Korea, Republic of); Dae Hyun Kim, Seoul National Univ. of Technology (Korea, Republic of) . . . . . [9437-63]

2:40 pm: **Structural temperature numerical analysis of a large rigid-continuous concrete bridge**, Linren Zhou, South China Univ. of Technology (China); Lei Wang, Univ. of Jinan (China); Jinping Ou, Harbin Institute of Technology (China) . . . . . [9437-64]

Coffee Break . . . . . Thu 3:00 pm to 3:30 pm

**SESSION 13B**

**LOCATION: ROYAL PALM TWO  
THU 1:20 PM TO 3:00 PM**

**Guided Wave III**

Session Chairs: **Ming Wang**, Northeastern Univ. (USA); **Xiaoning Jiang**, North Carolina State Univ. (USA)

1:20 pm: **Multifrequency, multimodal sparse reconstruction in Lamb wave based structural health monitoring**, Andrew L. Golato, Sridhar Santhanam, Fauzia Ahmad, Moeness G. Amin, Villanova Univ. (USA) . . . . . [9437-65]

1:40 pm: **Modeling ultrasonic NDE and guided-wave-based structural health monitoring**, Nitin B. Ravi, Vivek T. Rathod, Nibir Chakraborty, D. Roy Mahapatra, Indian Institute of Science (India); Ramanan Sridaran, Christian Boller, Univ. des Saarlandes (Germany) . . . . . [9437-66]

2:00 pm: **Nonlinear feature extraction methods for removing temperature effects in multi-mode guided-waves in pipes**, Matineh Eybpoosh, Mario Bergés, Hae Young Noh, Carnegie Mellon Univ. (USA) . . . . . [9437-67]

2:20 pm: **Sparse representation of guided-waves for damage diagnosis in pipelines: investigating the effects of damage size and location**, Matineh Eybpoosh, Mario Bergés, Hae Young Noh, Carnegie Mellon Univ. (USA) . . . . . [9437-68]

2:40 pm: **Experimental validation of analytical model for Lamb wave interaction with geometric discontinuity**, Banibrata Poddar, Victor Giurgiutiu, Univ. of South Carolina (USA) . . . . . [9437-69]

Coffee Break . . . . . Thu 3:00 pm to 3:30 pm

**CONFERENCE 9438**

Sessions 14A and 14B run concurrently.

**SESSION 14A**

**LOCATION: ROYAL PALM SIX  
THU 1:20 PM TO 3:00 PM**

**Guided Wave-Based  
SHM II**

Session Chairs: **Paul Fromme**, Univ. College London (United Kingdom); **Michael D. Todd**, Univ. of California, San Diego (USA)

1:20 pm: **Assessment of accumulated fatigue damage and remaining life prediction using acoustic emission fiber-optic sensors**, Andrei N. Zagrai, Quinlan Towler, Blaine Trujillo, New Mexico Institute of Mining and Technology (USA); Vahid Sotoudeh, Mehrdad Pakmehr, Richard J. Black, Joannes M. Costa, Behzad Moslehi, Intelligent Fiber Optic Systems Corp. (USA) . . . . . [9438-82]

1:40 pm: **Lamb wave propagation in vibrating structures for effective health monitoring**, Xubin Lu, Chee Kiong Soh, Panduranga Vittal Avvari, Nanyang Technological Univ. (Singapore) . . [9438-68]

2:00 pm: **Semi-analytical modelling of piezoelectric excitation of guided waves**, Michal K. Kalkowski, Timothy P. Waters, Emiliano Rustighi, Univ. of Southampton (United Kingdom) . . . . . [9438-69]

2:20 pm: **A haptic approach for structural health monitoring decision-making**, Zhu Mao, Michael D. Todd, Univ. of California, San Diego (USA); David D. L. Mascareñas, Los Alamos National Lab. (USA) . . [9438-70]

2:40 pm: **Development of vibro haptic interface for assessing structural impacts and damage**, Hwee Kwon Jung, Gyuhae Park, Myung Jun Lee, Chonnam National Univ. (Korea, Republic of); Chan Yik Park, Agency for Defense Development (Korea, Republic of) . . . . . [9438-71]

**SESSION 14B**

**LOCATION: ROYAL PALM THREE  
THU 1:20 PM TO 3:00 PM**

**Biomedical  
Applications: Organ and  
Implant Monitoring**

Session Chairs: **Xiaoning Jiang**, North Carolina State Univ. (USA); **Sourav Banerjee**, Univ. of South Carolina (USA)

1:20 pm: **Dual-frequency super harmonic imaging transducers for transectal ultrasound**, Jinwook Kim, Siboo Li, Xiaoning Jiang, North Carolina State Univ. (USA) . . . . . [9438-72]

1:40 pm: **Characterization of fungal pathogenesis using quantitative acoustic contrast tomography**, Sourav Banerjee, Subir Patra, Anindya Chanda, Univ. of South Carolina (USA) . . . . . [9438-73]

2:00 pm: **Thermography in the investigation of the inflammation inside the human muscle**, Nicolas P. Avdelidis, Chara K. Deli, Univ. of Thessaly (Greece); Panagiotis Theodorakeas, National Technical Univ. of Athens (Greece); Giannis Giakas, Athanasios Tsiokanos, Univ. of Thessaly (Greece); Maria Kouli, National Technical Univ. of Athens (Greece); Athanasios Z. Jamurtas, Univ. of Thessaly (Greece) . . . . . [9438-74]

2:20 pm: **Application of structural health monitoring technologies to biosystems: current status and path forward**, Suresh Bhalla, Indian Institute of Technology Delhi (India) . . . . . [9438-75]

2:40 pm: **On the repeatability of the EMI technique for the health monitoring of bonded elements**, Vincenzo Gulizzi, Univ. degli Studi di Palermo (Italy); Pervincenzo Rizzo, Univ. of Pittsburgh (USA); Alberto Milazzo, Univ. degli Studi di Palermo (Italy) . . . . . [9438-76]

Conference End.

**CONFERENCE 9430**

Sessions 11A and 11B run concurrently.

**SESSION 11A**

**LOCATION: TOWN AND COUNTRY BALLROOM  
THU 3:30 PM TO 4:50 PM**

**Applications of EAP Materials III**

Session Chairs: **Martin Bluemke**, Fraunhofer-Institut für Angewandte Polymerforschung (Germany); **Karl Krusamäe**, National Institute of Advanced Industrial Science and Technology (Japan)

3:30 pm: **Gel chemical transistor**, Masanori Arai, Jin Gong, Masato Makino, Md. Hasnat Kabir, Hidemitsu Furukawa, Yamagata Univ. (Japan) . . . . . [9430-80]

3:50 pm: **Dry deposition sequential process for an automated manufacturing of DEAP stack-actuators**, Dominik Tepel, Thorben Hoffstadt, Jürgen Maas, Ostwestfalen-Lippe Univ. of Applied Sciences (Germany) . . . . . [9430-81]

4:10 pm: **A dielectric elastomer actuator coupled with water: snap-through instability and giant deformation**, Hareesh Godaba, National Univ. of Singapore (Singapore); Choon Chiang Foo, Zhi Qian Zhang, A\*STAR Institute of High Performance Computing (Singapore); Boo Cheong Khoo, Jian Zhu, National Univ. of Singapore (Singapore) . . . . . [9430-82]

4:30 pm: **Effect of mass loading on ionic polymer metal composite actuators and sensors**, Sakthi Swarrup Jayabalan, Ranjan Ganguli, Giridhar Madras, Indian Institute of Science (India) . . . . . [9430-83]

**SESSION 11B**

**LOCATION: TOWNE  
THU 3:30 PM TO 4:50 PM**

**Haptic, Tactile, and Other Sensors II**

Session Chairs: **Holger Böse**, Fraunhofer-Institut für Silicatiforschung (Germany); **Samuel Shian**, Harvard Univ. (USA)

3:30 pm: **Multiobjective optimization of a PPy multilayered mechanical sensor based on a transmission line circuit model**, Nazanin Khalili, Hani E. Naguib, Roy Kwon, Univ. of Toronto (Canada) . [9430-84]

3:50 pm: **Thin-film dielectric elastomer sensors to measure the contraction force of smooth muscle cells**, Oluwaseun A. Araromi, Alexandre Poulin, Samuel Rosset, Ecole Polytechnique Fédérale de Lausanne (Switzerland); Melanie Favre, Cristina Martin-Olmos, Marta Giazon, Martha Liley, Ctr. Suisse d'Electronique et de Microtechnique SA (Switzerland); Herbert R. Shea, Ecole Polytechnique Fédérale de Lausanne (Switzerland) . . . . . [9430-85]

4:10 pm: **Humidity micro switch based on humidity-sensitive polymers**, Christian Bellmann, Technische Univ. Dresden (Germany); Arndt Steinke, Thomas Frank, CiS Forschungsinstitut für Mikrosensorik und Photovoltaik GmbH (Germany); Gerald Gerlach, Technische Univ. Dresden (Germany) . . . . . [9430-86]

4:30 pm: **Development of compact slip detection sensor using dielectric elastomer**, Ja Choon Koo, Do-Yeon Hwang, Jae-Young Choi, Baek-Chul Kim, Hyungpil Moon, Hyouk Ryeol Choi, Sungkyunkwan Univ. (Korea, Republic of) . . . . . [9430-87]

Conference End.

**CONFERENCE 9431**

Sessions 15A and 15B run concurrently.

**SESSION 15A**

**LOCATION: ROYAL PALM FIVE  
THU 3:30 PM TO 5:30 PM**

**SMA-Based Materials and Systems II**

Session Chairs: **Jinsong Leng**, Harbin Institute of Technology (China); **Tadashige Ikeda**, Nagoya Univ. (Japan)

3:30 pm: **Simulation and experimental studies of the SMA-activated needle behavior inside the tissue**, Bardia Konh, Mohammad Honarvar, Naresh V. Datla, Kurosh Darvish, Parsaoran Hutapea, Temple Univ. (USA) . . . . . [9431-89]

3:50 pm: **Optimization and testing of a continuous rotary motor based on shape memory wires and overrunning clutches**, Eugenio Dragoni, Giovanni Scirè Mammano, Univ. degli Studi di Modena e Reggio Emilia (Italy) . . . . . [9431-90]

4:10 pm: **An information indicator based on two-way shape memory alloys (SMAs)**, Huihui Wang, Williams B. Lane, Max Orozco, John Leong, Devin Pappas, Jacksonville Univ. (USA) . . . . . [9431-91]

4:30 pm: **Modeling framework for materials capable of solid-solid phase transformation: application to the analytical solution of the semi-infinite mode III crack problem in an idealized shape memory alloy**, Wael Zaki, Khalifa Univ. of Science, Technology and Research (United Arab Emirates); Ziad Mounni, Ecole Nationale Supérieure de Techniques Avancées (France) and Northwestern Polytechnical Univ. (China) . . . . . [9431-92]

4:50 pm: **Experimental investigation on a novel 3D isolator made of shape memory alloy pseudo-rubber**, Suchao Li, Harbin Institute of Technology (China) . . [9431-93]

5:10 pm: **Improvement in performance of reinforced concrete structures using shape memory alloys**, Kamalkishor M. Bajoria, Shreya S. Kaduskar, Indian Institute of Technology Bombay (India) . . [9431-94]

**SESSION 15B**

**LOCATION: ROYAL PALM ONE  
THU 3:30 PM TO 5:10 PM**

**Passive and Active Vibration Isolation Systems IV**

Session Chairs: **Dai-Hua Wang**, Chongqing Univ. (China)

3:30 pm: **Adaptive active vibration control to improve the fatigue life of a carbon-epoxy smart structure**, Gabriele Cazzulani, Simone Cinquemani, Ferruccio Resta, Francesco Ripamonti, Alessandro Torti, Politecnico di Milano (Italy) . . . . . [9431-95]

3:50 pm: **Non-linear control logics for vibrations suppression: a comparison between model-based and non-model-based techniques**, Francesco Ripamonti, Lorenzo Orsini, Ferruccio Resta, Politecnico di Milano (Italy) . . . . . [9431-96]

4:10 pm: **On optimal distributed control for vibration suppression on a flexible plate**, Xueji Zhang, Cassio T. Faria, Siemens Industry Software (Belgium) . . . . [9431-97]

4:30 pm: **Potential of viscous dampers for vibration mitigation of transmission overhead lines**, Asadollah Bassam, Amir Soltani, Sargent & Lundy LLC (USA) [9431-98]

4:50 pm: **Design and investigation of a linear smart actuator**, Krishna Chaitanya S., Vignan Univ. (India); Kaliyaperumal Dhanalakshmi, National Institute of Technology, Tiruchirappalli (India). [9431-99]

Conference End.



**CONFERENCE 9435**

Sessions 14A and 14B run concurrently.

**SESSION 14A**

**LOCATION: PACIFIC SALON SIX  
THU 3:30 PM TO 4:50 PM**

**Advanced Composite Structural Systems**

Session Chairs: **David Dennis Lee Mascarenas**, Los Alamos National Lab. (USA); **Bryan R. Loyola**, Sandia National Labs. (USA)

3:30 pm: **Relation between repeatability and speed of robot-based systems for composite aircraft production through multilateration sensor system**, Matthias Bock, Marcus Perner, Christian Krombholz, Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany) . . . . . [9435-85]

3:50 pm: **Soliton-based detection of delaminations and weak bonds in laminated composites**, Eunho Kim, Taru Singhal, Brian Chang, Jinkyu Yang, Univ. of Washington (USA) . . . . . [9435-86]

4:10 pm: **Self sensing composites with emi shielding and self repair**, Carolyn Dry, Natural Process Design, Inc. (USA) [9435-88]

4:30 pm: **Modelling of shear lag effect for piezo-elstodynamic structure for electro-mechanical imedance technique**, Sumedha Moharana, The Shiv Nadar Univ. (India); Suresh Bhalla, Indian Institute of Technology Delhi (India) . . . . . [9435-89]

**SESSION 14B**

**LOCATION: PACIFIC SALON FOUR  
THU 3:30 PM TO 5:30 PM**

**Modeling Techniques for Smart Structures**

Session Chairs: **Shamim N. Pakzad**, Lehigh Univ. (USA); **Mohammad Reza Jahanshahi**, Purdue Univ. (USA)

3:30 pm: **Structural damage detection using extended Kalman filter combined with statistical process control**, Chenhao Jin, Shinae Jang, Richard Christenson, Univ. of Connecticut (USA) . . . . . [9435-90]

3:50 pm: **Variation of modal properties induced by combined effects of temperature and boundary condition**, Wei Song, Shanglian Zhou, The Univ. of Alabama (USA) . . . . . [9435-91]

4:10 pm: **On predicting monitoring system effectiveness**, Carlo Cappello, Daniele Zonta, Univ. degli Studi di Trento (Italy); Branko Glisic, Princeton Univ. (USA); Matteo Pozzi, Carnegie Mellon Univ. (USA) [9435-92]

4:30 pm: **Optimal design of force magnification frame for piezoelectric-multilayer-stack energy harvester**, Shubin Chen, Stony Brook Univ. (USA); Lei Zuo, Virginia Polytechnic Institute and State Univ. (USA); Tian-Bing Xu, National Institute of Aerospace (USA); Wanlu Zhou, Stony Brook Univ. (USA) . . . . . [9435-93]

4:50 pm: **Experimental investigation of concrete hydration and fracture using embedded piezo sensor**, Suresh Bhalla, Indian Institute of Technology Delhi (India) . . . . . [9435-94]

5:10 pm: **Non-contact sensing through image-based 3D scene reconstruction in the presence of mismatched features**, Mohammad Reza Jahanshahi, Purdue Univ. (USA); Adnan I. Ansar, Curtis W. Padgett, Daniel Clouse, David S. Bayard, Jet Propulsion Lab. (USA) . . . . . [9435-95]

**CONFERENCE 9437**

Sessions 14A and 14B run concurrently.

**SESSION 14A**

**LOCATION: ROYAL PALM FOUR  
THU 3:30 PM TO 5:10 PM**

**Roadway and Pavement Inspection and Monitoring: SHM/NDE Technologies**

Session Chairs: **Ming Wang**, Northeastern Univ. (USA); **Yu-Min Su**, National Kaohsiung Univ. of Applied Sciences (Taiwan)

3:30 pm: **A Hessian-based methodology for automatic surface crack detection and classification from pavement images**, Sindhu Ghanta, Salar Shahini Shamsabadi, Jennifer Dy, Ming Wang, Ralf Birken, Northeastern Univ. (USA) . . . . . [9437-70]

3:50 pm: **Monitoring of pre-release cracks in prestressed concrete using fiber optic sensors**, Hiba Abdel-Jaber, Branko Glisic, Princeton Univ. (USA) . . . . . [9437-71]

4:10 pm: **Deterioration modeling for condition assessment of flexible pavements considering extreme weather events**, Yasamin Sadat Hashemi Tari, Salar Shahini Shamsabadi, Ralf Birken, Ming Wang, Northeastern Univ. (USA) . . [9437-72]

4:30 pm: **Conductive paint-filled cement paste sensor for accelerated percolation**, Hussam S. Saleem, Sari Kharroub, Simon Laflamme, Iowa State Univ. (USA); Filippo Ubertini, Univ. degli Studi di Perugia (Italy) . . . . . [9437-73]

4:50 pm: **Seebeck coefficient as a thermoelectric indicator for damage assessment of plain cement pastes**, Tsung-Chin Hou, Ko-Hung Tai, National Cheng Kung Univ. (Taiwan) . . . . . [9437-74]

**SESSION 14B**

**LOCATION: ROYAL PALM TWO  
THU 3:30 PM TO 4:50 PM**

**Radar and Microwave NDE Technologies**

Session Chairs: **Tzu Yang Yu**, Univ. of Massachusetts Lowell (USA); **Dryver R. Huston**, The Univ. of Vermont (USA)

3:30 pm: **Forward and inverse dielectric modeling of oven-dried cement paste specimens in the frequency range of 1.02 GHz to 4.50 GHz**, Jones Owusu Twumasi, Tzu Yang Yu, Univ. of Massachusetts Lowell (USA) . . . . . [9437-75]

3:50 pm: **OFDM and compressive sensing based stepped frequency continuous wave GPR-SAR imaging system**, Yu Zhang, Mohamed Metwally, Tian Xia, The Univ. of Vermont (USA) . . . . . [9437-76]

4:10 pm: **Sand moisture variation detection using instantaneous phase information in ground penetrating radar data**, Yu Zhang, Tian Xia, The Univ. of Vermont (USA) . . . . . [9437-77]

4:30 pm: **Phased array and nonlinear ground penetrating radar development**, Dryver R. Huston, Jonathan Razinger, Dylan Burns, Tian Xia, The Univ. of Vermont (USA) . . . . . [9437-78]

Conference End.

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- Student registration rates are available only to undergraduate and graduate students who are enrolled full time and have not yet received their Ph.D. Post-docs may not register as students. A student ID number or proof of student status is required with your registration.

### Press Registration

For credentialed press and media representatives only. Please email contact information, title, and organization to [media@spie.org](mailto:media@spie.org).

### SPIE Cashier

Registration Area

Open during registration hours

### Registration Payments

If you are paying by cash or check as part of your onsite registration, wish to add a course, workshop, or special event requiring payment, or have questions regarding your registration, visit the SPIE Cashier.

### Receipts and Certificate of Attendance

Preregistered attendees who did not receive a receipt or attendees who need a Certificate of Attendance may obtain those from the SPIE Cashier at Registration.

### Badge Corrections

Badge corrections can be made by the SPIE Cashier. Please have your badge removed from the badge holder and marked with your changes before approaching the counter.

### Refund Information

There is a US\$50 service charge for processing refunds. Requests for refunds must be received by 26 February 2015; all registration fees will be forfeited after this date. Membership dues, SPIE Digital Library subscriptions, or Special Events purchased are not refundable.

### U.S. Government Credit Cards

U.S. Government credit card users: have your purchasing officer contact the credit card company and get prior authorization before attempting to register. Advise your purchasing agent that SPIE is considered a 5968 company for authorization purposes.

## AUTHOR/PRESENTER INFORMATION

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### Speaker Check-In and Preview Station

Golden Foyer

Monday - Thursday · 7:30 am to 5:00 pm

All conference rooms have a computer workstation, projector, screen, lapel microphone, and laser pointer. All presenters are requested to come to Speaker Check-In with their memory devices or laptops to confirm their presentation display settings.

### Poster Setup Instructions

Golden Ballroom

Tuesday 10 March · 10:00 am to 4:00 pm

Poster presenters may set up between 10:00 am and 4:00 pm on Tuesday 10 March. Presenters who have not set up by 4:00pm on Tuesday will be considered a "no show" and their manuscript will not be published. Presenters must remove their posters on Wednesday by 4:00 pm. Posters not removed will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after 4:00 pm on Wednesday 11 March.

## ONSITE SERVICES

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### Internet Access

Golden Foyer

Complimentary wired Internet access is available; attendees can hook up their laptops or use provided workstations.

Also, our host hotel guest rooms at San Diego Town and Country Resort & Convention Center are equipped with high speed wireless Internet. This service is complimentary for SPIE hotel guests. Access is limited to the guest room areas. The password for connection is available when you check into the hotel, or you may dial ext. 1234 to get a password.

Note: WiFi is not provided in or near the meeting rooms.

## GENERAL INFORMATION

### SPIE Conference App

Free Conference Apps available for iPhone and Android smart phones.

### SPIE Book Display at Registration

Browse and place your order for the latest SPIE Books.

### Press

For Registered Press only. Press are urged to register before the meeting by emailing name, contact information, and name of publication to [media@spie.org](mailto:media@spie.org). Preregistration closes approximately 10 days before the start of the event.

### MSI Business Center

Grand Exhibit Hall corridor

Monday - Friday · 8:00 am to 4:30 pm

Services include copies, print documents from your laptop or storage device, and provide small package FedEx shipping, packing supplies, color copying service, fax services, and office supplies. Prices for services are posted onsite.

### Urgent Message Line

An urgent message line is available during registration hours: 619.908.5040

### Lost and Found

SPIE Cashier Station

Found items will be kept at SPIE Registration during Registration hours. At the end of the meeting, all found items will be turned over to Town & Country Hotel Lost and Found Department.

## FOOD AND BEVERAGE SERVICES

### Continental

Tiki Pavilion

Monday - Thursday · 7:00 to 8:15 am

A full continental breakfast is available for SPIE hotel guests located in the Tiki Pavilion. Please wear your badge and have your Town & Country room key when you arrive.

### Coffee Breaks

Lion Fountain Court

Monday · 10:00 to 10:30 am;  
3:00 to 3:30 pm

Exhibition Hall in Golden Ballroom

Tuesday and Wednesday  
10:00 to 10:30 am; 3:00 to 3:30 pm

Lion Fountain Court

Thursday · 10:00 to 10:30 am;  
3:00 to 3:30 pm

Complimentary coffee will be served twice daily, at 10:00 am and 3:00 pm. Check individual conference listings for exact times.

### Food & Refreshments for Purchase

Lion Fountain Court

Monday · 11:30 am to 1:30 pm

Exhibition Hall in Golden Ballroom

Tuesday - Wednesday · 11:30 am to 1:30 pm

Hot and cold snacks, hot entrees, deli sandwiches, salads, pastries and beverages are available for purchase. Cash and credit cards accepted.

### Desserts

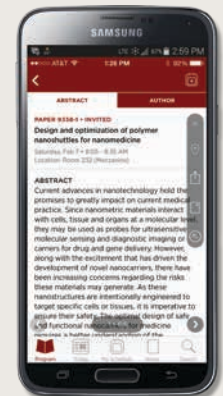
Complimentary tickets for dessert snacks are included in course and conference attendee registration packets.



**SPIE Conference and Exhibitions are known for their networking and information gathering opportunities.**

Schedule your time in the conferences... find your way around the exhibition floor... make new connections. Download a free Conference and Exhibition App for iPad, iPhone, and Android.

Download for free:



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## SPIE EVENT POLICIES

# Acceptance of Policies and Registration Conditions

The following Policies and Conditions apply to all SPIE Events. As a condition of registration, you will be required to acknowledge and accept the SPIE Registration Policies and Conditions contained herein.

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### Granting Attendee Registration and Admission

SPIE, or their officially designated event management, in their sole discretion, reserves the right to accept or decline an individual's registration for an event. Further, SPIE, or event management, reserves the right to prohibit entry or remove any individual whether registered or not, be they attendees, exhibitors, representatives, or vendors, who in their sole opinion are not, or whose conduct is not, in keeping with the character and purpose of the event. Without limiting the foregoing, SPIE and event management reserve the right to remove or refuse entry to any attendee, exhibitor, representative, or vendor who has registered or gained access under false pretenses, provided false information, or for any other reason whatsoever that they deem is cause under the circumstances.

### Misconduct Policy

SPIE is a professional, not-for-profit society committed to providing valuable conference and exhibition experiences. SPIE is dedicated to equal opportunity and treatment for all its members and meeting attendees. Attendees are expected to be respectful to other attendees, SPIE staff, and contractors. Harassment and other misconduct will not be tolerated; violators will be asked to leave the event.

### Identification

To verify registered participants and provide a measure of security, SPIE will ask attendees to present a government-issued Photo ID at registration to collect registration materials.

Individuals are not allowed to pick up badges for attendees other than themselves. Further, attendees may not have some other person participate in their place at any conference-related activity. Such other individuals will be required to register on their own behalf to participate.

### Capture and Use of a Person's Image

By registering for an SPIE event, I grant full permission to SPIE to capture, store, use, and/or reproduce my image or likeness by any audio and/or visual recording technique (including electronic/digital photographs or videos), and create derivative works of these images and recordings in any SPIE media now known or later developed, for any legitimate SPIE marketing or promotional purpose.

By registering for an SPIE event, I waive any right to inspect or approve the use of the images or recordings or of any written copy. I also waive any right to royalties or other compensation arising from or related to the use of the images, recordings, or materials. By registering, I release, defend, indemnify and hold harmless SPIE from and against any claims, damages or liability arising from or related to the use of the images, recordings or materials, including but not limited to claims of defamation, invasion of privacy, or rights of publicity or copyright infringement, or any misuse, distortion, blurring, alteration, optical illusion or use in composite form that may occur or be produced in taking, processing, reduction or production of the finished product, its publication or distribution.

### Payment Method

Registrants for paid elements of the event, who do not provide a method of payment, will not be able to complete their registration. Individuals with incomplete registrations will not be able to attend the conference until payment has been made. SPIE accepts VISA, MasterCard, American Express, Discover, Diner's Club, checks and wire transfers. Onsite registrations can also pay with Cash.

### Authors/Coauthors

By submitting an abstract, you agree to the following conditions:

- An author or coauthor (including keynote, invited, and solicited speakers) will register at the author registration rate, attend the meeting, and make the presentation as scheduled.
- A full-length manuscript (minimum 6 pages) for any accepted oral or poster presentation will be submitted for publication in the SPIE Digital Library, printed conference Proceedings, and CD. (Some SPIE events have other requirements that the author is made aware of at the time of submission.)
- Only papers presented at the conference and received according to publication guidelines and timelines will be published in the conference Proceedings and SPIE Digital Library (or via the requirements of that event).

### Audio, Video, Digital Recording Policy

Conferences, courses, and poster sessions: For copyright reasons, recordings of any kind are prohibited without prior written consent of the presenter or instructor. Attendees may not capture or use the materials presented in any meeting/course room or in course notes on display without written permission. Consent forms are available at Speaker Check-In. Individuals not complying with this policy will be asked to leave a given session and/or asked to surrender their recording media.

**EXHIBITION HALL:** For security and courtesy reasons, recordings of any kind are prohibited unless one has explicit permission from on-site company representatives. Individuals not complying with this policy will be asked to surrender their recording media and to leave the exhibition hall.

Your registration signifies your agreement to be photographed or videotaped by SPIE in the course of normal business. Such photos and video may be used in SPIE marketing materials or other SPIE promotional items.

## Laser Pointer Safety Information/Policy

SPIE supplies tested and safety-approved laser pointers for all conference meeting rooms. For safety reasons, SPIE requests that presenters use provided laser pointers.

Use of a personal laser pointer represents user's acceptance of liability for use of a non-SPIE-supplied laser pointer. If you choose to use your own laser pointer, it must be tested to ensure <5 mW power output. Laser pointers in Class II and IIIa (<5mW) are eye safe if power output is correct, but output must be verified because manufacturer labeling may not match actual output. Come to Speaker Check-In and test your laser pointer on our power meter. You are required to sign a waiver releasing SPIE of any liability for use of potentially non-safe, personal laser pointers. Misuse of any laser pointer can lead to eye damage.

## Access to Technical and Networking Events

Persons under the age of 18 including babies, carried or in strollers, and toddlers are not allowed in technical or networking events. Anyone 18 or older must register as an attendee. All technical and networking events require a valid conference badge for admission.

## Underage Persons on Exhibition Floor Policy

For safety and insurance reasons:

- No persons under the age of 18 will be allowed in the exhibition area during move-in and move-out.
- Children 14 and older, accompanied by an adult, will be allowed in the exhibition area during open exhibition hours only.
- All children younger than 14, including babies in strollers and toddlers, are not allowed in the exhibition area at any time.

## Unauthorized Solicitation Policy

Unauthorized solicitation in the Exhibition Hall is prohibited. Any non-exhibiting manufacturer or supplier observed to be distributing information or soliciting business in the aisles, or in another company's booth, will be asked to leave immediately.

## Unsecured Items Policy

Personal belongings should not be left unattended in meeting rooms or public areas. Unattended items are subject to removal by security. SPIE is not responsible for items left unattended.

## Wireless Internet Service Policy

At SPIE events where wireless is included with your registration, SPIE provides wireless access for attendees during the conference and exhibition but cannot guarantee full coverage in all locations, all of the time. Please be respectful of your time and usage so that all attendees are able to access the internet.

Excessive usage (e.g., streaming video, gaming, multiple devices) reduces bandwidth and increases cost for all attendees. No routers may be attached to the network. Properly secure your computer before accessing the public wireless network. Failure to do so may allow unauthorized access to your laptop as well as potentially introduce viruses to your computer and/or presentation. SPIE is not responsible for computer viruses or other computer damage.

## Mobile Phones and Related Devices Policy

Mobile phones, tablets, laptops, pagers, and any similar electronic devices should be silenced during conference sessions. Please exit the conference room before answering or beginning a phone conversation.

## Smoking

For the health and consideration of all attendees, smoking, including e-cigarettes, is not permitted at any event elements, such as but not limited to: plenaries, conferences, workshops, courses, poster sessions, hosted meal functions, receptions, and in the exhibit hall. Most facilities also prohibit smoking and e-cigarettes in all or specific areas. Attendees should obey any signs preventing or authorizing smoking in specified locations.

## Hold Harmless

Attendee agrees to release and hold harmless SPIE from any and all claims, demands, and causes of action arising out of or relating to your participation in the event you are registering to participate in and use of any associated facilities or hotels.

## Event Cancellation

If for some unforeseen reason SPIE should have to cancel the event, registration fees processed will be refunded to registrants. Registrants will be responsible for cancellation of travel arrangements or housing reservations and the applicable fees.

## Confidential Reporting of Unethical or Inappropriate Behavior

SPIE is an organization with strong values of responsibility and integrity. Our Ethics Statement and Code of Professional Conduct contain general guidelines for conducting business with the highest standards of ethics. SPIE has established a confidential reporting system for staff & other stakeholders to raise concerns about possible unethical or inappropriate behavior within our community. Complaints may be filed by phone or through the website, and, if preferred, may be made anonymously. The web address is [www.SPIE.ethicspoint.com](http://www.SPIE.ethicspoint.com) and the toll free hotline number is 1-888-818-6898.

## SPIE INTERNATIONAL HEADQUARTERS

PO Box 10  
Bellingham, WA 98227-0010 USA  
Tel: +1 360 676 3290  
Fax: +1 360 647 1445  
[help@spie.org](mailto:help@spie.org) • [www.SPIE.org](http://www.SPIE.org)

## SPIE EUROPE OFFICES

2 Alexandra Gate  
Ffordd Pengam, Cardiff, CF24 2SA UK  
Tel: +44 29 2089 4747  
Fax: +44 29 2089 4750  
[info@spieeurope.org](mailto:info@spieeurope.org) • [www.SPIE.org](http://www.SPIE.org)

# Proceedings.

Full paid registration includes your choice of Proceedings of SPIE (excluding student registrations). See the attached list for product order numbers for proceedings options from this meeting. You will need a product order number when you make your proceedings choice on the registration form.

## Available as part of registration:

**Symposium CD Collection**—a searchable CD of one or multiple proceedings volumes. Available within 8 weeks of the meeting.

**Symposium Online Collection**—online access to multiple related proceedings volumes via the SPIE Digital Library. Available as papers are published.

**Printed Proceedings Volume**—a printed book of a single proceedings volume. Available 6 weeks after the meeting.

**Online Proceedings Volume**—online access to a single proceedings volume via the SPIE Digital Library. Available as papers are published.

You may also purchase additional proceedings products beyond what you choose with your registration plan. **(Note: Online proceedings volumes not available for separate purchase).** See below for pricing and product order numbers.

## Accessing Online Proceedings

Access to purchased online proceedings will be ongoing using your SPIE login credentials; papers are available as they are published.

To access your purchased proceedings:

- Sign in with your SPIE account credentials at <https://spiedigitallibrary.org>. If you do not have an SPIE account, create one using the email address you used to register for the conference.
- Once you have signed in, click the My Account link at the top of the page. You can access your proceedings in the My Conference Proceedings tab.

**Note:** If your organization subscribes to the SPIE Digital Library, you can also access this content via your organization's account when logging on through your institution's network.

Should you need any assistance, please contact SPIE:

**Email:** [SPIEDLsupport@spie.org](mailto:SPIEDLsupport@spie.org)

**Phone (North America):** +1 888 902 0894

**Phone (Rest of World):** +1 360 685 5580

## Proceedings Collections

Online collections are not available for separate purchase.

Product Order Number		Collection Title/Included Volumes (See below for volume titles and editors)	Price for CD separate purchase
Symposium CD Collection	Symposium Online Collection		Meeting Attendees Only
CDS566	DLC566	<b>Smart Structures and Materials + Nondestructive Evaluation and Health Monitoring 2015</b> <i>9429, 9430, 9431, 9432, 9433, 9434, 9435, 9436, 9437, 9438, and 9439</i>	\$155

## Single Proceedings Volumes from Smart Structures

Online proceedings volumes are not available for separate purchase.

Product Order Number		Volume Title/Volume Editors	Price for print volume separate purchase
Printed Proceedings Volume	Online Proceedings Volume		Meeting Attendees Only
9429	DL9429	<b>Bioinspiration, Biomimetics, and Bioreplication 2015</b> <i>Akhlesh Lakhtakia</i>	\$90
9430	DL9430	<b>Electroactive Polymer Actuators and Devices (EAPAD) 2015</b> <i>Yoseph Bar-Cohen</i>	\$125
9431	DL9431	<b>Active and Passive Smart Structures and Integrated Systems 2015</b> <i>Wei-Hsin Liao</i>	\$130
9432	DL9432	<b>Behavior and Mechanics of Multifunctional Materials and Composites 2015</b> <i>Nakhiah C. Goulbourne</i>	\$70
9433	DL9433	<b>Industrial and Commercial Applications of Smart Structures Technologies 2015</b> <i>Kevin M. Farinholt</i>	\$60
9434	DL9434	<b>Nanosensors, Biosensors, and Info-Tech Sensors and Systems 2015</b> <i>Vijay K. Varadan</i>	\$70
9435	DL9435	<b>Sensors and Smart Structures Technologies for Civil, Mechanical, and Aerospace Systems 2015</b> <i>Jerome P. Lynch</i>	\$135
9436	DL9436	<b>Smart Sensor Phenomena, Technology, Networks, and Systems Integration 2015</b> <i>Kara J. Peters</i>	\$60
9437	DL9437	<b>Structural Health Monitoring and Inspection of Advanced Materials, Aerospace, and Civil Infrastructure 2015</b> <i>Peter J. Shull</i>	\$120
9438	DL9438	<b>Health Monitoring of Structural and Biological Systems 2015</b> <i>Tribikram Kundu</i>	\$105
9439	DL9439	<b>Smart Materials and Nondestructive Evaluation for Energy Systems 2015</b> <i>Norbert G. Meyendorf</i>	\$60



2016

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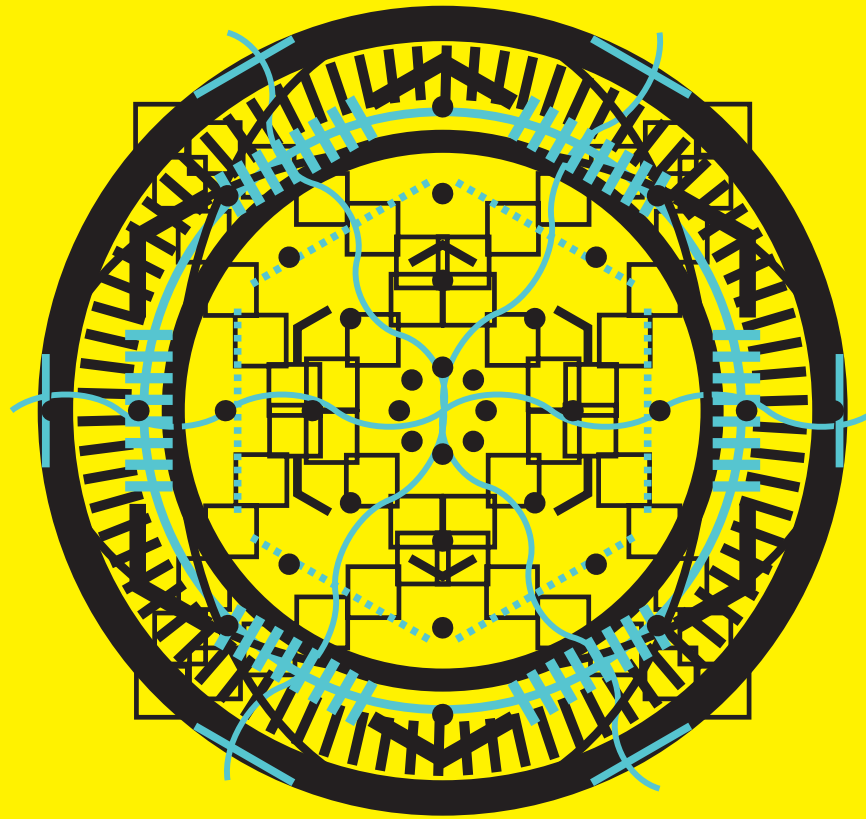
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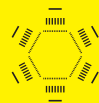
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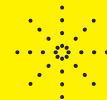
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