

2016

# SMART STRUCTURES NDE.

TECHNICAL  
PROGRAM

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Conferences & Courses  
20-24 March 2016

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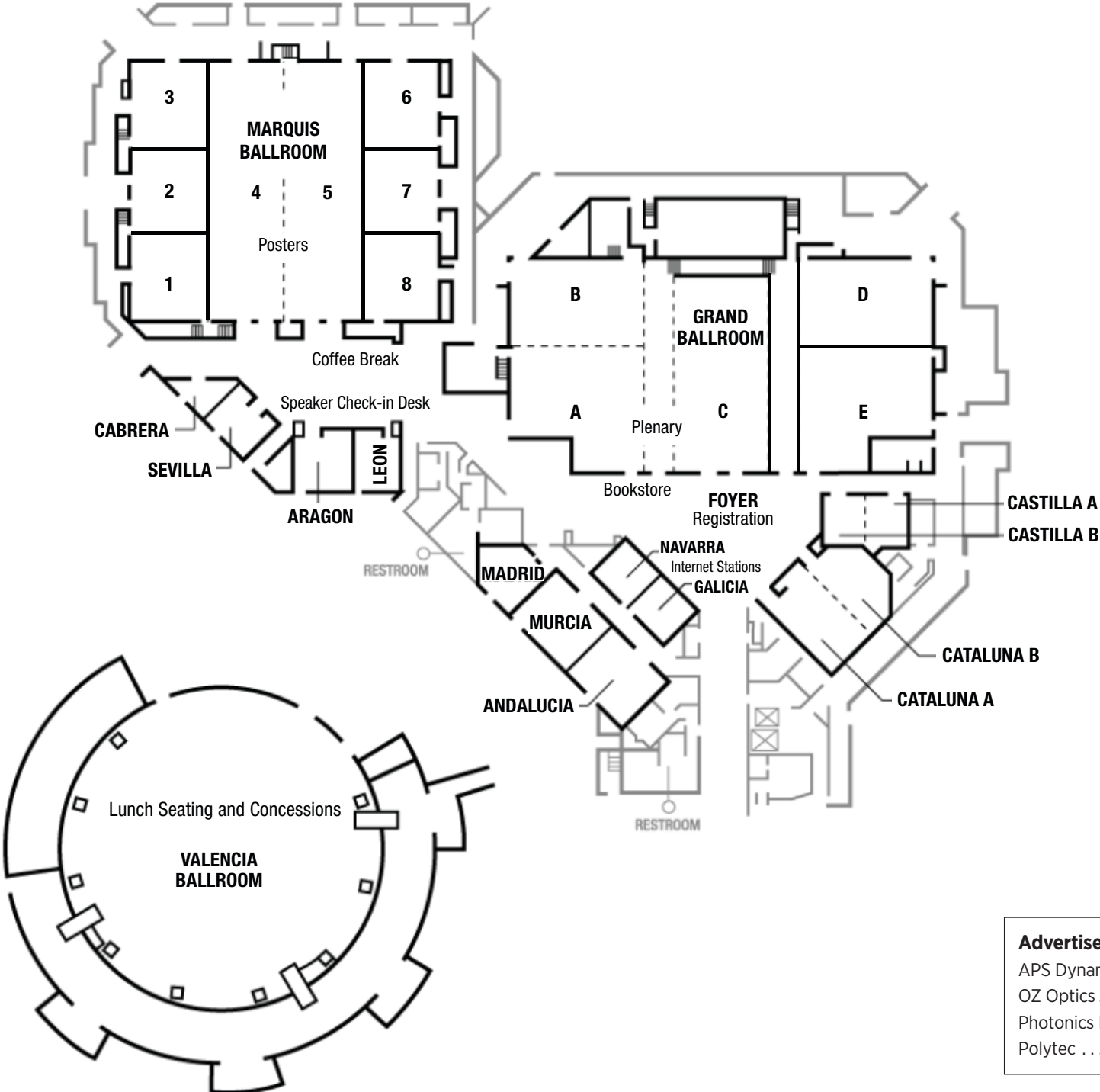
# Contents

JW Marriott Las Vegas Resort & Spa Floor Plan .....	2
Welcome .....	3
Daily Program Schedule .....	5
Plenary Presentations, Award Announcements .....	6-8
Sponsors .....	9
Special Events .....	10
Awards .....	11
Course Overview .....	12
EAP-in-Action Demo Session .....	13-15
Session Schedule .....	16-19
Technical Conferences .....	20-59
Index of Authors, Chairs, and Committee Members .....	60-73
General Information .....	74-75
Policies .....	76-77
Proceedings of SPIE .....	78

## TECHNICAL CONFERENCES

9797 Bioinspiration, Biomimetics, and Bioreplication VI ( <i>Martín-Palma</i> ) .....	20-36
9798 Electroactive Polymer Actuators and Devices (EAPAD) XVIII ( <i>Bar-Cohen</i> ) .....	20-58
9799 Active and Passive Smart Structures and Integrated Systems X ( <i>Park</i> ) .....	20-58
9800 Behavior and Mechanics of Multifunctional Materials and Composites X ( <i>Goulbourne</i> ) .....	20-48
9801 Industrial and Commercial Applications of Smart Structures Technologies X ( <i>Griffin</i> ) .....	20-34
9802 Nano-, Bio-, Info-Tech Sensors and Systems ( <i>Varadan</i> ) .....	21-54
9803 Sensors and Smart Structures Technologies for Civil, Mechanical, and Aerospace Systems ( <i>Lynch</i> ) .....	21-59
9804 Nondestructive Characterization and Monitoring of Advanced Materials, Aerospace, and Civil Infrastructure X ( <i>Yu</i> ) .....	21-59
9805 Health Monitoring of Structural and Biological Systems X ( <i>Kundu</i> ) .....	21-59
9806 Smart Materials and Nondestructive Evaluation for Energy Systems II ( <i>Meyendorf</i> ) .....	21-47

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<b>Advertisers Index</b>	
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OZ Optics . . . . .	inside back cover
Photonics Media . . . . .	inside front cover
Polytec . . . . .	4

# Welcome

The Organizing Committee of the SPIE 23rd Annual International Symposium on Smart Structures and Material Systems + Nondestructive Evaluation and Health Monitoring invites you to attend this year's meeting, now in Las Vegas, Nevada! This unique symposium offers many opportunities to network with colleagues from a variety of disciplines in academia, industry, and government from all over the world.

Organized in ten parallel conferences, SS/NDE brings together emerging technologies and advanced research in instrumentation, sensing, and measurement science with advanced materials, diagnostics, and smart systems. Engineers and researchers from government, military, academia and the commercial sector will discuss the current status and future directions of smart structures and materials, NDE, and health monitoring. Case studies, emerging research agendas, and innovative new technologies will be presented.

The symposium covers all aspects of the evolving fields of materials, enabling technologies, sensor/actuator design, and applications of these technologies to cover the whole spectrum of life in the 21st century, including commercial, medical, aerospace, and military fields. It also includes several conferences on NDE and structural health monitoring, safety, security, characterization of materials, detection of materials defects and degradation, evaluation of the state of damage enabling reliable component failure prediction, application of micro- and nanomaterial systems, energy systems, and infrastructure.

This meeting is a showcase for multidisciplinary research and provides an excellent opportunity to explore new research areas by teaming with new partners from many fields. We look forward to seeing you in Las Vegas!

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**H. Felix Wu**, U.S. Dept. of Energy (USA)

**Tzu-Yang Yu**, Univ. of Massachusetts Lowell (USA)

SPIE would like to express its deepest appreciation to the symposium chairs, conference chairs, program committees, and session chairs who have so generously given of their time and advice to make this symposium possible. The symposium, like our other conferences and activities, would not be possible without the dedicated contribution of our participants and members.

This program is based on commitments received up to the time of publication and is subject to change without notice.



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# DAILY SCHEDULE

Sunday 20 March	Monday 21 March	Tuesday 22 March	Wednesday 23 March	Thursday 24 March
<h2>SPECIAL EVENTS</h2>	<p><b>SSM Lifetime Achievement Award Presentation and NDE Lifetime Achievement Award Presentation</b>, 8:15 to 8:30 am, p. x</p> <p><i>Plenary Presentation: Magnetics + mechanics + nanoscale = electromagnetics future</i> (Carman) 8:30 to 9:15 am, p. 6</p> <p><i>Plenary Presentation: Smart materials and structures: opportunities for a new paradigm in design optimization</i> (Hussain) 9:15 to 10:00 am, p. 7</p> <p><b>EAPAD Keynote Presentation</b>, (Smela) 10:30 to 11:10 am, p. 10</p> <p><b>All Symposium Welcome Reception</b>, 6:00 to 7:30 pm, p. 10</p>	<p><i>Plenary Presentation: Use of the elastodynamic reciprocity theorem for ultrasonic problem solving</i> (Achenbach) 8:20 to 9:10 am, p. 7</p> <p><b>Poster Viewing</b>, 10:00 am to 4:00 pm, p. 10</p> <p><b>Lunch with the Experts – A Student Networking Event</b>, 12:30 to 1:20 pm, p. 10</p> <p><b>Poster Exhibition/Reception</b>, 6:00 to 7:30 pm, p. 10</p>	<p><i>Plenary Presentation: The DARPA atoms to product program</i> (Main) 8:20 to 9:10 am, p. 7</p> <p><b>Poster Viewing</b>, 10:00 am to 4:00 pm, p. 10</p> <p><b>SPIE Best Student Paper Session</b>, 1:30 to 4:00 pm, p. 10</p>	<p><b>SPIE 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. 11</p> <p><i>Plenary Presentation: High-frequency integrated phononic crystal structures</i> (Adibi) 8:25 to 9:10 am, p. 8</p>
<h2>CONFERENCES</h2>	<p>Conf. 9797 <b>Bioinspiration, Biomimetics, and Bioreplication VI</b> (<i>Martin-Palma</i>), p. 20-36</p> <p>Conf. 9798 <b>Electroactive Polymer Actuators and Devices (EAPAD) XVIII</b> (<i>Bar-Cohen</i>), p. 20-58</p> <p>Conf. 9799 <b>Active and Passive Smart Structures and Integrated Systems X</b> (<i>Park</i>), p. 20-58</p> <p>Conf. 9800 <b>Behavior and Mechanics of Multifunctional Materials and Composites X</b> (<i>Goulbourne</i>), p. 20-48</p> <p>Conf. 9801 <b>Industrial and Commercial Applications of Smart Structures Technologies X</b> (<i>Griffin</i>), p. 20-34</p> <p>Conf. 9802 <b>Nano-, Bio-, Info-Tech Sensors and Systems</b> (<i>Varadan</i>), p. 21-54</p> <p>Conf. 9803 <b>Sensors and Smart Structures Technologies for Civil, Mechanical, and Aerospace Systems</b> (<i>Lynch</i>), p. 21-59</p> <p>Conf. 9804 <b>Nondestructive Characterization and Monitoring of Advanced Materials, Aerospace, and Civil Infrastructure X</b> (<i>Yu</i>), p. 21-59</p> <p>Conf. 9805 <b>Health Monitoring of Structural and Biological Systems X</b> (<i>Kundu</i>), p. 21-59</p> <p>Conf. 9806 <b>Smart Materials and Nondestructive Evaluation for Energy Systems II</b> (<i>Meyendorf</i>), p. 21-47</p>			
<h2>COURSES</h2>	<p>SC1188 <b>Applications of Uncertainty Quantification and Sensitivity Analysis in Smart Materials and Adaptive Structures</b>, 8:30 am to 5:30 pm, p. 12</p> <p>SC634 <b>Electroactive Polymer Actuators and Devices</b>, 1:30 pm to 5:30 pm, p. 13</p>			

# Plenary Sessions

Monday 21 March 2016 ..... 8:15 to 10:00 AM

Location: Grand A/B

8:15 to 8:30 am:

## AWARDS

- **SSM Lifetime Achievement Award Presentation** presented to **James E. Hubbard**, Univ. of Maryland, College Park (USA)
- **NDE Lifetime Achievement Award Presentation** presented to **Victor Giurgiutiu**, Univ. of South Carolina (USA)

8:30 to 9:15

## MAGNETICS + MECHANICS + NANOSCALE = ELECTROMAGNETICS FUTURE



**Gregory P. Carman**

Univ. of California, Los Angeles (USA)

Abstract: Efficiently controlling magnetism in the small scale presents a significant problem for future miniature electromagnetic devices. In many macroscale electromagnetic systems we rely on a discovery made by Oersted 200 years ago

where an electrical current through a wire creates a distributed magnetic field. While this concept works well in the large scale it suffers significant problems at volumes below 1 cubic millimeter. One approach to manipulate nanoscale magnetic states is Spin Transfer Torque STT. However, experimental measurements on STT memory devices indicates 100 fJ is required to reorient a bit of memory with an energy barrier of  $-0.5\text{aJ}$ , i.e. 0.0005% efficiency. An efficiency of this level should be considered unacceptable and new nanoscale approaches are needed for future miniature electromagnetic devices.

Recently researchers have explored strain-mediated multiferroics to resolve this problem. For this material class a voltage-induced strain alters the magnetic anisotropy of nanoscale magnetoelastic elements. These strain mediated multiferroic composites consist of piezoelectric material coupled to nanoscale magnetoelastic elements to transfer electrical energy to magnetic energy through a mechanical transduction mechanism. The coupling coefficient (energy transferred) in piezoelectric materials (e.g. PZT) can be  $-0.8$  and the coupling coefficient in available magnetoelastic materials (e.g. Terfenol-D) is of similar magnitude  $-0.8$ . Thus the amount of energy to overcome a  $0.5\text{aJ}$  bit barrier is potentially

$-0.8\text{ aJ}$  or an efficiency of  $-60\%$  neglecting line losses, i.e. orders of magnitude improvement compared to existing approaches.

This presentation reviews the motivation, history, and recent progress on nanoscale strain mediated multiferroics. Research descriptions include analytical and experimental work on strain mediated multiferroic thin films, single magnetic domain structures, and superparamagnetic particles. The results indicate efficiencies orders of magnitude superior to STT approaches and presents a new approach to control magnetism in the small scale. Discussions of research opportunities as well as novel applications to motivate future studies are described.

Biography: **Gregory P. Carman** received the Ph.D. degree from Virginia Polytechnic Institute and State University in 1991. He joined the Mechanical and Aerospace Engineering Department at the University of California, Los Angeles, in 1991. He is the director of a new National Science Foundation Engineering Research Center entitled Translational Applications of Nanoscale Multiferroic Materials (TANMS) and is co-executive 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 American Society of Mechanical Engineers (ASME) from 2000 to 2002. He is an associate editor for the Journal of Intelligent Material Systems Structures and for Smart Materials and Structures. He received the Northrop Grumman Young Faculty Award in 1995 and three best paper awards from the ASME in 1996, 2001, and 2007. He was elected Fellow of the ASME in 2003 and was awarded the ASME Adaptive Structures and Material Systems Prize honoring his contributions to smart materials and structures in 2004. In 2015 SPIE honored him with the Smart Structures and Materials (SSM) Lifetime Achievement Award. Presently his research interests focus on analytical modeling, fabrication, and testing of multiferroic (magneto-electric) materials and developing devices for medical applications.





9:15 to 10:00 am

## SMART MATERIALS AND STRUCTURES: OPPORTUNITIES FOR A NEW PARADIGM IN DESIGN OPTIMIZATION



**Naveed Hussain**

The Boeing Co. (USA)

Abstract: Future aerospace vehicles will need to meet demanding performance requirements at significantly lower cost and compressed development timeline. The use of multidisciplinary system optimization tools enabled by innovative multifunctional design concepts will play a major role in expanding the design space to meet these stringent requirements. Multifunctional concepts that integrate advanced materials, printable electronics, distributed sensing, and distributed actuation, while monitoring and reacting to vehicle health, provide opportunities for a new paradigm in design optimization. This presentation will provide motivation for the increased use of smart structures, provide a number of diverse examples where such designs are being used or considered for aerospace vehicle implementation, and recommendations for future technology development.

Biography: **Naveed Hussain** is Vice President of Aeromechanics Technology and leads the Boeing Research & Technology research center in Southern California, where he oversees a team of scientists, technologists, technicians and engineers who are responsible for integrated technology development in the areas of flight sciences and structures. Past roles include leading Platform & Networked Systems Technology for BR&T, serving as chief engineer of Network & Tactical Systems for Boeing Defense, Space, & Security, and launching the BR&T-India research center in Bangalore. He began his Boeing career in 1990.

Tuesday 22 March 2016 . . . . . 8:20 to 9:10 AM

Location: Grand A/B

8:25 to 9:10 am

## USE OF THE ELASTODYNAMIC RECIPROcity THEOREM FOR ULTRASONIC PROBLEM SOLVING



**Jan D. Achenbach**

Northwestern Univ. (USA)

Abstract: For linearly elastic bodies the elastodynamic reciprocity theorem is an integral relation over the interior of a region  $V$  and its boundary  $S$ , which involves the displacements, the surface tractions, and the body forces of two elastodynamic states, State A and State B. In this lecture it is shown that

the theorem can be used to solve problems for guided waves, such as surface waves and waves in waveguides, which only requires the general form of the wave motion of State A, whose amplitude function is to be determined, and only the general form of State B, which is a virtual wave. Examples to be discussed are the surface wave generated by a concentrated load (Lamb's problem), the scattering of surface waves by a sub-surface crack and the scattering of torsional waves by a circumferential surface defect on a pipe.

Biography: **Jan D. Achenbach** has contributed to the theory and applications of ultrasonic methods to quantitative non-destructive evaluation, particularly the measurement of elastic properties of thin films by acoustic microscopy, and the detection of cracks and corrosion in safety-critical structures. In recent years he has been involved with the development of probabilistic methods for structural health monitoring of fatigue and corrosion damage in structural components. He is the author of a well-known book entitled *Wave Propagation in Elastic Solids* (Elsevier Science, 1973, still available in paperback), and a recent book entitled *Reciprocity in Elastodynamics* (Cambridge University Press, 2004), as well as three other books and numerous papers in technical journals. In 2003 he was awarded the 2003 National Medal of Technology, and in 2005 the National Medal of Science.

Wednesday 23 March 2016 . . . . . 8:20 to 9:10 AM

Location: Grand A/B

8:25 to 9:10 am

## THE DARPA ATOMS TO PRODUCT PROGRAM



**John A. Main**

Defense Advanced Research Projects Agency (USA)

Abstract: Many materials in the nanoscale regime exhibit unique physical characteristics not found at larger scales that enable important applications. Examples of nanoscale properties of interest

include quantized current-voltage behavior, dramatically lower melting points, significantly higher specific heats, enormous surface-to-volume ratios that enable rapid temperature changes, manipulated reactivity enabled by dissimilar catalytic surfaces placed in close proximity, three-to-four orders of magnitude increase in radiative heat transfer, and bandgaps/colors that change from bulk characteristics. Combinations of these properties enable new devices that are only achievable through fabrication of systems with nanoscale features. The DARPA Atoms to Product (A2P) seeks to develop technology to assemble from the nanoscale to the product or human scale, while maintaining and exploiting the unique material properties found only in the nanoscale regime.

Biography: **Dr. John A. Main** has spent his career developing new technologies and businesses. He is currently a Program Manager in the Defense Sciences Office at DARPA where he is responsible for initiating new DARPA programs in the physical sciences and fostering the R&D communities that will support those programs.

## PLENARY SESSIONS

Thursday 24 March 2016..... 8:10 to 9:10 AM

Location: Grand A/B

8:10 to 8:25 am:

### AWARDS

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

8:25 to 9:10 am

### HIGH-FREQUENCY INTEGRATED PHONONIC CRYSTAL STRUCTURES



**Ali Adibi**

Georgia Institute of Technology (USA)

Abstract: Planar phononic crystal (PnC) structures fabricated on CMOS-compatible substrates are of great interest for several applications including wireless communications and sensing. The presence of phononic bandgap (i.e., a range of frequencies with no propagating mechanical waves) allows

the realization of a large range of functional devices (e.g., waveguides, resonators, filters) by engineering the geometry of the structure. In addition, the existence of phononic bandgap in these materials enables the use of membrane-based structures (similar to MEMS-based devices) with negligible support loss. Such structures at higher frequencies (e.g. a few GHz) are of great interest for wireless communications. Several techniques for the realization of the integrated phononic crystals at high frequencies in CMOS-compatible substrates (including hole-based membranes, metallic-pillar-based membranes, and piezoelectric-pillar-based structures) will be discussed in this talk. Structures utilizing slab modes and surface acoustic waves will be discussed. Both the physical principles for the operation of the devices (e.g., physics of the formation of bandgap, guiding, and resonance mechanisms) and their implementation will be covered. Experimental evidence for the existence of the phononic bandgap in these structures and the use of their relatively wide bandgap for the implementation of practical PnC devices (especially waveguides and resonators) will be theoretically and experimentally demonstrated, and the prospects of these structures for practical applications (e.g., sensing and wireless communications) will be discussed.

Biography: **Ali Adibi** is the director of Bio and Environmental Sensing Technologies (BEST) and the Joseph M. Pettit Chair in the School of Electrical and Computer Engineering, Georgia Institute of Technology. His research group has pioneered several structures in the fields of integrated nanophotonics and phononic crystal structures for both information processing and sensing. He is the author of more than 140 journal papers and 400 conference papers. He is the editor-in-chief of the Journal of Nanophotonics, and the nanophotonic program track chair of the SPIE Photonics West meeting. He is the recipient of several awards including Presidential Early Career Award for Scientists and Engineers (PECASE), Packard Fellowship, NSF CAREER Award, and the SPIE Technology Achievement Award.



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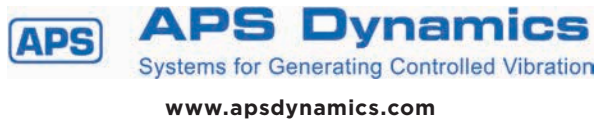
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# Special and Technical Events

## EAPAD Keynote Presentation

Monday 21 March 2016 ..... 10:30 to 11:10 AM

Location: Grand A/B



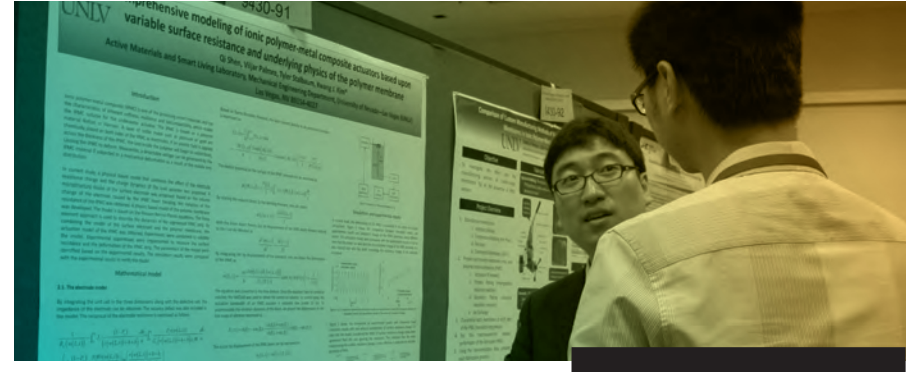
**Elisabeth Smela**

Univ. of Maryland, College Park (USA)

Abstract: EAP devices typically deliver either large displacements or high forces, but not both, whereas hydraulic actuators do provide both, within seconds, but they require a pressurized fluid source. By taking advantage of a micro-scale

phenomenon – electro-osmotic fluid pumping – it is possible to create a new type of “nastic” EAP that is self-contained and electrically actuated. The devices are fabricated by lamination of paper and elastomer layers, and by encapsulating a fluid – propylene carbonate – that does not generate gas bubbles. Applications such as smart stents with adjustable diameters are being pursued.

Biography: **Prof. Elisabeth Smela** is a Professor in the Department of Mechanical Engineering and the Institute for Systems Research at the University of Maryland, with affiliate appointments in Materials Science and Engineering and Electrical and Computer Engineering. She received a BS in physics from MIT and a PhD in electrical engineering from the University of Pennsylvania. Following her PhD she was a postdoc and then a researcher in Linköping, Sweden, where she began developing conjugated polymer microactuators, LEDs, and sensors, and examining the volume change mechanisms. She continued this work as a senior researcher in Riso, Denmark, before moving to studies of actuation in spun polyaniline fibers as Vice President of Research and Development at Santa Fe Science and Technology. Her research at UMD has focused on polymer and biological microsystems, included basic understanding of conjugated polymer actuators, microfabricated dielectric elastomer actuators, and nastic actuators. Her group is also working on tactile skins for co-robotics, a bio-nose on a chip based on olfactory sensory neurons, and mapping the positions of nucleic acids in tissue sections.



## All Symposium Welcome Reception

Monday 21 March ..... 6:00 to 7:30 PM

Location: The Lodge

All attendees are invited to relax, socialize, and enjoy refreshments in the casual outdoor environment of the “Lodge on the Lawn”. There are picnic games like bocce and horseshoes. Please remember to wear your conference registration badges. Attendees are encouraged to wear comfortable shoes and casual dress.

## Lunch with the Experts – A Student Networking Event

Tuesday 22 March ..... 12:30 to 1:20 PM

Location: Valencia Terrace

Open to Student Attendees

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 science and engineering. Seating is limited and will be granted on a first-come, first-served basis.

## Poster Exhibition/Reception

Tuesday 22 March 2016 ..... 6:00 to 7:30 PM

Location: Marquis 4/5

Conference attendees are invited to attend the poster session on Tuesday evening. Come view the posters, ask questions, and enjoy 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.

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## Poster Viewing

Tuesday 22 March ..... 10:00 AM to 4:00 PM

Wednesday 23 March ..... 10:00 AM to 4:00 PM

## SPIE Best Student Paper Session

Wednesday 23 March 2016 ..... 1:30 to 4:00 PM

Location: Marquis 3

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



# Award Events

Monday 21 March ..... 8:15 to 8:30 am

## 2016 NDE Lifetime Achievement Award

presented to



**Victor Giurgiutiu**

Univ. of South Carolina (USA)

*Biography:* **Dr. Victor Giurgiutiu** received his BSc(Eng) in Aeronautics and his PhD in Aeronautical Structures from Imperial College, London, UK in 1972 and 1977, respectively. He has a wide research interest in structural mechanics

that spans active materials, smart structures, structural health monitoring, mechatronics, and other multi-physics applications. Dr. Giurgiutiu is Professor of Mechanical Engineering and Director of the Laboratory for Active Materials and Smart Structures (LAMSS) at the University of South Carolina. He has published 7 books, 16 book chapters, 102 archival journal articles, and many conference papers. He is widely cited worldwide with h-index=39. His book on *Structural Health Monitoring with Piezoelectric Wafer Active Sensors* (Elsevier Academic Press, now at the 2nd Ed.) has been cited ~750 times, and two of his seminal papers have received ~500 and ~400 citations, respectively. He was elected Fellow of the Royal Aeronautical Society (RAeS), Fellow of ASME, and Associate Fellow of AIAA. Dr. Giurgiutiu serves as Special Issues Editor to the *Structural Health Monitoring – An International Journal* (Sage, UK). He is Associate Editor to the *Aeronautical Journal* of RAeS and Associate Editor to the *International Journal of Sustainable Materials and Structural Systems* (Inderscience Pub., Switzerland). He was recognized as Structural Health Monitoring Person of the Year 2003. He has recently completed his duty as co-chair of the SPIE Symposium on Smart Structures and NDE which comprises 10 parallel conferences and has an international participation of over 800 attendees. During 2006-2009 he served as Structural Mechanics Program Manager with the Air Force Office of Scientific Research (AFOSR).

## 2016 SSM Lifetime Achievement Award

presented to



**James E. Hubbard, Jr.**

Univ. of Maryland, College Park (USA)

*Biography:* **Dr. Hubbard, Jr.** holds a B.Eng., M.S. and Ph.D. in Mechanical Engineering from the Massachusetts Institute of Technology in 1977, 1978 and 1981, respectively. He began his career in 1971 as an engineering officer in the U.S. Merchant Marine serving in Vietnam. He received unlimited horsepower, steam, and diesel engine Marine Engineering license from the U.S. Coast Guard and at the age of 19 was one the youngest to get such an honor. In 1981, he joined the faculty at the Massachusetts Institute of Technology and served as Assistant Professor of Mechanical Engineering. There he distinguished himself by winning an IBM Young Faculty Development Award as part of a national competition. He went onto become the Section Chief of Adaptive Sensors at the Charles Stark Draper Laboratory in 1985 where he pioneered the application of Smart Structures in applications as diverse as adaptive optics, phased array sonar and large space structure vibration control. He has served as the 1st Chief Engineer of the Boston University Photonics Center, a \$100M investment by Boston University and the US Government in Photonics research. During his tenure at the BU Photonics Center he co-founded two companies whose commercial product base built upon his experience in smart materials, smart structures and smart material sensors. In 1999 his product line was recognized with the award of The Smart Structure Product Innovation Award from The International Society for Optics and Photonics (SPIE). He is currently the Langley Distinguished Professor of Aerospace Engineering and Full Professor at the University of Maryland. His research areas involve the design, analysis, simulation, and fabrication of spatially distributed systems, smart materials, smart structures and smart transducers. In 2009 at the ASME Conference on Smart Materials, Adaptive Structures and Intelligent Systems Dr. Hubbard was recognized as one of the early pioneers of the field of Smart Structures. He has received numerous awards for teaching and mentoring excellence including the M.I.T. Goodwin Medal for "Conspicuously Effective Teaching," The M.I.T. Steward Award for "Outstanding Service to the Community," and in 2002, he was awarded "The Key to the City," of his hometown of Danville, Virginia for Lifetime achievement and mentoring. He has also received many awards for his application of smart materials including the Charles Stark Draper Engineering Vice Presidents Annual Award for Best Technical Patent. Additionally, he was the 2002 receipt of Black Engineer of the Year President's Award. During the course of his career he has participated on panels, chaired sessions and given plenary and keynote presentations at many conferences which include ASME, ACC, IFAC, SMASIS, AIAA, SPIE and ICA. He has more than 100 technical publications, 24 patents U.S. and worldwide in the areas of Smart Structures and Photonics, and has served on numerous technical Boards and Committees including the AHS, AIAA and the National Academy of Engineering in a career spanning some 30 years of Board, Committee and professional service. He is a Fellow and Lifetime member of the American Institute of Aeronautics and Astronautics, a Fellow of the American Society of Mechanical Engineers and Senior Member of SPIE.

Thursday 24 March ..... 8:10 to 8:25 am

## SPIE Best Student Paper Awards

SPIE is sponsoring the best student paper contest. Papers will be presented in a special session on Wednesday afternoon. Entrants will be judged by a committee from SPIE. 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 and cash awards.

## 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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## Applications of Uncertainty Quantification and Sensitivity Analysis in Smart Materials and Adaptive Structures

### SC1188

Course level: Introductory  
CEU 0.65 \$555 SPIE Members | \$645 Non-members  
Sunday, 8:30 am to 5:30 pm

NEW

The purpose of this hands-on tutorial is to expose participants to statistical and numerical techniques that will allow them to quantify the accuracy of multi-physics models and simulation codes for active materials and structures when one accounts for uncertainty or errors in models, parameters, numerical simulation codes, and data. Additionally, we will discuss global sensitivity analysis techniques for parameters, as well as uncertainty propagation techniques, and illustrate how they provide insights regarding material behavior and can be used to quantify the accuracy of predictions.

In the first part of the tutorial, we will provide an overview of Bayesian statistics, sensitivity analysis methodologies, and numerical algorithms necessary to propagate input uncertainties through simulation codes. We will consider several case studies to illustrate these techniques for a variety of materials and smart structure applications. These include models for piezoelectric macro-fiber composites, shape memory alloys, viscoelastic polymers, graphene thermoacoustics, quantum-informed ferroelectric continuum models, and Rietveld analysis. In this part of the tutorial, we will provide participants with algorithms that quantify the uncertainties in model parameters, such as piezoelectric constants, when they are calibrated from experimental data. We will show how global sensitivity analysis can be used to rank model parameters and isolate those parameters that cannot be reliably estimated from data. To illustrate the uncertainty propagation techniques, we will demonstrate the construction of 95% prediction intervals for PZT models at a given applied field. Finally, we will demonstrate, in the context of a shape memory alloy example, the manner in which robust control designs can be improved through uncertainty quantification.

In the second, hands-on, part of the tutorial, we will have participants run case studies using MATLAB. These studies will include models and data provided by the instructors, but participants are also encouraged to bring their own models and data for testing during the tutorial, based on their specific problem(s) of interest.

### INTENDED AUDIENCE

The intended audience is graduate students, industrial practitioners, and academic professionals who are interested in quantifying uncertainty and global sensitivity in material and structural models in light of experiments or higher fidelity model predictions. Basic knowledge of probability and MATLAB programming is required, and a laptop with a working MATLAB license is required to fully participate in the hands-on portion of the course.

### INSTRUCTORS

**Ralph Smith** is a Distinguished Professor of Mathematics at North Carolina State University, who has expertise in mathematical modeling, uncertainty and sensitivity analysis, and control of smart materials and structures. He has written books on both smart materials and structures as well as uncertainty quantification and sensitivity analysis. He has investigated the role of uncertainty quantification in the context of macro-fiber composites and shape memory alloys including the use of uncertainty quantification to improve robust control design.

**William Oates** is an Associate Professor in the Department of Mechanical Engineering at Florida State University. His research includes constitutive model development, structural analysis, and experimental characterization of smart materials and adaptive structures. He has utilized Bayesian statistics to analyze smart materials and systems including quantum informed ferroelectric modeling, graphene thermoacoustics, piezoelectric composites, and multi-functional polymer constitutive model development.

### ADDITIONAL COMMENTS

In order to participate fully in the hands-on section of the course, attendees must bring a laptop pre-installed with an active MATLAB license. (Power for your laptop will be provided in the classroom.) If you do not have an active MATLAB license, you may download a free 30-day trial here: [https://www.mathworks.com/programs/trials/trial\\_request.html](https://www.mathworks.com/programs/trials/trial_request.html)

Also recommended, but not required, is experimental data that has already been fit to a model (e.g., via optimization) or desired to fit to a model.

### MONEY-BACK GUARANTEE

We are confident that once you experience an SPIE course for yourself you will look to us for your future education needs. However, if for any reason you are dissatisfied, we will gladly refund your money. We just ask that you tell us what you did not like; suggestions for improvement are always welcome.

### CONTINUING EDUCATION UNITS



SPIE has been approved as an accredited provider of CEUs by IACET, The International Association for Continuing Education and Training (Provider #1002091). In obtaining this approval, SPIE has demonstrated that it complies with the ANSI/IACET Standards which are widely recognized as standards of good practice.

SPIE reserves the right to cancel a course due to insufficient advance registration.

## Electroactive Polymer Actuators and Devices

### SC634

Course level: Introductory  
CEU 0.35 \$360 SPIE Members | \$410 Non-members  
Sunday, 1:30 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). 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.

#### 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.

#### INSTRUCTORS

**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://ndea.jpl.nasa.gov/nasa-nde/yosi/yosi.htm>

**John D. W. 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>

**Qibing 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.mse.ucla.edu/faculty/pei/>

# 18th Annual EAP-in-Action Session and Demonstrations

Monday 21 March · 4:30 to 5:45 pm · Location: Grand A/B



Session Chair:  
**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.

## Tentative EAP Demonstrations

### Devices from actuating fishing line

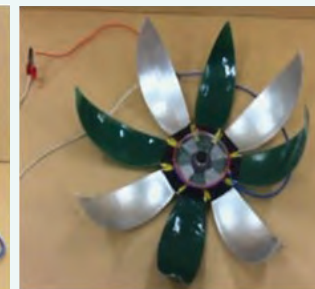
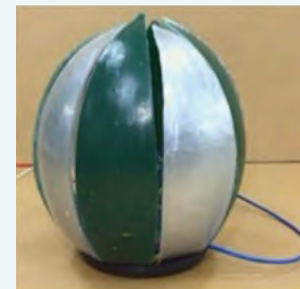
**Jeffrey Chan, Cameron Frayne, Brian Uifalusi, Justin Wyss, Joe Fang, Liam Henderson, Daniel Louie, Michael Uifalusi, Joshua Conde Ng, Tobias Kreykenbohm, Samuel Ng, Zetong Zhang, Soheil Kianzad, Yuta Dobashi, Ali Rafiee, John D.W. Madden**, Univ. of British Columbia (Canada)

Student teams from the University of British Columbia are developing devices that take advantage of the high stress and strain of coiled nylon-based thermal actuators. These devices are current driven, with the Joule heating enabling reversible contraction of the helically wound nylon fibers. Devices under development by the student teams include a flapping fish fin, a latch mechanism, and a wearable biomedical device. Projects are still underway, and so attendance at the conference will be on the condition that performance targets are met.

### Applications of smart polymers

**Liwu Liu, Jinrong Li, Fengfeng Li, Xiongfei Lv, Jinsong Leng**, Harbin Institute of Technology (China)

This demonstration will show smart polymer in action taking advantages of their being light weight, fast response, and large deformation. This advantages makes them attractive for applications in smart bionics, aerospace, biomedicine and other fields. The demonstration will include application of shape memory polymer (SMP) and dielectric elastomer EAP as actuators and deployable structures.



EAP-in-Action Demonstrations continue next 2 pages.

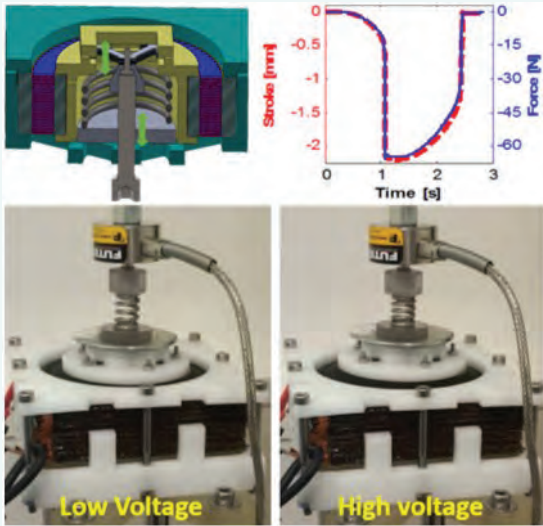


# 18TH ANNUAL EAP-IN-ACTION SESSION AND DEMONSTRATIONS

*continued*

## High force dielectric electroactive polymer (DEAP) membrane actuator

Steffen Hau, Alexander York, Saarland Univ. (Germany)

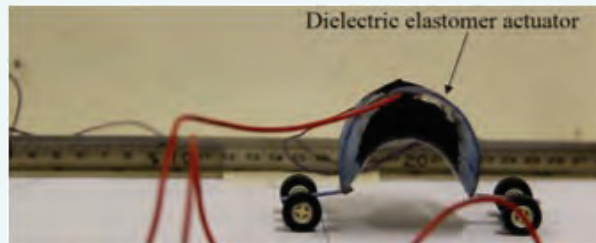


Energy efficiency, lightweight and scalability are key features for actuators in applications such as valves, pumps or any portable system. DEAP technology is able to fulfill these requirements better than commonly used technology e.g. solenoid, but has limitations concerning force and stroke. This demo will show the improvements that were made in increasing the force that is delivered by DEAP stack. Two different actuators are shown: The first is able to lift 10kg. The second can generate a force of 66N while acting against a spring load.

## Soft robots based on dielectric elastomer actuators

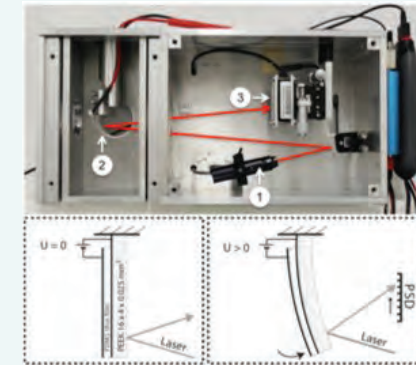
Jian Zhu, Yuzhe Wang, Ujjaval Gupta, National Univ. of Singapore (Singapore)

Artificial muscles were developed to mimic natural masseter muscles (superficial portion), using dielectric elastomer actuators. Soft actuators were installed onto a robotic skull, and will be shown moving the jaw and the mimicking natural muscles' displacement and velocity.



## Apparatus for measuring the actuation forces of DEAs via cantilever bending

Bekim Osmani, Tino Töpper, Vanessa Leung, and Bert Müller, Univ. of Basel (Switzerland)

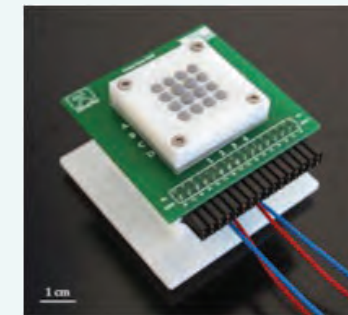


A compact, simple-to-operate apparatus for measuring the generated forces of planar dielectric elastomer actuators (DEA) will be demonstrated. DEA structures are fabricated on top of a cantilever substrate material with well-known mechanical properties such as

PEN, PEEK, or Kapton film. When a DC-voltage is applied to the planar electrodes on either side of the elastomer layer, the resulting deformation of the incompressible elastomer bends the cantilever. The bending curvature is measured by the deflection of a laser beam reflected from the cantilever onto a position sensitive detector. This cantilever system can be used to evaluate the maximal strains of single- as well as multilayer DEAs.

## Tactile display based on shape memory polymers

Nadine Besse, Samuel Rosset, Alexandre Poulin, Herbert Shea, Ecole Polytechnique Fédérale de Lausanne (EPFL) (Switzerland)



A fully latching and scalable 4x4 tactile display will be demonstrated to have 300 mN holding force and 300  $\mu$ m motion per taxel (tactile pixel). The device, which is intended to provide graphical

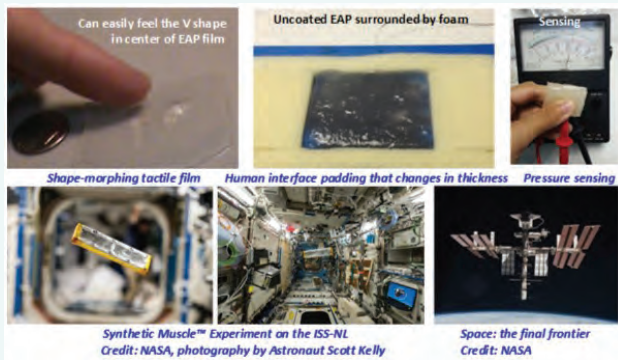
information to visually impaired users, consists of a shape memory polymer membrane, a compliant integrated heater per taxel, and a single common pneumatic actuation mechanism. Each taxel is individually addressable and the entire display can be refreshed in 5 seconds.



# 18TH ANNUAL EAP-IN-ACTION SESSION AND DEMONSTRATIONS

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

Lenore Rasmussen, Eric Sandberg, Leila Albers, Simone Rodriguez, Ras Labs (USA)



Ras Labs electroactive polymer (EAP) based materials and actuators contract, and with reversed electric input polarity, expand. A thin shape-morphing film of the material in the expansion mode produces raised surface zones in desired shapes. A thick shape-morphing pad can controllably contract or expand, which are being used to prototype self-adjusting extremely comfortable prosthetic socket liners and other void-filling continual-fit applications. These EAPs can easily serve dual use as sensors, which can be tied in to automatic adjustment and biofeedback, and can communicate the number of impacts and severity of impact/pressure. Actuation can be performed underwater or on land with suitable elastomeric coatings. These robust EAPs (extreme temperature, high and low pressures) are being tested for radiation resistance on the International Space Center (ISS) National Laboratory. A protective cage with Ras Labs Synthetic Muscle™ EAP samples, similar to the hardware of the ISS experiment, will be also be presented.

## New technology from the Biomimetics Laboratory and StretchSense Ltd.

Iain Anderson, Markus Henke, Patrin Illenberger, Andreas Tairyck, Allan Veale, Chris Walker, StretchSense Ltd. (New Zealand)



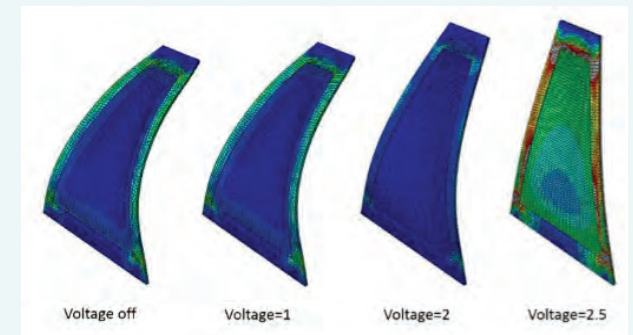
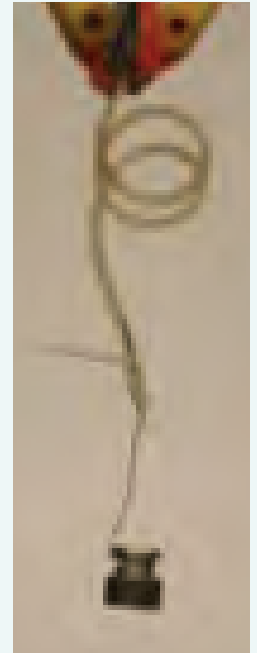
The Biomimetics Lab and our spinout company StretchSense Ltd. will demonstrate EAP advances that will lead to an exciting future of autonomous robots, wearable sensors, and energy harvesters!

- 1) Meet Trevor, the amazing EAP caterpillar with no control electronics! We can get Trevor to crawl by simply adding some DC charge to patterned conductor on the elastomer surface!
- (2) Wearable, stretch sensitive communication. We demonstrate how to communicate with your partner, in the dark, and between rooms without talking.
- (3) Giving wearable muscles cyber-proprioception. With soft wearable motion sensing we can augment our strength and get machines to follow our gesture based commands.
- (4) Self-powered wearable sensing. Stretchsense is developing sensors powered by human movement. This will enable wearable sensing that you can wear and forget.

## Shape memory programmable and electrically controllable IPMC

Qi Shen, Sarah Trabia, Tyler Stalbaum, Choonhan Lee, Robert Hunt, and Kwang Kim, Univ. of Nevada, Las Vegas (USA)

Recently, the UNLV team successfully demonstrated an ionic polymer-metal composite (IPMC) actuator, having multiple-shape memory by two external inputs, electrical and thermal. This demonstration introduces a soft multiple-shape-memory IPMC actuator having multiple degree-of-freedom that exhibited high maneuverability when controlled by two external inputs, allowing complex motions that are routine in nature.



## Soft robotics and smart SAM structures

Tiefeng Li, Yuhan Xie, Guorui Li, Yiming Liang, Xuxu Yang, Yongbing Jin, Zhejiang Univ. (China)

In this demonstration, soft robotics and smart structures driven by dielectric elastomer will be shown in large actuation task, fast response and actuating-sensing integrated abilities. The materials are made of temperature active tough hydrogel and the objective is to use them for bio-medical applications.

# CONFERENCE SESSION SCHEDULE

	<b>CONFERENCE 9797</b> Bioinspiration, Biomimetics, and Bioreplication VI	<b>CONFERENCE 9798</b> Electroactive Polymer Actuators and Devices (EAPAD) XVIII	<b>CONFERENCE 9799</b> Active and Passive Smart Structures and Integrated Systems X	<b>CONFERENCE 9800</b> Behavior and Mechanics of Multifunctional Materials and Composites IX	<b>CONFERENCE 9801</b> Industrial and Commercial Applications of Smart Structures Technologies X	<b>CONFERENCE 9802</b> Nano-, Bio-, Info-Tech Sensors and Systems
<b>Monday 21 March</b>	<p><b>SESSION 1</b> Mon 10:30 am to 11:10 am Opening Session (Martin-Palma)</p> <p><b>SESSION 2</b> Mon 11:10 am to 12:00 pm Vision (Knez)</p> <p><b>SESSION 3</b> Mon 1:20 pm to 3:00 pm Materials and Processing I (Lakhtakia)</p> <p><b>SESSION 4</b> Mon 3:30 pm to 5:10 pm Materials and Processing II (Kornev)</p> <p><b>SESSION 5</b> Mon 5:10 pm to 5:30 pm Efficiency (Lakhtakia)</p>	<p><b>SESSION 1</b> Mon 10:30 am to 12:10 pm EAP as Emerging Actuators (Bar-Cohen, Vidal)</p> <p><b>SESSION 2</b> Mon 1:20 pm to 3:00 pm Celebrating the 10th Anniversary of the Dielectric Elastomer Minimum Energy Structures (DEMES) (Bauer, Shea)</p> <p><b>EAP-IN-ACTION DEMONSTRATION SESSION</b> Mon 4:30 pm to 5:45 pm (Bar-Cohen)</p>	<p><b>SESSION 1</b> Mon 10:30 am to 11:50 am Energy Harvesting and Scavenging: Broadband/Nonlinear I (Park, Erturk)</p> <p><b>SESSION 2</b> Mon 1:20 pm to 3:00 pm Passive and Active Vibration Isolation Systems I (Wang, Dapino)</p> <p><b>SESSION 3</b> Mon 3:30 pm to 5:30 pm Structural Health Monitoring (Lee)</p>	<p><b>SESSION 1</b> Mon 10:30 am to 11:50 am Ferroelectrics (Goulbourne, Kim)</p> <p><b>SESSION 2</b> Mon 1:20 pm to 3:00 pm Magnetostrictive Materials (Naguib, Gallagher)</p> <p><b>SESSION 3</b> Mon 3:30 pm to 5:30 pm Shape Memory Materials (Lagoudas, Hartl)</p>	<p><b>SESSION 1</b> Mon 10:30 am to 12:00 pm Active Flow Control (Griffin)</p> <p><b>SESSION 2</b> Mon 1:30 pm to 3:10 pm Morphing and SMA (Browne)</p> <p><b>SESSION 3</b> Mon 3:40 pm to 6:00 pm Industrial Applications I (Browne)</p>	<p><b>SESSION 1</b> Mon 10:30 am to 11:10 am Keynote Lecture I (Varadan)</p> <p><b>SESSION 2</b> Mon 11:10 am to 12:20 pm Nanosensors and Systems I (Varadan)</p> <p><b>SESSION 3</b> Mon 1:30 pm to 2:10 pm Keynote Lecture II (Choi)</p> <p><b>SESSION 4</b> Mon 2:10 pm to 3:30 pm Nanosensors and Systems II (Khosla)</p> <p><b>SESSION 5</b> Mon 4:00 pm to 6:00 pm Nano and Micro-Systems I (Varadan)</p>
<b>Tuesday 22 March</b>	<p><b>SESSION 6</b> Tue 9:20 am to 10:00 am Flight (Lakhtakia)</p> <p><b>SESSION 7</b> Tue 10:30 am to 12:10 pm Optics and Photonics (Martin-Palma)</p> <p><b>SESSION 8</b> Tue 1:30 pm to 3:00 pm Devices and Actuators I (Kolle)</p> <p><b>SESSION 9</b> Tue 3:30 pm to 4:30 pm Functionalities and Applications (Knez)</p> <p><b>SESSION 10</b> Tue 4:30 pm to 5:30 pm Devices and Actuators II (Dry)</p> <p>Tue 5:30 pm to 5:55 pm Poster Pops (Lakhtakia)</p>	<p><b>SESSION 3</b> Tue 9:20 am to 12:10 pm Dielectric Elastomers (Smela, Vidal)</p> <p><b>SESSION 4</b> Tue 1:20 pm to 3:00 pm EAP Fabrication Techniques (Park, Price)</p> <p><b>SESSION 5</b> Tue 3:30 pm to 5:10 pm EAP Characterization (Vertechy, Gerhard)</p>	<p><b>SESSION 4</b> Tue 9:20 am to 10:00 am Piezo-based Materials and Systems I (Brei)</p> <p><b>SESSION 5</b> Tue 10:30 am to 11:50 am Energy Harvesting and Scavenging: Broadband/Nonlinear II (Tang, Harne)</p> <p><b>SESSION 6</b> Tue 1:20 pm to 3:00 pm Energy Harvesting and Scavenging: Piezoelectrics (Jung, Mascareñas)</p> <p><b>SESSION 7</b> Tue 3:30 pm to 5:50 pm SMA-based Materials and Systems I (Goo, Washington)</p>	<p><b>SESSION 4</b> Tue 9:20 am to 10:00 am Shape Memory Polymers (Ubertini)</p> <p><b>SESSION 5</b> Tue 10:30 am to 11:50 am Energy Storage and Harvesting (Ounaies, Li)</p> <p><b>SESSION 6</b> Tue 1:40 pm to 3:00 pm Piezoelectrics Materials (Sodano, Seidel)</p> <p><b>SESSION 7</b> Tue 3:30 pm to 5:50 pm Multifunctional Composites (Smith, Gordaninejad)</p>	<p><b>SESSION 4</b> Tue 9:20 am to 11:50 am Industrial Applications II (Park)</p> <p><b>SESSION 5</b> Tue 1:20 pm to 3:00 pm Energy Harvesting (Griffin)</p>	<p><b>SESSION 6</b> Tue 9:20 am to 10:40 am Keynote Lecture III (Khosla)</p> <p><b>SESSION 7</b> Tue 11:00 am to 12:20 pm 3D Printing and Applications I (Brantley)</p> <p><b>SESSION 8</b> Tue 1:40 pm to 2:20 pm Keynote Lecture IV (Varadan)</p> <p><b>SESSION 9</b> Tue 2:20 pm to 3:20 pm 3D Printing and Applications II (Ramasamy)</p> <p><b>SESSION 10</b> Tue 4:00 pm to 5:20 pm Nanosensor and Nanocomposite (Edwards)</p>

# CONFERENCE SESSION SCHEDULE

<b>CONFERENCE 9803</b> Sensors and Smart Structures Technologies for Civil, Mechanical, and Aerospace Systems		<b>CONFERENCE 9804</b> Nondestructive Characterization and Monitoring of Advanced Materials, Aerospace, and Civil Infrastructure X		<b>CONFERENCE 9805</b> Health Monitoring of Structural and Biological Systems X		<b>CONFERENCE 9806</b> Smart Materials and Nondestructive Evaluation for Energy Systems II	
<b>SESSION 1A</b> Mon 10:30 am to 11:50 am Keynote Session <i>(Wang, Sohn)</i> <b>SESSION 2A</b> Mon 1:20 pm to 3:00 pm Energy Harvesting Devices and Methods <i>(Sohn, Wang)</i>	<b>SESSION 1B</b> Mon 10:30 am to 11:50 am Human-Structure Interaction: Sensing and Analysis <i>(Noh, Mascarenas)</i> <b>SESSION 2B</b> Mon 1:40 pm to 3:00 pm Structural Health Monitoring of Bridges <i>(Gordaninejad, Jang)</i>	<b>SESSION 1</b> Mon 10:30 am to 11:50 am Microwave and Radar NDE <i>(Xia, Yu)</i> <b>SESSION 2</b> Mon 1:20 pm to 3:00 pm NDE/SHM for Aerospace Structures <i>(Gyekenyesi, Wu)</i>	<b>SESSION 1</b> Mon 10:30 am to 11:50 am Guided Wave for Composite Inspection <i>(Kundu, Grill)</i> <b>SESSION 2</b> Mon 1:20 pm to 3:00 pm Bridge Monitoring <i>(Reis, Pai)</i>	<b>SESSION 1</b> Mon 10:30 am to 11:50 am Fuel Cells and Energy Storage <i>(Michaelis)</i> <b>SESSION 2</b> Mon 1:20 pm to 3:00 pm SHM <i>(Peters)</i>			
<b>SESSION 3A</b> Mon 3:30 pm to 5:50 pm Advances in Acoustic and Ultrasonic Transducers <i>(Wang, Meyendorf)</i>	<b>SESSION 3B</b> Mon 3:30 pm to 5:30 pm Nanoengineered Thin Film Sensors for SHM <i>(Burton, Ryu)</i>	<b>SESSION 3</b> Mon 3:30 pm to 4:30 pm Civilian Sensing for Civil Infrastructure <i>(Omenzetter, Huang)</i> <b>SESSION 4</b> Mon 4:30 pm to 5:50 pm Optimization, System Identification, and Soft Computing <i>(Omenzetter, Huang)</i>	<b>SESSION 3</b> Mon 3:30 pm to 5:50 pm Building and Bridge Monitoring <i>(Su, Yu)</i>	<b>SESSION 3</b> Mon 3:30 pm to 5:10 pm Energy Harvesting I <i>(Meyendorf)</i>			
<b>SESSION 4A</b> Tue 9:20 am to 10:00 am Advances in Thermography <i>(Burton)</i> <b>SESSION 5A</b> Tue 10:30 am to 11:50 am Damage Detection by Tomographic Methods <i>(Tallman, Semperlotti)</i> <b>SESSION 6A</b> Tue 1:20 pm to 3:00 pm Smart Structural Composites Based on Nanofillers <i>(Chen, Laflamme)</i>	<b>SESSION 4B</b> Tue 9:20 am to 10:00 am Smart Structure Methods for Disaster Mitigation <i>(Asanuma)</i> <b>SESSION 5B</b> Tue 10:30 am to 11:50 am Big Data and SHM Informatics <i>(Etouney, Glisic)</i> <b>SESSION 6B</b> Tue 1:20 pm to 3:00 pm Sensing for Health Assessment of Transportation Systems <i>(Song, Wang)</i>	<b>SESSION 5</b> Tue 9:20 am to 10:00 am Keynote Session I <i>(Yu)</i> <b>SESSION 6</b> Tue 10:30 am to 11:50 am NDE for Wind Turbines <i>(Omenzetter)</i> <b>SESSION 7</b> Tue 1:20 pm to 3:00 pm Ultrasonic NDE <i>(Yu, Su)</i>	<b>SESSION 4</b> Tue 9:20 am to 10:00 am Acoustic Source Localization <i>(Yu, Fromme)</i> <b>SESSION 5</b> Tue 10:30 am to 11:50 am Nonlinear Guided Wave Based Techniques <i>(Fromme, Niezrecki)</i> <b>SESSION 6</b> Tue 1:20 pm to 3:00 pm Modeling Wave Propagation and Crack Propagation <i>(Uhl, Banerjee)</i>	<b>SESSION 4</b> Tue 9:20 am to 10:00 am Keynote Lecture <i>(Omenzetter)</i> <b>SESSION 5</b> Tue 10:30 am to 11:50 am Wind Energy <i>(Meyendorf)</i> <b>SESSION 6</b> Tue 1:20 pm to 3:00 pm Materials Processing and Characterization I <i>(Ostachowicz)</i>			
<b>SESSION 7A</b> Tue 3:30 pm to 5:50 pm Application of Fiber Optic Sensing for SHM of Structures <i>(Asanuma, Huang)</i>	<b>SESSION 7B</b> Tue 3:30 pm to 5:50 pm Damage Detection and Prognosis of Civil Structures <i>(Loh, Li)</i>	<b>SESSION 8</b> Tue 3:30 pm to 5:50 pm NDE for Composites <i>(Wu, Gyekenyesi)</i>	<b>SESSION 7</b> Tue 3:30 pm to 5:50 pm Guided Waves for SHM <i>(Ostachowicz, Desai)</i>	<b>SESSION 7</b> Tue 3:30 pm to 4:30 pm Propulsion <i>(Peters)</i> <b>SESSION 8</b> Tue 4:30 pm to 5:30 pm Nuclear Energy <i>(Peters)</i>			

# CONFERENCE SESSION SCHEDULE

	CONFERENCE 9798 Electroactive Polymer Actuators and Devices (EAPAD) XVIII	CONFERENCE 9799 Active and Passive Smart Structures and Integrated Systems X	CONFERENCE 9800 Behavior and Mechanics of Multifunctional Materials and Composites X	CONFERENCE 9802 Nano-, Bio-, Info-Tech Sensors and Systems		
Wednesday 23 March	<p><b>SESSION 6A</b> Wed 9:20 am to 12:10 pm Power Generation and Energy Harvesting (Leng, Fontana)</p> <p><b>SESSION 7A</b> Wed 1:20 pm to 3:00 pm Ionic EAP Materials and Actuators I (Akle, Spontak)</p>	<p><b>SESSION 6B</b> Wed 9:20 am to 12:10 pm Theoretical Modeling and Analysis (Zhu, Leung)</p> <p><b>SESSION 7B</b> Wed 1:20 pm to 3:00 pm New EAP Materials, Processes, and Fabrication Techniques I (Jager, Rasmussen)</p>	<p><b>SESSION 8A</b> Wed 9:20 am to 10:00 am SMA-based Materials and Systems II (Sodano)</p> <p><b>SESSION 9A</b> Wed 10:30 am to 12:10 pm Energy Harvesting and Scavenging: Fluid-Structure Interaction (Bryant)</p> <p><b>SESSION 10A</b> Wed 1:40 pm to 3:00 pm Piezo-based Materials and Systems II (Schwesinger, Ozer)</p>	<p><b>SESSION 8B</b> Wed 9:20 am to 10:00 am Modeling, Optimization, Signal Processing, Sensing, Control, and Design of Integrated Systems I (Goulbourne)</p> <p><b>SESSION 9B</b> Wed 10:30 am to 12:10 pm Passive and Active Vibration Isolation Systems II (Zuo, Adhikari)</p> <p><b>SESSION 10B</b> Wed 1:40 pm to 3:00 pm Passive and Active Vibration Isolation Systems III (Laflamme, Tang)</p>	<p><b>SESSION 8</b> Wed 9:20 am to 10:00 am Nanocomposites Materials I (Ciocanel)</p> <p><b>SESSION 9</b> Wed 10:30 am to 12:10 pm Nanocomposites Materials II (Dry)</p> <p><b>SESSION 10</b> Wed 1:40 pm to 3:20 pm Modeling of Multifunctional Materials (Oates, Yu)</p>	<p><b>SESSION 11</b> Wed 9:20 am to 10:20 am Keynote Lecture V (Varadan)</p> <p><b>SESSION 12</b> Wed 10:50 am to 12:40 pm Fabrication and Characterization I (Kim)</p> <p><b>SESSION 13</b> Wed 1:40 pm to 3:20 pm Fabrication and Characterization II (Choi)</p>
	<p><b>SESSION 8A</b> Wed 3:30 pm to 5:50 pm New EAP Materials, Processes, and Fabrication Techniques II (Su, Randriamahazaka)</p>	<p><b>SESSION 8B</b> Wed 3:30 pm to 5:50 pm Applications of EAP (Rossiter, Böse)</p>	<p><b>SESSION 11A</b> Wed 3:30 pm to 6:10 pm Energy Harvesting and Scavenging: Modeling (Liao, Anton)</p>	<p><b>SESSION 11B</b> Wed 3:30 pm to 6:10 pm Passive and Active Vibration Isolation Systems IV (Cazzulani, Kauffman)</p>	<p><b>SESSION 14</b> Wed 3:50 pm to 5:30 pm Fabrication and Characterization III (Yoon)</p>	
Thursday 24 March	<p><b>SESSION 9A</b> Thu 9:20 am to 12:10 pm Applications of EAP Materials to Robotics (Shea, Kim)</p> <p><b>SESSION 10A</b> Thu 1:20 pm to 3:00 pm Ionic EAP Materials and Actuators II (Henke, Wallmersperger)</p> <p><b>SESSION 11A</b> Thu 3:30 pm to 4:50 pm New EAP Materials, Processes, and Fabrication Techniques IV (Pei, Vidal)</p>	<p><b>SESSION 9B</b> Thu 9:20 am to 12:10 pm New EAP Materials, Processes, and Fabrication Techniques III (Koh, Tadesse)</p> <p><b>SESSION 10B</b> Thu 1:20 pm to 4:50 pm Haptic, Tactile, and Other Sensors (Van Volkinburg, Biedermann)</p>	<p><b>SESSION 12A</b> Thu 9:20 am to 10:00 am Micro and Nano Integrated Systems (Park)</p> <p><b>SESSION 13A</b> Thu 10:30 am to 11:50 am Energy Harvesting and Scavenging: General (Liang, Scruggs)</p> <p><b>SESSION 14A</b> Thu 1:20 pm to 3:00 pm Energy Harvesting and Scavenging: Broadband/Nonlinear III (Park, Leng)</p> <p><b>SESSION 15A</b> Thu 3:30 pm to 5:50 pm Energy Harvesting and Scavenging: Applications (Ghasemi-Nejhad, Wang)</p>	<p><b>SESSION 12B</b> Thu 9:20 am to 10:00 am Passive and Active Vibration Isolation Systems V (Todd)</p> <p><b>SESSION 13B</b> Thu 10:30 am to 11:50 am Aircraft, MAV/UAV, and Morphing Systems (Han)</p> <p><b>SESSION 14B</b> Thu 1:20 pm to 3:00 pm Modeling, Optimization, Signal Processing, Sensing, Control, and Design of Integrated Systems II (Ohayon, Gandhi)</p> <p><b>SESSION 15B</b> Thu 3:30 pm to 5:50 pm Magneto Rheological Systems (Choi, Behrooz)</p>	<p><b>SESSION 15</b> Thu 9:20 am to 10:20 am Application in Engineering and Medicine I (Ramasamy)</p> <p><b>SESSION 16</b> Thu 10:50 am to 11:50 am Application in Engineering and Medicine II (Varadan)</p>	



# CONFERENCE SESSION SCHEDULE

CONFERENCE 9803 Sensors and Smart Structures Technologies for Civil, Mechanical, and Aerospace Systems		CONFERENCE 9804 Nondestructive Characterization and Monitoring of Advanced Materials, Aerospace, and Civil Infrastructure X	CONFERENCE 9805 Health Monitoring of Structural and Biological Systems X	CONFERENCE 9806 Smart Materials and Nondestructive Evaluation for Energy Systems II
<p><b>SESSION 8A</b> Wed 9:20 am to 10:00 am Fusion of Fiber Optic and Ultrasonic Sensing I <i>(Peters)</i></p> <p><b>SESSION 9A</b> Wed 10:30 am to 12:10 pm Fusion of Fiber Optic and Ultrasonic Sensing II <i>(Peters, Ecke)</i></p> <p><b>SESSION 10A</b> Wed 1:40 pm to 3:00 pm Control of Aeroelastic Structures using Smart Materials <i>(Staszewski, Tallman)</i></p>	<p><b>SESSION 8B</b> Wed 9:20 am to 10:00 am UAV Technology for System Monitoring <i>(Wang)</i></p> <p><b>SESSION 9B</b> Wed 10:30 am to 12:10 pm System ID and SHM of Civil and Mechanical Systems <i>(Jung, Zonta)</i></p> <p><b>SESSION 10B</b> Wed 1:40 pm to 3:00 pm Novel Methods in Control of Seismically Excited Structures <i>(Johnson, Wang)</i></p>	<p><b>SESSION 9</b> Wed 9:20 am to 10:00 am Keynote Session II <i>(Yu)</i></p> <p><b>SESSION 10</b> Wed 10:30 am to 12:30 pm Image and Video Sensing <i>(Shull, Xia)</i></p> <p><b>SESSION 11</b> Wed 2:00 pm to 3:00 pm NDE for Offshore and Railroad Structures <i>(Lau, Su)</i></p>	<p><b>SESSION 8</b> Wed 9:20 am to 10:00 am Pipes and Tubes <i>(Sohn, Zagrai)</i></p> <p><b>SESSION 9</b> Wed 10:30 am to 12:10 pm Nonlinear Techniques <i>(Giurgiutiu, Sohn)</i></p> <p><b>SESSION 10</b> Wed 1:20 pm to 3:00 pm Periodic Structure and Metamaterial I <i>(Huang, Yang)</i></p>	<p><b>SESSION 9</b> Wed 9:20 am to 10:00 am Materials Processing and Characterization II <i>(Meyendorf, Matikas)</i></p> <p><b>SESSION 10</b> Wed 10:30 am to 12:10 am Energy Harvesting II <i>(Meyendorf, Matikas)</i></p>
<p><b>SESSION 11A</b> Wed 3:30 pm to 6:10 pm Guided Wave Methods for Damage Identification <i>(Matikas, Todd)</i></p>	<p><b>SESSION 11B</b> Wed 3:30 pm to 5:50 pm Novel Sensing Transducers for Smart Structure Application <i>(Wynne, Loh)</i></p>	<p><b>SESSION 12</b> Wed 3:30 pm to 5:10 pm Laser and Optical NDE <i>(Lau, Su)</i></p> <p><b>SESSION 13</b> Wed 5:10 pm to 6:10 pm Signal Processing Techniques in NDE <i>(Lau, Su)</i></p>	<p><b>SESSION 11</b> Wed 3:30 pm to 6:10 pm Periodic Structure and Metamaterial II <i>(Yang, Huang)</i></p>	
<p><b>SESSION 12A</b> Thu 9:20 am to 10:00 am Advances in Piezoelectric Transducers <i>(Mascareñas)</i></p> <p><b>SESSION 13A</b> Thu 10:30 am to 11:50 am Applications of Acoustic and Ultrasonics for SHM <i>(Ostachowicz, Burton)</i></p> <p><b>SESSION 14A</b> Thu 1:20 pm to 3:00 pm Smart Material Solutions for Control Applications <i>(Huang, Swartz)</i></p> <p><b>SESSION 15A</b> Thu 3:30 pm to 5:50 pm Acoustic and Ultrasonic Waves: Models and Experiments <i>(Oppenheim, Hong)</i></p>	<p><b>SESSION 12B</b> Thu 9:20 am to 10:00 am Non-contact Sensing Methods <i>(Wynne)</i></p> <p><b>SESSION 13B</b> Thu 10:30 am to 11:50 am Monitoring and Control of Fluid-Structure Interaction <i>(Mita, Philen)</i></p> <p><b>SESSION 14B</b> Thu 1:20 pm to 3:00 pm Advances in Wireless Monitoring Technology <i>(Ni)</i></p> <p><b>SESSION 15B</b> Thu 3:30 pm to 5:50 pm Advanced in FBG Sensing <i>(Bao)</i></p>	<p><b>SESSION 14</b> Thu 9:20 am to 10:00 am Keynote Session III <i>(Yu)</i></p> <p><b>SESSION 15</b> Thu 10:30 am to 11:50 am Time Reversal, Nonlinear, and Inverse Problems <i>(Chen)</i></p> <p><b>SESSION 16</b> Thu 1:20 pm to 3:00 pm Thermal NDE <i>(Shull, Matikas)</i></p> <p><b>SESSION 17</b> Thu 3:30 pm to 5:50 pm Sensors and Sensing Networks <i>(Wang, Wu)</i></p>	<p><b>SESSION 12A</b> Thu 9:20 am to 10:00 am Acoustic Emission Based SHM <i>(Croxford, Wang)</i></p> <p><b>SESSION 13A</b> Thu 10:30 am to 11:50 am Signal Processing and Damage Detection <i>(Zagrai, Baid)</i></p> <p><b>SESSION 14A</b> Thu 1:20 pm to 3:00 pm Innovative Sensing and Novel Instruments <i>(Grill, Jiang)</i></p> <p><b>SESSION 15A</b> Thu 3:30 pm to 6:10 pm Novel Instruments and Innovative Sensing <i>(Wang, Reis)</i></p>	<p><b>SESSION 12B</b> Thu 9:20 am to 10:00 am Composite Monitoring <i>(Ostachowicz, Gopalakrishnan)</i></p> <p><b>SESSION 13B</b> Thu 10:30 am to 11:50 am Practical Considerations of SHM <i>(Todd, Tian)</i></p> <p><b>SESSION 14B</b> Thu 1:20 pm to 3:00 pm Use of Sensor Technologies for Condition Assessment of Highway Infrastructure <i>(Azari)</i></p> <p><b>SESSION 15B</b> Thu 3:30 pm to 6:10 pm NDE and Rapid Global Assessment of Highway Bridges <i>(Azari)</i></p>

**CONFERENCE 9797**

Monday–Tuesday  
21–22 March 2016  
Proceedings of SPIE  
Vol. 9797

**Bioinspiration,  
Biomimetics, and  
Bioreplication VI**

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**CONFERENCE 9798**

Monday–Thursday  
21–24 March 2016  
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**Electroactive Polymer  
Actuators and Devices  
(EAPAD) XVIII**

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*Committee continues page 20*

**CONFERENCE 9799**

Monday–Thursday  
21–24 March 2016  
Proceedings of SPIE  
Vol. 9799

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

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

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*Committee continues page 20*

**CONFERENCE 9800**

Monday–Wednesday  
21–23 March 2016  
Proceedings of SPIE  
Vol. 9800

**Behavior and  
Mechanics of  
Multifunctional  
Materials and  
Composites X**

*Conference Chair:* **Nakhiah C. Goulbourne**, Univ. of Michigan (USA)

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**CONFERENCE 9801**

Monday–Tuesday  
21–22 March 2016  
Proceedings of SPIE  
Vol. 9801

**Industrial and  
Commercial  
Applications of  
Smart Structures  
Technologies X**

*Conference Chair:* **Steven F. Griffin**, The Boeing Co. (USA)

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**CONFERENCE 9802**

Monday–Thursday  
21–24 March 2016  
Proceedings of SPIE  
Vol. 9802

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

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

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**CONFERENCE 9803**

Monday–Thursday  
21–24 March 2016  
Proceedings of SPIE  
Vol. 9803

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

*Conference Chair:* **Jerome P. Lynch**, Univ. of Michigan (USA)

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

*Program Committee:* **Hiroshi Asanuma**, Chiba Univ. (Japan); **Xiaoyi Bao**, Univ. of Ottawa (Canada); **Chih Chen Chang**, Hong Kong Univ. of Science and Technology (Hong Kong, China); **Genda Chen**, Missouri Univ. of Science and Technology (USA); **Wolfgang Ecker**, Leibniz-Institut für Photonische Technologien e.V. (Germany); **Alison B. Flatau**, Univ. of Maryland, College Park (USA); **Branko Glisic**, Princeton Univ. (USA); **Faramarz Gordaninejad**, Univ. of Nevada, Reno (USA); **Benjamin K. Henderson**, Air Force Research Lab. (USA); **Jung-Wuk Hong**, KAIST (Korea, Republic of); **Neil A. Hoult**, Queen's Univ. (Canada); **Haiying Huang**, The Univ. of Texas at Arlington (USA); **Ying Huang**, North Dakota State Univ. (USA); **Shinae Jang**, Univ. of Connecticut (USA); **Jeong-Tae Kim**, Pukyong National Univ. (Korea, Republic of); **Junhee Kim**, Dankook Univ. (Korea, Republic of); **Masahiro Kurata**, Kyoto Univ. (Japan); **Simon Laflamme**, Iowa State Univ. (USA); **Francesco Lanza di Scalea**, Univ. of California, San Diego (USA); **Hui Li**, Harbin Institute of Technology (China); **Wei-Hsin Liao**, The Chinese Univ. of Hong Kong (Hong Kong, China); **Chin-Hsiung Loh**, National Taiwan Univ. (Taiwan); **Kenneth J. Loh**, Univ. of California, Davis (USA); **Bryan R. Loyola**, Sandia National Labs. (USA); **David Dennis Lee Mascarenas**, Los Alamos National Lab. (USA); **Theodore E. Matikas**, Univ. of Ioannina (Greece);

*Committee continues page 23*

**CONFERENCE 9804**

Monday–Thursday  
21–24 March 2016  
Proceedings of SPIE  
Vol. 9804

**Nondestructive  
Characterization  
and Monitoring of  
Advanced Materials,  
Aerospace, and Civil  
Infrastructure X**

*Conference Chair:* **Tzu-Yang Yu**, Univ. of Massachusetts Lowell (USA)

*Conference Co-Chairs:* **Andrew L. Gyekenyesi**, Ohio Aerospace Institute (USA); **Peter J. Shull**, The Pennsylvania State Univ. (USA); **H. Felix Wu**, U.S. Dept. of Energy (USA)

*Program Committee:* **Ralf B. Bergmann**, Bremer Institut für angewandte Strahltechnik GmbH (Germany); **Gary Carr**, Federal Railroad Administration (USA); **Genda Chen**, Missouri Univ. of Science and Technology (USA); **Shen-En Chen**, The Univ. of North Carolina at Charlotte (USA); **Mohammed M. Ettouney**, Weidlinger Associates, Inc. (USA); **Valery F. Godinez-Azuaga**, Shaw Pipeline Services (USA); **Nenad Gucunski**, Rutgers, The State Univ. of New Jersey (USA); **Dryver R. Huston**, The Univ. of Vermont (USA); **Xiaoning Jiang**, North Carolina State Univ. (USA); **Simon Laflamme**, Iowa State Univ. (USA); **David Lau**, City Univ. of Hong Kong (Hong Kong, China); **Kenneth J. Loh**, Univ. of California, Davis (USA); **Jerome P. Lynch**, Univ. of Michigan (USA); **Theodoros E. Matikas**, Univ. of Ioannina (Greece); **Oliver J. Myers**, Clemson Univ. (USA); **Piotr Omenzetter**, Univ. of Aberdeen (United Kingdom); **Didem Ozevin**, Univ. of Illinois at Chicago (USA); **Akira Sasamoto**, National Institute of Advanced Industrial Science and Technology (Japan); **Caesar Singh**, U.S. Dept. of Transportation (USA); **Yu-Min Su**, National Kaohsiung Univ. of Applied Sciences (Taiwan); **Yan Wan**, Univ. of North Texas (USA); **Ming L. Wang**, Northeastern Univ. (USA);

*Committee continues page 23*

**CONFERENCE 9805**

Monday–Thursday  
21–24 March 2016  
Proceedings of SPIE  
Vol. 9805

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

*Conference Chair:* **Tribikram Kundu**, The Univ. of Arizona (USA)

*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); **Srinivasan Gopalakrishnan**, Indian Institute of Science (India); **Daniel J. Guymar**, Institut National des Sciences Appliquées de Lyon (France); **Guoliang Huang**, Univ. of Missouri School of Medicine (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); **Perngjin F. Pai**, Univ. of Missouri-Columbia (USA); **Xinlin Qing**, Xiamen Univ. (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); **Tadeusz Uhl**, AGH Univ. of Science and Technology (Poland);

*Committee continues page 23*

**CONFERENCE 9806**

Monday–Wednesday  
21–23 March 2016  
Proceedings of SPIE  
Vol. 9806

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

*Conference Chair:* **Norbert G. Meyendorf**, Iowa State Univ. of Science and Technology (USA)

*Conference Co-Chairs:* **Theodoros E. Matikas**, Univ. of Ioannina (Greece); **Kara J. Peters**, North Carolina State Univ. (USA)

*Program Committee:* **Ali Abdul-Aziz**, NASA Glenn Research Ctr. (USA); **George Y. Baekli**, NASA Glenn Research Ctr. (USA); **Leonard Bond**, Iowa State Univ. (USA); **Michael Dalichow**, Quality Network Inc. (USA); **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 IKTS (Germany); **Piotr Omenzetter**, Univ. of Aberdeen (United Kingdom); **Dong-Jin Yoon**, Korea Research Institute of Standards and Science (Korea, Republic of)



## TECHNICAL CONFERENCES

### CONFERENCE 9797

### CONFERENCE 9798

**Anne Ladegaard Skov**, Technical Univ. of Denmark (Denmark); **Ji Su**, NASA Langley Research Ctr. (USA); **Minoru Taya**, Univ. of Washington (USA); **I-Hsiang Tseng**, Feng Chia Univ. (Taiwan); **Rocco Vertechy**, Univ. degli Studi di Bologna (Italy); **Frédéric Vidal**, Univ. de Cergy-Pontoise (France); **Gordon G. Wallace**, Univ. of Wollongong (Australia); **Thomas Wallmersperger**, Technische Univ. Dresden (Germany); **Qiming M. Zhang**, The Pennsylvania State Univ. (USA); **Jian Zhu**, National Univ. of Singapore (Singapore); **Pawel Zylka**, Wroclaw Univ. of Technology (Poland)

### CONFERENCE 9799

**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); **Lei Zuo**, Virginia Polytechnic Institute and State Univ. (USA)

### CONFERENCE 9800

### CONFERENCE 9801

Monday 21 March

### Monday Plenary Session • 8:15 am to 10:00 am

8:15 TO 8:30 AM:

**SSM Lifetime Achievement Award Presentation**  
presented to **James E. Hubbard**, Univ. of Maryland, College Park (USA)

**NDE Lifetime Achievement Award Presentation**  
presented to **Victor Giurgiutiu**, Univ. of South Carolina (USA)



Plenary Presentation: 8:30 to 9:15 AM

**Magnetics + Mechanics + Nanoscale = Electromagnetics Future**

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



Plenary Presentation: 9:15 to 10:00 am

**Smart Materials and Structures: Opportunities for a New Paradigm in Design Optimization**

**Naveed Hussain**, The Boeing Co. (USA)



CONF. 9802

CONFERENCE 9803

**Norbert G. Meyendorf**, Iowa State Univ. of Science and Technology (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); **Kara J. Peters**, North Carolina State Univ. (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); **Wei Song**, The Univ. of Alabama (USA); **Billie F. Spencer Jr.**, Univ. of Illinois at Urbana-Champaign (USA); **Wieslaw J. Staszewski**, AGH Univ. of Science and Technology (Poland); **R. Andrew Swartz**, Michigan Technological Univ. (USA); **Michael D. Todd**, Univ. of California, San Diego (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); **Rosalind M. Wynne**, Villanova Univ. (USA); **Chung-Bang Yun**, Ulsan National Institute of Science and Technology (Korea, Republic of); **Yunfeng Zhang**, Univ. of Maryland, College Park (USA); **Daniele Zonta**, Univ. degli Studi di Trento (Italy)

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CONFERENCE 9804

**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 9805

**Wei-Chih Wang**, Univ. of Washington (USA); **Jinkyu Yang**, 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)

Sponsored by



CONFERENCE 9806

Monday 21 March

Monday Plenary Session · 8:15 am to 10:00 am

8:15 TO 8:30 AM:

**SSM Lifetime Achievement Award Presentation**  
presented to **James E. Hubbard**, Univ. of Maryland, College Park (USA)

**NDE Lifetime Achievement Award Presentation**  
presented to **Victor Giurgiutiu**, Univ. of South Carolina (USA)



Plenary Presentation: 8:30 to 9:15 AM  
**Magnetics + Mechanics + Nanoscale = Electromagnetics Future**  
**Gregory P. Carman**, Univ. of California, Los Angeles (USA)



Plenary Presentation: 9:15 to 10:00 am  
**Smart Materials and Structures: Opportunities for a New Paradigm in Design Optimization**  
**Naveed Hussain**, The Boeing Co. (USA)

**CONFERENCE 9797**

Bioinspiration, Biomimetics, and Bioreplication VI

**SESSION 1**

**LOCATION: MARQUIS 7  
MON 10:30 AM TO 11:10 AM**

**Opening Session**

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

10:30 am: **Challenges for biomimetic night time sky polarization navigation** (*Keynote Presentation*), Javaan S. Chahl, Michael Lucas, Univ. of South Australia (Australia). . . . . [9797-1]

**SESSION 2**

**LOCATION: MARQUIS 7  
MON 11:10 AM TO 12:00 PM**

**Vision**

Session Chair: **Mato Knez**, CIC nanoGUNE Consolider (Spain)

11:10 am: **Superior visual performance in nocturnal insects: neural principles and bio-inspired technologies** (*Invited Paper*), Eric J. Warrant, Lund Univ. (Sweden) [9797-2]

11:40 am: **The influence of active vision on the exoskeleton of intelligent agents**, Theodore B. Terry, Patrice Smith, Walden Univ. (USA) . . . . . [9797-3]

Lunch Break . . . . Mon 12:00 pm to 1:20 pm

**CONFERENCE 9798**

Electroactive Polymer Actuators and Devices (EAPAD) XVIII

**SESSION 1**

**LOCATION: GRAND A/B  
MON 10:30 AM TO 12:10 PM**

**EAP as Emerging Actuators**

Session Chairs: **Yoseph Bar-Cohen**, Jet Propulsion Lab. (USA); **Frédéric Vidal**, Univ. de Cergy-Pontoise (France)

10:30 am: **Nastic actuators** (*Keynote Presentation*), Elisabeth Smela, Univ. of Maryland, College Park (USA) . . . . . [9798-1]

11:10 am: **Autonomous artificial muscle robots without electronics** (*Invited Paper*), Markus Henke, Iain A. Anderson, The Univ. of Auckland (New Zealand) . . . . . [9798-2]

11:30 am: **Multi-layer robot skin with embedded sensors and muscles**, Yonas Tadesse, The Univ. of Texas at Dallas (USA) . . . . . [9798-3]

11:50 am: **Standards for dielectric elastomer transducers**, Federico Carpi, Queen Mary, Univ. of London (United Kingdom); Iain A. Anderson, The Univ. of Auckland (New Zealand); Siegfried G. Bauer, Johannes Kepler Univ. Linz (Austria); Gabriele Frediani, Queen Mary, Univ. of London (United Kingdom); Giuseppe Gallone, Univ. di Pisa (Italy); Massimiliano Gai, Cardiff Univ. (United Kingdom); Christian Graaf, Ostwestfalen-Lippe Univ. of Applied Sciences (Germany); Claire Jean-Mistral, Institut National des Sciences Appliquées de Lyon (France); William Kaal, Fraunhofer-Institut für Betriebsfestigkeit und Systemzuverlässigkeit (Germany); Guggi Kofod, Inmold Biosystems A/S (Denmark); Matthias Kollrosche, Univ. Potsdam (Germany); Roy D. Kornbluh, SRI International (USA); Benny Lassen, Univ. of Southern Denmark (Denmark); Marc Matysek, Continental AG (Germany); Silvain A. Michel, Empa (Switzerland); Stephan Nowak, Bayer AG (Germany); Benjamin M. O'Brien, StretchSense (New Zealand); Qibing Pei, Univ. of California, Los Angeles (USA); Ron Pelrine, SRI International (USA); Björn Rechenbach, Univ. of Southern Denmark (Denmark); Samuel Rosset, Herbert R. Shea, Ecole Polytechnique Fédérale de Lausanne (Switzerland) . . . . . [9798-4]

Lunch Break . . . . . Mon 12:10 pm to 1:20 pm

**CONFERENCE 9799**

Active and Passive Smart Structures and Integrated Systems X

**SESSION 1**

**LOCATION: GRAND E  
MON 10:30 AM TO 11:50 AM**

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

Session Chairs: **Gyuhae Park**, Chonnam National Univ. (Korea, Republic of); **Alper Erturk**, Georgia Institute of Technology (USA)

10:30 am: **Nonlinear vibration energy harvesting based on variable double well potential function**, Wei Yang, Shahrzad Towfighian, Yu Chen, Binghamton Univ. (USA) . . . . . [9799-1]

10:50 am: **Nonlinear switching circuits integrated to a structurally nonlinear broadband energy harvester**, Tarcisio M. Silva, Escola Politécnica da Univ. de São Paulo (Brazil); David Tan, Georgia Institute of Technology (USA); Carlos De Marqui Jr., Univ. de São Paulo (Brazil); Alper Erturk, Georgia Institute of Technology (USA) . . . . . [9799-2]

11:10 am: **In vacuo elastodynamics of a flexible cantilever for wideband energy harvesting**, David Tan, Alper Erturk, Georgia Institute of Technology (USA) . . . . . [9799-3]

11:30 am: **On the optimization of mechanical harvesters based on highly nonlinear solitary waves**, Kaiyuan Li, Piervincenzo Rizzo, Univ. of Pittsburgh (USA) . . . . . [9799-4]

Lunch Break . . Mon 11:50 am to 1:40 pm

**CONFERENCE 9800**

Behavior and Mechanics of Multifunctional Materials and Composites X

**SESSION 1**

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

**Ferroelectrics**

Session Chairs: **Nakhiah C. Goulbourne**, Univ. of Michigan (USA); **Kwang Jin Kim**, Univ. of Nevada, Las Vegas (USA)

10:30 am: **A quantum informed homogenized energy model for ferroelectric materials**, Lider Leon, Jiabin Yu, Ralph C. Smith, North Carolina State Univ. (USA); William S. Oates, Justin Collins, Florida State Univ. (USA) . . . . . [9800-1]

10:50 am: **Characterizing new compositions of [001]C relaxor ferroelectric single crystals using a work-energy model**, John A. Gallagher, Merrimack College (USA) . . . . . [9800-2]

11:10 am: **Uncertainty analysis of continuum scale ferroelectric energy landscapes using density functional theory**, Justin Collins, Florida State Univ. (USA); Ralph C. Smith, North Carolina State Univ. (USA); William S. Oates, Florida State Univ. (USA) . . . . . [9800-3]

11:30 am: **Development of ionic gels using thiol-based monomers in ionic liquid**, Kumkum Ahmed, Yamagata Univ. (Japan); Naofumi Naga, Shibaura Institute of Technology (Japan); Hidemitsu Furukawa, Yamagata Univ. (Japan) . . . . . [9800-4]

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

**CONFERENCE 9801**

Industrial and Commercial Applications of Smart Structures Technologies X

**SESSION 1**

**LOCATION: MARQUIS 8  
MON 10:30 AM TO 12:00 PM**

**Active Flow Control**

Session Chair: **Steven F. Griffin**, The Boeing Co. (USA)

10:30 am: **Enhanced fuel efficient on tractor-trailers using synthetic jets-based active flow control** (*Invited Paper*), Michael Amitay, Rensselaer Polytechnic Institute (USA) and Actasys, Inc. (USA); David Menicovich, Daniele Gallardo, Actasys, Inc. (USA) . . . . . [9801-1]

11:00 am: **Fluidic actuators for active flow control on airframe**, Martin Schueller, Perez Weigel, Mathias Lipowski, Fraunhofer-Institut für Elektronische Nanosysteme (Germany); Michael Meyer, Airbus Group Innovations (Germany); Matthias Bauer, Technische Univ. Berlin (Germany); Jean-Pierre Rosenblum, Dassault Aviation (France); Eric Coustols, ONERA (France) . . . . . [9801-2]

11:20 am: **The development and application of piezoelectric bending beam actuators**, Wilfred K. Chan, Rensselaer Polytechnic Institute (USA); Dan J. Clingman, The Boeing Co. (USA); Michael Amitay, Rensselaer Polytechnic Institute (USA) . . . . . [9801-3]

11:40 am: **Development of piezo-based membranes for synthetic jet actuators: experiments and modeling**, Kevin Housley, Rensselaer Polytechnic Institute (USA); Aaron M. Sassoon, Dan J. Clingman, The Boeing Co. (USA); Michael Amitay, Rensselaer Polytechnic Institute (USA) . . . . . [9801-4]

Lunch Break . . . . Mon 12:00 pm to 1:30 pm

**CONFERENCE 9802**

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

**SESSION 1**

**LOCATION: MARQUIS 6  
MON 10:30 AM TO 11:10 AM**

**Keynote Lecture I**

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

10:30 am: **Nano based sensor for assessment of weaponry structural degradation** (*Keynote Presentation*), Christina L. Brantley, Eugene Edwards, U.S. Army Research, Development and Engineering Command (USA); Paul Ruffin, Alabama A&M Univ. (USA) . . . . . [9802-1]

**SESSION 2**

**LOCATION: MARQUIS 6  
MON 11:10 AM TO 12:20 PM**

**Nanosensors and Systems I**

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

11:10 am: **Graphene nanoribbon field effect transistor temperature sensor** (*Invited Paper*), Yaser M. Banadaki, Ashok Srivastava, Safura Sharifi, Louisiana State Univ. (USA) . . . [9802-2]

11:40 am: **Synthesis and characterization of cellulose nanocrystal/graphene oxide blended films**, Abdullahlil Kafy, Asma Akther, Md. I. Shishir, Eun-byul Jo, Jaehwan Kim, Inha Univ. (Korea, Republic of) . [9802-3]

12:00 pm: **Highly conductive and flexible graphene hybrid fibers and wearable electronic applications**, Wonoh Lee, Korea Institute of Materials Science (Korea, Republic of); Jea Uk Lee, Korea Institute of Materials Science (Korea, Republic of) and Korea Research Institute of Chemical Technology (Korea, Republic of) [9802-4]  
Lunch Break Mon 12:20 pm to 1:30 pm

**CONFERENCE 9803**

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

**Sessions 1A and 1B run concurrently.**

**SESSION 1A**

**LOCATION: GRAND D  
MON 10:30 AM TO 11:50 AM**

**Keynote Session**

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

10:30 am: **Disaster mitigation based on smart structures/materials** (*Keynote Presentation*), Hiroshi Asanuma, Chiba Univ. (Japan); Ji Su, NASA Langley Research Ctr. (USA); Mohsen Shahinpoor, The Univ. of Maine (USA); Ferdinando Felli, Antonio Paolozzi, Sapienza Univ. di Roma (Italy); Mehrdad Ghasemi-Nejhad, Lloyd Hihara, Univ. of Hawai'i at Manoa (USA); Sontipee Aimmanee, King Mongkut's Univ. of Technology Thonburi (Thailand); Yasubumi Furuya, Hirotsaki Univ. (Japan); Kazuhiko Adachi, Chubu Univ. (Japan); Tetsuro Yanaseko, Shinya Okabe, Chiba Univ. (Japan). [9803-1]

11:10 am: **Networking of optical fiber sensors for extreme environments** (*Keynote Presentation*), Kara J. Peters, North Carolina State Univ. (USA) . [9803-2]

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

**SESSION 1B**

**LOCATION: CATALUNA A  
MON 10:30 AM TO 11:50 AM**

**Human-Structure Interaction: Sensing and Analysis**

Session Chairs: **Hae Young Noh**, Carnegie Mellon Univ. (USA); **David D. L. Mascarenas**, Los Alamos National Lab. (USA)

10:30 am: **Extending human proprioception to cyberphysical systems**, Leah P. Dickstein, Univ. of California, Berkeley (USA); Kevin Keller, North Carolina State Univ. (USA); Ethan Robinson, Virginia Polytechnic Institute and State Univ. (USA); Heidi A. Hahn, Alessandro Cattaneo, David D. Mascareñas, Los Alamos National Lab. (USA) [9803-3]

10:50 am: **Characterizing wave propagation to improve indoor step-level person localization using floor vibration**, Mostafa Mirshekari, Yan Pui Lam, Shijia Pan, Haochuan Lei, Pei Zhang, Haeyoung Noh, Carnegie Mellon Univ. (USA) [9803-4]

11:10 am: **Ambient structural sensing for human occupancy level estimation**, Shijia Pan, Pei Zhang, Haeyoung Noh, Carnegie Mellon Univ. (USA) . . . . . [9803-5]

11:30 am: **Watching robot equipped with Kinect v2 focusing on gait**, Ami Ogawa, Akira Mita, Ayanori Yorozu, Masaki Takahashi, Keio Univ. (Japan). . . . . [9803-6]

Lunch Break . . . . . Mon 11:50 am to 1:40 pm

**CONFERENCE 9804**

Nondestructive Characterization and Monitoring of Advanced Materials, Aerospace, and Civil Infrastructure X

**SESSION 1**

**LOCATION: MARQUIS 2  
MON 10:30 AM TO 11:50 AM**

**Microwave and Radar NDE**

Session Chairs: **Tian Xia**, The Univ. of Vermont (USA); **Tzuyang Yu**, Univ. of Massachusetts Lowell (USA)

10:30 am: **Extracting sparse crack features from correlated background in ground penetrating radar concrete imaging using robust principal component analysis technique**, Yu Zhang, Tian Xia, The Univ. of Vermont (USA) . . . . . [9804-1]

10:50 am: **Underground object size estimation based on neural networks in synthetic aperture imaging of ground penetrating radar data**, Yu Zhang, Dryver Huston, Tian Xia, The Univ. of Vermont (USA) . . . . . [9804-2]

11:10 am: **Sizing and ranging criteria for SAR images of steel and wood specimens**, Viet Q. Le, Tzuyang Yu, Jones Owusu Twumasi, Qixiang Tang, Univ. of Massachusetts Lowell (USA) [9804-3]

11:30 am: **Near-field microwave nondestructive and quantitative evaluation of liquid ingress in honeycomb sandwich composites**, Peiyu Wang, Yongmao Pei, Peking Univ. (China) . . . . . [9804-4]

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

**CONFERENCE 9805**

Health Monitoring of Structural and Biological Systems X

**SESSION 1**

**LOCATION: MARQUIS 1  
MON 10:30 AM TO 11:50 AM**

**Guided Wave for Composite Inspection**

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

10:30 am: **Characterization of propagation and scattering via wavefield imaging for improved in situ imaging of impact damage in composites**, Jennifer E. Michaels, Westin B. Williams, Thomas E. Michaels, Georgia Institute of Technology (USA) . . . . . [9805-1]

10:50 am: **Numerical and experimental studies of delamination detection in short fiber reinforced composites using Lamb waves**, Pawel Kudela, 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) [9805-2]

11:10 am: **Model assisted probability of detection for a guided waves based SHM technique**, Vittorio Memmolo, Fabrizio Ricci, Natalino D. Boffa, Ernesto Monaco, Univ. degli Studi di Napoli Federico II (Italy) . . . [9805-3]

11:30 am: **Phased array beamforming and imaging in composite laminates using guided waves**, Zhenhua Tian, Univ. of South Carolina (USA); Cara A. C. Leckey, NASA Langley Research Ctr. (USA); Lingyu Yu, Univ. of South Carolina (USA) . . . . . [9805-4]  
Lunch Break . . . . . Mon 11:50 am to 1:20 pm

**CONFERENCE 9806**

Smart Materials and Nondestructive Evaluation for Energy Systems II

**SESSION 1**

**LOCATION: MARQUIS 3  
MON 10:30 AM TO 11:50 AM**

**Fuel Cells and Energy Storage**

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

10:30 am: **Nondestructive cell evaluation techniques in SOFC stack manufacturing** (*Keynote Presentation*), Christian Wunderlich, Fraunhofer-IKTS CMD (Germany) . . . . . [9806-1]

11:10 am: **Thermal-energy behavior of cool roof membranes with phase change materialsof membranes with phase change materials**, Anna Laura Pisello, Cristina Piselli, Veronica Lucia Castaldo, Univ. degli Studi di Perugia (Italy); Luisa Fernanda Cabeza, Univ. de Lleida (Spain); Franco Cotana, Univ. degli Studi di Perugia (Italy) . . . . . [9806-2]

11:30 am: **Investigating effectiveness of activated carbons of natural sources on various supercapacitors**, Md. Shahnewaz Sabit Faisal, Ramazan Asmatulu, Wichita State Univ. (USA) . [9806-4]

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



**CONFERENCE 9797**

**SESSION 3**

**LOCATION: MARQUIS 7  
MON 1:20 PM TO 3:00 PM**

**Materials and Processing I**

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

1:20 pm: **Butterfly proboscis as a fiber-based self-cleaning micro fluidic system** (*Invited Paper*), Kostya Kornev, Peter Adler, Charles E. Beard, Suellen Pometto, Golnaz N. Tomaraei, Clemson Univ. (USA) . . . [9797-4]

1:50 pm: **Bioinspired functional materials** (*Invited Paper*), Cordt Zollfrank, Technische Univ. München (Germany) . . . . . [9797-5]

2:20 pm: **Ultrahigh-performance continuous DNA nanofibers by bioinspired top-down/bottom-up nanomanufacturing**, Kaspars Maleckis, Yuris A. Dzenis, Univ. of Nebraska-Lincoln (USA) . . . . . [9797-44]

2:40 pm: **Robotic localization of chemical sources using E. Coli chemotaxis**, Timothy Davison, Hoa Nguyen, Kevin Nickels, Duncan Frasch, Trinity Univ. (USA) . . . . . [9797-37]

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

**CONFERENCE 9798**

**SESSION 2**

**LOCATION: GRAND A/B  
MON 1:20 PM TO 3:00 PM**

**Celebrating the 10th Anniversary of the Dielectric Elastomer Minimum Energy Structures (DEMES)**

Session Chairs: **Siegfried G. Bauer**, Johannes Kepler Univ. Linz (Austria); **Herbert R. Shea**, Ecole Polytechnique Fédérale de Lausanne (Switzerland)

1:20 pm: **Fabrication strategies for exploring the anisotropic electroactuation of dielectric elastomers** (*Invited Paper*), Richard J. Spontak, Krishna B. Subramani, Daniel P. Armstrong, Enes Cakmak, Tushar K. Ghosh, North Carolina State Univ. (USA) . . . . . [9798-5]

2:00 pm: **Dielectric elastomer actuation for active porosity control**, Zhi Ren, Alexander Goldsberry, Yu Qiu, Qibing Pei, Univ. of California, Los Angeles (USA) . . . . . [9798-6]

2:20 pm: **Performance comparison of materials for dielectric elastomer actuators and generators**, Rocco Vertechy, Univ. degli Studi di Bologna (Italy); Marco Fontana, Scuola Superiore Sant'Anna (Italy) . . . . . [9798-7]

2:40 pm: **Enhanced dielectric strength and actuation of acrylic elastomer with silicone gel encapsulation**, Thanh-Giang La, Gih-Keong Lau, Nanyang Technological Univ. (Singapore) . . . . . [9798-8]

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

**CONFERENCE 9799**

**SESSION 2**

**LOCATION: GRAND E  
MON 1:40 PM TO 3:00 PM**

**Passive and Active Vibration Isolation Systems I**

Session Chairs: **Kon-Well Wang**, Univ. of Michigan (USA); **Marcelo J. Dapino**, The Ohio State Univ. (USA)

1:40 pm: **Parametric study of wave propagation in hierarchical auxetic perforated metamaterials**, Kevin Billon, Morvan Ouisse, Emeline Sadoulet-Reboul, FEMTO-ST (France); Manuel Collet, Ecole Centrale de Lyon (France); Fabrizio Scarpa, Univ. of Bristol (United Kingdom) . . [9799-6]

2:00 pm: **3D printed elastic honeycombs with graded density for tailorable energy absorption**, Simon Bates, Richard S. Trask, Ian R. Farrow, Univ. of Bristol (United Kingdom) . . . . . [9799-7]

2:20 pm: **Energy exchange and localization in a modular metastructure under impulsive excitation**, Zhen Wu, Kon-Well Wang, Univ. of Michigan (USA); Ryan L. Harne, The Ohio State Univ. (USA) . [9799-8]

2:40 pm: **Vibration control via stiffness switching of magnetostrictive transducers**, Justin J. Scheidler, Vivake M. Asnani, NASA Glenn Research Ctr. (USA); Marcelo J. Dapino, The Ohio State Univ. (USA) . . . . . [9799-9]

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

**CONFERENCE 9800**

**SESSION 2**

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

**Magnetostrictive Materials**

Session Chairs: **Hani E. Naguib**, Univ. of Toronto (Canada); **John A. Gallagher**, Merrimack College (USA)

1:20 pm: **Creep behavior of magnetorheological elastomers under combined magnetic and mechanical loads**, Nima Ghafoorianfar, Univ. of Wisconsin-Platteville (USA) . . . . . [9800-5]

1:40 pm: **Magnetostrictive composites for wireless stress sensing applications**, Alexander Yoffe, Technion-Israel Institute of Technology (Israel) . . . . . [9800-6]

2:00 pm: **Elimination of thermal instability in precise positioning of Galfenol actuators**, Mojtaba Ghodsi, Ashraf Saleem, Khurshid Alam, Abdullah Ozer, Amur Al-Yahmadi, Sultan Qaboos Univ. (Oman); Mohammad Hadi Ghodsi, Yazd Univ. (Iran, Islamic Republic of); Hamidreza Hoshyarmanesh, Isfahan Univ. of Technology (Iran, Islamic Republic of); Mohammad Reza Sheykholeslami, Arak Univ. (Iran, Islamic Republic of) . . . [9800-7]

2:20 pm: **Implementation of a magnetostrictive actuator for active vibration control**, Abdullah Ozer, Mojtaba Ghodsi, Ashraf Saleem, Sultan Qaboos Univ. (Oman); Akio Sekiguchi, Kisarazu National College of Technology (Japan) . . . [9800-8]

2:40 pm: **Anisotropic thermal property of magnetically oriented graphene-polymer composites**, Xiaojie Wang, Bin Li, Caiping Wang, Shuai Dong, Institute of Advanced Manufacturing Technology (China) . [9800-9]

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

**CONFERENCE 9801**

**SESSION 2**

**LOCATION: MARQUIS 8  
MON 1:30 PM TO 3:10 PM**

**Morphing and SMA**

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

1:30 pm: **Toward the bi-modal camber morphing of large aircraft wing flaps: the CleanSky GRA experience**, Rosario Pecora, Francesco Amoroso, Marco Magnifico, Leonardo Lecce, Univ. degli Studi di Napoli Federico II (Italy) . . . . . [9801-5]

1:50 pm: **KRISTINA: Kinematic Rib based Structural system for Innovative Adaptive trailing edge**, Rosario Pecora, Francesco Amoroso, Marco Magnifico, Univ. degli Studi di Napoli Federico II (Italy); Ignazio Dimino, Antonio Concilio, Ctr. Italiano Ricerche Aerospaziali (Italy) . . . . . [9801-6]

2:10 pm: **Distributed electromechanical actuation system design for a morphing trailing edge wing**, Ignazio Dimino, Gianluca Diodati, Ctr. Italiano Ricerche Aerospaziali (Italy); Avner Volovick, Lior Zivan, Israel Aerospace Industries Ltd. (Israel); Antonio Concilio, Ctr. Italiano Ricerche Aerospaziali (Italy) . . . . . [9801-7]

2:30 pm: **Design of superelastic friction ringspring with enhanced dissipative properties**, Andrea Spaggiari, Univ. degli Studi di Modena e Reggio Emilia (Italy) . . . . . [9801-8]

2:50 pm: **Modeling of electric resistance of shape memory alloys: self-sensing for temperature and actuation control of active hybrid composites**, Sebastian Nissle, Moritz Hübner, Martin Gurka, Institut fuer Verbundwerkstoff (Germany) . . [9801-9]

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



**CONFERENCE 9802**

**SESSION 3**

**LOCATION: MARQUIS 6  
MON 1:30 PM TO 2:10 PM**

**Keynote Lecture II**

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

1:30 pm: **Strategic space technology development** (*Keynote Presentation*), Ron Litchford, NASA Headquarters (USA) . . . . . [9802-5]

**SESSION 4**

**LOCATION: MARQUIS 6  
MON 2:10 PM TO 3:30 PM**

**Nanosensors and Systems II**

Session Chair: **Ajit Khosla**, Yamagata Univ. (Japan)

2:10 pm: **A styrene-butadiene rubber (SBR)/carbon nanotube-based smart force sensor for automotive tire deformation monitoring** (*Invited Paper*), Min-Young Cho, Ji-Sik Kim, Kyungpook National Univ. (Korea, Republic of); Seung-Bok Choi, Inha Univ. (Korea, Republic of); Ho-Geun Lee, Daeduk College (Korea, Republic of); Gi-Woo Kim, Inha Univ. (Korea, Republic of) . . . . . [9802-6]

2:30 pm: **Non-conventional synthesis of carbon nano-onions by the low-temperature unfolding of MWCNTs via interaction with theraphthal**, Oxana V. Kharissova, Univ. Autónoma de Nuevo León (Mexico); Rasika Dias, The Univ. of Texas at Arlington (USA); Boris Kharisov, Univ. Autónoma de Nuevo León (Mexico); Jiechao Jiang, The Univ. of Texas at Arlington (USA) . . . . . [9802-7]

2:50 pm: **Nanoforest of hydrothermally grown of carbon nanotubes with nanowires for a high efficiency dye-sensitized solar cell**, Oxana V. Kharissova, Beatriz Ortega, Alena Borisovna, Moises Hinojosa, Univ. Autónoma de Nuevo León (Mexico) . . . . . [9802-8]

3:10 pm: **Metallic single-walled carbon nanotube for ionized radiation detection**, Yaser M. Banadaki, Ashok Srivastava, Safura Sharifi, Louisiana State Univ. (USA) . . . . . [9802-9]

Coffee Break . . Mon 3:30 pm to 4:00 pm

**CONFERENCE 9803**

Sessions 2A and 2B run concurrently.

**SESSION 2A**

**LOCATION: GRAND D  
MON 1:20 PM TO 3:00 PM**

**Energy Harvesting Devices and Methods**

Session Chairs: **Hoon Sohn**, KAIST (Korea, Republic of); **Ming L. Wang**, Northeastern Univ. (USA)

1:20 pm: **On the optimization of mechanical harvesters based on highly nonlinear solitary waves**, Wen Deng, Amir Nasrollahi, Piervincenzo Rizzo, Kaiyuan Li, Univ. of Pittsburgh (USA); Ronald D. Schreckengost, Pennsylvania State Dept. of Transportation (USA) . . . . . [9803-7]

1:40 pm: **A mechanical energy harvested magnetorheological damper with self-sensing ability**, Ki Sum Chu, Li Zou, Wei-Hsin Liao, The Chinese Univ. of Hong Kong (Hong Kong, China) [9803-8]

2:00 pm: **Energy harvesting form high amplitude low frequency contact forces**, Muath A. Bani-Hani, M. Amin Karami, Univ. at Buffalo (USA) . . . . . [9803-9]

2:20 pm: **Effects of charging circuits on the performance of vibration-based energy harvesting**, Hui Zhang, David Ma, Univ. of Hawai'i at Manoa (USA) . . . . . [9803-10]

2:40 pm: **Design of a hybrid-type energy harvester for low-frequency vibration**, Suyoung Yang, Hoon Sohn, KAIST (Korea, Republic of) . . . . . [9803-11]

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

**SESSION 2B**

**LOCATION: CATALUNA A  
MON 1:40 PM TO 3:00 PM**

**Structural Health Monitoring of Bridges**

Session Chairs: **Faramarz Gordaninejad**, Univ. of Nevada, Reno (USA); **Shinae Jang**, Univ. of Connecticut (USA)

1:40 pm: **A self-sensing adaptive magnetorheological elastomer-based bridge bearing with wireless transmission**, Faramarz Gordaninejad, Majid Behrooz, Univ. of Nevada, Reno (USA) . . [9803-12]

2:00 pm: **Rapid cable tension estimation using dynamic properties and geometric effects**, Rosana E. Martinez-Castro, Shinae Jang, Univ. of Connecticut (USA); Bryan Campbell, Virginia Polytechnic Institute and State Univ. (USA) . . . . . [9803-14]

2:20 pm: **Method for detecting ice accretion on bridge cables using continuous wavelet transform**, Julia Andre, Yizheng Liao, Anne S. Kiremidjian, Ram Rajagopal, Stanford Univ. (USA); Christos Georgaklis, Technical Univ. of Denmark (Denmark) . . . . [9803-15]

2:40 pm: **Statistical analysis of modal properties of a cable-stayed bridge through long-term structural health monitoring with wireless smart sensor networks**, Parisa Asadollahi, Jian Li, The Univ. of Kansas (USA) . . . . . [9803-16]

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

**CONFERENCE 9804**

**SESSION 2**

**LOCATION: MARQUIS 2  
MON 1:20 PM TO 3:00 PM**

**NDE/SHM for Aerospace Structures**

1:20 pm: **Data collection and analysis software development for rotor dynamics testing in spin laboratory**, Ali Abdul-Aziz, NASA Glenn Research Ctr. (USA); Daniel Arble, Univ. of Maryland, College Park (USA); Mark R. Woike, NASA Glenn Research Ctr. (USA) . [9804-5]

1:40 pm: **Optimization of a multi-element piezoelectric transducer for mode-selective guided wave generation**, Peyman Yazdanpanah Moghadam, Univ. de Sherbrooke (Canada) and Georgia Institute of Technology (USA); Nicolas Quaegebeur, Univ. de Sherbrooke (Canada); Massimo Ruzzene, Georgia Institute of Technology (USA); Patrice Masson, Univ. de Sherbrooke (USA) . . . . . [9804-6]

2:00 pm: **Ultrasonic guided wave inspection of Inconel 625 brazed lap joints**, Pierre Comot, Philippe Bocher, Pierre Bélanger, École de Technologie Supérieure (Canada) . . . . . [9804-7]

2:20 pm: **Fatigue crack growth monitoring of idealized gearbox spline component using acoustic emission**, Lu Zhang, Didem Ozevin, Univ. of Illinois at Chicago (USA); William Hardman, Naval Air Warfare Ctr. Aircraft Div. (USA); Seth Kessler, Metis Design Corp. (USA); Alan Timmons, Naval Air Warfare Ctr. Aircraft Div. (USA) . . . . . [9804-8]

2:40 pm: **A unified formulation for guided-wave propagation in multi-layered mixed anisotropic-isotropic hybrid aerospace composites**, Darun Barazanchy, Victor Giurgiutiu, Univ. of South Carolina (USA) . . . . . [9804-9]

**CONFERENCE 9805**

**SESSION 2**

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

**Bridge Monitoring**

Session Chairs: **Henrique L. Reis**, Univ. of Illinois at Urbana-Champaign (USA); **Perngjin F. Pai**, Univ. of Missouri (USA)

1:20 pm: **Automated surface crack detection and quantification using computer vision technique for concrete structures**, Soroush Mokhtari, Liuliu Wu, Hae-Bum Yun, Univ. of Central Florida (USA) . . . . . [9805-5]

1:40 pm: **Damage detection based on mode shapes of a girder bridge constructed from responses of a moving vehicle under impact excitation**, Zhong-Qiang Qi, Francis T. K. Au, The Univ. of Hong Kong (Hong Kong, China) . . . . . [9805-6]

2:00 pm: **Performance of support vector machine in detection of anomalies using measurement data of the Ironton-Russell bridge**, Aditi Dalvi, Mehdi Norouzi, Victor Hunt, Arthur Helmicki, Univ. of Cincinnati (USA) . . . . . [9805-7]

2:20 pm: **A structural health monitoring application on a small-span prestressed bridge**, Lei Wang, Univ. of Jinan (China) . . . . [9805-8]

2:40 pm: **Numerical simulation of the wind effects on the temperature analysis of bridges**, Lan Chen, Fengwu Li, Linren Zhou, South China Univ. of Technology (China) . . . . . [9805-9]

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

**CONFERENCE 9806**

**SESSION 2**

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

**SHM**

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

1:20 pm: **Investigating the effects of low temperature on composite materials**, Siavash Shoja, Viktor Berbyuk, Anders Boström, Chalmers Univ. of Technology (Sweden) . . . . . [9806-4]

1:40 pm: **Smart patch integration development of compression connector structural health monitoring in overhead transmission lines**, Hong Wang, Jy-An J. Wang, Oak Ridge National Lab. (USA); Fei Ren, Temple Univ. (USA); John Chan, Electric Power Research Institute, Inc. (USA) . . . . . [9806-5]

2:00 pm: **Simultaneous measurement of distributed temperature and strain using Raman OTDR with fiber Bragg gratings**, Il-Bum Kwon, Korea Research Institute of Standards and Science (Korea, Republic of); Jong Hyun Byeon, FIBERPRO, Inc. (Korea, Republic of); Min Yong Jeon, Chungnam National Univ. (Korea, Republic of) . . . . . [9806-6]

2:20 pm: **Quantification and optimization of the value of SHM and NDE for offshore energy systems**, Anu Hanish Nithin, Piotr Omenszetter, Univ. of Aberdeen (United Kingdom) . . . . . [9806-7]

2:40 pm: **Adaptive pitch control of wind turbines under uncertainties**, Yuan Yuan, Jiong Tang, Univ. of Connecticut (USA) . . . . . [9806-8]

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

**CONFERENCE 9797**

**SESSION 4**

**LOCATION: MARQUIS 7  
MON 3:30 PM TO 5:10 PM**

**Materials and Processing II**

Session Chair: **Kostya Kornev**, Clemson Univ. (USA)

3:30 pm: **Lightweight, damage resistance of the Allomyrina Dichotoma beetle forewing**, Ngoc San Ha, Nam Seo Goo, Konkuk Univ. (Korea, Republic of) . . . . . [9797-9]

3:50 pm: **3D printing of ultrasonically arranged hierarchical composites**, Thomas M. Llewellyn-Jones, Richard S. Trask, Bruce Drinkwater, Univ. of Bristol (United Kingdom). . . . . [9797-10]

4:10 pm: **Hard x-ray imaging to reveal the three-dimensional microstructure of soft and hard tissues**, Anna Khimchenko, Georg Schulz, Simone E. Hieber, Univ. Basel (Switzerland); Samiul Hasan, microworks GmbH (Germany); Christos Bikis, Univ. Basel (Switzerland); Bert Müller, Univ. Basel (Switzerland) and Biomaterials Science Ctr. (Switzerland) . . . . . [9797-11]

4:30 pm: **Experimental and simulation evaluation of additively manufactured titanium-polymer composites**, Sajedeh Nasr Esfahani, Mohsen Taheri Andani, Narges Shayesteh Moghadam, Univ. of Toledo (USA); Reza Mirzaeifar, Virginia Polytechnic Institute and State Univ. (USA); Mohammad H. Elahinia, The Univ. of Toledo (USA) . [9797-12]

4:50 pm: **Fabrication of hierarchical arrays by sacrificial layer mediated nanoimprinting for biomimetic dry-adhesion**, Hemant K. Raut, Avinash Bajji, Hong Yee Low, Singapore Univ. of Technology & Design (Singapore) . . [9797-13]

**SESSION 5**

**LOCATION: MARQUIS 7  
MON 5:10 PM TO 5:30 PM**

**Efficiency**

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

5:10 pm: **Bio-inspired approach to modeling urban building density**, Yilong Han, John Taylor, Virginia Polytechnic Institute and State Univ. (USA) . . . [9797-14]

**CONFERENCE 9798**

**LOCATION: GRAND A/B  
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 pages 13–15.

**CONFERENCE 9799**

**SESSION 3**

**LOCATION: GRAND E  
MON 3:30 PM TO 5:30 PM**

**Structural Health Monitoring**

Session Chair: **Jung-Ryul Lee**, KAIST (Korea, Republic of)

3:30 pm: **Impedance monitoring at tendon-anchorage via mountable PZT interface and temperature-effect compensation**, Thanh-Canh Huynh, Tuan-Cuong Nguyen, Tae-Hwan Kim, Sang-Hoon Choi, Jeong-Tae Kim, Pukyong National Univ. (Korea, Republic of) . . . . . [9799-10]

3:50 pm: **Thermal stress characterization using the impedance-based structural health monitoring system**, Xuan Zhu, Francesco Lanza di Scalea, Univ. of California, San Diego (USA); Mahmood Fateh, Federal Railroad Administration (USA) . . . . . [9799-11]

4:10 pm: **Damage identification based on direct inverse analysis with piezoelectric impedance signatures**, Qi Shuai, Univ. of Connecticut (USA); Gang Liang, Shanghai Maritime Univ. (China); Jiong Tang, Univ. of Connecticut (USA) . . . . . [9799-12]

4:30 pm: **A compressive sensing approach for damage detection and condition monitoring**, Myung jun Lee, Jun Young Jeon, Gyuhae Park, Chonnam National Univ. (Korea, Republic of); To Kang, Jin-Ho Park, Korea Atomic Energy Research Institute (Korea, Republic of) . . . . . [9799-13]

4:50 pm: **Composite NDE using full-field pulse-echo ultrasonic propagation imaging system**, Seung-Chan Hong, Jung-Ryul Lee, KAIST (Korea, Republic of) . . . . . [9799-15]

5:10 pm: **Continuous fatigue crack monitoring of bridges: Long-Term Electrochemical Fatigue Sensor (LTEFS)**, Monty Moshier, Embry-Riddle Aeronautical Univ. (USA); Levi Nelson, Ryan Brinkerhoff, Southern Utah Engineering Experts LLC (USA); Marybeth Miceli, Miceli Infrastructure Consulting, LLC (USA) . . . . . [9799-16]

**CONFERENCE 9800**

**SESSION 3**

**LOCATION: ANDALUCIA  
MON 3:30 PM TO 5:30 PM**

**Shape Memory Materials**

Session Chairs: **Dimitris C. Lagoudas**, Texas A&M Univ. (USA); **Darren J. Hartl**, Texas A&M Univ. (USA)

3:30 pm: **Analysis of shape memory alloy sensory particles for damage detection via substructure and continuum damage modeling**, Brent R. Bielefeldt, Amine Benzerga, Darren J. Hartl, Texas A&M Univ. (USA) . . . . . [9800-10]

3:50 pm: **Fracture toughness of shape memory alloy actuators: effect of thermomechanical coupling and transformation-induced plasticity**, Sameer Jape, Theocharis Baxevanis, Dimitris C. Lagoudas, Texas A&M Univ. (USA) [9800-11]

4:10 pm: **Experimental characterization of SMA actuator cables**, Daniel B. Biggs, John A. Shaw, Univ. of Michigan (USA) . [9800-12]

4:30 pm: **Actuation fatigue modeling and lifetime predictions of nickel-titanium based shape memory alloy actuators**, Rob W. Wheeler III, Dimitris C. Lagoudas, Texas A&M Univ. (USA) . . . . . [9800-13]

4:50 pm: **Structure, energy, and tensile strength of symmetric and asymmetric tilt grain boundaries in nickel-titanium shape memory alloys**, Fatemeh Yazdandoost, Reza Mirzaeifar, Virginia Polytechnic Institute and State Univ. (USA) . . . . . [9800-14]

5:10 pm: **Investigation on the effect of bi-axial bias magnetic field on the voltage output of a MSMA based power harvester**, Roger Guiel, Constantin Ciocanel, Heidi P. Feigenbaum, Northern Arizona Univ. (USA) . . . . . [9800-15]

**CONFERENCE 9801**

**SESSION 3**

**LOCATION: MARQUIS 8  
MON 3:40 PM TO 6:00 PM**

**Industrial Applications I**

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

3:40 pm: **Digital valve for high pressure high flow applications**, Mircea Badescu, Stewart Sherrit, Xiaoqi Bao, Yoseph Bar-Cohen, Jeffery L. Hall, Derek A. Lewis, Jet Propulsion Lab. (USA) . . . . . [9801-10]

4:00 pm: **An ultrasonic horn atomizer with closed loop driving circuit**, Yuan-Fang Chou, Kai-Jhong Chen, National Taiwan Univ. (Taiwan); Jui-Mei Hsu, Industrial Technology Research Institute (Taiwan) . . . . . [9801-11]

4:20 pm: **Image processing based on-line automobile panel crack detection**, Hwee Kwon Jung, Gyuhae Park, Chang Won Lee, Chonnam National Univ. (Korea, Republic of) . . . . . [9801-12]

4:40 pm: **Self-repairing composite walls for pressurized space habitat**, Carolyn Dry, Natural Process Design, Inc. (USA) [9801-13]

5:00 pm: **Electroacoustics modeling of piezoelectric welders for ultrasonic additive manufacturing processes**, Adam J. Hehr, Marcelo J. Dapino, The Ohio State Univ. (USA) . . . . . [9801-14]

5:20 pm: **Active vortex generator deployed on demand by size independent actuation of shape memory alloy wire integrated fiber reinforced polymers**, Moritz Hübler, Sebastian Nisse, Martin Gurka, Ulf Breuer, Institut fuer Verbundwerkstoff (Germany); Jelmer Wassenaar, DG Flugzeugbau GmbH (Germany) . . . . . [9801-15]

5:40 pm: **Composite welding and repair through microwave utilization**, Edward Sosa, Texas State Univ. (USA) and Jacobs Technology, Inc. (USA) . . . . . [9801-16]



**CONF. 9802**

**SESSION 5**

**LOCATION: MARQUIS 6  
MON 4:00 PM TO  
6:00 PM**

**Nano and Micro-  
Systems I**

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

4:00 pm: **Beyond lithium-ion-next generation batteries** (*Keynote Presentation*), Ajit Khosla, Yamagata Univ. (Japan) and Lab 177 Inc. (Canada) . . . . . [9802-10]

4:40 pm: **Adapting radioisotope power generation for general use**, Adam J. Duzik, National Institute of Aerospace (USA); Sang H. Choi, NASA Langley Research Ctr. (USA) . . . . . [9802-11]

5:00 pm: **Low temperature epitaxy and characterization of diamond cubic SiGe on trigonal (0001) sapphire**, Adam J. Duzik, National Institute of Aerospace (USA); Sang H. Choi, NASA Langley Research Ctr. (USA) . . . . . [9802-12]

5:20 pm: **Mass and rotary inertia sensing from vibrating cantilever nanobeams**, Sondipon Adhikari, Swansea Univ. (United Kingdom) [9802-13]

5:40 pm: **Development of nanofabrication process for cost/time-effective nano-island patterns and optical application**, Aktaruzzaman Al-Hossain, Shivan Haran, Ilwoe Seok, Arkansas State Univ. (USA) . . . . . [9802-14]

**CONFERENCE 9803**

**Sessions 3A and 3B run concurrently.**

**SESSION 3A**

**LOCATION: GRAND D  
MON 3:30 PM TO 5:50 PM**

**Advances in Acoustic and Ultrasonic Transducers**

Session Chairs: **Xingwei Wang**, Univ. of Massachusetts Lowell (USA); **Norbert G. Meyendorf**, Iowa State Univ. of Science and Technology (USA)

3:30 pm: **In-plane shear PWAS phased arrays for SHM**, Wentao Wang, Peng Wang, Wensong Zhou, Hui Li, Harbin Institute of Technology (China) . . . [9803-17]

3:50 pm: **A self-diagnostic adhesive for monitoring bonded joints in aerospace structures**, Yitao Zhuang, Yu-Hung Li, Fotis Kopsaftopoulos, Fu-Kuo Chang, Stanford Univ. (USA) . . . . . [9803-18]

4:10 pm: **Optimization of ultrasonic transducers for selective guided wave actuation**, Pawel Packo, Paulina Zbyrad, Mateusz Miszczynski, Tadeusz Stepinski, Tadeusz Uhl, Jerzy Lis, AGH Univ. of Science and Technology (Poland) [9803-19]

4:30 pm: **All-optically driven system in ultrasonic wave-based structural health monitoring**, Siwen Bi, Nan Wu, Jingcheng Zhou, Univ. of Massachusetts Lowell (USA); Chen Zhang, Haifeng Zhang, Univ. of North Texas (USA); Xingwei Wang, Univ. of Massachusetts Lowell (USA) . . . [9803-20]

4:50 pm: **HotSense: a high temperature piezoelectric platform for sensing and monitoring in extreme environments**, Tim Stevenson, Thomas Wines, David Martin, William Vickers, Michael Laws, Ionix Advanced Technologies Ltd. (United Kingdom) . . . . . [9803-21]

5:10 pm: **Advanced instrumentation for acousto-ultrasonic based structural health monitoring**, Stephen P. van der Velden, Ian G. Powlesland, Joel Smithard, George Jung, Nik Rajic, Steve C. Galea, Defence Science and Technology Group (Australia) . . . . . [9803-22]

5:30 pm: **Interdigital transducers in structural health monitoring based on Lamb waves: a state of the art**, Tadeusz Stepinski, Michal Manka, Adam Martowicz, AGH Univ. of Science and Technology (Poland); Vivek Rathold, Indian Institute of Science, (India) . . . . . [9803-23]

**SESSION 3B**

**LOCATION: CATALUNA A  
MON 3:30 PM TO 5:30 PM**

**Nanoengineered Thin Film Sensors for SHM**

Session Chairs: **Andrew R. Burton**, Univ. of Michigan (USA); **Donghyeon Ryu**, New Mexico Institute of Mining and Technology (USA)

3:30 pm: **Electrical conductivity of nanocomposites based on carbon nanotubes under tensile strength: 3D multiscale modeling approach**, Krzysztof Grabowski, Paulina Zbyrad, Wieslaw J. Staszewski, Tadeusz Uhl, Pawel Packo, AGH Univ. of Science and Technology (Poland) . . . . . [9803-24]

3:50 pm: **Multifunctional mechanoluminescent composites for autonomous and self-powered impact damage detection**, Donghyeon Ryu, Nicolas Castaño, Raj Bhakta, Michael Romero, Jamie Kimberley, New Mexico Institute of Mining and Technology (USA) . . . . . [9803-26]

4:10 pm: **Performance assessment of a remote-readable graphite-oxide (GO) based tamper-evident**, Alessandro Cattaneo, Gautam Gupta, Geraldine M. Purdy, Joseph H. Dumont, Aditya D. Mohite, Karen A. Miller, Alexandria N. Marchi, Charles R. Farrar, David D. Mascareñas, Los Alamos National Lab. (USA) . . . . . [9803-27]

4:30 pm: **Distributed thin film sensor array for damage detection and localization**, Austin Downey, Simon Laflamme, Apurba Kumar Das, Umesh Vaidya, Iowa State Univ. of Science and Technology (USA); Filippo Ubertini, Antonella D'Alessandro, Univ. degli Studi di Perugia (Italy) . . . . . [9803-28]

4:50 pm: **Characterization and control of patterned carbon nanotube thin films strain sensor elements**, Andrew R. Burton, Jerome P. Lynch, Univ. of Michigan (USA) . . . . . [9803-29]

5:10 pm: **High-sensitivity strain visualization using electroluminescence technologies**, Jian Xu, The Univ. of Arizona (USA) and Wuhan Polytechnic Univ. (China); Hongki Jo, The Univ. of Arizona (USA) . . . . . [9803-30]

**CONFERENCE 9804**

**SESSION 3**

**LOCATION: MARQUIS 2  
MON 3:30 PM TO 4:30 PM**

**Civilian Sensing for Civil Infrastructure**

Session Chairs: **Piotr Omenzetter**, Univ. of Aberdeen (United Kingdom); **Zhenhua Huang**, Univ. of North Texas (USA)

3:30 pm: **Security challenge to using smartphones for SHM**, Yeka J. Abueh, Hong Liu, Univ. of Massachusetts Dartmouth (USA) [9804-10]

3:50 pm: **Research on public participant integrity monitoring of the Great Wall using smartphone**, Niannian Wang, Xuefeng Zhao, Dalian Univ. of Technology (China); Linan Wang, Chinese Academy of Cultural Heritage Institute of Architecture Conservation (China); Yan Yu, Mingchu Li, Jinping Ou, Dalian Univ. of Technology (China) . . . . . [9804-11]

4:10 pm: **Identification of the operational frequencies of 300+ bridges using smartphones**, Sebastian Castellanos, Johannio Marulanda, Monica Preciado, Alejandro Cruz, Peter Thomson, Univ. del Valle (Colombia) . . . . . [9804-12]

**SESSION 4**

**LOCATION: MARQUIS 2  
MON 4:30 PM TO 5:50 PM**

**Optimization, System Identification, and Soft Computing**

Session Chairs: **Piotr Omenzetter**, Univ. of Aberdeen (United Kingdom); **Zhenhua Huang**, Univ. of North Texas (USA)

4:30 pm: **Cuckoo search algorithm for model updating**, Faisal Shabbir, Univ. of Engineering and Technology, Taxila (Pakistan); Piotr Omenzetter, Univ. of Aberdeen (United Kingdom) . . . [9804-13]

4:50 pm: **Particle swarm optimization for optimal sensor placement in ultrasonic SHM systems**, Philippe Blanloeuil, Nur Azmira Elena Nurhazli, Martin Veidt, The Univ. of Queensland (Australia) . . . . . [9804-14]

5:10 pm: **Dynamic behaviors of historical wrought iron truss bridges: a field testing case study**, Kaoshan Dai, Ying Wang, Tongji Univ. (China); Andrew Hedric, Zhenhua Huang, Univ. of North Texas (USA) . . . . . [9804-15]

5:30 pm: **A study of thermal response of concrete towers employing statistical models**, Mahdi Norouzi, Aditi Dalvi, Victor J. Hunt, Arthur Helmicki, Univ. of Cincinnati (USA) . . . . [9804-16]

**CONFERENCE 9805**

**SESSION 3**

**LOCATION: MARQUIS 1  
MON 3:30 PM TO 5:50 PM**

**Building and Bridge Monitoring**

Session Chairs: **Zhongqing Su**, The Hong Kong Polytechnic Univ. (Hong Kong, China); **Lingyu Yu**, Univ. of South Carolina (USA)

3:30 pm: **Sparse generalized pencil of function and its application to system identification and structural health monitoring**, Reza Mohammadi Ghazi, Oral Buyukozturk, Massachusetts Institute of Technology (USA) . . . . . [9805-10]

3:50 pm: **Uncertainty analysis of practical structural health monitoring systems currently employed for tall buildings consisting of small number of sensors**, Kenta Hirai, Akira Mita, Keio Univ. (Japan) . . . . . [9805-11]

4:10 pm: **Bayesian updating of building models using incomplete modal data without mode matching**, Hao Sun, Oral Buyukozturk, Massachusetts Institute of Technology (USA) . . . . . [9805-12]

4:30 pm: **The analysis about condition assessment of bridge based on discrete dynamic Bayesian networks**, Buyu Jia, Xiaolin Yu, Quansheng Yan, South China Univ. of Technology (China) [9805-16]

4:50 pm: **Estimation of seismic response of buildings with a few accelerometers without input data**, Yu Suzuki, Akira Mita, Keio Univ. (Japan) . . . . . [9805-14]

5:10 pm: **Ultrasonic guided wave monitoring of actively protected RC structures from corrosion using CFRP**, Ashutosh Sharma, Payal Sachdeva, Shruti Sharma, Sandeep Sharma, Thapar Univ. (India) [9805-15]

5:30 pm: **Gap between technically accurate information and socially appropriate information for structural health monitoring system installed into tall buildings**, Akira Mita, Keio Univ. (Japan) . . . [9805-13]

**CONF. 9806**

**SESSION 3**

**LOCATION: MARQUIS 3  
MON 3:30 PM TO 5:10 PM**

**Energy Harvesting I**

Session Chair: **Norbert G. Meyendorf**, Iowa State Univ. of Science and Technology (USA)

3:30 pm: **Energy harvesting from dancing: for broadening in participation in STEM fields**, Yonas Tadesse, The Univ. of Texas at Dallas (USA) . . . . . [9806-9]

3:50 pm: **U-shape magnetostrictive vibration based power generator for universal use**, Toshiyuki Ueno, Kanazawa Univ. (Japan) . . . . . [9806-10]

4:10 pm: **Magnetoelastic beam with extended polymer for low frequency vibration energy harvesting**, Alwathiqbellah Ibrahim, Shahrzad Towfighian, Mohammad Younis, Quang Su, Binghamton Univ. (USA) . . . . . [9806-11]

4:30 pm: **Multiple patch-based piezoelectric energy harvesters integrated to a thin plate with AC-DC conversion: analytical modeling and numerical validation**, Amirreza Aghakhani, Ipek Basdogan, Koç Univ. (Turkey); Alper Erturk, Georgia Institute of Technology (USA) . . [9806-12]

4:50 pm: **Modeling, experimental verification, and application of a low-frequency zigzag energy harvester based on impact principle**, Shengxi Zhou, Daniel J. Inman Sr., Univ. of Michigan (USA); Junyi Cao Sr., Xi'an Jiaotong Univ. (China) . . . . . [9806-13]

**CONFERENCE 9797**

Bioinspiration, Biomimetics, and Bioreplication VI

**CONFERENCE 9798**

Electroactive Polymer Actuators and Devices (EAPAD) XVIII

**CONFERENCE 9799**

Active and Passive Smart Structures and Integrated Systems X

**CONFERENCE 9800**

Behavior and Mechanics of Multifunctional Materials and Composites X

**CONFERENCE 9801**

Industrial and Commercial Applications of Smart Structures Technologies X

**Tuesday Plenary Session · 8:20 am to 9:10 am**



Plenary Presentation: 8:25 to 9:10 AM

**Use of the Elastodynamic Reciprocity Theorem for Ultrasonic Problem Solving**

Jan D. Achenbach, Northwestern Univ. (USA)

**SESSION 6**

**LOCATION: MARQUIS 7  
TUE 9:20 AM TO 10:00 AM**

**Flight**

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

9:20 am: **Characteristics of a biological-inspired hovering flapping wing micro air vehicle**, Quoc-Viet Nguyen, Marco Debiasi, Woei-Leong Chan, National Univ. of Singapore (Singapore). . . . . [9797-15]

9:40 am: **Pitch, roll, and yaw moment generator for insect-like tailless flapping-wing MAV**, Hoang Vu Phan, Hoon Cheol Park, Konkuk Univ. (Korea, Republic of) . . . . . [9797-16]

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

**SESSION 3**

**LOCATION: GRAND A/B  
TUE 9:20 AM TO 12:10 PM**

**Dielectric Elastomers**

Session Chairs: **Elisabeth Smela**, Univ. of Maryland, College Park (USA); **Frédéric Vidal**, Univ. de Cergy-Pontoise (France)

9:20 am: **Computational modeling of electromechanical instabilities in dielectric elastomers** (*Invited Paper*), Harold Park, Boston Univ. (USA). . . [9798-9]

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

**SESSION 4**

**LOCATION: GRAND E  
TUE 9:20 AM TO 10:00 AM**

**Piezo-based Materials and Systems I**

Session Chair: **Diann E. Brei**, Univ. of Michigan (USA)

9:20 am: **An experimental study on reflector wave-front error correction using PZT actuators**, Lan Lan, Shuidong Jiang, Yang Zhou, Houfei Fang, Shanghai YS Information Technology Co., Ltd. (China); Zhigang Wu, Jianming Du, Dalian Univ. of Technology (China) . . . . . [9799-17]

9:40 am: **Design and development of a double piezoelectric pump-hydraulic hybrid actuator**, Yongzhe Li, Ngoc San Ha, Nam Seo Goo, Konkuk Univ. (Korea, Republic of); Tae Heun Kim, Firstec Co., Ltd. (Korea, Republic of); Chang Seop Lee, Agency for Defense Development (Korea, Republic of) . . . . . [9799-18]

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

**SESSION 4**

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

**Shape Memory Polymers**

Session Chair: **Filippo Ubertini**, Univ. degli Studi di Perugia (Italy)

9:20 am: **Design and development of origami structure for impact properties**, Mohamed Ali E. Kshad, Hani E. Naguib, Univ. of Toronto (Canada) . . . . . [9800-16]

9:40 am: **Durability of carbon fiber reinforced shape memory polymer composites in space**, Joon Hyeok Jang, Seok Bin Hong, Yong San Ahn, Seoul National Univ. (Korea, Republic of); Nam Seo Goo, Konkuk Univ. (Korea, Republic of); Jin-Gyun Kim, Yong-Youn Nam, Korea Institute of Machinery & Materials (Korea, Republic of); Woong-Ryeol Yu, Seoul National Univ. (Korea, Republic of) . . . . . [9800-17]

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

**SESSION 4**

**LOCATION: MARQUIS 8  
TUE 9:20 AM TO 11:50 AM**

**Industrial Applications II**

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

9:20 am: **Chatter in cylindrical grinding and its suppression**, Yao Yan, Univ. of Electronic Science and Technology of China (China); Jian Xu, Tongji Univ. (China) . . . . . [9801-17]

9:40 am: **Carbon nanotubes produced by the spray pyrolysis method from different carbon sources**, Beatriz Ortega Garcia, Oxana V. Kharissova, Univ. Autónoma de Nuevo León (Mexico); Francisco Servando Aguirre-Tostado, Ctr. de Investigación en Materiales Avanzados, S.C. (Mexico); Rasika Dias, The Univ. of Texas at Arlington (USA); Boris Kharisov, Univ. Autónoma de Nuevo León (Mexico) . . . . . [9801-18]

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



**CONFERENCE 9802**

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

**CONFERENCE 9803**

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

**CONFERENCE 9804**

Nondestructive Characterization and Monitoring of Advanced Materials, Aerospace, and Civil Infrastructure X

**CONFERENCE 9805**

Health Monitoring of Structural and Biological Systems X

**CONFERENCE 9806**

Smart Materials and Nondestructive Evaluation for Energy Systems II

**Tuesday Plenary Session · 8:20 am to 9:10 am**



Plenary Presentation: 8:25 to 9:10 AM

**Use of the Elastodynamic Reciprocity Theorem for Ultrasonic Problem Solving**

Jan D. Achenbach, Northwestern Univ. (USA)

**SESSION 6**

**LOCATION: MARQUIS 6  
TUE 9:20 AM TO 10:40 AM**

**Keynote Lecture III**

Session Chair: **Ajit Khosla**, Yamagata Univ. (Japan)

9:20 am: **3D gel printer for soft and wet matter engineering** (*Keynote Presentation*), Hidemitsu Furukawa, Yamagata Univ. (Japan) . . .[9802-15]

10:00 am: **3D printing of nano and microstructures**, Vijay K. Varadan, The Pennsylvania State Univ. (USA) . . . . .[9802-16]

10:20 am: **Internal structure analysis of particle-double network gels used in a gel organ replica**, Mei Abe, Masanori Arai, Azusa Saito, Kazuyuki Sakai, Masaru Kawakami, Hidemitsu Furukawa, Yamagata Univ. (Japan) . . .[9802-17]

Coffee Break Tue 10:40 to 11:00 am

Sessions 4A and 4B run concurrently.

**SESSION 4A**

**LOCATION: GRAND D  
TUE 9:20 AM TO 10:00 AM**

**Advances in Thermography**

Session Chair: **Andrew R. Burton**, Univ. of Michigan (USA)

9:20 am: **Extraction of thermal Green's function using diffuse fields: a passive approach applied to thermography**, Margherita Capriotti, Simone Sternini, Francesco Lanza di Scalea, Stefano Mariani, Univ. of California, San Diego (USA) . . . . .[9803-31]

9:40 am: **3D temperature field reconstruction using ultrasound sensing system**, Yuqian Liu, Tong Ma, Chengyu Cao, Univ. of Connecticut (USA); Xingwei Wang, Univ. of Massachusetts Lowell (USA) . . . . .[9803-32]

Coffee Break Tue 10:00 to 10:30 am

**SESSION 4B**

**LOCATION: CATALUNA A  
TUE 9:20 AM TO 10:00 AM**

**Smart Structure Methods for Disaster Mitigation**

Session Chair: **Hiroshi Asanuma**, Chiba Univ. (Japan)

9:20 am: **Smart disaster mitigation in Thailand**, Sontipee Aimmanee, King Mongkut's Univ. of Technology Thonburi (Thailand); Hiroshi Asanuma, Chiba Univ. (Japan) . . . . .[9803-33]

9:40 am: **Development of smart mechanical material systems to be used in disaster environments**, Hiroshi Asanuma, Tetsuro Yanaseko, Tatsuhiro Koseko, Yuki Hirayama, Shinya Okabe, Chiba Univ. (Japan) . . . . .[9803-34]

Coffee Break Tue 10:00 to 10:30 am

**SESSION 5**

**LOCATION: MARQUIS 2  
TUE 9:20 AM TO 10:00 AM**

**Keynote Session I**

Session Chair: **Tzuyang Yu**, Univ. of Massachusetts Lowell (USA)

9:20 am: **Laser vibrometry for wind turbines inspections** (*Keynote Presentation*), Reinhard Ebert, Fraunhofer-Institut für Optronik, Systemtechnik und Bildauswertung (Germany) . . . . .[9804-17]

Coffee Break Tue 10:00 to 10:30 am

**SESSION 4**

**LOCATION: MARQUIS 1  
TUE 9:20 AM TO 10:00 AM**

**Acoustic Source Localization**

Session Chairs: **Lingyu Yu**, Univ. of South Carolina (USA); **Paul Fromme**, Univ. College London (United Kingdom)

9:20 am: **Acoustic emission source localization based on distance domain signal representation**, Mateusz Gawronski, Krzysztof Grabowski, Wieslaw J. Staszewski, Tadeusz Uhl, Pawel Packo, AGH Univ. of Science and Technology (Poland) . . . . .[9805-17]

9:40 am: **Acoustic source localization in an anisotropic plate without knowing its material properties: a new approach**, Won Hyun Park, College of Optical Sciences, The Univ. of Arizona (USA); Tribikram Kundu, The Univ. of Arizona (USA) . . . . .[9805-18]

Coffee Break Tue 10:00 to 10:30 am

**SESSION 4**

**LOCATION: MARQUIS 3  
TUE 9:20 AM TO 10:00 AM**

**Keynote Lecture**

Session Chair: **Piotr Omenzetter**, Univ. of Aberdeen (United Kingdom)

9:20 am: **Highlights and challenges in nondestructive evaluation for metallic and composite structures** (*Keynote Presentation*), Wieslaw M. Ostachowicz, The Szewalski Institute of Fluid-Flow Machinery (Poland) and Warsaw Univ. of Technology (Poland) . . . . .[9806-15]

Coffee Break Tue 10:00 to 10:30 am

**CONFERENCE 9797**

**SESSION 7**

**LOCATION: MARQUIS 7  
TUE 10:30 AM TO 12:10 PM**

**Optics and Photonics**

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

10:30 am: **Bio-inspired, color-tunable, mechano-responsive photonic fibers** (*Invited Paper*), Mathias Kolle, Joseph D. Sandt, Marcus Urann, Massachusetts Institute of Technology (USA); Peter Vukusic, Univ. of Exeter (United Kingdom) . [9797-17]

11:00 am: **A self-assembled, reconfigurable “compound eye” from an smectic liquid crystal on a curved interface** (*Invited Paper*), Kathleen Stebe, Univ. of Pennsylvania (USA) . . . . . [9797-18]

11:30 am: **Rejoice in unexpected gifts from parrots and butterflies**, Akhlesh Lakhtakia, The Pennsylvania State Univ. (USA)[9797-19]

11:50 am: **Bioinspired photonic nanostructures via 3D direct laser writing**, Julia Purto, Leibniz-Institut für Neue Materialien gGmbH (Germany) and Univ. des Saarlandes (Germany); Elmar Kroner, Leibniz-Institut für Neue Materialien gGmbH (Germany) . . . . . [9797-20]

Lunch Break . . . . Tue 12:10 pm to 1:30 pm

**CONFERENCE 9798**

**SESSION 3**

Continued

10:30 am: **Instability and thermodynamics of dielectric elastomers** (*Invited Paper*), Liwu Liu, Yanju Liu, Jinsong Leng, Harbin Institute of Technology (China) . . . [9798-10]

11:10 am: **Electro-crumpling instability and breakdown strength of stretched dielectric membranes**, Bo Li, Xi’an Jiaotong Univ. (China) . . . . . [9798-11]

11:30 am: **High-force Dielectric Electroactive Polymer (DEAP) membrane actuator**, Steffen Hau, Alexander York, Stefan S. Seelecke, Univ. des Saarlandes (Germany) . . . . . [9798-12]

11:50 am: **Large continuous actuation of an artificial muscle module**, Adrian Koh, National Univ. of Singapore (Singapore) . . . . . [9798-13]

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

**CONFERENCE 9799**

**SESSION 5**

**LOCATION: GRAND E  
TUE 10:30 AM TO 11:50 AM**

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

Session Chairs: **Lihua Tang**, The Univ. of Auckland (New Zealand); **Ryan L. Harne**, The Ohio State Univ. (USA)

10:30 am: **Control between coexistent attractors for optimal performance of a bistable piezoelectric vibration energy harvester**, Daniel Geijer, Jeffrey L. Kauffman, Univ. of Central Florida (USA) . . . . . [9799-19]

10:50 am: **Exploring the roles of standard rectifying circuits on the performance of a nonlinear piezoelectric energy harvester**, Lihua Tang, Yue Han, James Hand, The Univ. of Auckland (New Zealand); Ryan L. Harne, The Ohio State Univ. (USA) [9799-20]

11:10 am: **Global stabilization of high-energy resonance for a nonlinear wideband electromagnetic vibration energy harvester**, Arata Masuda, Takeru Sato, Kyoto Institute of Technology (Japan). . . . . [9799-22]

11:30 am: **Galloping-based piezo-aeroelastic energy harvester for wireless sensors to be installed on freight trains**, Gisella Tomasini, Stefano Giappino, Andrea Costa, Politecnico di Milano (Italy)[9799-109]

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

**CONFERENCE 9800**

**SESSION 5**

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

**Energy Storage and Harvesting**

Session Chairs: **Zoubeida Ounaies**, The Pennsylvania State Univ. (USA); **Jiangyu Li**, Univ. of Washington (USA)

10:30 am: **Multifunctional lightweight composite with updated morphology for increased power storage capacity**, Andrew Liebig, Constantin Ciocanel, Cindy Browder, William Andrews, Northern Arizona Univ. (USA) . . . . . [9800-18]

10:50 am: **Fabrication and characterization of layered conductive polymer on nylon membrane templates for high performance, thin-film supercapacitor electrodes**, HaoTian Harvey Shi, Hani E. Naguib, Univ. of Toronto (Canada) [9800-19]

11:10 am: **Development of multifunctional fiber reinforced polymer composites through ZnO nanowire arrays**, Mohammad H. Malakooti, Univ. of Michigan (USA); Brendan A. Patterson, Hyun-Sik Hwang, Univ. of Florida (USA); Henry A. Sodano, Univ. of Michigan (USA) . . . . . [9800-20]

11:30 am: **Localized thermal and electrical conductivity imaging of multiphase thermoelectric composites**, Ehsan Nasr Esfahani, Jiangyu Li, Univ. of Washington (USA) . . . . . [9800-21]

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

**CONFERENCE 9801**

**SESSION 4**

Continued

10:30 am: **Nanotechnology-based remediation of petroleum impurities from water**, Boris Kharisov, Oxana V. Kharisova, Univ. Autónoma de Nuevo León (Mexico); Rasika Dias, The Univ. of Texas at Arlington (USA) . . . . . [9801-10]

10:50 am: **Comparison of binary and multi-level logic electronics for embedded systems**, Shirly M. Damti, Steve E. Watkins, R. J. Stanley, Missouri Univ. of Science and Technology (USA) . . . . . [9801-21]

11:10 am: **End-of-life assessments of smart materials and structures**, Eylem Asmatulu, Wichita State Univ. (USA) . . . . . [9801-29]

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

CONFERENCE 9802

SESSION 7

LOCATION: MARQUIS 6  
TUE 11:00 AM TO 12:20 PM

**3D Printing and Applications I**

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

11:00 am: **Development of gel materials with high transparency and mechanical strength for use with a 3D gel printer "SWIM-ER"**, Taishi Tase, Koji Okada, Kyuichiro Takamatsu, Azusa Saito, Masaru Kawakami, Hidemitsu Furukawa, Yamagata Univ. (Japan) . . [9802-18]

11:20 am: **Modeling the transparent shape memory gels by 3D printer Acculas**, Hiroaki Kumagai, Masanori Arai, Kazuyuki Sakai, Gong Jin, Masaru Kawakami, Hidemitsu Furukawa, Yamagata Univ. (Japan) . . . . . [9802-19]

11:40 am: **Establishment of gel materials with different mechanical properties by 3D gel printer "SWIM-ER"**, Takafumi Ota, Taishi Tase, Koji Okada, Kyuichiro Takamatsu, Azusa Saito, Masaru Kawakami, Hidemitsu Furukawa, Yamagata Univ. (Japan) . . [9802-20]

12:00 pm: **Preparation of hydrogels nanocomposite using modified nano-cellulose as a cross-linker**, Magdi Gibril, Univ. of KwaZulu-Natal (South Africa) . . . . . [9802-21]

Lunch Break . Tue 12:20 to 1:40 pm

CONFERENCE 9803

Sessions 5A and 5B run concurrently.

SESSION 5A

LOCATION: GRAND D  
TUE 10:30 AM TO 11:50 AM

**Damage Detection by Tomographic Methods**

Session Chairs: **Tyler Tallman**, Univ. of Michigan (USA); **Fabio Semperlotti**, Univ. of Notre Dame (USA)

10:30 am: **An application of fractional calculus to tomographic identification of structural damage**, Salvatore Buonocore, Univ. of Notre Dame (USA); **Fabio Semperlotti**, Univ. of Notre Dame (USA) and Purdue Univ. (USA); **Mihir Sen**, Univ. of Notre Dame (USA) . . . . . [9803-35]

10:50 am: **Unpowered wireless ultrasound tomography system**, Farshad Zahedi, Haiying Huang, The Univ. of Texas at Arlington (USA) . . . . . [9803-36]

11:10 am: **Electrical resistance tomography with constrained sine wave solutions for impact damage identification in glass fiber/epoxy/carbon black laminate composites**, Tyler Tallman, Purdue Univ. (USA) . . . . . [9803-37]

11:30 am: **In-plane translation and rotation measurement by using digital sampling moiré method**, Xinxing Chen, Chih Chen Chang, Hong Kong Univ. of Science and Technology (Hong Kong, China) . . . . . [9803-38]

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

SESSION 5B

LOCATION: CATALUNA A  
TUE 10:30 AM TO 11:50 AM

**Big Data and SHM Informatics**

Session Chairs: **Mohammed M. Ettouney**, Weidlinger Associates, Inc. (USA); **Branko Glisic**, Princeton Univ. (USA)

10:30 am: **Sub-Nyquist signal-reconstruction-free operational modal analysis and damage detection in the presence of noise**, Kyriaki Gkoktsi, Agathoklis Giaralis, Bamrung T. Siesakul, City Univ. London (United Kingdom) . [9803-39]

10:50 am: **A cloud based cyber infrastructure for integrated bridge monitoring data management**, Seongwoon Jeong, Stanford Univ. (USA); **Yilan Zhang**, Jerome P. Lynch, Univ. of Michigan (USA); **Hoon Sohn**, KAIST (Korea, Republic of); **Kincho H. Law**, Stanford Univ. (USA) . [9803-40]

11:10 am: **Essentiality and applications of tripod analogy for SHM use in bridge management**, Mohammed M. Ettouney, Weidlinger Associates, Inc. (USA); **Sharada Alampalli**, Sandeep Alampalli, Prospect Solutions, LLC (USA) . . . . . [9803-41]

11:30 am: **Big data and high-performance analytics in structural health monitoring for bridge management**, Sharada Alampalli, Prospect Solutions, LLC (USA); **Mohammed M. Ettouney**, Weidlinger Associates, Inc. (USA); **Sandeep Alampalli**, Prospect Solutions, LLC (USA) . . . . . [9803-42]

Lunch Break Tue 11:50 am to 1:20 pm

CONFERENCE 9804

SESSION 6

LOCATION: MARQUIS 2  
TUE 10:30 AM TO 11:50 AM

**NDE for Wind Turbines**

Session Chair: **Piotr Omenzetter**, Univ. of Aberdeen (United Kingdom)

10:30 am: **Vibration-based damage detection algorithm for WTT structures**, Tuan-Cuong Nguyen, Tae-Hwan Kim, Sang-Hoon Choi, Joo-Young Ryu, Jeong-Tae Kim, Pukyong National Univ. (Korea, Republic of) . . . . . [9804-18]

10:50 am: **Dynamic survey of wind turbine vibrations**, Chih-Hung Chiang, Keng-Tsang Hsu, Chia-Chi Cheng, Chieh-Chen Pan, Chaoyang Univ. of Technology (Taiwan); **Chih-Luen Huang**, Tao-Ming Cheng, Univ. of Illinois at Urbana-Champaign (USA) . . . . . [9804-19]

11:10 am: **Employing unmanned aerial vehicle to monitor the health conditions of wind turbine**, Shengmin Wu, Chih-Huang Chiang, Jia-Jyun Jhang, Yishuo Huang, Chaoyang Univ. of Technology (Taiwan) . . . . . [9804-20]

11:30 am: **Multistage gearbox fault diagnosis based on synchronous sampling technique**, Shengli Zhang, Jiong Tang, Univ. of Connecticut (USA) . . . . . [9804-21]

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

CONFERENCE 9805

SESSION 5

LOCATION: MARQUIS 1  
TUE 10:30 AM TO 11:30 AM

**Nonlinear Guided Wave Based Techniques**

Session Chairs: **Paul Fromme**, Univ. College London (United Kingdom); **Christopher Nizerecki**, Univ. of Massachusetts Lowell (USA)

10:30 am: **Amplitude-dependent contraction/elongation of nonlinear Lamb waves**, Pawel Packo, Wieslaw J. Staszewski, Tadeusz Uhl, AGH Univ. of Science and Technology (Poland); **Michael J. Leamy**, Georgia Institute of Technology (USA) . . . . . [9805-19]

10:50 am: **On analytical modeling of contact acoustic nonlinearity of guided waves and its application to evaluating severity of fatigue damage**, Kai Wang, Zhongqing Su, The Hong Kong Polytechnic Univ. (Hong Kong, China) . . . . . [9805-20]

11:10 am: **Progressive damage state evolution and quantification in composites**, Subir Patra, Sourav Banerjee, Univ. of South Carolina (USA) . . . . . [9805-21]

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

CONFERENCE 9806

SESSION 5

LOCATION: MARQUIS 3  
TUE 10:30 AM TO 11:50 AM

**Wind Energy**

Session Chair: **Norbert G. Meyendorf**, Iowa State Univ. of Science and Technology (Germany)

10:30 am: **Development of novel general equation for multistage epicyclic gearset with corrected teeth: non-constrained approach**, Piotr Kijanka, Adam Jablonski, Tomasz Barszcz, AGH Univ. of Science and Technology (Poland) . . . . . [9806-16]

10:50 am: **Quantifying voids effecting delamination in carbon/epoxy composites: static and fatigue fracture behavior**, Issa A. A. Hakim, Univ. of Dayton (USA) and Fraunhofer IKTS-MD (Germany) and Omar Al-Mukhtar Univ. (Libya); **Steven Donaldson**, The Univ. of Dayton (USA); **Norbert G. Meyendorf**, Iowa State Univ. of Science and Technology (USA); **Daniel May**, Mohamed Abo Ras, AMIC GmbH (Germany); **David Walter**, Bundesanstalt für Materialforschung und -prüfung (Germany) . . . [9806-17]

11:10 am: **Terahertz ISAR, infrared thermography, and x-ray imaging of large area wind turbine blade defects**, Robert Martin, Christopher S. Baird, Robert H. Giles, Univ. of Massachusetts Lowell (USA); **Andrew Schoenberg**, Composites Engineering and Research Lab. (USA) and Southern Maine Community College (USA); **Christopher Nizerecki**, Univ. of Massachusetts Lowell (USA) [9806-18]

11:30 am: **Neuro-fuzzy computing for vibration-based damage localization and severity estimation in an experimental wind turbine blade with superimposed operational effects**, Simon Hoell, Lloyd's Register Foundation Ctr. for Safety and Reliability (United Kingdom) and Univ. of Aberdeen (United Kingdom); **Piotr Omenzetter**, Univ. of Aberdeen (United Kingdom) . . . . . [9806-19]

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



**CONFERENCE 9797**

**SESSION 8**

**LOCATION: MARQUIS 7  
TUE 1:30 PM TO 3:00 PM**

**Devices and Actuators I**

Session Chair: **Mathias Kolle**, Massachusetts Institute of Technology (USA)

1:30 pm: **Biomimetic artificial sphincter muscles: status and challenges** (*Invited Paper*), Vanessa Y. F. Leung, Bert Müller, Univ. Basel (Switzerland) . . . . . [9797-21]

2:00 pm: **Biomimetic photo-actuation: progress and challenges**, Michael P. M. Dicker, Paul M. Weaver, Jonathan M. Rossiter, Ian P. Bond, Charl F. J. Faul, Univ. of Bristol (United Kingdom) . . . . . [9797-22]

2:20 pm: **3D printed wrist joint actuated by TCP muscles for use in humanoids, prosthetics, and autonomous robots**, Abhijeet Narwal, Yonas Tadesse, The Univ. of Texas at Dallas (USA) . . . . . [9797-23]

2:40 pm: **Bio-inspired solid-state SMA actuated robotic arm**, Cody A. Wright, Onur Bilgen, Old Dominion Univ. (USA) . . . . . [9797-24]

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

**CONFERENCE 9798**

**SESSION 4**

**LOCATION: GRAND A/B  
TUE 1:20 PM TO 3:00 PM**

**EAP Fabrication Techniques**

Session Chairs: **Harold Park**, Boston Univ. (USA); **Aaron D. Price**, Western Univ. (Canada)

1:20 pm: **Printing of CNT/silicone rubber for a wearable flexible stretch sensor**, Agee S. Kurian, Timothy J. Giffney, The Univ. of Auckland (New Zealand); Jim Lee, Kazakh-British Technical Univ. (Kazakhstan); Jadranka Travas-Sejdic, Kean C. Aw, The Univ. of Auckland (New Zealand) . [9798-14]

1:40 pm: **Fully printed three microns thick dielectric elastomer actuator**, Alexandre Poulin, Samuel Rosset, Herbert R. Shea, Ecole Polytechnique Fédérale de Lausanne (Switzerland) . . . . . [9798-15]

2:00 pm: **Fabrication and frequency based control of a self-sensing electroactive polymer and piezoelectric bimorph**, Kyle R. Van Volkinburg, Univ. of California, Irvine (USA); Leeya Engel, Moti Ben-David, Tel Aviv Univ. (Israel); Gregory N. Washington, Univ. of California, Irvine (USA); Yosi Shacham-Diamand, Slava Krylov, Tel Aviv Univ. (Israel) . . . . . [9798-16]

2:20 pm: **A novel printed patterning method to fabricate soft, flexible micromanipulators based on conjugated polymer trilayer microactuators**, Alexandre Khaldi, Daniel Falk, Ali Maziz, Edwin W. H. Jager, Linköping Univ. (Sweden) . [9798-17]

2:40 pm: **Fabrication and characterization of printed EAP based actuators on flexible plastic substrates**, Albert J. J. M. van Breemen, Holst Ctr. (Netherlands); Gerwin H. Gelinck, Holst Ctr. (Netherlands) and Technische Univ. Eindhoven (Netherlands) . . . . . [9798-18]

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

**CONFERENCE 9799**

**SESSION 6**

**LOCATION: GRAND E  
TUE 1:20 PM TO 3:00 PM**

**Energy Harvesting and Scavenging: Piezoelectrics**

Session Chairs: **Hyung-Jo Jung**, KAIST (Korea, Republic of); **David D. Mascareñas**, Los Alamos National Lab. (USA)

1:20 pm: **Motion amplification using a flextensional compliant mechanism for enhanced energy harvesting**, Mohammed A. Abdelnaby, Akhbar El Yom Academy (Egypt); Mustafa H. Arafa, The American Univ. in Cairo (Egypt) . . . . . [9799-23]

1:40 pm: **Efficiency improvement of a cantilever-type energy harvester using torsional vibration**, Hyung-Jo Jung, In-ho Kim, KAIST (Korea, Republic of); Seon Jun Jang, Hoseo Univ. (Korea, Republic of); Jeong-Hoi Koo, Miami Univ. (USA) [9799-24]

2:00 pm: **Periodic substructure for multi-frequency energy harvesting with single piezoelectric patch**, Francesco Braghin, Nora Lecis, Iman Mehdipour, Politecnico di Milano (Italy) . . . . . [9799-25]

2:20 pm: **Power conditioning for low-voltage piezoelectric stack energy harvesters**, Ellen A. Skow, Stephen M. Leadenham, Kenneth A. Cunefare, Alper Erturk, Georgia Institute of Technology (USA) . . . . . [9799-26]

2:40 pm: **Two degrees of freedom piezoelectric vibration energy harvester**, Wei Wang, ShengSheng Liu, Junyi Cao, Shengxi Zhou, Lin Jing, Xi'an Jiaotong Univ. (China) . . . . . [9799-27]

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

**CONFERENCE 9800**

**SESSION 6**

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

**Piezoelectrics Materials**

Session Chairs: **Henry A. Sodano**, Univ. of Florida (USA); **Gary D. Seidel**, Virginia Polytechnic Institute and State Univ. (USA)

1:20 pm: **Experimental characterization of PZT fibers using IDE electrodes**, Hassene Ben Atitallah, Zoubeida Ounaies, The Pennsylvania State Univ. (USA) . . [9800-22]

1:40 pm: **Fabrication and characterization of  $\beta$ -poly(vinylidene fluoride)/silane-treated titanium dioxide dielectric nano-composites**, Yu-Chen Sun, HaoTian Harvey Shi, Hani E. Naguib, Univ. of Toronto (Canada) . . . . . [9800-23]

2:00 pm: **Piezoelectric and dielectric properties of nanoporous polyvinylidene (PVDF) films**, Ping Zhao, Shifa Wang, Alec Kadlec, Univ. of Minnesota, Duluth (USA) . . . . . [9800-24]

2:20 pm: **Realization of face-shear piezoelectric coefficient d36 in PZT ceramics via ferroelastic domain engineering**, Hongchen Miao, Peking Univ. (China) . . . . . [9800-25]

2:40 pm: **Development, fabrication, and multiobjective optimization of highly sensitive conjugated polymer based piezoresistive sensors in electronic skin applications**, Nazanin Khalili, Hani E. Naguib, Roy H. Kwon, Univ. of Toronto (Canada) . . . . . [9800-50]

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

**CONFERENCE 9801**

**SESSION 5**

**LOCATION: MARQUIS 8  
TUE 1:20 PM TO 3:00 PM**

**Energy Harvesting**

Session Chair: **Steven F. Griffin**, The Boeing Co. (USA)

1:20 pm: **Mechanical motion conversion from reciprocating translation to one-directional rotation for effective energy harvesting**, Kabir Ahmed, Soobum Lee, Univ. of Maryland, Baltimore County (USA) . . . . . [9801-22]

1:40 pm: **Characterization of micro-generators embedded in COTS watches for wearable energy harvesting**, Tiancheng Xue, Shantnu Kakkar, The Univ. of Utah (USA); Qianyu Lin, Duke Univ. (USA); Shad Roundy, The Univ. of Utah (USA) . [9801-23]

2:00 pm: **Characterization of real-world vibration sources with a view toward optimal energy harvesting architectures**, Robert K. Rantz, Shad Roundy, The Univ. of Utah (USA) . . . . . [9801-24]

2:20 pm: **Inertial and impact energy harvesters for smart tire sensors**, Leon M. Headings, Miao Wang, Gowtham Venkatraman, Marcelo J. Dapino, The Ohio State Univ. (USA) . . . . . [9801-25]

2:40 pm: **Experimental comparison of piezoelectric and magnetostrictive shunt dampers**, Vivake M. Asnani, NASA Glenn Research Ctr. (USA); Zhangxian Deng, The Ohio State Univ. (USA); Justin J. Scheidler, NASA Glenn Research Ctr. (USA); Marcelo J. Dapino, The Ohio State Univ. (USA) [9801-26]

Conference End.



**CONFERENCE 9802**

**SESSION 8**

**LOCATION: MARQUIS 6  
TUE 1:40 PM TO 2:20 PM**

**Keynote Lecture IV**

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

1:40 pm: **Propagation of elastic waves in nano structures** (Keynote Presentation), Srinivasan Gopalakrishnan, Indian Institute of Science (India) . . . . . [9802-22]

**SESSION 9**

**LOCATION: MARQUIS 6  
TUE 2:20 PM TO 3:20 PM**

**3D Printing and Applications II**

Session Chair: **Mouli Ramasamy**,  
The Pennsylvania State Univ.  
(USA)

2:20 pm: **Single molecule force spectroscopy study of y-polyglutamic acid by using atomic force microscopy**, Parbhej Ahamed, Masaru Kawakami, Hidemitsu Furukawa, Yamagata Univ. (Japan) . . . . . [9802-23]

2:40 pm: **A frequency domain Ritz method based spectral finite element formulation for the computation of band structure of the pentamod metamaterials**, Sushovan Mukherjee, Srinivasan Gopalakrishnan, Indian Institute of Science (India) . . . . . [9802-25]

3:00 pm: **Friction and wear evaluation of high-strength gel**, Toshiaki Kameyama, Masato Wada, Masato Makino, Masaru Kawakami, Hidemitsu Furukawa, Yamagata Univ. (Japan) . . . . . [9802-26]

Coffee Break Tue 3:20 pm to 4:00 pm

**CONFERENCE 9803**

Sessions 6A and 6B run concurrently.

**SESSION 6A**

**LOCATION: GRAND D  
TUE 1:20 PM TO 3:00 PM**

**Smart Structural Composites Based on Nanofillers**

Session Chairs: **Genda Chen**, Missouri Univ. of Science and Technology (USA); **Simon Laflamme**, Iowa State Univ. of Science and Technology (USA)

1:20 pm: **In-situ material state monitoring using embedded CdSe nanocrystals**, Dylan Shane, Christine Smudde, Cole Brubaker, Talitha Frecker, Ian Njoroge, Sandra J. Rosenthal, Florence Sanchez, Kane Jennings, Douglas Adams, Vanderbilt Univ. (USA) . . . . . [9803-43]

1:40 pm: **Comparative study on corrosion monitoring of steel bar in mortar: Fe-C coated LPFG sensor versus EIS**, Yizheng Chen, Fujian Tang, Yi Bao, Yan Tang, Genda Chen, Missouri Univ. of Science and Technology (USA) . . . . . [9803-44]

2:00 pm: **Surface and subsurface damage detection in cement-based materials using electrical resistance tomography**, Tao Ruan, Amir Poursaeed, Clemson Univ. (USA) . . . . . [9803-45]

2:20 pm: **Strain sensitivity of carbon nanotube cement-based composites for structural health monitoring**, Antonella D'Alessandro, Filippo Ubertini, Univ. degli Studi di Perugia (Italy); **Simon Laflamme**, Iowa State Univ. of Science and Technology (USA); **Marco Rallini**, Annibale Luigi Materazzi, Josè M. Kenny, Univ. degli Studi di Perugia (Italy) . . . . . [9803-46]

2:40 pm: **Alignment of carbon iron into polydimethylsiloxane to create conductive composite with low percolation threshold and high piezoresistivity**, Shuai Dong, Institute of Advanced Manufacturing Technology (China) and Univ. of Science and Technology of China (China); **Xiaojie Wang**, Institute of Advanced Manufacturing Technology (China) . . . . . [9803-47]

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

**SESSION 6B**

**LOCATION: CATALUNA A  
TUE 1:20 PM TO 3:00 PM**

**Sensing for Health Assessment of Transportation Systems**

Session Chairs: **Wei Song**, The Univ. of Alabama (USA); **Ming L. Wang**, Northeastern Univ. (USA)

1:20 pm: **Real-time image processing for non-contact monitoring of dynamic displacements using smartphone technologies**, Nikolas J. Gelo, Jae-Hong Min, Hongki Jo, The Univ. of Arizona (USA) . . . . . [9803-48]

1:40 pm: **Thermal stress measurement in continuous welded rail using the hole-drilling method**, Xuan Zhu, Francesco Lanza di Scalea, Univ. of California, San Diego (USA); **Mahmood Fateh**, Federal Railroad Administration (USA) . . . . . [9803-49]

2:00 pm: **A smart solution for the vibration suppression in cables for the electric power distribution**, Francesco Ripamonti, Gabriele Cazzulani, Ferruccio Resta, Politecnico di Milano (Italy) [9803-50]

2:20 pm: **Field validation of road roughness evaluation using in-pavement strain sensors**, Zhiming Zhang, Fodan Deng, Ying Huang, Raj Bridgelall, North Dakota State Univ. (USA) . . . . . [9803-51]

2:40 pm: **Corrosivity monitoring system using RFID-based sensors**, Lydia Lawand, Oleg Shirayev, Nader Vahdati, Paul Rostron, Khalil Alhandawi, The Petroleum Institute (United Arab Emirates) . . . [9803-52]

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

**CONFERENCE 9804**

**SESSION 7**

**LOCATION: MARQUIS 2  
TUE 1:20 PM TO 3:00 PM**

**Ultrasonic NDE**

Session Chairs: **Tzuyang Yu**, Univ. of Massachusetts Lowell (USA); **Yu-Min Su**, National Kaohsiung Univ. of Applied Sciences (Taiwan)

1:20 pm: **Piezoceramic omnidirectional transduction of the fundamental shear horizontal guided wave mode**, Pierre Belanger, Guillaume Boivin, École de Technologie Supérieure (Canada) . . . . . [9804-22]

1:40 pm: **Defect detection performance of the UCSD non-contact air-coupled ultrasonic guided wave inspection of rails prototype**, Stefano Mariani, Thompson V. Nguyen, Simone Sternini, Francesco Lanza di Scalea, Univ. of California, San Diego (USA); **Mahmood Fateh**, Federal Railroad Administration (USA) . . . . [9804-23]

2:00 pm: **Characterization of microcracking damage in concrete using diffuse ultrasonic waves**, Suyun Ham, Jinying Zhu, Univ. of Nebraska-Lincoln (USA) . . [9804-24]

2:20 pm: **Quantitative sensing of corroded steel rebar embedded in cement mortar specimens using ultrasonic testing**, Jones Owusu Twumasi, Viet Q. Le, Qixiang Tang, Tzuyang Yu, Univ. of Massachusetts Lowell (USA) . . . . . [9804-25]

2:40 pm: **Ultrasonic transmission from fiber optic generators on steel plate**, Siwen Bi, Nan Wu, Jingcheng Zhou, Xingwei Wang, Jones Owusu Twumasi, Qixiang Tang, Tzuyang Yu, Univ. of Massachusetts Lowell (USA) . . . . . [9804-26]

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

**CONFERENCE 9805**

**SESSION 6**

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

**Modeling Wave Propagation and Crack Propagation**

Session Chairs: **Tadeusz Uhl**, AGH Univ. of Science and Technology (Poland); **Sourav Banerjee**, Univ. of South Carolina (USA)

1:20 pm: **Highly parallelized modeling of fatigue crack induced nonlinear ultrasonics using an explicit local interaction simulation approach**, Yanfeng Shen, Carlos E. S. Cesnik, Univ. of Michigan (USA) . . . . . [9805-23]

1:40 pm: **Defect induced guided waves mode conversion**, Tomasz Wandowski, Pawel Kudela, Pawel H. Malinowski, Wieslaw M. Ostachowicz, The Szwalski Institute of Fluid-Flow Machinery (Poland) . . . . . [9805-24]

2:00 pm: **Crack propagation modeling using Peridynamic theory**, Mohammad Hadi Hafezi, Tribikram Kundu, The Univ. of Arizona (USA) . . . . . [9805-25]

2:20 pm: **Simulation of guided wave propagation near numerical Brillouin zones**, Piotr Kijanka, Kajetan Dziedzic, Wieslaw J. Staszewski, Pawel Packo, AGH Univ. of Science and Technology (Poland) . . . . . [9805-26]

2:40 pm: **Peridynamic modelling for mortar and shape memory alloy mix**, Mohammad Hadi Hafezi, The Univ. of Arizona (USA); **Reza Alebrahim**, National Univ. of Malaysia (Malaysia); **Tribikram Kundu**, The Univ. of Arizona (USA) . . . [9805-27]

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

**CONFERENCE 9806**

**SESSION 6**

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

**Materials Processing and Characterization I**

Session Chair: **Wieslaw M. Ostachowicz**, The Szwalski Institute of Fluid-Flow Machinery (Poland)

1:20 pm: **NDE for additive manufacturing**, Alexander Michaelis, Fraunhofer-IKTS (Germany) . . . . . [9806-20]

1:40 pm: **Artificial feel device on aircraft control stick using magneto-rheological foam feedback system**, Vignesh Manoharan, Daewon Kim, Embry-Riddle Aeronautical Univ. (USA) . . . . . [9806-21]

2:00 pm: **A novel methodology for self-healing at the nanoscale in CNT/epoxy composites**, Elizabeth Quigley, Siddhant Datta, Aditi Chattopadhyay, Arizona State Univ. (USA) . . . . . [9806-22]

2:20 pm: **Ensuring near-optimum homogeneity and densification levels in nano-reinforced ceramics**, Konstantinos G. Dassios, Nektaria-Marianthi Barkoula, Panagiota Alafogianni, Univ. of Ioannina (Greece); **Guillaume Bonnefont**, Gilbert Fantozzi, Institut National des Sciences Appliquées de Lyon (France); **Theodore E. Matikas**, Univ. of Ioannina (Greece) . . . . . [9806-23]

2:40 pm: **A methodology for evaluation of aging process for control of reliability**, Volodymyr V. Skliarov, National Scientific Ctr. "Institute of Metrology" (Ukraine) . . . . . [9806-24]

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

**CONFERENCE 9797**

**SESSION 9**

**LOCATION: MARQUIS 7  
TUE 3:30 PM TO 4:30 PM**

**Functionalities and Applications**

Session Chair: **Mato Knez**, CIC nanoGUNE Consolider (Spain)

3:30 pm: **Characterization of mechano-sensitive nano-containers for targeted vasodilation**, Marzia Buscema, Univ. Basel (Switzerland); Andreas Zumbuehl, Univ. de Fribourg (Switzerland); Bert Müller, Univ. Basel (Switzerland) . . . . . [9797-41]

3:50 pm: **Wireless feedback control using cochlea-inspired sensing architecture**, Courtney Peckens, Hope College (USA); Jerome P. Lynch, Univ. of Michigan (USA); Ireana Cook, Hope College (USA) . . . [9797-26]

4:10 pm: **The impact of uropygial gland secretions on mechanically induced wearing of feather keratin**, Benjamin M. Ott, Annika Müsse, Hermann Wagner, RWTH Aachen Univ. (Germany) . . . . . [9797-27]

**SESSION 10**

**LOCATION: MARQUIS 7  
TUE 4:30 PM TO 5:30 PM**

**Devices and Actuators II**

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

4:30 pm: **A predictive model for biomimetic plate type broadband frequency sensor**, Riaz Ahmed, Sourav Banerjee, Univ. of South Carolina (USA) . . . . . [9797-28]

4:50 pm: **Stingray-inspired robot with simply actuated intermediate motion**, Jack Gaiennie, Lincoln Neely, Nick Noble, Jon Erickson, Washington and Lee Univ. (USA) . . . [9797-29]

5:10 pm: **Robotic hand with position locking mechanism using TCP muscles for applications in prosthetic hand and humanoids**, Lokesh Saharan, Yonas Tadesse, The Univ. of Texas at Dallas (USA) . . . [9797-30]

**LOCATION: MARQUIS 7  
5:30 PM TO 5:55 PM**

**Poster Pops**

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

In addition to their poster presentations, the poster authors will provide 2-minute oral presentations during the conference. Conference End.

**CONFERENCE 9798**

**SESSION 5**

**LOCATION: GRAND A/B  
TUE 3:30 PM TO 5:10 PM**

**EAP Characterization**

Session Chairs: **Rocco Vertechy**, Univ. degli Studi di Bologna (Italy); **Reimund Gerhard**, Univ. of Potsdam (Germany)

3:30 pm: **Ras Labs-CASIS-ISS NL experiment for synthetic muscle resistance to ionizing radiation** (*Invited Paper*), Lenore Rasmussen, Eric Sandberg, Ras Labs., LLC (USA); Charles A. Gentile, Lewis D. Meixler, George Ascione, Robert Hitchner, James Taylor, Princeton Plasma Physics Lab. (USA); Dan Hoffman, Princeton Univ. (USA); David Cylinder, Nova Photonics, Inc. (USA); Daniel Prillaman, Leon Moy, Patrick Mark, Robert Nodarse, U.S. Army Armament Research, Development and Engineering Ctr. (USA); Nicole Allen, Princeton Plasma Physics Lab. (USA); Logan Valenza, Florida Institute of Technology (USA); Surbhi Hablani, Skidmore College (USA); Whitney Blocher, Tyler Fuerst, Sergio Gallucci, Clarkson Univ. (USA); Stephanie Liffland, The Univ. of North Carolina at Chapel Hill (USA) . . . . . [9798-19]

4:10 pm: **Electrical breakdown of dielectric elastomers: influence of compression, electrode's curvature, and environmental humidity**, Bin Chen, Queen Mary, Univ. of London (United Kingdom); Matthias Kollosche, Univ. Potsdam (Germany); Mark Stewart, National Physical Lab. (United Kingdom); James Busfield, Federico Carpi, Queen Mary, Univ. of London (United Kingdom) . . . . . [9798-20]

4:30 pm: **The behavior of dielectric elastomer actuators connected in series and parallel**, Guorui Li, Yuhan Xie, Xuxu Yang, Zhejiang Univ. (China); Tingyu Cheng, Univ. of California, San Diego (USA); Zhilong Huang, Tiefeng Li, Zhejiang Univ. (China) . . . . . [9798-21]

4:50 pm: **Study on Mullins effect of dielectric elastomer composite**, Xiongfei Lyu, Liwu Liu, Jialiang Tao, Yanju Liu, Jinsong Leng, Harbin Institute of Technology (China) . . . . . [9798-22]

**CONFERENCE 9799**

**SESSION 7**

**LOCATION: GRAND E  
TUE 3:30 PM TO 5:50 PM**

**SMA-based Materials and Systems I**

Session Chairs: **Nam Seo Goo**, Konkuk Univ. (Korea, Republic of); **Gregory N. Washington**, Univ. of California, Irvine (USA)

3:30 pm: **Relationship between power density and temperature of SMA spring**, Cheol Hoon Park, Sang Yong Ham, Se Young Kim, Sang Kyu Choi, Young Su Son, Korea Institute of Machinery & Materials (Korea, Republic of) . . . . . [9799-28]

3:50 pm: **Load carrying capacity of RCC beam by replacing steel reinforcement bars with shape memory alloy bars**, Kamalkishor M. Bajoria, Shreya S. Kaduskar, Indian Institute of Technology Bombay (India) . . . . . [9799-29]

4:10 pm: **Fabrication and test bending behavior of shape memory polymer composite hinges**, Thanh Duc Dao, Ngoc San Ha, Nam Seo Goo, Konkuk Univ. (Korea, Republic of); Woong-Ryeol Yu, Seoul National Univ. (Korea, Republic of) [9799-30]

4:30 pm: **Design of an electronic oscillator for resonant pressure sensor with non-allocated sensor and actuator**, Akila Ravindran, Uma Gandhi, National Institute of Technology, Tiruchirappalli (India); Suresh Kaluvan, Seung-Bok Choi, Inha Univ. (Korea, Republic of) . . . . . [9799-31]

4:50 pm: **Experimental validation of an analysis framework for morphing radiators**, Christopher L. Bertagne, Texas A&M Univ. (USA); Lisa R. Erickson, Rubik B. Sheth, NASA Johnson Space Ctr. (USA); John D. Whitcomb, Darren J. Hartl, Texas A&M Univ. (USA) . . . . . [9799-32]

5:10 pm: **Optimization of SMA layers in composite structures to enhance damping**, Pouya Haghdoost, Simone Cinquemani, Nora Lecis, Politecnico di Milano (Italy); Paola Bassani, Consiglio Nazionale delle Ricerche (Italy) . . . [9799-33]

5:30 pm: **Use of the shape memory polymer polystyrene in the creation of thin film stretchable sensors for wearable applications**, Kyle R. Van Volkinburg, Thao Nguyen, Jonathan Pegan, Michelle Khine, Gregory N. Washington, Univ. of California, Irvine (USA) . . . . . [9799-34]

**CONFERENCE 9800**

**SESSION 7**

**LOCATION: ANDALUCIA  
TUE 3:30 PM TO 5:50 PM**

**Multifunctional Composites**

Session Chairs: **Ralph C. Smith**, North Carolina State Univ. (USA); **Faramarz Gordaninejad**, Univ. of Nevada, Reno (USA)

3:30 pm: **Mechanical analysis of carbon fiber reinforced shape memory polymer composite for self-deployable structure in space environment**, Seok Bin Hong, Yong San Ahn, Joon Hyeok Jang, Seoul National Univ. (Korea, Republic of); Nam Seo Goo, Konkuk Univ. (Korea, Republic of); Jin-Gyun Kim, Korea Institute of Machinery & Materials (Korea, Republic of); Woong-Ryeol Yu, Seoul National Univ. (Korea, Republic of) . . . . . [9800-26]

3:50 pm: **New sensing method of interfacial evaluation of carbon fiber/epoxy composites using electrical resistance measurement and wetting tests**, Joung-Man Park, Gyeongsang National Univ. (Korea, Republic of) and The Univ. of Utah (USA); Dong-Jun Kwon, Pyeong-Su Shin, Jin-Yeong Choi, Gyeongsang National Univ. (Korea, Republic of); Lawrence K. DeVries, The Univ. of Utah (USA) . . . . . [9800-27]

4:10 pm: **Improvement of fatigue life and prevention of internal crack initiation of chopped carbon fiber reinforced plastics modified with micro glass fibers**, Ryohei Fujitani, Kazuya Okubo, Toru Fujii, Doshisha Univ. (Japan) . . . . . [9800-28]

4:30 pm: **Self-repair of cracks in brittle material systems**, Carolyn Dry, Natural Process Design, Inc. (USA) . . . . . [9800-29]

4:50 pm: **A thermally tunable phononic crystal**, Alireza Bayat, Faramarz Gordaninejad, Univ. of Nevada, Reno (USA) . . . . . [9800-30]

5:10 pm: **Real time in-situ sensing of damage evolution in nanocomposite bonded surrogate energetic materials**, Engin Sengezer, Gary D. Seidel, Virginia Polytechnic Institute and State Univ. (USA) . . . . . [9800-31]

5:30 pm: **Self-repair technology in various pressurized composite systems**, Carolyn Dry, Natural Process Design, Inc. (USA) . . . . . [9800-32]

**CONFERENCE 9802**

**SESSION 10**

**LOCATION: MARQUIS 6  
TUE 4:00 PM TO 5:20 PM**

**Nanosensor and Nanocomposite**

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

4:00 pm: **Advances in low-cost, stretchable electronics for biosystems** (*Keynote Presentation*), Daniel D. Hilbich, Simon Fraser Univ. (Canada) . . . . . [9802-27]

4:40 pm: **Imaging of the nano-structure of soft and wet materials by new type of DLS method** (*Invited Paper*), Kazuyuki Sakai, Hiroaki Kumagai, Mei Abe, Yuta Watanabe, Masaru Kawakami, Hidemitsu Furukawa, Yamagata Univ. (Japan) . . . . . [9802-29]

5:00 pm: **Design of paper-based MEMS sensor for food toxicity detection**, Vimala Juliet A., Sanchanna Ganesan, SRM Univ. (India) . . . . . [9802-30]



**CONFERENCE 9803**

Sessions 7A and 7B run concurrently.

**SESSION 7A**

**LOCATION: GRAND D  
TUE 3:30 PM TO 5:50 PM**

**Application of Fiber Optic Sensing for SHM of Structures**

Session Chairs: **Hiroshi Asanuma**, Chiba Univ. (Japan); **Ying Huang**, North Dakota State Univ. (USA)

3:30 pm: **In-line fiber Bragg grating sensors for steel corrosion detection**, Fodan Deng, Ying Huang, Fardad Azami, North Dakota State Univ. (USA) . . . [9803-53]

3:50 pm: **Acoustic emission detection with fiber optical sensors for dry cask storage health monitoring**, Bin Lin, Lingyu Yu, Victor Giurgiutiu, Univ. of South Carolina (USA) . . . . . [9803-54]

4:10 pm: **Fiber optic approach for detecting corrosion**, Roman Kostecki, Heike Ebendorff-Heidepriem, The Univ. of Adelaide (Australia); Claire E. Davis, Grant McAdam, Defence Science and Technology Group (Australia); Tanya M. Monro, Univ. of South Australia (Australia) . . . . . [9803-55]

4:30 pm: **Oil pipeline geohazard monitoring using optical fiber FBG strain sensors**, Andres Salazar-Ferro, Salazar Ferro Ingenieros S.A. (Colombia); Alexis Mendez, MCH Engineering LLC (USA) . . . . . [9803-56]

4:50 pm: **Dynamic measurement based optical fiber sensor for high speed monitoring of turbine blades**, Francesco Braghin, Gabriele Cazzulani, Politecnico di Milano (Italy) . . . . . [9803-58]

5:10 pm: **Use of FBG sensors for health monitoring of pipelines**, Ferdinando Felli, Sapienza Univ. di Roma (Italy); Antonio Paolozzi, Sapienza Univ. di Roma (Italy) and Centro Fermi (Italy); Cristian Vendittozzi, Sapienza Univ. di Roma (Italy); Claudio Paris, Centro Fermi (Italy) and Sapienza Univ. di Roma (Italy); Hiroshi Asanuma, Chiba Univ. (Japan) . . . . . [9803-59]

5:30 pm: **New strategy toward internet of things: structural health monitoring using a combined fiber-optic and acoustic emission wireless sensor platform**, Dien Nguyen, Veraphotonics, Inc. (USA); C. Page, L. Wilson, Exponent (USA) . . . . . [9803-189]

**SESSION 7B**

**LOCATION: CATALUNA A  
TUE 3:30 PM TO 5:50 PM**

**Damage Detection and Prognostic of Civil Structures**

Session Chairs: **Chin-Hsiung Loh**, National Taiwan Univ. (Taiwan); **Hui Li**, Harbin Institute of Technology (China)

3:30 pm: **Angular velocity-based structural damage detection**, Yizheng Liao, Anne S. Kiremidjian, Ram Rajagopal, Stanford Univ. (USA); Chin-Hsiung Loh, National Taiwan Univ. (Taiwan) . . . . . [9803-60]

3:50 pm: **Mechanical equivalent of Bayesian inference from monitoring data**, Carlo Cappello, Denise Bolognani, Daniele Zonta, Univ. degli Studi di Trento (Italy) . . . . . [9803-61]

4:10 pm: **Structural damage detection using ABC-Subsim based hierarchical sparse Bayesian model updating**, Yong Huang, Harbin Institute of Technology (China); James L. Beck, California Institute of Technology (USA); Majid K. Vakilzadeh, Chalmers Univ. of Technology (Sweden); Hui Li, Harbin Institute of Technology (China) . . . . . [9803-62]

4:30 pm: **Application of time series based damage detection and localization algorithms to structures under ambient excitations**, Chin-Hsiung Loh, Chuan-Kai Chan, National Taiwan Univ. (Taiwan); Chung-Hsien Lee, National Taiwan Univ. (Taiwan) . . . . . [9803-63]

4:50 pm: **A novel filter enabled state estimation for structural systems under unknown inputs**, Wei Song, The Univ. of Alabama (USA) . . . . . [9803-64]

5:10 pm: **Matrix factorization to time-frequency distribution for structural health monitoring**, Chia-Ming Chang, National Taiwan Univ. (Taiwan); Shieh-Kung Huang, National Ctr. for Research on Earthquake Engineering (Taiwan) . . . . . [9803-65]

5:30 pm: **Extended Kalman filter based structural damage detection for MR damper controlled structures**, Chenhao Jin, Shinae Jang, Xiaorong Sun, Univ. of Connecticut (USA); Zhaoshuo Jiang, San Francisco State Univ. (USA); Richard Christenson, Univ. of Connecticut (USA) . . . . . [9803-66]

**CONFERENCE 9804**

**SESSION 8**

**LOCATION: MARQUIS 2  
TUE 3:30 PM TO 5:50 PM**

**NDE for Composites**

Session Chairs: **H. Felix Wu**, U.S. Dept. of Energy (USA); **Andrew L. Gyekenyesi**, Ohio Aerospace Institute (USA)

3:30 pm: **Optical transmission scanning for damage quantification in impacted GFRP composites**, Anton Khomenko, Oleksii Karpenko, Michigan State Univ. (USA) and Composite Vehicle Research Ctr. (USA); Ermias G. Koricho, Composite Vehicle Research Ctr. (USA) and Michigan State Univ. (USA); Mahmoodul Haq, Gary L. Cloud, Lalita Udpa, Michigan State Univ. (USA) and Composite Vehicle Research Ctr. (USA) . . . . . [9804-27]

3:50 pm: **Monitoring chemical degradation of glass fiber composites using hyperspectral imaging**, Vassilis M. Papadakis, Bernhard Müller, Michiel Hagenbeek, Jos Sinke, Roger M. Groves, Technische Univ. Delft (Netherlands) . . . . . [9804-28]

4:10 pm: **Nonlinear damage detection and localization using a time domain approach**, Salvatore Boccardi, Daniele Calla, Gian-Piero Malfense Fierro, Francesco Ciampa, Michele Meo, Univ. of Bath (United Kingdom) . . . . . [9804-29]

4:30 pm: **Creation of health indicators for the prognostics of damage growth in composite materials**, Zheng Liu, The Univ. of British Columbia Okanagan (Canada); Nezhir Mrad, Defence Research and Development Canada (Canada) . . [9804-30]

4:50 pm: **A 2D areal scan for imaging composite damage using an enhanced CCRTM technique**, Jiize He, Fuh-Gwo Yuan, North Carolina State Univ. (USA) . . . . . [9804-31]

5:10 pm: **Health monitoring a composite structure throughout the life cycle**, James S. Chilles, Anthony J. Croxford, Ian P. Bond, Univ. of Bristol (United Kingdom) . [9804-32]

5:30 pm: **Self healing fiber reinforced composites employing carbon nano-tubes reinforced healing agents delivered via micro vascular networks**, Dimitrios Bekas, Alkiviadis Paipetis, Univ. of Ioannina (Greece) . . . . . [9804-33]

**CONFERENCE 9805**

**SESSION 7**

**LOCATION: MARQUIS 1  
TUE 3:30 PM TO 5:50 PM**

**Guided Waves for SHM**

Session Chairs: **Wieslaw M. Ostachowicz**, The Szwedalski Institute of Fluid-Flow Machinery (Poland); **Niranjan Desai**, Purdue Univ. (USA)

3:30 pm: **Finite element modeling of guided wave scattering at delaminations in composite panels**, Bibi I. S. Murat, Paul Fromme, Univ. College London (United Kingdom) . . . . . [9805-28]

3:50 pm: **Helical guided waves in liquid-filled cylindrical shells subjected to static pressurization stress**, Brennan Dubuc, Salvatore Salamone, The Univ. of Texas at Austin (USA) . . . . . [9805-29]

4:10 pm: **A hybrid non-reflective boundary technique for efficient simulation of guided waves using local interaction simulation approach**, Hui Zhang, Carlos E. S. Cesnik, Univ. of Michigan (USA) [9805-30]

4:30 pm: **Detecting delaminations and disbondings on full-scale wing composite panel by guided waves based SHM system**, Ernesto Monaco, Natalino D. Boffa, Vittorio Memmolo, Fabrizio Ricci, Leandro Maio, Univ. degli Studi di Napoli Federico II (Italy) . . . . . [9805-31]

4:50 pm: **Incorporating scatterer responses in a sparse reconstruction approach to guided-wave structural health monitoring**, Andrew L. Golato, Sridhar Santhanam, Fauzia Ahmad, Moeness Amin, Villanova Univ. (USA) . . . . . [9805-32]

5:10 pm: **A temperature effects compensation technique for Lamb wave based SHM**, Rahim Gorgin, Zhanjun Wu, Yuebin Zheng, Dalian Univ. of Technology (China) . . . . . [9805-33]

5:30 pm: **Higher and sub-harmonic Lamb wave mode generation due to debond-induced contact nonlinearity**, Christudas R. Bijudas, Anurup Guha, Indian Institute of Space Science and Technology (India) . . . . . [9805-35]

**CONFERENCE 9806**

**SESSION 7**

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

**Propulsion**

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

3:30 pm: **Four point bending analytical-experimental assessment for detecting failure and damage in environmental barrier coated CMC specimen**, Ali Abdul-Aziz, Martha H. Jaskowiak, Ramakrishna T. Bhatt, NASA Glenn Research Ctr. (USA) . . . . . [9806-25]

3:50 pm: **Performance of PZT stacks under high-field electric cycling at various temperatures in heavy-duty diesel engine fuel injectors**, Hong Wang, Sung-Min Lee, Hua-Tay Lin, Oak Ridge National Lab. (USA); Randy Stafford, Cummins, Inc. (USA) . . . . . [9806-26]

4:10 pm: **Optimization of various parameters of polanga (Calophyllum inophyllum) based biodiesel engine through modified genetic algorithm using different sensors**, Shefali Dhingra, Kurukshetra Univ. (India) . . . . . [9806-27]

**SESSION 8**

**LOCATION: MARQUIS 3  
TUE 4:30 PM TO 5:30 PM**

**Nuclear Energy**

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

4:30 pm: **Impact damage identification of composite vessels through acoustic emission on-line monitoring**, 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) . . . . . [9806-28]

4:50 pm: **Evaluation of the stability of large-sized electrical equipment to the seismic impacts by NDE method**, Volodymyr V. Skliarov, National Scientific Ctr. "Institute of Metrology" (Ukraine) . . . . . [9806-29]

5:10 pm: **Develop an piezoelectric sensing based on SHM system for nuclear dry storage system**, Linlin Ma, Zhenhua Tian, Stephen Howden, Bin Lin, Xiaoyi Sun, Lingyu Yu, Univ. of South Carolina (USA) . . . . . [9806-30]



# POSTER/EXHIBITION RECEPTION

Tuesday 22 March | 6:00 to 7:30 pm

## CONFERENCE 9797

### Bioinspiration, Biomimetics, and Bioreplication VI

**Static friction of biomimetic surface microstructure of PDMS under wet and dry conditions**, Haiwu Yu, Hongduo Jia, Ling Gong, Rong Li, Caiping Wang, Xiaojie Wang, Institute of Advanced Manufacturing Technology (China) . . . . . [9797-31]

**Demonstrations of bio-inspired perching landing gear for UAVs**, Mindy Tieu, Duncan M. Michael, Jeffery B. Pflueger, Manik S. Sethi, Kelli N. Shimazu, Tatiana M. Anthony, Christopher L. Lee, Franklin W. Olin College of Engineering (USA) . . . . . [9797-32]

**A soft biomimetic tongue: model reconstruction and motion tracking**, Xuanming Lu, Nanjing Univ. of Science and Technology (China) and The Univ. of Auckland (New Zealand); Weiliang Xu, The Univ. of Auckland (New Zealand); Xiaoning Li, Nanjing Univ. of Science and Technology (China) . . . . . [9797-33]

**A 4-DOF biodynamic lumped-parameter model for a seated occupant**, Li-Jun Qian, Wei Cheng, Xian-Xu Bai, Hefei Univ. of Technology (China) . . . . . [9797-34]

**Effects of fluid-structure interaction on the aerodynamics of an insect wing**, Anh Tuan Nguyen, Jae-Hung Han, KAIST (Korea, Republic of) . . . . . [9797-35]

**The Texas horned lizard as model for robust capillary structures for passive directional transport of cooling lubricants**, Philipp Comanns, RWTH Aachen Univ. (Germany); Kai Winands, Fraunhofer-Institut für Produktionstechnologie IPT (Germany); Hermann Wagner, RWTH Aachen Univ. (Germany); Werner Baumgartner, Johannes Kepler Univ. Linz (Austria) . . . . . [9797-36]

**Bioinspired twisted composites based on Bouligand structures**, Fulvio Pinto, Onorio Iervolino, Dmitri Ginzburg, Univ. of Bath (United Kingdom); Gennaro Scarselli, Univ. del Salento (Italy); Michele Meo, Univ. of Bath (United Kingdom) . . . . . [9797-38]

**Feasibility study and preliminary design of load-assisting clothes for lumbar protection inspired by human musculoskeletal systems**, Riho Hashimoto, Arata Masuda, Hao Chen, Sou Kobayashi, Kyoto Institute of Technology (Japan) . . . . . [9797-39]

**Design and fabrication of thin microvascularised polymer matrices inspired from secondary lamellae of fish gills**, Prasoon Kumar, Indian Institute of Technology Bombay (India) and Monash Univ. (Australia); Prasanna S. Gandhi, Indian Institute of Technology Bombay (India); Mainak Majumder, Monash Univ. (Australia) . . . . . [9797-40]

**Modeling and multi-objective optimization of karanja (pongamia pinnata) based biodiesel engine using non-dominated sorting genetic algorithm-II**, Sunil Dhingra, Kurukshetra Univ. (India) and Univ. Institute of Engineering and Technology (India); Gian Bhushan, National Institute of Technology (India); Kashyap K. Dubey, Maharshi Dayanand Univ., Rohtak (India) and Univ. Institute of Engineering and Technology (India) . . . . . [9797-42]

## CONFERENCE 9798

### Electroactive Polymer Actuators and Devices (EAPAD) XVIII

**Modeling a curved IPMC actuator based on intrinsic equations**, Hossein Moeinkhah, Univ. of Sistan and Baluchestan (Iran, Islamic Republic of) . . . . . [9798-88]

**Photocatalytic activity of TiO<sub>2</sub> nanomaterials for methylene blue dye degradation**, Deuk Yong Lee, Siwon Son, Daelim College (Korea, Republic of); Min-Seok Jeon, Korea Testing Laboratory (Korea, Republic of); Myung-Hyun Lee, Korea Institute of Ceramic Engineering and Technology (Korea, Republic of); Bae-Yeon Kim, Incheon National Univ. (Korea, Republic of) . . . . . [9798-89]

**A multi-physical model for charge and mass transport in a flexible ionic polymer sensor**, Zicai Zhu, Univ. of Tartu (Estonia); Kinji Asaka, National Institute of Advanced Industrial Science and Technology (Japan); Kentaro Takagi, Nagoya Univ. (Japan); Alvo Aabloo, Univ. of Tartu (Estonia); Tetsuya Horiuchi, National Institute of Advanced Industrial Science and Technology (Japan) . . . . . [9798-91]

**Dual responsive material from magnetite nanoparticles and polyurethane matrix**, Karat Petcharoen, Anuvat Sirivat, The Petroleum and Petrochemical College (Thailand) . . . . . [9798-92]

**Thermodynamics of dielectric elastomer undergoing temperature variation**, Yanju Liu, Liwu Liu, Jinsong Leng, Harbin Institute of Technology (China) . . . . . [9798-93]

**Anisotropic actuation in dielectric elastomer actuators**, Daniel P. Armstrong, Richard J. Spontak, North Carolina State Univ. (USA) . . . . . [9798-94]

**Parametric studies of hyaluronic acid microspheres crosslinked by divinyl sulfone**, Deuk Yong Lee, Cheolbyung Cheon, Siwon Son, Daelim College (Korea, Republic of); Jin-Tae Kim, Neo Biotech Co., Ltd. (Korea, Republic of); Nam-Ihn Cho, Sun Moon Univ. (Korea, Republic of) . . . . . [9798-95]

**Poly(2-chloroaniline)/pectin hydrogel as electroactive actuator**, Wanar Kongkaew, Anuvat Sirivat, The Petroleum and Petrochemical College (Thailand) . . . . . [9798-96]

**Preparation and characterization of multiwalled carbon nanotubes / natural rubber composite for compliant electrode application**, Paweenuch Thangkitthanachoke, Anuvat Sirivat, The Petroleum and Petrochemical College (Thailand) . . . . . [9798-97]

**Improvements of electromechanical properties of biodegradable PLA: effects of plasticizer type and electric field**, Natlita Thummarungsan, Anuvat Sirivat, The Petroleum and Petrochemical College (Thailand) . . . . . [9798-98]

**Position control of fishing line artificial muscles (coiled polymer actuators) from nylon thread**, Takeshi Arakawa, Kentaro Takagi, Nagoya Univ. (Japan); Kenji Tahara, Kyushu Univ. (Japan); Kinji Asaka, National Institute of Advanced Industrial Science and Technology (Japan) . . . . . [9798-99]

**Enhanced electromechanical response of Ionic Polymer-Metal Composite (IPMC) actuators by various Nafion roughening levels**, Yanjie Wang, Hualing Chen, Jiayu Liu, Xi'an Jiaotong Univ. (China) . . . . . [9798-100]

**The actuation of different dielectric elastomer structures with various electrodes**, Yuhuan Xie, Yiming Liang, Xuxu Yang, Chi Li, Tiefeng Li, Zhejiang Univ. (China); Xuan Wang, Nanjing Univ. (China) . . . . . [9798-101]

**Preparation and characterization of sulfonated carbon nanotube/Nafion IPMC actuators**, Jie Ru, Yanjie Wang, Xi'an Jiaotong Univ. (China); Longfei Chang, Hefei Univ. of Technology (China); Hualing Chen, Bo Li, Shuhai Jia, Xi'an Jiaotong Univ. (China) . . . . . [9798-102]

**A novel transparent dielectric elastomer sensor for compressive force measurements**, Yiming Liang, Guorui Li, Yuhuan Xie, Xuxu Yang, Tiefeng Li, Zhejiang Univ. (China) . . . . . [9798-103]

**Simulation of the transient electromechanical behavior of dielectric elastomer transducers under differing loads**, Holger Mößinger, Florentine Förster-Zügel, Henry Haus, Helmut F. Schlaak, Technische Univ. Darmstadt (Germany) . . . . . [9798-104]

**Electrically tunable, optical microcavity based on metallized and ultra-soft PDMS gel**, Markus Franke, Irma Slowik, Georgi Paschew, Ulrich Merkel, Hartmut Fröb, Andreas Richter, Karl Leo, TU Dresden (Germany) . . . . . [9798-105]

**Mass and charge transport in IPMC actuators with fractal interfaces**, Longfei Chang, Yucheng Wu, Hefei Univ. of Technology (China); Zicai Zhu, Univ. of Tartu (Estonia); Heng Li, Hefei Univ. of Technology (China) . . . . . [9798-106]

**Application of the H filter in high speed turn maneuvering target tracking algorithm**, Hongwei Sun, Zhenda Lei, Jianguo Automation Research Institute (China) . . . . . [9798-107]

**Development of self-sensing actuator of IPMC without supply voltage to sensor**, Shigenori Sano, Takahiro Ohashi, Toyohashi Univ. of Technology (Japan); Kentaro Takagi, Nagoya Univ. (Japan); Naoki Uchiyama, Toyohashi Univ. of Technology (Japan) . . . . . [9798-108]

**A dynamic physics-based model for a tubular IPMC sensor under torsional excitation**, Hong Lei, Montassar A. Sharif, Xiaobo Tan, Michigan State Univ. (USA) . . . . . [9798-109]

**Novel pre-strain method for dielectric electroactive polymers**, Brittany Newell, Gary W. Krutz, Purdue Univ. (USA); Frank Stewart, Kevin Pascal, Parker Hannifin Corp. (USA) . . . . . [9798-110]

**A multi array dual mode tactile proximity sensor using carbon microcoils**, Hyo Seung Han, Junwoo Park, Tien Dat Nguyen, Uikyum Kim, Sungkyunkwan Univ. (Korea, Republic of); Soon Cheol Jeong, Doo In Kang, Chang Sung Corp. (Korea, Republic of); Hyouk Ryeol Choi, Sungkyunkwan Univ. (Korea, Republic of) . . . . . [9798-111]

**Development of a biomimetic roughness sensor for tactile information with an elastomer**, Ja Choon Koo, Hyouk Ryeol Choi, Hyungpil Moon, Sung Joon Kim, Jae-Young Choi, Sungkyunkwan Univ. (Korea, Republic of) . . . . . [9798-112]

**Self-sensing soft robot for twisting applications using Gallium-Indium**, Sarah Trabia, Taeseon Hwang, Kwang Jin Kim, Univ. of Nevada, Las Vegas (USA) [9798-113]

**Switchable adhesion for wafer-handling based on dielectric elastomer stack transducers**, Tanja Grotepaß, Janis Butz, Florentine Förster-Zügel, Helmut F. Schlaak, Technische Univ. Darmstadt (Germany) . . . . . [9798-115]

Conference attendees are invited to attend the poster session 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 22 March. View poster presentation guidelines.

**Electro-spraying and ultra-violet light curing of polydimethylsiloxane to fabricate thin films for low-voltage dielectric elastomer actuators and sensors**, Florian M. Weiss, Univ. Basel (Switzerland); Gabor M. Kovacs, Empa (Switzerland); Tino Töpfer, Bekim Osmani, Bert Müller, Basel Univ. Hospital (Switzerland) . . . . . [9798-116]

**Novel 2D: self-sensing structure of dielectric elastomer actuator via structure arrangements**, Runan Zhang, Patrick S. Keogh, Pejman Irvani, Univ. of Bath (United Kingdom) . . . . . [9798-117]

**Characterization of screen printed electrodes for Dielectric Electro-active Polymers (DEAP): influence of screen dimensions and electrode thickness on actuator performance**, Bettina Fasolt, ZeMA gGmbH (Germany); Micah W. Hodgins, Alexander York, Stefan S. Seelecke, Univ. des Saarlandes (Germany) . . . . . [9798-119]

**A study of self-clearing in metalized electrode for multilayered electroactive polymer (MLEAP) based actuators**, Saad Ahmed, Zoubeida Ounaies, The Pennsylvania State Univ. (USA) . . . . . [9798-120]

**Electrodynamic network model for multilayer DE stack-transducers**, Thorben Hoffstadt, Philip Meier, Jürgen Maas, Ostwestfalen-Lippe Univ. of Applied Sciences (Germany) . . . . . [9798-122]

**Aerospace applications utilizing conductive and electroactive polymers**, Patrick Kinlen, Matthew A. Flack, Boeing Technology Services (USA) . . . . . [9798-123]

**Active materials, unconventional designs**, Stoyan K. Smoukov, A. Khaldi, Univ. of Cambridge (United Kingdom); Cédric Plesse, Frédéric Vidal, Univ. de Cergy-Pontoise (France); N. Denkov, S. Tcholakova, I. Lesov, D. Cholakova, Sofia Univ. "St. Kliment Ohridski" (Bulgaria) . . . . . [9798-124]

## CONFERENCE 9799

### Active and Passive Smart Structures and Integrated Systems X

**Structural design of active seismic isolation floor with a charging function**, Hayato Nakakoji, Nanako Miura, Kyoto Institute of Technology (Japan) . . . [9799-55]

**Design principle of a nonlinear robust dynamic vibration absorber based on equivalent dynamic stiffness**, Yuki Koga, Arata Masuda, Kyoto Institute of Technology (Japan) . . . . . [9799-110]

**Human-simulated intelligent control of train braking response of bridge with MRB**, Rui Li, Chongqing Univ. of Posts and Telecommunications (China) . . . [9799-111]

**Seismic isolation device having charging function by a transducer**, Takashi Yamaguchi, Nanako Miura, Kyoto Institute of Technology (Japan); Masaki Takahashi, Keio Univ. (Japan) . . . . . [9799-112]

**Electrically controlled release of naproxen using polyazulene/deproteinized natural rubber blend film**, Rattanapond Kaewchingduang, Anuvat Sirivat, Chulalongkorn Univ. (Thailand) . . . . . [9799-113]

**An investigation on a semiactive magnetorheological tuned liquid column damper (MR-TLCD)**, Hongxin Sun, Xiuyong Wang, Hunan Univ. of Science and Technology (China) . . . . . [9799-114]

**Design of a sensor system based on multi-direction isolation and application in time-delayed active control**, Xiuting Sun, Univ. of Shanghai for Science and Technology (China) and Tongji Univ. (China); Jian XU, Shu Zhang, Tongji Univ. (China) . . . . . [9799-115]

**Spiral passive electromagnetic sensor (SPES) for composite damage detection and diagnosis of aircraft structures**, Onorio Iervolino, Michele Meo, Univ. of Bath (United Kingdom) . . . . . [9799-116]

**Power converter design for energy-harvesting shock absorber**, Chien-An Chen, Khai Ngo, Lei Zuo, Virginia Polytechnic Institute and State Univ. (USA) . . . . . [9799-117]

**Uncertainty observer-based fuzzy sliding controller for active railway suspension systems**, Dung Sy Nguyen, Ho Chi Minh Univ. of Industry (Viet Nam); Seung-Bok Choi, Inha Univ. (Korea, Republic of) . . . . . [9799-118]

**Controlled release of folic acid from zeolite Y/Ca-alginate composite hydrogel assembly by electrical stimulation in transdermal drug delivery**, Nophawan Paradee, Anuvat Sirivat, Chulalongkorn Univ. (Thailand) . . . . . [9799-119]

**Low frequency inertial control strategy for seismic attenuation with passive monolithic mechanical sensors**, Fabrizio Barone, Gerardo Giordano, Fausto Acernese, Rocco Romano, Univ. degli Studi di Salerno (Italy) . . . . . [9799-120]

**Active mass damper system for high-rise buildings using neural oscillator and position controller considering stroke limitation of the auxiliary mass**, Junichi Hongu, Daisuke Iba, Morimasa Nakamura, Ichiro Moriwaki, Kyoto Institute of Technology (Japan) . . . . . [9799-121]

**Pounding-induced stress waves analysis and its mitigation in highway bridges under earthquakes**, Suchao Li, Harbin Institute of Technology (China) . . [9799-122]

**Magneto-Thermo-Triboelectric Generator(MTTG) for thermal energy harvesting**, Kwang-Yeop Jang, James Lee, Dong-Gun Lee, Korea Polytechnic Univ. (Korea, Republic of) . . . . . [9799-123]

**Hybrid energy harvesting using active thermal backplane**, Hyun Wook Kim, Dong-Gun Lee, Korea Polytechnic Univ. (Korea, Republic of) . . . . . [9799-124]

**Design of haptic master featuring small-sized MR brakes**, Jung Woo Sohn, Han-Gyeol Gang, Kumoh National Institute of Technology (Korea, Republic of); Seung-Bok Choi, Inha Univ. (Korea, Republic of) . . . . . [9799-125]

**New design of hydraulic mount considering three operating modes of Magneto-rheological fluid for vibration control**, Xuan Phu Do, Seung-Bok Choi, Soon-Yong Yang, Inha Univ. (Korea, Republic of) . . . . . [9799-126]

**Using the group of non-linear cells design metamaterial bar**, Weili Cao, Rongxiang Cao, Institute of Automation (China) . . . . . [9799-127]

**An inverse model for magnetorheological dampers based on a restructured phenomenological model**, Li-Jun Qian, Bo Liu, Peng Chen, Xian-Xu Bai, Hefei Univ. of Technology (China) . . . . . [9799-128]

**Seismic performance evaluation of recentring-damper-based steel structure under near-fault ground motions**, Hui Qian, Zhengzhou Univ. (China); Gangbing Song, Univ. of Houston (USA); Dahai Zhao, Yanshan Univ. (China) . . . . . [9799-129]

**Investigation of piezoelectric impedance-based health monitoring of structure interface debonding**, Li Xiao, Wuhan Univ. (China); Guofeng Chen, Xiaomeng Chen, Inner Mongolia Dynamic Machines Research Institute (China); Wenzhong Qu, Wuhan Univ. (China) . . . . . [9799-130]

**A deformable walking robot with tensegrity structure using nylon artificial muscle**, Lianjun Wu, Monica Jung de Andrade, Yonas Tadesse, Ray H. Baughman, The Univ. of Texas at Dallas (USA) . . . . . [9799-131]

**Modeling and control of a magnetorheological fluid knee**, Saurabh Bapat, The M. Nguyen, Alan Suarez, California State Univ., Fresno (USA) . . . . . [9799-132]

**Multi-scale analysis and optimized design of laminated-MRE bearings**, Shiwei Chen, Chongqing Univ. of Science and Technology (China) and Institute of Advanced Manufacturing Technology (China); Ze Zhang, Chongqing Univ. of Posts and Telecommunications (China) and Institute of Advanced Manufacturing Technology (China); Xiaojie Wang, Institute of Advanced Manufacturing Technology (China); Rui Li, Chongqing Univ. of Posts and Telecommunications (China) [9799-133]

**A novel design of energy harvester laminated piezoelectric material to the Magneto Rheological Elastomer (MRE) cantilever beam**, Shilong Sun, Peter W. Tse, City Univ. of Hong Kong (Hong Kong, China) . . . . . [9799-134]

**Broadband performance of a piezoelectric energy harvester based on the internal resonance of buckled beam**, Liuyang Xiong, Lihua Tang, The Univ. of Auckland (New Zealand); Liqun Chen, Hu Ding, Shanghai Univ. (China); Brian R. Mace, The Univ. of Auckland (New Zealand) . . . . . [9799-135]

**Energy harvesting performance of a broadband electromagnetic vibration energy harvester for powering industrial wireless sensor networks**, Long Ren, Renwen Chen, Huakang Xia, Xiaoxiao Zhang, Nanjing Univ. of Aeronautics and Astronautics (China) . . . . . [9799-136]

**Nondestructive evaluation of pyroshock propagation using hydrocodes**, Juho Lee, Dae-Hyeon Hwang, KAIST (Korea, Republic of); Jae-Kyeong Jang, Chonbuk National Univ. (Korea, Republic of); Jung-Ryul Lee, Jae-Hung Han, KAIST (Korea, Republic of) . . . . . [9799-137]

**Experimental validation of a sub-surface model of solar power for distributed marine sensor systems**, Gregory G. Hahn Jr., Michael W. Shafer, Northern Arizona Univ. (USA) . . . . . [9799-138]

**Dynamic terminal sliding mode control of a shape memory alloy actuated system**, Meeshawn S. Marathe, S. M. Srinivasan, Indian Institute of Technology Madras (India) . . . . . [9799-139]

**Functionalized hexagonal boron nitride nanocoatings for protection of transparent plastics**, Thu Van Tran, Aybala Usta, Ramazan Asmatulu, Wichita State Univ. (USA) . . . . . [9799-141]

## CONFERENCE 9800

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

**Experimental investigation on dependency of Terfenol-D transducers performance on working conditions**, Mohammad Reza Sheykholeslami, Yousef Hojjat, Tarbiat Modares Univ. (Iran, Islamic Republic of); Simone Cinquemani, Marco Tarabini, Politecnico di Milano (Italy); Mojtaba Ghodsi, Sultan Qaboos Univ. (Oman) . . . . . [9800-45]

**A physics model of the multi-degree freedom ionic polymer-metal composite cylinder actuator**, Qi Shen, Univ. of Nevada, Las Vegas (USA); Viljar Palmre, The Univ. of Texas Health Science Ctr. at Houston (USA); Jameson Y. Lee, Kwang Jin Kim, Univ. of Nevada, Las Vegas (USA) . . . . . [9800-47]

**Creation of smart composites using an embroidery machine**, Nobuhiro Torii, Kosuke Oka, Tadashige Ikeda, Nagoya Univ. (Japan) . . . . . [9800-48]



# POSTER/EXHIBITION RECEPTION

Tuesday 22 March | 6:00 to 7:30 pm

**Finite element analysis of the dynamic behavior of radially polarized Functionally Graded Piezoelectric (FGP) structures,** Ramkumar Kandasamy, Fangsen Cui, A\*STAR Institute of High Performance Computing (Singapore) . . . . . [9800-49]

## CONFERENCE 9801

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

**On the use of giant magnetostrictive materials in sonic transducers for liquid atomizers,** Mohammad Reza Sheykholeslami, Tarbiat Modares Univ. (Iran, Islamic Republic of); Mojtaba Ghodsi, Sultan Qaboos Univ. (Oman); Yousef Hojjat, Hesam Sadeghian, Tarbiat Modares Univ. (Iran, Islamic Republic of); Simone Cinquemani, Politecnico di Milano (Italy) . . . . . [9801-27]

**Analytical model of a giant magnetostrictive resonance transducer,** Mohammad Reza Sheykholeslami, Yousef Hojjat, Saeed Ansari, Tarbiat Modares Univ. (Iran, Islamic Republic of); Simone Cinquemani, Politecnico di Milano (Italy); Mojtaba Ghodsi, Sultan Qaboos Univ. (Oman) . . . . . [9801-28]

## CONFERENCE 9802

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

**Multiple leak detection method for long distance pipeline applying S-parameters based TDR signal model and Bayesian scheme,** Sihyeong Woo, Teajin Kim, Hyunseok Oh, Junmin Lee, Byeng D. Youn, Seoul National Univ. (Korea, Republic of) . . . . . [9802-24]

**Investigation of the dynamic effects of partial sensor debonding in smart composite laminates,** Asif Khan, Heung Soo Kim, Dongguk Univ. (Korea, Republic of) . . . . . [9802-53]

**Wearable nano-composite strain sensors with high sensitivity,** Tae-Jun Ha, Junyoung Jeon, Kwangwoon Univ. (Korea, Republic of) . . . . . [9802-54]

**Photonic crystal fiber modal interferometer for explosives detection,** Chuanyi Tao, Chongqing Univ. of Technology (China); Heming Wei, Yinian Zhu, Sridhar Krishnaswamy, Northwestern Univ. (USA) . . . . . [9802-55]

**In vivo spinal nerve sensing in MISS using Raman spectroscopy,** Hao Chen, Weiliang Xu, Neil Broderick, Zonglai Mo, The Univ. of Auckland (New Zealand) and The Dodd-Walls Ctr. for Photonic and Quantum Technologies (New Zealand) . . . . . [9802-56]

**A study of oxidant and surfactant type effects on synthesis of polyindole by emulsion polymerization,** Katesara Phasuksom, Anuvat Sirivat, Chulalongkorn Univ. (Thailand) . . . . . [9802-57]

**Synthesis of poly(p-phenylene) nanoparticles and effect of dopant on its electrical conductivity,** Pongpol Choeichom, Anuvat Sirivat, Chulalongkorn Univ. (Thailand) . . . . . [9802-58]

**Development of complex 3D microstructures based on computer generated holography and their usage for biomedical applications,** Arvydas Palevicius, Viktoras Grigaliunas, Giedrius Janusas, Paulius Palevicius, Rokas Sakalys, Kaunas Univ. of Technology (Lithuania) . . . . . [9802-59]

**A microscope based on fiber optic taper,** Weiming Wang, Yan Yu, Hui Huang, Dalian Univ. of Technology (China) . . . . . [9802-60]

**Conformal self-assembled thin films for optical pH sensors,** Daniela M. Topasna, Gregory A. Topasna, Minghanbo Liu, Ching-Hung Tseng, Virginia Military Institute (USA) . . . . . [9802-61]

**Foam metal metamaterial panel for mechanical waves isolation,** Hongwei Sun, Jiangsu Automation Research Institute (China) . . . . . [9802-62]

**Feasibility of transparent flexible ultrasonic haptic actuator,** Asma Akther, Abdullahil Kafy, Hyun-Chan Kim, Jaehwan Kim, Inha Univ. (Korea, Republic of) . . . . . [9802-63]

**The effect of NiTi superelastic fixation hardware on bone remodeling,** Bahram Raad, Narges Shayesteh Moghaddam, Mohammad Elahinia, The Univ. of Toledo (USA) . . . . . [9802-64]

**Superhydrophobic PAN nanofibers for gas diffusion layers of proton exchange membrane fuel cells,** Mohammad Salahuddin, Gisuk Hwang, Ramadan Asmatulu, Wichita State Univ. (USA) . . . . . [9802-65]

**Mechanical properties of thermosensitive Chitosan-graphene nanogels for sustained drug delivery applications,** Ramadan Asmatulu, Wichita State Univ. (USA) . . . . . [9802-66]

## CONFERENCE 9803

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

**Application of 3D digital image correlation for validation and calibration of FEM model of self-supporting metal plates structures,** Krzysztof Malowany, Warsaw Univ. of Technology (Poland); Artur Piekarczyk, Building Research Institute (Poland); Marcin Malesa, Malgorzata Kujawinska, Warsaw Univ. of Technology (Poland); Przemyslaw Wiech, Building Research Institute (Poland); Pawel Skrzypczak, Warsaw Univ. of Technology (Poland) . . . . . [9803-141]

**Detection of instability in reticulated shell structures,** Qiuhua Duan, Guirong Yah, Missouri Univ. of Science and Technology (USA); Xugang Hua, Hunan Univ. (China); Ruoqiang Feng, Key Lab. of Concrete and Prestressed Concrete Structures of Ministry of Education (China) . . . . . [9803-142]

**Progressive collapse analysis using updated models for alternate path analysis after a blast,** Edward Eskew, Shinae Jang, Univ. of Connecticut (USA) . . . . . [9803-143]

**Study on seismic performance of shear frame structure system with metallic rubber dampers,** Yagebai Zhao, Northeast Forestry Univ. (China); Suchao Li, Harbin Institute of Technology (China); Chenxi Mao, China Earthquake Administration (China) . . . . . [9803-144]

**Corrosion monitoring along infrastructures using distributed fiber optic sensing,** Khalil Alhandawi, Nader Vahdati, Oleg Shirayev, Lydia Lawand, The Petroleum Institute (United Arab Emirates) . . . . . [9803-145]

**Analysis of stability and slow-fast oscillations in space manipulator with time delay,** Shanying Jiang, Shanghai Institute of Technology (China); Jian Xu, Tongji Univ. (China) . . . . . [9803-146]

**Analysis of gyroscopic instability of free-yaw horizontal-axis wind turbine blades with complex geometric-inertial configurations,** Antonio Velazquez, Ohio Univ. (USA); R. Andrew Swartz, Michigan Technological Univ. (USA); Jaime E. Acuña-Benavente, Ohio Univ. (USA) . . . . . [9803-147]

**Loading capacity of RC short columns confined with superelastic shape memory alloy wires,** Hui Qian, Chenkai Hong, Xinjun Gao, Zhengzhou Univ. (China); Gangbing Song, Univ. of Houston (USA) . . . . . [9803-148]

**Highly sensitive ultraviolet sensors based on organic-transistor platform using Azobenzene-containing ion-gel films as gate dielectrics,** Kang Eun Lee, Korea Institute of Materials Science (Korea, Republic of); Jea Uk Lee, Korea Institute of Materials Science (Korea, Republic of) and Korea Research Institute of Chemical Technology (Korea, Republic of); Dong Gi Seong, Moon-Kwang Um, Wonoh Lee, Korea Institute of Materials Science (Korea, Republic of) . . . . . [9803-149]

**Acoustic metamaterial panels based on multi frequency vibration absorbers,** Hongwei Sun, Jiangsu Automation Research Institute (China) . . . . . [9803-150]

**Strain monitoring of a composite wing,** Joseph Strathman, Steve E. Watkins, Amardeep Kaur, David C. Macke Jr., Missouri Univ. of Science and Technology (USA) . . . . . [9803-151]

**Damage identification in highway bridges using distribution factors,** Michael Gangone, The Univ. of Texas at Tyler (USA) . . . . . [9803-152]

**Multi-metric strain estimation at unmeasured locations of plate structures using augmented Kalman filter,** Dyan Melvin, Hongki Jo, Babak Khodabandelo, The Univ. of Arizona (USA) . . . . . [9803-153]

**A smart-hose for concrete displacing booms,** Francesco Ripamonti, Giuseppe Bucca, Ferruccio Resta, Politecnico di Milano (Italy) . . . . . [9803-155]

**Vehicle monitoring system using RF transmission incorporating FSK technique,** Abhishek P. Chowdhuri, Avirup Roy, Mayukh Sinha, Anurag Chaudhuri, B.P. Poddar Institute of Management & Technology (India) . . . . . [9803-156]

**Simultaneous sensing of film thickness and temperature using an InSb Hall element driven by time-inversion,** Jun-ichiro Yuji, Tohru Ueda, Kumamoto National College of Technology (Japan) . . . . . [9803-157]

**Emergency response system using opto-electronic impact sensors and MEMS,** Avirup Roy, Abhishek P. Chowdhuri, Mayukh Sinha, Anurag Chaudhuri, B.P. Poddar Institute of Management & Technology (India) . . . . . [9803-158]

**Modeling of PZT-induced Lamb wave propagation in structures by using a novel two-layer spectral finite element,** Xiaotong Liu, Li Zhou, Nanjing Univ. of Aeronautics and Astronautics (China) . . . . . [9803-159]

**Crane hoisting monitoring using smartphone,** Xuefeng Zhao, Bo Jiao, Yang Zhang, Sunde Gao, Yan Yu, Dalian Univ. of Technology (China) . . . . . [9803-160]

**Development of three-axis inkjet printer for gear sensors,** Daisuke Iba, Ricardo Rodriguez Lopez, Takahiro Kamimoto, Morimasa Nakamura, Ichiro Moriawaki, Kyoto Institute of Technology (Japan) . . . . . [9803-161]

**Large band high sensitivity motion measurement and control of spacecrafts and satellites,** Fabrizio Barone, Gerardo Giordano, Fausto Acemese, Rocco Romano, Univ. degli Studi di Salerno (Italy) [9803-162]

**An enhanced probabilistic reconstruction algorithm for composites,** Hu Sun, Beijing Aeronautical Science and Technology Research Institute of COMAC (China) . . . . . [9803-163]

**Analysis of longitudinal seismic response of bridge with magneto-rheological elastomeric bearings,** Rui Li, Chongqing Univ. of Posts and Telecommunications (China) . . . . . [9803-164]

**Multiple damage identification and imaging in an aluminum plate using effective Lamb wave response automatic extraction technology,** Qinghua Ouyang, Li Zhou, Xiaotong Liu, Nanjing Univ. of Aeronautics and Astronautics (China) . . . . . [9803-165]

Conference attendees are invited to attend the poster session 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 22 March. View poster presentation guidelines.



**Development of a numerical model for vehicle-bridge interaction analysis of railway bridges**, Hee Ju Kim, Korea Institute of Civil Engineering and Building Technology (Korea, Republic of); Eun Sang Cho, Hyundai Engineering Co., Ltd. (Korea, Republic of); Junsu Ham, Inha Univ. (Korea, Republic of); Gi Tae Park, Tae Heon Kim, Korea Institute of Civil Engineering and Building Technology (Korea, Republic of) . . . . . [9803-166]

**A transducer layer for damage detection in carbon fiber composites**, Mohammad S. Salmanpour, Zahra Sharif Khodaei, Mohammad H. Aliabadi, Imperial College London (United Kingdom) . . . . . [9803-167]

**The state of the art on innovative monitoring system in Korea**, Kitae Park, Tae Heon Kim, Hee Ju Kim, Byungchul Kim, Korea Institute of Civil Engineering and Building Technology (Korea, Republic of) . . . . . [9803-169]

**Monitoring global climate change using LARES and other geodetic satellites**, Antonio Paolozzi, Sapienza Univ. di Roma (Italy) and Centro Fermi (Italy); Claudio Paris, Centro Fermi (Italy); Erricos C. Pavlis, Univ. of Maryland, Baltimore County (USA); Giampiero Sindoni, Cristian Vendittozzi, Sapienza Univ. di Roma (Italy); Ignazio Ciufolini, Univ. del Salento (Italy). [9803-170]

**Lifelog-based lighting design for biofied building**, Fumika Kake, Akira Mita, Keio Univ. (Japan) . . . . . [9803-171]

**Experimental characterization of an adaptive aileron: lab tests and FE correlation**, Gianluca Amendola, Ignazio Dimino, Ctr. Italiano Ricerche Aerospaziali (Italy); Francesco Amoroso, Rosario Pecora, Univ. degli Studi di Napoli Federico II (Italy) . . . . . [9803-172]

**Two-mode-fiber-based Brillouin sensor for simultaneous measurement of temperature and bending distribution**, Kwang-Yong Song, Yong Hyun Kim, Chung-Ang Univ. (Korea, Republic of); Kwani Lee, Korea Institute of Science and Technology (Korea, Republic of) . . . . . [9803-174]

**Detection of flaws on surface of civil infrastructures and their profiling using imaging system with laser displacement sensor**, Paritosh Giri, Sergey Kharkovsky, Western Sydney Univ. (Australia) [9803-175]

**Dynamic behavior of longitudinally polarized Functionally Graded Piezoelectric (FGP) structures with temperature dependent properties**, Ramkumar Kandasamy, Fangsen Cui, A\*STAR Institute of High Performance Computing (Singapore) . . . . . [9803-176]

**Experimental study of frost heaving force based on transient shock response using piezoceramic sensors**, Ruolin Wang, Tongxiao Peng, Wuhan Univ. (China); Ming L. Wang, Northeastern Univ. (USA) . . . . . [9803-177]

**Proposal of honeycomb-based deployable breakerwater**, Hiroshi Asanuma, Shinya Okabe, Chiba Univ. (Japan). . . . . [9803-178]

**A fluidic micro-strip based high-pressure sensor with low temperature crosstalk**, Wenge Zhu, Clemson Univ. (USA); Jie Huang, Missouri Univ. of Science and Technology (USA); Baokai Cheng, Hai Xiao, Clemson Univ. (USA) . . . . . [9803-179]

**Wireless sensor node for detection of freight train derailment**, Andrea Costa, Damiano Milani, Ferruccio Resta, Gisella Tomasini, Politecnico di Milano (Italy) . . . . . [9803-181]

**Damage location based on change in structural shape for civil large-scale space structures**, Guirong Yan, Missouri Univ. of Science and Technology (USA); Jianxin Yu, The Univ. of Texas at El Paso (USA); Jiahao Zu, Missouri Univ. of Science and Technology (USA); Xugang Hua, Hunan Univ. (China) . . . . . [9803-182]

**Adhesive bond failure monitoring with triboluminescent optical fiber sensor**, Md Abu S. Shohag, High Performance Materials Institute (USA); Emily Hammel, High Performance Materials Institute (USA) and Florida State Univ. (USA); David O. Olawale, High Performance Materials Institute (USA) and Nanotechnology Patronas Group Inc. (USA); Okenwa O. Okoli, Florida State Univ. (USA) . . . . . [9803-183]

**Preparation of polyaniline/multi-carbon nanotubes composite films/discs and characterization of their damping and strain sensing properties**, Weiwei Lin, Cesar Levy, Yonatan Rotenberg, Kevin P. Ward, Florida International Univ. (USA) . . . . . [9803-184]

**Stereovision-based vibration monitoring test of a masonry building model**, Baohua Shan, Harbin Institute of Technology (China); Yunli Gao, Dalian Nationalities Univ. (China); Yu Shen, China Southwest Architectural Design and Research Institute Corp. Ltd. (China) . . . . . [9803-185]

**Active vertical tail buffeting suppression based on macro fiber composites**, Chengzhe Zou, Bin Li, Li Liang, Wei Wang, Northwestern Polytechnical Univ. (China) . . . . . [9803-186]

**Highly sensitive full-field strain sensor by mechano-luminescent materials**, Ali Imani Azad, Jiahua Zhu, Gun-Jin Yun, The Univ. of Akron (USA) . . . . . [9803-187]

**Dof-based submatrix scaling factors for damage detection in reinforced concrete bridges**, Kyeongtaek Park, Marco Torbol, Ulsan National Institute of Science and Technology (Korea, Republic of) . [9803-188]

## CONFERENCE 9804

### Nondestructive Characterization and Monitoring of Advanced Materials, Aerospace, and Civil Infrastructure X

**Application of Hilbert-Huang transform for abnormal behavior point detection in vibration of structure**, Tae-Heon Kim, Hee Ju Kim, Ki-Tae Park, Korea Institute of Construction Technology (Korea, Republic of) . . . . . [9804-69]

**Investigating the effect of crack on propagation of ultrasonic guided waves in pipes via wavelet analysis**, Mohammad Riahi, Iran Univ. of Science and Technology (Iran, Islamic Republic of) . . . . . [9804-70]

**Comparison and analysis of two modern methods (BOCDA & ICM) in the structural health monitoring techniques in aerospace**, Mohammad Riahi, Iran Univ. of Science and Technology (Iran, Islamic Republic of) . . . . . [9804-71]

**Photogrammetric analysis of concrete specimens and structures for condition assessment**, Nicolas D'Amico, Tzuyang Yu, Univ. of Massachusetts Lowell (USA) . . . . . [9804-72]

**Decentralized identification based on joint extended and unscented Kalman filters for hysteretic system**, Dongwang Tao, Institute of Engineering Mechanics (China) and China Earthquake Administration (China); Hui Li, Harbin Institute of Technology (China) . . . . . [9804-73]

**Research on quick seismic damage investigation using smartphone**, Xuefeng Zhao, Ruicong Han, Yan Yu, Mingchu Li, Weitong Hu, Jinping Ou, Dalian Univ. of Technology (China) . . . . . [9804-74]

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# POSTER/EXHIBITION RECEPTION

Tuesday 22 March | 6:00 to 7:30 pm

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**Integrated 3D laser scanning and the segmented thermal images for structural health monitoring**, Yishuo Huang, Chih-Huang Chiang, Ken-Tsang Hsu, Chiying Wu, Chaoyang Univ. of Technology (Taiwan) . . . . . [9804-75]

**Finite element approach analysis for characteristics of electromagnestic acoustic Lamb wave**, Songsong Li, Dalian Ocean Univ. (China); Xiaoming Chen, Dalian Univ. of Technology (China) . . . . . [9804-76]

**Output-only damage detection in beam structures using statistical analysis of Hilbert-Huang transformation of measured response**, Mohammad Javad Khosraviani, Majid Ghasemi, Islamic Azad Univ. of Qazvin (Iran, Islamic Republic of) . . . . . [9804-78]

**Identification of breathing cracks in a beam structure with entropy**, Buddhi Wimarshana Senake Ralalage, Nan Wu, Univ. of Manitoba (Canada) . . . . . [9804-79]

**Finite element simulation for damage detection of surface rust in steel rebars using elastic waves**, Qixiang Tang, Tzuyang Yu, Univ. of Massachusetts Lowell (USA) . . . . . [9804-80]

**Characterization of unknown bridge foundations with structural identification methods**, Qiang Mao, Matteo Mazzotti, John DeVitis, Mustafa O. Furkan, Ivan Bartoli, Kurt Sjoblom, A. Emin Aktan, Drexel Univ. (USA) . . . . . [9804-81]

**Investigation of the corrosion of A36 steel over time using Raman spectroscopy**, Toni McCulloch, Namgyu Kim, Hae-Bum Yun, Univ. of Central Florida (USA) [9804-82]

**Sensitivity analysis for optimal placement of electrodes for damage detection in composites using the electrical resistance change method**, Paulina Diaz-Montiel, Luis Escalona, Satchi Venkataraman, San Diego State Univ. (USA) . . . . . [9804-83]

**Damage evaluation of carbon nanofibers flax fiber composite plates by acoustic emission technology**, Dongsheng Li, Dalian Univ. of Technology (China) . . . . . [9804-84]

**Guided wave damage detection with PZT-FBG sensing**, Xiaoyi Sun, Zhenhua Tian, Lingyu Yu, Bin Lin, Univ. of South Carolina (USA) . . . . . [9804-85]

**Damage detection in nano-reinforced composites using impedance spectroscopy**, Dimitrios Bekas, Alkiviadis Paipetis, Univ. of Ioannina (Greece)[9804-86]

**Non-destructive evaluation of adhesive layer using a planar array capacitive imaging technology**, Yuyan Zhang, Limei Zhao, Yintang Wen, Yanshan Univ. (China) . . . . . [9804-87]

**A review of nondestructive testing approach using mechanical and electromagnetic waves**, Denvid Lau, Qiwen Qiu, City Univ. of Hong Kong (Hong Kong, China) . . . . . [9804-88]

**Damage characterization in engineering materials using a combination of optical, acoustic, and thermal techniques**, Ilias K. Tragazikis, Dimitrios A. Exarchos, Panagiota Aikaterini T. Dalla, Theodoros E. Matikas, Univ. of Ioannina (Greece) . . . . . [9804-89]

**Sealing machine damaged composite edges via high strength adhesives for improved mechanical properties**, Jason Yeoh, Ibrahim M. Alarifi, Abdulaziz Alharbi, Ramazan Asmatulu, Wichita State Univ. (USA) . . . . . [9804-91]

## CONFERENCE 9805

### Health Monitoring of Structural and Biological Systems X

**Long-term monitoring of structures through 3D point cloud analysis**, Bahman Jafari, Ali Khaloo, David Lattanzi, George Mason Univ. (USA) . . . . . [9805-94]

**Multi-field coupled sensing network for monitoring health of composite bolted joint**, Yishou Wang, Xiamen Univ. (China); Xinlin Qing, Xiamen Univ. (China); Beijing Aeronautical Science and Technology Research Institute of COMAC (China); Dong Liang, Xiamen Univ. (China) . . . . . [9805-95]

**The application of data mining and cloud computing techniques in data-driven models for structural health monitoring**, Shervin Khazaeli, Amir G. Ravandi, Srishti Banerji, Ashutosh Bagchi, Concordia Univ. (Canada) . . . . . [9805-96]

**Fabrication and characterization of nano structured Mg-doped Cds/AAO nano porous membrane for sensing applications**, Hany S. Hamdy, Beni-Suef Univ. (Egypt) . . . . . [9805-97]

**Rotor damage detection by using piezoelectric impedance**, Yi Qin, Yi Tao, Yongfang Mao, Chongqing Univ. (China) . . . . . [9805-98]

**Optimized sensor location for estimating story-drift angle for tall buildings subject to earthquakes**, Sayuki Ozawa, Akira Mita, Keio Univ. (Japan) . . . . . [9805-99]

**The random field model of the spatial distribution of vehicle loads on long-span bridges**, Zhicheng Chen, Hui Li, Yuequan Bao, Harbin Institute of Technology (China) . . . . . [9805-100]

**Wave propagation in sandwich plates with multi-periodic lattice cores: a novel dynamic design**, Xin Fang, Jihong Wen, Jianfei Yin, DianLong Tu, National Univ. of Defense Technology (China) . . . . . [9805-101]

**Energy transport and localization in disordered nonlinear lattices**, Eunho Kim, Sean E. Phenisee, Jinkyu Yang, Univ. of Washington (USA) . . . . . [9805-103]

**Manipulating acoustic waves by acoustic metasurfaces**, Ying Wu, King Abdullah Univ. of Science and Technology (Saudi Arabia); Jun Mei, South China Univ. of Technology (China) . . . . . [9805-104]

**Embedded monitoring of CFRP composites under harsh environments using position varied fiber Bragg grating sensor arrays**, Yurim Park, Jin-Hyuk Kim, Pratik Shrestha, Heejung Kwon, Chun-Gon Kim, KAIST (Korea, Republic of) . [9805-105]

**Consolidating guided wave simulations and experimental data: a dictionary leaning approach**, K. Supreet Alguri, Joel Harley, The Univ. of Utah (USA) . [9805-106]

**Geometry control of long-span continuous girder concrete bridge during construction through finite element model updating**, Jie Wu, South China Univ. of Technology (China) and The Univ. of Kansas (USA); Quansheng Yan, South China Univ. of Technology (China); Jian Li, The Univ. of Kansas (USA); Minyi Hu, South China Univ. of Technology (China) . . . . . [9805-107]

**Adaptive acoustic metamaterials with tunable effective mass densities**, Rui Zhu, Yangyang Chen, Guoliang Huang, Univ. of Missouri (USA) . . . . . [9805-108]

**Initial strength gain monitoring of cement mortar using embedded piezoelectric sensors**, Arun Narayanan, V.L. Subramaniam Kolluru, Indian Institute of Technology Hyderabad (India) . . [9805-109]

**Finite element modelling of non-bonded piezo sensors for biomedical health monitoring of bones based on EMI technique**, Shashank Srivastava, Indira Gandhi National Open Univ. (India); Suresh Bhalla, Alok Madan, Ashok Gupta, Indian Institute of Technology Delhi (India) . . . . . [9805-110]

**Remaining service life under seismic consideration**, S. K. Dhawan, Abhinav Bindal, Indian Institute of Technology Delhi (India); Shashank Srivastava, Indira Gandhi National Open Univ. (India); Suresh Bhalla, Bishwajit Bhattacharjee, Indian Institute of Technology Delhi (India) . . . . . [9805-111]

**Small-strain measurement in bridge connections using the digital image correlation technique**, Niranjan Desai, Purdue Univ. (USA) . . . . . [9805-112]

## CONFERENCE 9806

### Smart Materials and Nondestructive Evaluation for Energy Systems II

**Energy harvesting under excitation of clamped-clamped beam**, Ashok K. Batra, Al-Muatasim Alomari, Mohan D. Aggarwal, Alak Bandyopadhyay, Alabama A&M Univ. (USA) ..... [9806-37]

**A study on the multilayer  $\pi$ -type thermoelectric power generation module using the metal direct bonding technology**, Hiroshi Sato, National Institute of Advanced Industrial Science and Technology (Japan); Teturo Yanaseko, Yokohama National Univ. (Japan); Yuki Hirayama, Hiroshi Asanuma, Chiba Univ. (Japan) ..... [9806-38]

**Thermally super-insulated and flaming retardant 3D graphene scaffolds with hierarchical honeycomb microstructures**, Qiangqiang Zhang, Harbin Institute of Technology (China); Menglong Hao, Purdue Univ. (USA); Xiang Xu, Hui Li, Harbin Institute of Technology (China); Timothy Fisher, Purdue Univ. (USA) ..... [9806-39]

**Acoustic metamaterial bar with non-linear spring-mass cells**, Rongxiang Cao, Weili Cao, Institute of Automation (China) ..... [9806-40]

**The effect of corrosion on the fatigue life of SiC particle reinforced aluminum matrix composites**, Panagiota Aikaterini T. Dalla, Ilias K. Tragazikis, Dimitrios A. Exarchos, Theodore E. Matikas, Univ. of Ioannina (Greece) ..... [9806-41]

**Detection of damage in advanced composite materials using laser Doppler vibrometry**, Theodoti Z. Kordatou, Ilias K. Tragazikis, Theodoros E. Matikas, Univ. of Ioannina (Greece) ..... [9806-42]

**Acoustic emission signatures of fire damaged modes in fiber reinforced concrete**, Anastasios C. Mpalaskas, Univ. of Ioannina (Greece); Dimitrios G. Aggelis, Danny Van Hemelrijck, Vrije Univ. Brussel (Belgium); Theodore E. Matikas, Univ. of Ioannina (Greece) ..... [9806-43]

**Correlation between acoustic emission parameters and strength of marble**, Anastasios C. Mpalaskas, Univ. of Ioannina (Greece); Dimitrios G. Aggelis, Vrije Univ. Brussel (Belgium); Theodore E. Matikas, Univ. of Ioannina (Greece) ..... [9806-44]

**Design of piezoelectric transformer for DC/DC converter with evolutionary optimization method**, Dejan Vasic, Lionel Vido, Lab. of Systems and Applications of Information and Energy Technologies (France) and Ecole Normale Supérieure de Cachan (France) ..... [9806-45]

**Development of an advanced, high-frequency GPR technique for the assessment of concrete structures: from modeling predictions to experimental results**, Eleni Cheilakou, Theodoros E. Matikas, Univ. of Ioannina (Greece) [9806-46]

**Polarization and electrochemical Impedance techniques to measure corrosion resistance of newly fabricated nanocrystalline Al-Fe-Cr alloy**, Asiful Seikh, Muneer Baig, King Saud Univ. (Saudi Arabia); Hany Rizk Ammar, Suez Univ. (Egypt) ..... [9806-47]



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**CONFERENCE 9798**

Electroactive Polymer Actuators and Devices (EAPAD) XVIII

**CONFERENCE 9799**

Active and Passive Smart Structures and Integrated Systems X

**CONFERENCE 9800**

Behavior and Mechanics of Multifunctional Materials and Composites X

**CONFERENCE 9802**

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

**Wednesday Plenary Session · 8:20 am to 9:10 am**



Plenary Presentation: 8:25 to 9:10 am

**The DARPA Atoms to Product Program**

John A. Main, Defense Advanced Research Projects Agency (USA)

Sessions 6A and 6B run concurrently.

**SESSION 6A**

LOCATION: GRAND A/B  
WED 9:20 AM TO 12:10 PM

**Power Generation and Energy Harvesting**

Session Chairs: **Jinsong Leng**, Harbin Institute of Technology (China); **Marco Fontana**, Scuola Superiore Sant'Anna (Italy)

9:20 am: **From electrode charges on dielectric elastomers to trapped charges and electric dipoles in electrets and ferroelectrets: fundamental and applications-relevant aspects of diversity in electroactive polymers** (*Invited Paper*), Reimund Gerhard, Univ. Potsdam (Germany) [9798-23]

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

**SESSION 6B**

LOCATION: MARQUIS 7  
WED 9:20 AM TO 12:10 PM

**Theoretical Modeling and Analysis**

Session Chairs: **Jian Zhu**, National Univ. of Singapore (Singapore); **Vanessa Y. F. Leung**, Univ. Basel (Switzerland)

9:20 am: **General thermodynamic theory of the stress-composition interaction for bucky-gel electrochemical actuators** (*Invited Paper*), Hyacinthe Randriamahazaka, Univ. Paris 7-Denis Diderot (France); Kinji Asaka, National Institute of Advanced Industrial Science and Technology (Japan) . . . . . [9798-29]

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

Sessions 8A and 8B run concurrently.

**SESSION 8A**

LOCATION: GRAND E  
WED 9:20 AM TO 10:00 AM

**SMA-based Materials and Systems II**

Session Chair: **Henry A. Sodano**, Univ. of Florida (USA)

9:20 am: **Passive vibration damping of carbon fiber reinforced plastic with PZT particles and SMA powder**, Jaemin Jung, Woo Il Lee, Dasom Lee, Sungho Park, Sungnam Moon, Seoul National Univ. (Korea, Republic of) . . . . . [9799-35]

9:40 am: **Investigation on low velocity impact resistance of SMA composite material**, Dianyin Hu, Wenbin Mei, Rongqiao Wang, Ao Jia, Xiaoyong Zhang, BeiHang Univ. (China) . . . . . [9799-36]

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

**SESSION 8B**

LOCATION: MARQUIS 8  
WED 9:20 AM TO 10:00 AM

**Modeling, Optimization, Signal Processing, Sensing, Control, and Design of Integrated Systems I**

Session Chair: **Nakhiah C. Goulbourne**, Univ. of Michigan (USA)

9:20 am: **Origami structures with self-locking properties**, Hongbin Fang, Suyi Li, Univ. of Michigan (USA); Jian Xu, Tongji Univ. (China); Kon-Well Wang, Univ. of Michigan (USA) . . . . . [9799-37]

9:40 am: **Control approach development for variable recruitment artificial muscles**, Tyler Jenkins, Matthew Bryant, North Carolina State Univ. (USA) . . . . . [9799-38]

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

**SESSION 8**

LOCATION: ANDALUCIA  
WED 9:20 AM TO 10:00 AM

**Nanocomposites Materials I**

Session Chair: **Constantin Ciocanel**, Northern Arizona Univ. (USA)

9:20 am: **Self-sensing and thermal-energy experimental characterization of multifunctional cement-matrix composites with carbon nanoinclusions**, Antonella D'Alessandro, Anna Laura Pisello, Sara Sambuco, Filippo Ubertini, Univ. degli Studi di Perugia (Italy); Francesco Asdrubali, Univ. degli Studi di Roma Tre (Italy); Annibale Luigi Materazzi, Franco Cotana, Univ. degli Studi di Perugia (Italy) . . . . . [9800-34]

9:40 am: **Effects of silanized graphene nanoflakes on mechanical properties of carbon fiber reinforced laminate composites**, Rifath Mahmud Rony Shagor, Ramazan Asmatulu, Wichita State Univ. (USA) . . . . . [9800-51]

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

**SESSION 11**

LOCATION: MARQUIS 6  
WED 9:20 AM TO 10:20 AM

**Keynote Lecture V**

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

9:20 am: **Design of a bullet beam pattern of a micro ultrasound transducer** (*Keynote Presentation*), Yongrae Roh, Seongmin Lee, Kyungpook National Univ. (Korea, Republic of) . . . . . [9802-31]

10:00 am: **Superelastic torsional actuator for matching the stiffness profile in knee extension and flexion in a dynamic KAFO**, Feng Tian, Mohammad Elahinia, Mohamed Samir Hefzy, The Univ. of Toledo (USA) . . . . . [9802-32]

Coffee Break . . . . . Wed 10:20 am to 10:50 am

**CONFERENCE 9803**

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

**CONFERENCE 9804**

Nondestructive Characterization and Monitoring of Advanced Materials, Aerospace, and Civil Infrastructure X

**CONFERENCE 9805**

Health Monitoring of Structural and Biological Systems X

**CONFERENCE 9806**

Smart Materials and Nondestructive Evaluation for Energy Systems II

**Wednesday Plenary Session · 8:20 am to 9:10 am**



Plenary Presentation: 8:25 to 9:10 am

**The DARPA Atoms to Product Program**

John A. Main, Defense Advanced Research Projects Agency (USA)

Sessions 8A and 8B run concurrently.

**SESSION 8A**

**LOCATION: GRAND D  
WED 9:20 AM TO 10:00 AM**

**Fusion of Fiber Optic and Ultrasonic Sensing I**

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

9:20 am: **Ultrasound generation from an optical fiber sidewall**, Jingcheng Zhou, Nan Wu, Siwen Bi, Xingwei Wang, Univ. of Massachusetts Lowell (USA). . . . [9803-67]

9:40 am: **Load and crack monitoring using signal evaluation of piezo sensors and fiber optic sensor based structural health monitoring**, Muneesh Maheshwari, Venu G. M. Anaamdas, John H. L. Pang, Swee C. Tjin, Anand Asundi, Nanyang Technological Univ. (Singapore). . . . . [9803-68]

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

**SESSION 8B**

**LOCATION: CATALUNA A  
WED 9:20 AM TO 10:00 AM**

**UAV Technology for System Monitoring**

Session Chair: **Yang Wang**, Georgia Institute of Technology (USA)

9:20 am: **Artificial hair sensor designs for flight control studies of UAVs with different scales**, Weihua Su, The Univ. of Alabama (USA); Gregory W. Reich, Air Force Research Lab. (USA). . . . . [9803-69]

9:40 am: **Automated UAV deployment and control of mobile wireless sensing networks for infrastructure monitoring applications**, Mitsuhiro Hirose, Jerome P. Lynch, Univ. of Michigan (USA). . . [9803-70]

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

**SESSION 9**

**LOCATION: MARQUIS 2  
WED 9:20 AM TO 10:00 AM**

**Keynote Session II**

Session Chair: **Tzuyang Yu**, Univ. of Massachusetts Lowell (USA)

9:20 am: **Recent R&D activities on track integrity at Federal Railroad Administration (Keynote Presentation)**, Gary Carr, Federal Railroad Administration (USA) . . . . . [9804-34]

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

**SESSION 8**

**LOCATION: MARQUIS 1  
WED 9:20 AM TO 10:00 AM**

**Pipes and Tubes**

Session Chairs: **Hoon Sohn**, KAIST (Korea, Republic of); **Andrei N. Zagrai**, New Mexico Institute of Mining and Technology (USA)

9:20 am: **In-situ measurement of the height of condensed water in steam pipes with dynamic flow**, Shyh-Shiuh Lih, Hyeong Jae Lee, Yoseph Bar-Cohen, Jet Propulsion Lab. (USA) . . . . . [9805-36]

9:40 am: **Advanced signal processing technique for damage detection in steel tubes**, Umar Amjad, Susheel K. Yadav, Cac Minh Dao, Kiet T. Dao, Tribikram Kundu, The Univ. of Arizona (USA) . . . . . [9805-37]

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

**SESSION 9**

**LOCATION: MARQUIS 3  
WED 9:20 AM TO 10:00 AM**

**Materials Processing and Characterization II**

Session Chairs: **Norbert G. Meyendorf**, Iowa State Univ. of Science and Technology (USA); **Theodoros E. Matikas**, Univ. of Ioannina (Greece)

9:20 am: **NDE applications in micro electronic industries**, Norbert G. Meyendorf, Iowa State Univ. of Science and Technology (USA); Martin Oppermann, TU Dresden (Germany); Peter Krueger, Fraunhofer IKTS-MD (Germany) . . [9806-31]

9:40 am: **Sensitivity analysis of laser-based ultrasonic wave generation using finite element method**, Seyed Mehdi Mirsadeghi, Ron Hugo, Simon Park, Univ. of Calgary (Canada). . . . . [9806-32]

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

**CONFERENCE 9798**

Sessions 6A and 6B run concurrently.

**SESSION 6A**

Continued

10:30 am: **Energy harvesting for dielectric elastomer sensing**, Iain A. Anderson, The Univ. of Auckland (New Zealand) and StretchSense (New Zealand); Ben M. O'Brien, StretchSense (New Zealand). . . . . [9798-24]

10:50 am: **Big power from walking**, Patrin K. Illenberger, 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); Udaya K. Madawala, The Univ. of Auckland (New Zealand). . . . . [9798-25]

11:10 am: **Modelling self-priming circuits for dielectric elastomer generators towards optimum voltage boost**, Plinio Rodrigues de Oliveira Zanini, Jonathan M. Rossiter, Martin Homer, Univ. of Bristol (United Kingdom). . . . . [9798-26]

11:30 am: **High performance dielectric elastomer generators based on synthetic rubber**, Marco Fontana, Scuola Superiore Sant'Anna (Italy); Rocco Vertechy, Univ. degli Studi di Bologna (Italy); Giacomo Moretti, Scuola Superiore Sant'Anna (Italy). . . . . [9798-27]

11:50 am: **Pre-stretch induced leakage current in VHB electroactive polymers**, Saber Hammami, Univ. Grenoble Alpes (France) and Univ. Tunis El Manar (Tunisia); Claire Jean-Mistral, Institut National des Sciences Appliquées de Lyon (France); Fathi Jomni, Univ. Tunis El Manar (Tunisia); Alain Sylvestre, Univ. Grenoble Alpes (France). . . . . [9798-28]

Lunch Break Wed 12:10 to 1:20 pm

**SESSION 6B**

Continued

10:30 am: **Modeling and simulation of chemically stimulated hydrogel layers using the multifield theory**, Martin Sobczyk, Thomas Wallmersperger, TU Dresden (Germany). . . . . [9798-30]

10:50 am: **Fundamental study on helically oriented twisted polymer fibre for smart actuator**, Shazed Md Aziz, Sina Naficy, Javad Foroughi, Hugh R. Brown, Geoffrey M. Spinks, Univ. of Wollongong (Australia). . . . . [9798-31]

11:10 am: **Modeling and control of a dielectric elastomer actuator**, Jian Zhu, Ujjaval Gupta, National Univ. of Singapore (Singapore); Guo-Ying Gu, Shanghai Jiao Tong Univ. (China). . . . . [9798-32]

11:30 am: **Electro-mechanical performance analysis of inflated dielectric elastomer membrane for micro pump applications**, Abhishek Saini, Dilshad Ahmad, Karali Patra, Indian Institute of Technology Patna (India). . . . . [9798-33]

11:50 am: **Analytical approach on the performance of a helical dielectric elastomer actuator**, Daewon Kim, Audrey Gbaguidi, Vamsi Krishna Konduru, Chase Rossman, Embry-Riddle Aeronautical Univ. (USA). . . . . [9798-34]

Lunch Break .Wed 12:10 to 1:20 pm

**CONFERENCE 9799**

Sessions 9A and 9B run concurrently.

**SESSION 9A**

**LOCATION: GRAND E  
WED 10:30 AM TO 12:10 PM**

**Energy Harvesting and Scavenging: Fluid-Structure Interaction**

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

10:30 am: **Toward efficient aeroelastic energy harvesting through limit cycle shaping**, Benjamin Kirschmeier, Matthew Bryant, North Carolina State Univ. (USA). . . . . [9799-39]

10:50 am: **Dramatic effect of fluid damping on the performance of a nonlinear M-shaped broadband energy harvester**, David Tan, Christopher Sugino, Stephen M. Leadenham, Alper Erturk, Georgia Institute of Technology (USA). . . . . [9799-40]

11:10 am: **Aeroelastic modelling of a piezo-solar tensioned energy harvesting ribbon**, Punnag Chatterjee, Matthew Bryant, North Carolina State Univ. (USA) [9799-41]

11:30 am: **Controlling limit cycle oscillation amplitudes for energy harvesting purposes**, Himanshu Shukla, Mayuresh J. Patil, Virginia Polytechnic Institute and State Univ. (USA). . . . . [9799-42]

11:50 am: **PVDF-based energy harvesters for in-pipe applications**, Norbert Schwesinger, Sherif Keddis, Technische Univ. München (Germany) . . . . [9799-43]

Lunch Break Wed 12:10 to 1:40 pm

**SESSION 9B**

**LOCATION: MARQUIS 8  
WED 10:30 AM TO 12:10 PM**

**Passive and Active Vibration Isolation Systems II**

Session Chairs: **Lei Zuo**, Virginia Polytechnic Institute and State Univ. (USA); **Sondipon Adhikari**, Swansea Univ. (United Kingdom)

10:30 am: **Vibration suppression in MEMS devices using electrostatic forces**, Hamed Haddad Khodaparast, Hadi Madinei, Michael I. Friswell, Sondipon Adhikari, Swansea Univ. (United Kingdom). . . . . [9799-44]

10:50 am: **Exact H<sub>2</sub> optimal solution to dual-functional series electromagnetic tuned mass dampers**, Yilun Liu, Virginia Polytechnic Institute and State Univ. (USA); Chi-Chiang Lin, National Chung Hsing Univ. (Taiwan); Lei Zuo, Virginia Polytechnic Institute and State Univ. (USA). . . . . [9799-45]

11:10 am: **Tuned liquid column damper implementation with real-time hybrid simulation**, Carlos Riascos, Peter Thomson, Univ. del Valle (Colombia). . . . . [9799-46]

11:30 am: **Active vibration control of lightweight floor systems**, Jakob Baader, ETH Zürich (Switzerland). . . . . [9799-47]

11:50 am: **Analytical modeling of a simple passive electromagnetic eddy current friction damper**, Mohsen Amjadian, Anil Kumar Agrawal, The City College of New York (USA). . . . . [9799-48]

Lunch Break .Wed 12:10 to 2:00 pm

**CONFERENCE 9800**

**SESSION 9**

**LOCATION: ANDALUCIA  
WED 10:30 AM TO 12:10 PM**

**Nanocomposites Materials II**

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

10:30 am: **Evaluation of progressive damage of nano-modified composite laminates under repeated impacts**, Ermias G. Koricho, Oleksii Y. Karpenko, Anton Khomenko, Mahmoodul Haq, Gary L. Cloud, Lalita Udpa, Michigan State Univ. (USA). . . . . [9800-35]

10:50 am: **Strain analysis of nanowire interfaces in multiscale composites**, Mohammad H. Malakooti, Univ. of Michigan (USA); Zhi Zhou, Univ. of Florida (USA); John H. Spears, Univ. of Central Florida (USA); Timothy J. Shankwitz, Univ. of Florida (USA); Henry A. Sodano, Univ. of Michigan (USA). . . . . [9800-36]

11:10 am: **On the continuum mechanics approach for the analysis of single walled carbon nanotubes**, Muhammad Salman Chaudhry, Aleksander Czekanski, York Univ. (Canada). . . . . [9800-37]

11:30 am: **Aramid nanofibers as carbon fiber's surface modifiers for improving interfacial adhesion**, Jea Uk Lee, Korea Institute of Materials Science (Korea, Republic of) and Korea Research Institute of Chemical Technology (Korea, Republic of); Wonoh Lee, Korea Institute of Materials Science (Korea, Republic of). . . . . [9800-38]

11:50 am: **Preparation, characterization, and properties of carbon nanotube/polyurea nanocomposites**, Jing Qiao, Longtao Jiang, Gaohui Wu, Harbin Institute of Technology (China). . . . . [9800-39]

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

**CONFERENCE 9802**

**SESSION 12**

**LOCATION: MARQUIS 6  
WED 10:50 AM TO 12:40 PM**

**Fabrication and Characterization I**

Session Chair: **Jaehwan Kim**, Inha Univ. (Korea, Republic of)

10:50 am: **Patternable cellulose nanocrystals composite nanofibers** (*Invited Paper*), Wei-Chih Wang, Edward Le, Univ. of Washington (USA). . . . . [9802-33]

11:20 am: **UV response of cellulose ZnO hybrid nanocomposite**, Seongcheol Mun, Hyun-u Ko, Seung-Ki Min, Hyun-Chan Kim, Jaehwan Kim, Inha Univ. (Korea, Republic of). . . . . [9802-34]

11:40 am: **Cellulose nanocrystal and poly[di(ethylene glycol) adipate] blend for tunable lens**, Hyun-u Ko, Hyun-Chan Kim, Yaguang Li, Inha Univ. (Korea, Republic of); Sang-Youn Kim, Korea Univ. of Technology and Education (Korea, Republic of); Jaehwan Kim, Inha Univ. (Korea, Republic of). . . . . [9802-35]

12:00 pm: **Fabrication of cellulose nanofiber transparent films for IT applications**, Lindong Zhai, Sangho Song, Jeong-Woong Kim, Yaguang Li, Jaehwan Kim, Inha Univ. (Korea, Republic of). . . . . [9802-36]

12:20 pm: **Feasibility study of ZnO nanowire for miniaturized accelerometer**, Hyun-Chan Kim, Hyun-u Ko, Sangho Song, Young-Min Yun, Jaehwan Kim, Inha Univ. (Korea, Republic of). . . . . [9802-37]

Lunch Break Wed 12:40 to 1:40 pm



CONFERENCE 9803

Sessions 9A and 9B run concurrently.

SESSION 9A

LOCATION: GRAND D  
WED 10:30 AM TO 12:10 PM

**Fusion of Fiber Optic and Ultrasonic Sensing II**

Session Chairs: **Kara J. Peters**, North Carolina State Univ. (USA); **Wolfgang Ecke**, Leibniz-Institut für Photonische Technologien e.V. (Germany)

10:30 am: **Ultrasonic temperature measurements with fiber optic system**, Siwen Bi, Nan Wu, Jingcheng Zhou, Univ. of Massachusetts Lowell (USA); Tong Ma, Yuqian Liu, Chengyu Cao, Univ. of Connecticut (USA); Xingwei Wang, Univ. of Massachusetts Lowell (USA). . . . . [9803-71]

10:50 am: **Monitoring cure properties of out-of-autoclave BMI composites using IFPI sensor**, Amardeep Kaur, Sudharshan Anandan, Missouri Univ. of Science and Technology (USA); Lei Yuan, Clemson Univ. (USA); Steve E. Watkins, Missouri Univ. of Science and Technology (USA); Hai Xiao, Clemson Univ. (USA); K. Chandrashekhara, Missouri Univ. of Science and Technology (USA) . . . . . [9803-72]

11:10 am: **Characterization of embedded fiber optic strain sensors into metallic structures via ultrasonic additive manufacturing**, John J. Schomer, Adam J. Hehr, Marcelo J. Dapino, The Ohio State Univ. (USA) . . . . . [9803-73]

11:30 am: **Metal-core piezoelectric fiber based smart layer for damage detection using sparse virtual element boundary measurement**, Chao Zhang, Nanjing Univ. of Aeronautics and Astronautics (China); Li Cheng, The Hong Kong Polytechnic Univ. (Hong Kong, China); Jinhao Qiu, Nanjing Univ. of Aeronautics and Astronautics (China); Hao Xu, The Hong Kong Polytechnic Univ. (Hong Kong, China) . . . . . [9803-74]

11:50 am: **Guided wave-based pipe damage inspection by fiber optic sensor**, Wensong Zhou, Hui Li, Yongkang Dong, Harbin Institute of Technology (China) . . . . . [9803-75]

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

SESSION 9B

LOCATION: CATALUNA A  
WED 10:30 AM TO 12:10 PM

**System ID and SHM of Civil and Mechanical Systems**

Session Chairs: **Hyung-Jo Jung**, KAIST (Korea, Republic of); **Daniele Zonta**, Univ. degli Studi di Trento (Italy)

10:30 am: **Diagnostic framework for model inadequacy in structural identification (St-ID) by likelihood-free Bayesian computation**, Hyung-Jo Jung, Seung-Seop Jin, KAIST (Korea, Republic of) . . . [9803-76]

10:50 am: **Cyclo-non-cyclo-stochastic subspace identification method for rotating machinery and spinning structures**, Antonio Velazquez, Ohio Univ. (USA); R. Andrew Swartz, Michigan Technological Univ. (USA) . . . . . [9803-77]

11:10 am: **Experimental model updating with frequency response function**, Yu Hong, Southwest Jiaotong Univ. (China) and Georgia Institute of Technology (USA); Xi Liu, Xinjun Dong, Yang Wang, Georgia Institute of Technology (USA); Qianhui Pu, Southwest Jiaotong Univ. (China) . . . . . [9803-78]

11:30 am: **A hybrid method for damage detection and quantification in advanced X-COR composite structures**, Rajesh Kumar Neerukatti, Abhishek Rajadas, Arizona State Univ. (USA); Luke Borkowski, United Technologies Research Ctr. (USA); Aditi Chattopadhyay, Arizona State Univ. (USA); Daniel Huff, The Boeing Co. (USA) . . . . . [9803-79]

11:50 am: **Formula for the arc length of a superhelix**, Sungyeop Lim, Soonhung Han, KAIST (Korea, Republic of) . . . . . [9803-80]

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

CONFERENCE 9804

SESSION 10

LOCATION: MARQUIS 2  
WED 10:30 AM TO 12:30 PM

**Image and Video Sensing**

Session Chairs: **Peter J. Shull**, The Pennsylvania State Univ. (USA); **Tian Xia**, The Univ. of Vermont (USA)

10:30 am: **Repurposing video recordings for structure motion estimations**, David Lattanzi, Ali Khaloo, George Mason Univ. (USA) . . . . . [9804-35]

10:50 am: **Damage detection of concrete masonry structures by enhancing deformation measurement using DIC**, Mohammad Bolhassani, Satish Rajaram, Ahmad A. Hamid, Antonios Kotsos, Ivan Bartoli, Drexel Univ. (USA) . . . . . [9804-36]

11:10 am: **A novel vision-based system for pavement crack recognition and quantification based on image processing and machine learning techniques**, Soroush Mokhtari, Liuliu Wu, Hae-Bum Yun, Univ. of Central Florida (USA) . . . . . [9804-37]

11:30 am: **Bolt-loosening identification of bolt connections by vision image-based technique**, Tae-Hwan Kim, Tuan-Cuong Nguyen, Thanh-Canh Huynh, Jae-Hyung Park, Jeong-Tae Kim, Pukyong National Univ. (Korea, Republic of) . . . . . [9804-38]

11:50 am: **An autonomous unmanned aerial vehicle sensing system for structural health monitoring of bridges**, Daniel R. Reagan, Christopher Niezrecki, Tzuyang Yu, Univ. of Massachusetts Lowell (USA) . . . . . [9804-39]

12:10 pm: **Preparation and characterization of phase change material for thermal energy storage in buildings**, Tommy Lo, City Univ. of Hong Kong (Hong Kong, China) . . . . . [9804-90]

Lunch Break . . . . Wed 12:30 pm to 2:20 pm

CONFERENCE 9805

SESSION 9

LOCATION: MARQUIS 1  
WED 10:30 AM TO 12:10 PM

**Nonlinear Techniques**

Session Chairs: **Victor Giurgiutiu**, Univ. of South Carolina (USA); **Hoon Sohn**, KAIST (Korea, Republic of)

10:30 am: **Estimation of the aging level of rejuvenated asphalt concrete pavements using nonlinear ultrasonics**, Megan McGovern, William G. Buttler, Henrique L. Reis, Univ. of Illinois at Urbana-Champaign (USA) . . . . . [9805-38]

10:50 am: **Wideband excitation in nonlinear vibro-acoustic modulation for damage detection**, Andrzej P. Klepka, Wieslaw J. Staszewski, Lukasz Pieczonka, Maciej Adamczyk, Tadeusz Uhl, AGH Univ. of Science and Technology (Poland) . . . . . [9805-39]

11:10 am: **Damage visualization using synchronized noncontact laser ultrasonic scanning**, Peipei Liu, Timotius Yonathan Sunarsa, Hoon Sohn, KAIST (Korea, Republic of) . . . . . [9805-40]

11:30 am: **A nonlocal numerical approach for modeling of temperature-dependent crack-wave interaction**, Piotr Kijanka, Adam Martowicz, Wieslaw J. Staszewski, Kajetan Dziedzic, AGH Univ. of Science and Technology (Poland) . . . . . [9805-41]

11:50 am: **Nonlinear magnetoelectric effect in layered piezoelectric/magnetostrictive composites under combined magnetic field, stress, and electric field loading**, Hao Xu, Yongmao Pei, Peking Univ. (China) . . . . . [9805-42]

Lunch Break . . . . Wed 12:10 pm to 1:20 pm

CONFERENCE 9806

SESSION 10

LOCATION: MARQUIS 3  
WED 10:30 AM TO 12:10 PM

**Energy Harvesting II**

Session Chairs: **Norbert G. Meyendorf**, Iowa State Univ. of Science and Technology (USA); **Theodoros E. Matikas**, Univ. of Ioannina (Greece)

10:30 am: **Wide operation frequency band magnetostrictive vibration power generator using nonlinear spring constant by permanent magnet**, Shogo Furumachi, Kanazawa Univ. (Japan) . . . . . [9806-33]

10:50 am: **Fatigue study and improve reliability of cantilever type micro piezoelectric energy harvesters reinforced with flexible adhesive conductive tape**, Ting-Kai Lin, Yu-Chieh Hsieh, Wen-Jong Wu, National Taiwan Univ. (Taiwan) . . . . . [9806-34]

11:10 am: **Parameter study and optimization for piezoelectric energy harvester for TPMS considering speed variation**, Amin Toghi Eshghi, Soobum Lee, Univ. of Maryland, Baltimore County (USA); Hanmin Lee, Young-Cheol Kim, Korea Institute of Machinery and Materials (Korea, Republic of) . . . . . [9806-35]

11:30 am: **Design and experimental evaluation of flextensional-cantilever based piezoelectric transducers for flow energy harvesting**, Hyeong Jae Lee, Stewart Sherrit, Phil Walkemeyer, Jet Propulsion Lab. (USA); Luis Phillipe Tosi, Tim Colonius, California Institute of Technology (USA) . . . . . [9806-36]

11:50 am: **Comparative studies between different nanofiber photocatalysts for water splitting**, Abdulaziz Alharbi, Ibrahim M. Alarifi, Wichita State Univ. (USA); Waseem S. Khan, Majmaah Univ. (Saudi Arabia); Ramazan Asmatulu, Wichita State Univ. (USA) . . . . . [9806-49]

Conference End.

**CONFERENCE 9798**

Sessions 7A and 7B run concurrently.

**SESSION 7A**

**LOCATION: GRAND A/B  
WED 1:20 PM TO 3:00 PM**

**Ionic EAP Materials and Actuators I**

Session Chairs: **Barbar J. Akle**, Lebanese American Univ. (Lebanon); **Richard J. Spontak**, North Carolina State Univ. (USA)

1:20 pm: **Some electrochemical aspects of aqueous ionic polymer-composite actuators**, Zane Zondaka, Edgar Hamburg, Andres Punning, Urmas Johanson, Alvo Aabloo, Univ. of Tartu (Estonia) . . . [9798-35]

1:40 pm: **Design and manufacturing of an array of micro IPMC hair-like sensors**, Barbar J. Akle, Elio Challita, Charbel Tawk, Lebanese American Univ. (Lebanon) . . . . . [9798-36]

2:00 pm: **Ionic Polymer Metal Composites (IPMCs) micropillars for real-time dynamic tracking of biological cells adhesion, migration, and traction**, Mohsen Shahinpoor, Abouhamed Saberi, Sharon Ashworth, The Univ. of Maine (USA) . . . . . [9798-37]

2:20 pm: **Novel fabrication of ionic polymer-metal composites by spraying method**, Sarah Trabia, Taeseon Hwang, Kwang Jin Kim, Univ. of Nevada, Las Vegas (USA) . . . . . [9798-38]

2:40 pm: **IPMC cilia system for artificial muscle applications**, Taeseon Hwang, Univ. of Nevada, Las Vegas (USA); Viljar Palmre, The Univ. of Texas Medical School at Houston (USA); Tyler P. Stalbaum, Qi Shen, Sarah Trabia, Kwang Jin Kim, Univ. of Nevada, Las Vegas (USA) . . . . . [9798-39]

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

**SESSION 7B**

**LOCATION: MARQUIS 7  
WED 1:20 PM TO 3:00 PM**

**New EAP Materials, Processes, and Fabrication Techniques I**

Session Chairs: **Edwin W.H. Jager**, Linköping Univ. (Sweden); **Lenore Rasmussen**, Ras Labs., LLC (USA)

1:20 pm: **Photopolymerization of 3D conductive polypyrrole structures via digital light processing**, Aaron D. Price, The Univ. of Western Ontario (Canada) . . . . . [9798-40]

1:40 pm: **Processing of dielectric laminate actuator based on high precision dispenser and ink jet**, Hiroya Imamura, Kevin Kadooka, Minoru Taya, Univ. of Washington (USA); Mutsumi Kimura, Shinshu Univ. (Japan) . . . . . [9798-41]

2:00 pm: **Chemically modified reduced graphene oxide and PEDOT:PSS composite electrodes based highly bendable ionic polymer actuator**, Jaehwan Kim, Moumita Kotal, Il-Kwon Oh, KAIST (Korea, Republic of) . . . . . [9798-42]

2:20 pm: **A stretchable electroadhesive based on multilayer acrylic elastomers**, Mihai Duduta, Harvard Univ. (USA); Robert J. Wood, Harvard School of Engineering and Applied Sciences (USA); David R. Clarke, Harvard Univ. (USA) . . . . . [9798-43]

2:40 pm: **Crosslinkage of polymethylhydrosiloxanes utilizing a diallyl functionalized nitroaniline derivative**, Miriam Biedermann, Martin Blümke, Hartmut Krüger, Michael Wegener, Fraunhofer-Institut für Angewandte Polymerforschung (Germany) . . . . [9798-44]

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

**CONFERENCE 9799**

Sessions 10A and 10B run concurrently.

**SESSION 10A**

**LOCATION: GRAND E  
WED 1:40 PM TO 3:00 PM**

**Piezo-based Materials and Systems II**

Session Chairs: **Norbert Schwesinger**, Technische Univ. München (Germany); **Ozkan Ozer**, Univ. of Nevada, Reno (USA)

1:40 pm: **Comparison of piezoelectric layered plates based on d31 and d33 coupling for micro-actuators**, Cuong H. Nguyen, Buskerud Univ. College (Norway); Ulrik Hanke, Vestfold Univ. College (Norway); Einar Halvorsen, Buskerud Univ. College (Norway) . . . . . [9799-49]

2:00 pm: **Interaction of multiple actuators for synchronized switching damping control**, Gabriele Cazzulani, Francesco Braghin, Fabrizio Mazzocchi, Politecnico di Milano (Italy) . . . . . [9799-50]

2:20 pm: **Design and modeling of new suspension system using direct drive servo-valve system actuated by piezostack actuator**, Chulhee Han, Seung-Bok Choi, Inha Univ. (Korea, Republic of) . . . . . [9799-51]

2:40 pm: **Modeling and stabilization results for a current and charge-actuated active constrained layer (ACL) beam model with electrostatic assumption**, Ozkan Ozer, Univ. of Nevada, Reno (USA) . . . . . [9799-52]

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

**SESSION 10B**

**LOCATION: MARQUIS 8  
WED 2:00 PM TO 3:00 PM**

**Passive and Active Vibration Isolation Systems III**

Session Chairs: **Simon Laflamme**, Iowa State Univ. of Science and Technology (USA); **Jiong Tang**, Univ. of Connecticut (USA)

2:00 pm: **Use of inerter devices for weight reduction of tuned mass-dampers for seismic protection of multi-story building: the tuned Mass-Damper-Interter (TMDI)**, Agathoklis Giaralis, Laurentiu Marian, City Univ. London (United Kingdom) . . [9799-53]

2:20 pm: **Semi-active friction damper for buildings subject to seismic excitation**, Juan S. Mantilla López, Peter Thomson, Alexander Solarate Benavides, Daniel Gomez Pizano, Univ. del Valle (Colombia) [9799-54]

2:40 pm: **Development of base isolation device complied with the ultimate strength design code in Japan**, Isao Nishimura, Tokyo City Univ. (Japan); Satoshi Suzuki, Aichi Institute of Technology (Japan) . . . . . [9799-56]

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

**CONFERENCE 9800**

**SESSION 10**

**LOCATION: ANDALUCIA  
WED 1:40 PM TO 3:00 PM**

**Modeling of Multifunctional Materials**

Session Chairs: **William S. Oates**, Florida State Univ. (USA); **Woong-Ryeol Yu**, Seoul National Univ. (Korea, Republic of)

1:40 pm: **Simulation of controllable permeation in PNIPAAm coated membranes**, Adrian Ehrenhofer, Thomas Wallmersperger, Andreas Richter, TU Dresden (Germany) . . . . . [9800-41]

2:00 pm: **A continuum damage mechanics based approach with atomistic contribution for damage modelling of CNT infused nanopolymers**, Ashwin Rai, Nithya Subramanian, Bonsung Koo, Siddhant Datta, Aditi Chattopadhyay, Arizona State Univ. (USA) . . . . . [9800-42]

2:20 pm: **Probing ionic transport using electrochemical strain microscopy: modeling and experiment**, Ahmadrza Eshghinejad, Jiangyu Li, Univ. of Washington (USA) . . . . . [9800-43]

2:40 pm: **Improvement in properties of composite materials by embedding superelastic shape memory alloy wires**, Luv Verma, Srinivasan M. Sivakumar, S. Vedantam, Indian Institute of Technology Madras (India) . . . . . [9800-44]

Conference End.

**CONFERENCE 9802**

**SESSION 13**

**LOCATION: MARQUIS 6  
WED 1:40 PM TO 3:20 PM**

**Fabrication and Characterization II**

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

1:40 pm: **Cellulos/polyvinyl alcohol based hydrogels for reconfigurable lens** (*Keynote Presentation*), Jayaramudu Tippabattini, Hyun-u Ko, Xiaoyuan Gao, Yaguang Li, Inha Univ. (Korea, Republic of); Sang-Youn Kim, Korea Univ. of Technology and Education (Korea, Republic of); Jaehwan Kim, Inha Univ. (Korea, Republic of) . . . . . [9802-38]

2:20 pm: **Intelligent actuation of water drop on graphene coated mesh**, Rassoul Tabassian, Jung-Hwan Oh, Il-Kwon Oh, KAIST (Korea, Republic of) . . . . . [9802-39]

2:40 pm: **Actuation mechanisms of carbon nanotube-based architectures**, Sebastian M. Geier, Thorsten Mahrholz, Peter Wierach, Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany); Michael Sinapius, Technische Univ. Braunschweig (Germany) . . . . . [9802-40]

3:00 pm: **Bandwidth of a noise suppression phase locked loop for non-contact vital sign detection**, Zongyang Xia, Ying Zhang, Georgia Institute of Technology (USA) . . . . . [9802-41]

Coffee Break . . . . .Wed 3:20 pm to 3:50 pm

**CONFERENCE 9803**

Sessions 10A and 10B run concurrently.

**SESSION 10A**

**LOCATION: GRAND D  
WED 1:40 PM TO 3:00 PM**

**Control of Aeroelastic Structures using Smart Materials**

Session Chairs: **Wieslaw Jerzy Staszewski**, AGH Univ. of Science and Technology (Poland); **Tyler Tallman**, Univ. of Michigan (USA)

1:40 pm: **Experimental, analytical, and numerical analyses of multifunctional skins for morphing wing applications**, Sebastian M. Geier, Markus Kintscher, Peter Wierach, Hans Peter Monner, Martin Wiedemann, Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany) . . . [9803-81]

2:00 pm: **Estimation of morphing airfoil shape and aerodynamic load using artificial hair sensors**, Nathan S. Butler, Weihua Su, The Univ. of Alabama (USA); Kaman S. Thapa Magar, Wright State Research Institute (USA); Gregory W. Reich, Air Force Research Lab. (USA) . . . [9803-82]

2:20 pm: **Numerical design of an adaptive aileron**, Gianluca Amendola, Ignazio Dimino, Antonio Concilio, Ctr. Italiano Ricerche Aerospaziali (Italy); Marco Magnifico, Rosario Pecora, Univ. degli Studi di Napoli Federico II (Italy) . . . . . [9803-83]

2:40 pm: **Effects of geometric nonlinearities of shape memory alloy springs on the aeroelastic behavior of a typical aeroelastic section**, Vagner C. Sousa, Carlos De Marqui Jr., Univ. de São Paulo (Brazil); Mohammad H. Elahinia, The Univ. of Toledo (USA) . . . . . [9803-84]

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

**SESSION 10B**

**LOCATION: CATALUNA A  
WED 1:40 PM TO 3:00 PM**

**Novel Methods in Control of Seismically Excited Structures**

Session Chairs: **Erik A. Johnson**, The Univ. of Southern California (USA); **Yang Wang**, Georgia Institute of Technology (USA)

1:40 pm: **Performance and robustness of hybrid model predictive control for controllable dampers in building models**, Erik A. Johnson, Wael M. Elhaddad, Elham Hemmet Abiri, The Univ. of Southern California (USA) . . . . . [9803-85]

2:00 pm: **Feature extraction of far-field ground motions using wavelet packet transform: early warning indices for long-period sensitivity facilities**, Shieh-Kung Huang, National Ctr. for Research on Earthquake Engineering (Taiwan) and National Taiwan Univ. (Taiwan); Chin-Hsiung Loh, Chin-Tsun Chen, National Taiwan Univ. (Taiwan) . . . . . [9803-86]

2:20 pm: **Structural control using Bayesian dynamic network**, Jinkyoo Park, Stanford Univ. (USA); Yang Wang, Georgia Institute of Technology (USA); Kincho H. Law, Stanford Univ. (USA) . . . . . [9803-87]

2:40 pm: **Optimization of sensors position for fault tolerant independent modal space control of vibrating structures**, Ilmas Bayati, Gabriele Cazzulani, Simone Cinquemani, Politecnico di Milano (Italy) . . . . . [9803-88]

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

**CONFERENCE 9804**

**SESSION 11**

**LOCATION: MARQUIS 2  
WED 2:20 PM TO 3:00 PM**

**NDE for Offshore and Railroad Structures**

Session Chairs: **Denvid Lau**, City Univ. of Hong Kong (Hong Kong, China); **Yu-Min Su**, National Kaohsiung Univ. of Applied Sciences (Taiwan)

2:20 pm: **Health monitoring of offshore structures using wireless sensor network: experimental investigations**, Srinivasan Chandrasekaran, Thailammai Chitambaram, Indian Institute of Technology Madras (India) . . . . . [9804-40]

2:40 pm: **Passive and non-contact stress sensing for longitudinal stress in rail using naturally grown iron oxides on rail surface**, Namgyu Kim, Toni McCulloch, Hae-Bum Yun, Univ. of Central Florida (USA) . . . . . [9804-41]

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

**CONFERENCE 9805**

**SESSION 10**

**LOCATION: MARQUIS 1  
WED 1:20 PM TO 3:00 PM**

**Periodic Structure and Metamaterial I**

Session Chairs: **Guoliang Huang**, Univ. of Missouri School of Medicine (USA); **Jinkyu Yang**, Univ. of Washington (USA)

1:20 pm: **Sculpting of stress waves in nonlinear mechanical metamaterials**, Eunho Kim, Rajesh Chaunsali, Matthew Toles, Jinkyu Yang, Univ. of Washington (USA) . . . . . [9805-43]

1:40 pm: **Elastic hyperbolic metamaterial with anisotropic mass density**, Rui Zhu, Yangyang Chen, Guoliang Huang, Univ. of Missouri (USA) . . . . . [9805-44]

2:00 pm: **Acoustic perfect absorber based on metasurface with deep sub-wavelength thickness**, Badreddine Assouar, Yong Li, Univ. de Lorraine (France) . . . . . [9805-45]

2:20 pm: **Modeling of dissipative elastic metamaterials and their application for broadband wave mitigation**, Yangyang Chen, Guoliang Huang, Univ. of Missouri (USA) . . . . . [9805-46]

2:40 pm: **Resonantly loaded thermoelastic stress analysis for on-site inspections**, Rachael C. Tighe, Geoffrey P. Howell, Janice M. Dulieu-Barton, Univ. of Southampton (United Kingdom); J. Philip Tyler, Enabling Process Technologies Ltd. (United Kingdom); Stephen Lormor, EDF Energy plc (United Kingdom) . . . . . [9805-47]

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



CONFERENCE 9798

Sessions 8A and 8B run concurrently.

SESSION 8A

LOCATION: GRAND A/B  
WED 3:30 PM TO 5:50 PM

**New EAP Materials, Processes, and Fabrication Techniques II**

Session Chairs: **Ji Su**, NASA Langley Research Ctr. (USA); **Hyacinthe Randriamahazaka**, Univ. Paris 7-Denis Diderot (France)

3:30 pm: **On the shape memory polymer-metal composite bio-mimetic actuator: multi-input control**, Qi Shen, Sarah Trabia, Tyler P. Stalbaum, Univ. of Nevada, Las Vegas (USA); Viljar Palmre, The Univ. of Texas Medical School at Houston (USA); Kwang Jin Kim, Univ. of Nevada, Las Vegas (USA) . . . . . [9798-45]

3:50 pm: **Robotic extrusion processes for direct ink writing of 3D conductive polyaniline structures**, F. Benjamin Holness, Aaron D. Price, The Univ. of Western Ontario (Canada) . . . . . [9798-46]

4:10 pm: **Bending actuators from nylon**, Seyed Mohammad Mirvakili, Ian W. Hunter, Massachusetts Institute of Technology (USA) . . . . . [9798-121]

4:30 pm: **Embedded Carbide-derived Carbon (CDC) particles in polypyrrole (PPy) for linear actuator**, Zane Zondaka, Robert Valner, Alvo Aabloo, Anna-Liisa Peikolainen, Rudolf Kiefer, Univ. of Tartu (Estonia) [9798-48]

4:50 pm: **DR1-co-PMMA in PDMS as poled elastomer composites**, Yee Song Ko, Empa (Switzerland) and Ecole Polytechnique Fédérale de Lausanne (Switzerland); Dorina M. Opris, Empa (Switzerland); Frank A. Nüesch, Empa (Switzerland) and Ecole Polytechnique Fédérale de Lausanne (Switzerland) [9798-49]

5:10 pm: **Optimal structural design of twisted and coiled polymer actuator driven by joule heating**, Kyeong Ho Cho, Min Geun Song, Hosang Jung, Jungwoo Park, Hyungpil Moon, Ja Choon Koo, Jae-Do Nam, Hyouk Ryeol Choi, Sungkyunkwan Univ. (Korea, Republic of) . . . . . [9798-50]

5:30 pm: **A novel thermal induced snap-through device of hydrogels**, Zipeng Ma, Tiefeng Li, Xuxu Yang, Guorui Li, Junjie Liu, Yuhan Xie, Yiming Liang, Zhejiang Univ. (China) . . . . . [9798-51]

SESSION 8B

LOCATION: MARQUIS 7  
WED 3:30 PM TO 5:50 PM

**Applications of EAP**

Session Chairs: **Jonathan M. Rossiter**, Univ. of Bristol (United Kingdom); **Holger Böse**, Fraunhofer-Institut für Silicatforschung (Germany)

3:30 pm: **Cooking with DEAs: a compliant 1-gram gripper that easily picks up an egg (Invited Paper)**, Herbert R. Shea, Jun Shintake, Samuel Rosset, Dario Floreano, Ecole Polytechnique Fédérale de Lausanne (Switzerland) . . . . . [9798-52]

4:10 pm: **Butterfly-patterned dielectric elastomer actuator utilizing highly stretchable and robust silver nanowires network**, Jun-Ho Choi, Il-Kwon Oh, Jaeho Ahn, Jung-Yong Lee, KAIST (Korea, Republic of) . . . . . [9798-53]

4:30 pm: **The design of active actuation for capsule robot based on IPMC**, Lei Wang, Meng Zhang, Xu Yang, Min Yu, Qingsong He, Zhendong Dai, Nanjing Univ. of Aeronautics and Astronautics (China) . . . . . [9798-54]

4:50 pm: **Fish-skeleton visualization of bending actuators**, Andres Punning, Sunjai Nakshatharan, Univ. of Tartu (Estonia); Siim Assi, Univ of Tartu (Estonia); Alvo Aabloo, Urmas Johanson, Univ. of Tartu (Estonia) . . . . . [9798-55]

5:10 pm: **Soft shape-adaptive gripping device made from artificial muscle**, Edgar Hamburg, Veiko Vunder, Urmas Johanson, Friedrich Kaasik, Alvo Aabloo, Univ. of Tartu (Estonia) . . . . . [9798-56]

5:30 pm: **Lab-on-chip microdevices for cellular mechanotransduction in bladder**, Ali Maziz, Linköping Univ. (Sweden); Karl Svennersten, Katarina Hallén-Grufman, Karolinska Institutet (Sweden); Edwin W. H. Jager, Linköping Univ. (Sweden) . . [9798-57]

CONFERENCE 9799

Sessions 11A and 11B run concurrently.

SESSION 11A

LOCATION: GRAND E  
WED 3:30 PM TO 6:10 PM

**Energy Harvesting and Scavenging: Modeling**

Session Chairs: **Wei-Hsin Liao**, The Chinese Univ. of Hong Kong (Hong Kong, China); **Steven R. Anton**, Tennessee Technological Univ. (USA)

3:30 pm: **A dimensionless model of impact piezoelectric energy harvesting with dissipation**, Xinlei Fu, Wei-Hsin Liao, The Chinese Univ. of Hong Kong (Hong Kong, China) . . . . . [9799-57]

3:50 pm: **Dynamics of energy harvesting backpack with human being interaction**, Yue Yuan, Lei Zuo, Virginia Polytechnic Institute and State Univ. (USA) . . . . . [9799-58]

4:10 pm: **Optimization of vibratory energy harvesters with stochastic parametric uncertainty**, Ashkan Haji Hosseinloo, Konstantin Turitsyn, Massachusetts Institute of Technology (USA) . . . . . [9799-59]

4:30 pm: **A new energy harvester based on a piezoelectric beam with exponential thickness variation**, Sohrab Mirzaabedini, Haifeng Zhang, Univ. of North Texas (USA) . . . . . [9799-60]

4:50 pm: **Predicting long-term energy harvesting performance of piezoelectric transducers subject to degradation and failure**, Adam M. Wickenheiser, Varun G. M. Gandhi, The George Washington Univ. (USA) . . . . . [9799-61]

5:10 pm: **An efficient low frequency horizontal diamagnetic levitation mechanism based vibration energy harvester**, Sri Vikram Palagummi, Fu-Hwo Yuan, North Carolina State Univ. (USA) . . . . . [9799-62]

5:30 pm: **A multiple degree of freedom modeling approach of piezoelectret foam in a multilayer stack configuration**, Edward C. Tefft IV, Rielly G. Newton, Steven R. Anton, Tennessee Technological Univ. (USA) [9799-63]

5:50 pm: **A comparative study on the self-powered mechatronic and electronic synchronized switch interfaces for piezoelectric energy harvesting systems**, Haili Liu, ShanghaiTech Univ. (China) and Stony Brook Univ. (USA); Cong Ge, Junrui Liang, ShanghaiTech Univ. (China); Ya S. Wang, Stony Brook Univ. (USA) . . . . . [9799-64]

SESSION 11B

LOCATION: MARQUIS 8  
WED 3:30 PM TO 6:10 PM

**Passive and Active Vibration Isolation Systems IV**

Session Chairs: **Gabriele Cazzulani**, Politecnico di Milano (Italy); **Jeffrey L. Kauffman**, Univ. of Central Florida (USA)

3:30 pm: **Shape control of piezolaminated beams for optimal location of piezoelectric actuator and sensor**, Rajan Wankhade, Government College of Engineering, Karad (India); Kamalkishor Bajoria, Indian Institute of Technology Bombay (India) . . . . . [9799-65]

3:50 pm: **Comparison of passive inductor designs for piezoelectric shunt damping**, Boris Lossouarn, Olivier Thierry, Mathieu Aucejo, Jean-François Deü, Conservatoire National des Arts et Métiers (France) . . . . . [9799-66]

4:10 pm: **The effect of delayed feedback control on amplitude and vibration suppression bandwidth of saturation control**, Yanying Zhao, Jia Yin, Nanchang Hangkong Univ. (China) . . . . . [9799-67]

4:30 pm: **Design of a stand-alone active damper for distributed control of vibration**, Simone Cinquemani, Gabriele Cazzulani, Andrea Costa, Ferruccio Resta, Politecnico di Milano (Italy) . . . . . [9799-68]

4:50 pm: **Optimal layout of piezo patches and control circuit parameters for vibration damping of a bounded beam using switching control**, Francesco Braghin, Gabriele Cazzulani, Politecnico di Milano (Italy) . . . . . [9799-69]

5:10 pm: **Incorporating a disturbance observer with direct velocity feedback for control of human-induced vibrations**, Donald S. Nyawako, Univ. of Exeter (United Kingdom); Paul Reynolds, Univ. of Exeter (United Kingdom) and Full Scale Dynamics Ltd. (United Kingdom); Emma J. Hudson, Univ. of Exeter (United Kingdom) . . . . . [9799-70]

5:30 pm: **State switching in regions of high modal density**, Garrett K. Lopp, Jeffrey L. Kauffman, Univ. of Central Florida (USA) . . . . . [9799-71]

5:50 pm: **Control of vibration in smart structures via consensus modified positive position feedback technique**, S. Nima Mahmoodi, Ehsan Omid, The Univ. of Alabama (USA) . . . . . [9799-72]

CONFERENCE 9802

SESSION 14

LOCATION: MARQUIS 6  
WED 3:50 PM TO 5:30 PM

**Fabrication and Characterization III**

Session Chair: **Hwan-Sik Yoon**, The Univ. of Alabama (USA)

3:50 pm: **Development of a miniaturized optical neurotransmitter sensing system for real-time monitoring of neural activity**, Min H. Kim, Hargsoon Yoon, Kyo D. Song, Norfolk State Univ. (USA); Sang H. Choi, NASA Langley Research Ctr. (USA); Uhn Lee, Gachon Univ. Gil Medical Ctr. (Korea, Republic of); Jongsung Kim, Gachon Univ. (Korea, Republic of) . . . . . [9802-42]

4:10 pm: **High power density rectenna array**, Kyo D. Song, John Day, Norfolk State Univ. (USA); Sang H. Choi, NASA Langley Research Ctr. (USA); Hargsoon Yoon, Norfolk State Univ. (USA) . . . . . [9802-43]

4:30 pm: **Wearable nanosensor system for monitoring mild traumatic brain injuries in football players**, Mouli Ramasamy, Vijay K. Varadan, The Pennsylvania State Univ. (USA) . . . . . [9802-44]

4:50 pm: **Mechanically stiff carbon fiber electrodes for chronic dopamine sensing in the rat brain**, Min H. Kim, Norfolk State Univ. (USA); Laurie L. Wellman, Hyunjeong Liew, Larry D. Sanford, Eastern Virginia Medical School (USA); Hargsoon Yoon, Norfolk State Univ. (USA) . . . [9802-45]

5:10 pm: **Study of emotion based neurocardiology through wearable systems**, Mouli Ramasamy, Vijay K. Varadan, The Pennsylvania State Univ. (USA) . . . . . [9802-46]

CONFERENCE 9803

Sessions 11A and 11B run concurrently.

SESSION 11A

LOCATION: GRAND D  
WED 3:30 PM TO 6:10 PM

**Guided Wave Methods for Damage Identification**

Session Chairs: **Theodore E. Matikas**, Univ. of Ioannina (Greece); **Michael D. Todd**, Univ. of California, San Diego (USA)

3:30 pm: **Impacts of non-uniform structural vibration on through-substrate ultrasonic event reporting in structural health monitoring**, Saptarshi Das, Bo Dong, Subir Biswas, Michigan State Univ. (USA) . . . . [9803-89]

3:50 pm: **Regularized discriminant analysis for multi-sensor decision fusion and damage detection with Lamb waves**, Spandan Mishra, O. Arda Vanli, Fred W. Huffer, Sungmoon Jung, Florida State Univ. (USA) . . . . . [9803-90]

4:10 pm: **Damage identification for H beams using PZT with optimized sensing arrangement**, Fan Wu, Yang Song, Shanghai Jiao Tong Univ. (China) . . . . . [9803-91]

4:30 pm: **Damage sensitivity investigations of EMI technique on different materials through coupled field analysis**, Bhriгу Joshi, The Northcap Univ. (India); Sailesh Adhikari, Indian Institute of Technology Delhi (India); Shashank Srivastava, Indira Gandhi National Open Univ. (India); Suresh Bhalla, Indian Institute of Technology Delhi (India) . . . . . [9803-92]

4:50 pm: **Disbond identification in a honeycomb composite sandwich structure using ultrasonic guided wave and embedded piezoelectric sensors**, Shirsendu Sikdar, Sauvik Banerjee, Indian Institute of Technology Bombay (India) . . . . . [9803-93]

5:10 pm: **Nonlinear ultrasonic fatigue crack detection using a single piezoelectric transducer under temperature variation**, Yun-kyu An, Dong Jun Lee, Sejong Univ. (Korea, Republic of) . . . . . [9803-94]

5:30 pm: **The application of symbolic dynamics time series analysis for assessing barely visible indentation damage in composite sandwich structures using ultrasonic guided waves**, Samir Mustapha, Mohammad Ali Fakhri, American Univ. of Beirut (Lebanon); Mehri Sadat Makki Alamdari, National ICT Australia (Australia); Lin Ye, The Univ. of Sydney (Australia) . . . . . [9803-95]

5:50 pm: **Online damage detection in metallic isotropic cylindrical shells using guided wave modes by pitch catch and time reversal methods**, Jayesh Prabhakaran, Christudas R. Bijudas, Indian Institute of Space Science and Technology (India) . . . . . [9803-96]

SESSION 11B

LOCATION: CATALUNA A  
WED 3:30 PM TO 5:50 PM

**Novel Sensing Transducers for Smart Structure Application**

Session Chairs: **Rosalind M. Wynne**, Villanova Univ. (USA); **Kenneth J. Loh**, Univ. of California, San Diego (USA)

3:30 pm: **High-pressure sensor using piezoelectric bending resonators**, Xiaoqi Bao, Stewart Sherrit, Nobuyuki Takano, Jet Propulsion Lab. (USA) . [9803-97]

3:50 pm: **Model calibration for a soft elastomeric capacitor sensor considering slippage under fatigue cracks**, Xiangxiong Kong, Jian Li, Caroline R. Bennett, The Univ. of Kansas (USA); Simon Laflamme, Iowa State Univ. of Science and Technology (USA) . . . . . [9803-99]

4:10 pm: **A novel class of MEMS accelerometers for very high-G munitions environment**, Jahangir Rastegar, Dake Feng, Omnitek Partners, LLC (USA) . . . . . [9803-100]

4:30 pm: **Triaxial tunable mechanical monolithic sensors for large band low frequency monitoring and characterization of sites and structures**, Fabrizio Barone, Gerardo Giordano, Fausto Acernese, Rocco Romano, Univ. degli Studi di Salerno (Italy) . [9803-101]

4:50 pm: **A piezoelectric shear stress sensor for wind tunnel flow measurement**, Taeyang Kim, Aditya Saini, Jinwook Kim, Ashok Gopalathnam, Yong Zhu, North Carolina State Univ. (USA); Frank L. Palmieri, Christopher J. Wohl, NASA Langley Research Ctr. (USA); Xiaoning Jiang, North Carolina State Univ. (USA) . . . . . [9803-102]

5:10 pm: **Autonomous stress imaging cores: from concept to reality**, Stephen P. van der Velden, Nik Rajic, Chris Brooks, Steve C. Galea, Defence Science and Technology Group (Australia) . . . . . [9803-103]

5:30 pm: **MEMS sensor based magnetic field sensor using ferrofluid**, Bharathkumar Hegde, Dinesh N. S., Indian Institute of Science (India) . . . . . [9803-104]

CONFERENCE 9804

SESSION 12

LOCATION: MARQUIS 2  
WED 3:30 PM TO 5:10 PM

**Laser and Optical NDE**

Session Chairs: **Denvid Lau**, City Univ. of Hong Kong (Hong Kong, China); **Yu-Min Su**, National Kaohsiung Univ. of Applied Sciences (Taiwan)

3:30 pm: **Scanning laser ultrasound and wavenumber spectroscopy for in-process inspection of additively manufactured parts**, Eric B. Flynn, EliseAnne C. Koskelo, Los Alamos National Lab. (USA) . . . . . [9804-44]

3:50 pm: **Nonlinear thermosonics and laser vibrometry for barely visible impact damage of a composite stiffener panel**, Gian Piero Malfense Fierro, Michele Meo, Univ. of Bath (United Kingdom) . . . . . [9804-45]

4:10 pm: **Geometric identification and damage detection of structural elements by terrestrial laser scanner**, Tsung-Chin Hou, Yu-Wei Liu, National Cheng Kung Univ. (Taiwan); Yu-Min Su, National Kaohsiung Univ. of Applied Sciences (Taiwan) . . . . . [9804-46]

4:30 pm: **Mueller matrix ellipsometry: a powerful tool for nondestructive characterization of nanostructures**, Shiyuan Liu, Xiuguo Chen, Chuanwei Zhang, Hao Jiang, Huazhong Univ. of Science and Technology (China) [9804-47]

4:50 pm: **A laser-based defect detection scheme in CFRP-concrete systems**, Qiwen Qiu, Denvid Lau, City Univ. of Hong Kong (Hong Kong, China) . . . . . [9804-48]

SESSION 13

LOCATION: MARQUIS 2  
WED 5:10 PM TO 6:10 PM

**Signal Processing Techniques in NDE**

Session Chairs: **Denvid Lau**, City Univ. of Hong Kong (Hong Kong, China); **Yu-Min Su**, National Kaohsiung Univ. of Applied Sciences (Taiwan)

5:10 pm: **Improving synthetic aperture focusing technique for thick concrete specimens via frequency banding**, Dwight A. Clayton, Oak Ridge National Lab. (USA) . [9804-49]

5:30 pm: **A novel background subtraction technique based on gray-scale morphology for weld defect detection**, Masoumeh Aminzadeh, Thomas R. Kurfess, Georgia Institute of Technology (USA) . . . . . [9804-50]

5:50 pm: **Lamb wave feature extraction using discrete wavelet transformation and principal component analysis**, Mojtaba Ghodsi, Sultan Qaboos Univ. (Oman); Hamidreza Ziaiefar, Milad Amiryan, Tarbiat Modares Univ. (Iran, Islamic Republic of); Farhang Honarvar, K.N. Toosi Univ. of Technology (Iran, Islamic Republic of); Yousef Hojjat, Tarbiat Modares Univ. (Iran, Islamic Republic of); Mehdi Mahmoudi, Amur Al-Yahmadi, Sultan Qaboos Univ. (Oman) . . . [9804-51]

CONFERENCE 9805

SESSION 11

LOCATION: MARQUIS 1  
WED 3:30 PM TO 5:50 PM

**Periodic Structure and Metamaterial II**

Session Chairs: **Jinkyu Yang**, Univ. of Washington (USA); **Guoliang Huang**, Univ. of Missouri School of Medicine (USA)

3:30 pm: **Origami-based mechanical metamaterials with tunable bistability and impact mitigation**, Hiromi Yasuda, Jinkyu Yang, Univ. of Washington (USA) . . . . . [9805-48]

3:50 pm: **Mechanically robust microfluidics and bulk wave acoustics to sort microparticles**, Erin R. Dauson, Kelvin B. Gregory, David W. Greve, Gregory P. Healy, Irving J. Oppenheim, Carnegie Mellon Univ. (USA) . . . . . [9805-49]

4:10 pm: **Double Dirac cones in two-dimensional phononic crystals**, Jun Mei, South China Univ. of Technology (China); Ying Wu, King Abdullah Univ. of Science and Technology (Saudi Arabia) . . . . . [9805-51]

4:30 pm: **Sound scattering of submerged shell coated with locally resonant sonic material**, Jianfei Yin, Jihong Wen, Honggang Zhao, Dianlong Yu, National Univ. of Defense Technology (China) . . . . . [9805-52]

4:50 pm: **Anomalous refraction of guided waves via embedded acoustic metasurfaces**, Hongfei Zhu, Univ. of Notre Dame (USA); Ying Wu, Fabio Semperlotti, Purdue Univ. (USA) . . . . . [9805-53]

5:10 pm: **A design method for membrane-type acoustic metamaterials with magnetic tunability**, Xing Chen, Yongmao Pei, Peking Univ. (China) . . . . . [9805-54]

5:30 pm: **Improving low-frequency acoustic absorption of sintered fibrous metals with metamaterials**, Changru Chen, Yong Cheng, Shanshan Yao, Xiaoming Zhou, Gengkai Hu, Beijing Institute of Technology (China) [9805-55]

**CONFERENCE 9798**

Electroactive Polymer Actuators and Devices (EAPAD) XVIII

**CONFERENCE 9799**

Active and Passive Smart Structures and Integrated Systems X

**CONFERENCE 9802**

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

**Thursday Plenary Session · 8:10 am to 9:10 am**

8:10 to 8:25 AM:

**SPIE Best Student Paper Awards**

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



Plenary Presentation: 8:25 to 9:10 am

**High-frequency Integrated Phononic Crystal Structures**

Ali Adibi, Georgia Institute of Technology (USA)

Sessions 9A and 9B run concurrently.

**SESSION 9A**

**LOCATION: GRAND A/B  
THU 9:20 AM TO 12:10 PM**

**Applications of EAP Materials to Robotics**

Session Chairs: **Herbert R. Shea**, Ecole Polytechnique Fédérale de Lausanne (Switzerland); **Kwang Jin Kim**, Univ. of Nevada, Las Vegas (USA)

9:20 am: **Here today, gone tomorrow: biodegradable soft robots** (*Invited Paper*), Jonathan M. Rossiter, Univ. of Bristol (United Kingdom); Jonathan Winfield, Ioannis Ieropoulos, Univ. of the West of England (United Kingdom). . . . . [9798-58]

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

**SESSION 9B**

**LOCATION: MARQUIS 7  
THU 9:20 AM TO 12:10 PM**

**New EAP Materials, Processes, and Fabrication Techniques III**

Session Chairs: **Adrian Koh**, National Univ. of Singapore (Singapore); **Yonas Tadesse**, The Univ. of Texas at Dallas (USA)

9:20 am: **Electromechanical behavior of a novel dielectric elastomer sensor for compressive force detection**, Junjie Liu, Guoyong Mao, Xiaoqiang Huang, Zhejiang Univ. (China); Zhanan Zou, Univ. of Colorado at Boulder (USA); Shaoxing Qu, Peng Wang, Zhejiang Univ. (China) . . . . . [9798-63]

9:40 am: **Aerosol-jet-printing silicone layers and electrodes for dielectric elastomer actuators in one processing device**, Sebastian Reitelshöfer, Maximilian Landgraf, Jörg Franke, Friedrich-Alexander-Univ. Erlangen-Nürnberg (Germany)[9798-64]

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

Sessions 12A and 12B run concurrently.

**SESSION 12A**

**LOCATION: GRAND E  
THU 9:20 AM TO 10:00 AM**

**Micro and Nano Integrated Systems**

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

9:20 am: **Power harvesting from vertically aligned PZT nanowire arrays**, Mohammad H. Malakooti, Univ. of Michigan (USA); Zhi Zhou, Univ. of Florida (USA); Henry A. Sodano, Univ. of Michigan (USA) . [9799-73]

9:40 am: **Light-guiding dynamic 3D self-organized liquid crystal nanostructures**, Quan Li, Liquid Crystal Institute (USA) . . . . . [9799-74]

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

**SESSION 12B**

**LOCATION: MARQUIS 8  
THU 9:20 AM TO 10:00 AM**

**Passive and Active Vibration Isolation Systems V**

Session Chair: **Michael D. Todd**, Univ. of California, San Diego (USA)

9:20 am: **Analysis and testing of an integrated semi-active seat suspension for both longitudinal and vertical vibration control**, Xian-Xu Bai, Peng Jiang, Hui Pan, Li-Jun Qian, Hefei Univ. of Technology (China) . . . . . [9799-75]

9:40 am: **The impact of boundary conditions and fluid velocity on damping for a fluid conveying pipe in a viscous fluid**, Eric J. Kjolsing, Michael D. Todd, Univ. of California, San Diego (USA) . . . [9799-76]

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

**SESSION 15**

**LOCATION: MARQUIS 6  
THU 9:20 AM TO 10:20 AM**

**Application in Engineering and Medicine I**

Session Chair: **Mouli Ramasamy**, The Pennsylvania State Univ. (USA)

9:20 am: **Depth electrode array for monitoring and imaging of fast neural activity and functional network in the brain**, Hargsoon Yoon, Min Kim, Norfolk State Univ. (USA). . . . . [9802-47]

9:40 am: **Hydrothermal growth of ZnO nanowires on flexible fabric substrates**, Gwangwook Hong, Sangho Yun, Joo-Hyung Kim, Inha Univ. (Korea, Republic of)[9802-48]

10:00 am: **Impedance biosensor with rapid detection capability of low concentration of E.coli O157:H7**, Shibajyoti Ghosh Dastider, Syed Barizuddin, Nuh Yuksek, Univ. of Missouri (USA); Majed El-Dweik, Lincoln Univ. (USA); Mahmoud Almasri, Univ. of Missouri (USA). . . . . [9802-49]

Coffee Break . . . .Thu 10:20 am to 10:50 am



**CONFERENCE 9803**

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

**CONFERENCE 9804**

Nondestructive Characterization and Monitoring of Advanced Materials, Aerospace, and Civil Infrastructure X

**CONFERENCE 9805**

Health Monitoring of Structural and Biological Systems X

**Thursday Plenary Session · 8:10 am to 9:10 am**

8:10 to 8:25 AM:

**SPIE Best Student Paper Awards**

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



Plenary Presentation: 8:25 to 9:10 am

**High-frequency Integrated Phononic Crystal Structures**

Ali Adibi, Georgia Institute of Technology (USA)

Sessions 12A and 12B run concurrently.

**SESSION 12A**

**LOCATION: GRAND D  
THU 9:20 AM TO 10:00 AM**

**Advances in Piezoelectric Transducers**

Session Chair: **David D. Mascareñas**, Los Alamos National Lab. (USA)

9:20 am: **Experimental studies on fatigue behavior of Macro Fiber Composite (MFC) under mechanical loading**, Akash Pandey, Arockiarajan Arunachalaksi, Indian Institute of Technology Madras (India) . . . [9803-105]

9:40 am: **Nondestructive testing and hardness measurement based on contact resonance of piezoelectric cantilevers**, Faxin Li, Ji Fu, Peking Univ. (China) . . . . . [9803-106]

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

**SESSION 12B**

**LOCATION: CATALUNA A  
THU 9:20 AM TO 10:00 AM**

**Non-contact Sensing Methods**

Session Chair: **Rosalind M. Wynne**, Villanova Univ. (USA)

9:20 am: **Practical application of RINO, a smartphone-based dynamic displacement sensing application, for wind tunnel tests**, Seung-Woo Lee, TESolution Co. Ltd. (Korea, Republic of); Kyle P. Knez, Jae-Hong Min, Nikolas J. Gelo, Jong-Hyun Jeong, Hongki Jo, The Univ. of Arizona (USA) . . [9803-107]

9:40 am: **Hyperspectral range imaging for transportation systems evaluation**, Raj Bridgelall, James B. Rafert, North Dakota State Univ. (USA); Donald K. Atwood, Michigan Tech Research Institute (USA); Denver Tolliver, North Dakota State Univ. (USA) . . . . . [9803-108]

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

**SESSION 14**

**LOCATION: MARQUIS 2  
THU 9:20 AM TO 10:00 AM**

**Keynote Session III**

Session Chair: **Tzuyang Yu**, Univ. of Massachusetts Lowell (USA)

9:20 am: **Frequency-domain modeling and dynamic characteristics evaluation of existing wind turbine systems** (*Keynote Presentation*), Chih-Huang Chiang, Chaoyang Univ. of Technology (Taiwan); Chih-Peng Yu, National Chung-Hsin Univ. (Taiwan) . . . . . [9804-52]

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

Sessions 12A and 12B run concurrently.

**SESSION 12A**

**LOCATION: MARQUIS 1  
THU 9:20 AM TO 10:00 AM**

**Acoustic Emission Based SHM**

Session Chairs: **Anthony J. Croxford**, Univ. of Bristol (United Kingdom); **Wei-Chih Wang**, National Taiwan Ocean Univ. (Taiwan)

9:20 am: **Identifying geometric features of fatigue crack from acoustic emission signals**, Jingjing Bao, Banibrata Poddar, Victor Giurgiutiu, Univ. of South Carolina (USA) . . . . . [9805-56]

9:40 am: **Embedded and conventional ultrasonic sensors for monitoring acoustic emission during thermal fatigue**, Blaine Trujillo, Andrei Zagrai, New Mexico Institute of Mining and Technology (USA) . . . . . [9805-57]

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

**SESSION 12B**

**LOCATION: MARQUIS 3  
THU 9:20 AM TO 10:00 AM**

**Composite Monitoring**

Session Chairs: **Wieslaw M. Ostachowicz**, The Szewalski Institute of Fluid-Flow Machinery (Poland); **S. Gopalakrishnan**, Indian Institute of Science (India)

9:20 am: **Validation of transverse isotropy of a honeycomb sandwich panel for NDT applications**, Christoph Schaal, Steffen Tai, Ajit Mal, Univ. of California, Los Angeles (USA) . . . . . [9805-58]

9:40 am: **Real-time damage localization and quantification of high velocity impact in fiber reinforced composite structures**, John McCrea, Joel Johnston, Chris Sorini, Aditi Chattopadhyay, Arizona State Univ. (USA) . . . . . [9805-59]

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

CONFERENCE 9798

Sessions 9A and 9B run concurrently.

SESSION 9A

Continued

10:30 am: **Development of soft robots using dielectric elastomer actuators** (*Invited Paper*), Jian Zhu, Hareesh Godaba, Yuzhe Wang, Jiawei Cao, National Univ. of Singapore (Singapore). . . . . [9798-59]

11:10 am: **Bistable electroactive polymer with sharp rigid-to-rubbery phase transition**, Yu Qiu, Zhi Ren, Wei Hu, Chao Liu, Qibing Pei, Univ. of California, Los Angeles (USA) . . . . . [9798-60]

11:30 am: **Rotating acoustic panel driven by antagonistic dielectric elastomer tape actuators in a reverse-biased configuration**, Tizoc Cruz-Gonzalez, Univ. of Michigan (USA) . . . . . [9798-61]

11:50 am: **Dielectric elastomer actuators for facial expression**, Jian Zhu, Yuzhe Wang, National Univ. of Singapore (Singapore) . . . . . [9798-62]

Lunch Break . . . . Thu 12:10 pm to 1:20 pm

SESSION 9B

Continued

10:30 am: **Compliant electrodes using crumpled indium-tin-oxide thin films**, Hui-Yng Ong, Nanyang Polytechnic (Singapore); Gih-Keong Lau, Nanyang Technological Univ. (Singapore). . . . . [9798-65]

10:50 am: **Property modification of Nafion via polymer blending with ethylene vinyl alcohol**, Taeseon Hwang, Jungsoo Nam, Qi Shen, Sarah Trabia, Univ. of Nevada, Las Vegas (USA); Jonghwan Suhr, Sungkyunkwan Univ. (USA); Dong-Chan Lee, Kwang Jin Kim, Univ. of Nevada, Las Vegas (USA) . . . . . [9798-66]

11:10 am: **Characterization of ultraviolet light cured polydimethylsiloxane films for low-voltage, dielectric elastomer actuators**, Tino Töpfer, Fabian Wohlfender, Florian M. Weiss, Bekim Osmani, Vanessa Y. F. Leung, Bert Müller, Univ. Basel (Switzerland) . . . . . [9798-67]

11:30 am: **Morphology and conductivity of Au electrodes on polydimethylsiloxane using (3-mercaptopropyl)trimethoxysilane (MPTMS) as an adhesion promoter**, Bekim Osmani, Florian M. Weiss, Tino Töpfer, Vanessa Y. F. Leung, Bert Müller, Univ. Basel (Switzerland) . . . . . [9798-68]

11:50 am: **Microfabrication of stacked dielectric elastomer actuator fibers**, Mert Corbaci, Kathleen Lamkin-Kennard, Rochester Institute of Technology (USA) . . . . . [9798-69]

Lunch Break . . . . Thu 12:10 pm to 1:20 pm

CONFERENCE 9799

Sessions 13A and 13B run concurrently.

SESSION 13A

LOCATION: GRAND E  
THU 10:30 AM TO 11:50 AM

**Energy Harvesting and Scavenging: General**

Session Chairs: **Junrui Liang**, ShanghaiTech Univ. (China); **Jeffrey T. Scruggs**, Univ. of Michigan (USA)

10:30 am: **Figure of merit comparison of PP-based electret and PVDF-based piezoelectric polymer energy harvesters**, Miroslav Mrlik, Tomas Bata Univ. of Zlín (Czech Republic); Stephen M. Leadenham, Georgia Institute of Technology (USA); Mariam AlMaadeed, Qatar Univ. (Qatar); Alper Erturk, Georgia Institute of Technology (USA) . . . . . [9799-77]

10:50 am: **Electromagnetic energy harvesting from nonlinear oscillator of two degree-of-freedom pendulum**, Hongyan Wang, Qiqihar Univ. (China); Jiong Tang, Univ. of Connecticut (USA) . . . . . [9799-78]

11:10 am: **Pyroelectric energy harvesting with a high curie temperature material LiNbO<sub>3</sub>**, Hasanul Karim, MD Rashedul Hasan Sarker, Shaimum Shahriar, Mohammad Arif I. Shuvo, Diego I. Delfin, Deidra Hodges, Norman Love, Yirong Lin, The Univ. of Texas at El Paso (USA)[9799-79]

11:30 am: **Vibration energy harvesting with polyphase AC transducers**, James McCullagh, Jeffrey T. Scruggs, Takehiko Asai, Univ. of Michigan (USA) . . . . [9799-80]

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

SESSION 13B

LOCATION: MARQUIS 8  
THU 10:30 AM TO 11:50 AM

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

Session Chair: **Jae-Hung Han**, KAIST (Korea, Republic of)

10:30 am: **Variable buoyancy system for unmanned multi-domain vehicles**, Marc MacLeod, Matthew Bryant, North Carolina State Univ. (USA). . . . . [9799-81]

10:50 am: **High-fidelity simulation and reduced-order modelling of integrally-actuated membrane wings with feedback control**, Stefano Buoso, Rafael Palacios, Imperial College London (United Kingdom) . . . . . [9799-82]

11:10 am: **Lessons learned from wind tunnel testing of a droop-nose morphing wingtip**, Srinivas Vasista, Johannes Riemenschneider, Bram van de Kamp, Hans Peter Monner, Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany); Ronald C. M. Cheung, Christopher Wales, Jonathan E. Cooper, Univ. of Bristol (United Kingdom) . . . . . [9799-83]

11:30 am: **Variable stiffness sandwich panels using electrostatic interlocking core**, Callum J. C. Heath, Ian P. Bond, Kevin D. Potter, Univ. of Bristol (United Kingdom) . . . . . [9799-84]

Lunch Break . . . . Thu 11:50 am to 1:40 pm

CONFERENCE 9802

SESSION 16

LOCATION: MARQUIS 6  
THU 10:50 AM TO 11:50 AM

**Application in Engineering and Medicine II**

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

10:50 am: **Differential diagnosis of cardiovascular diseases and T-wave alternans**, Vijay K. Varadan, The Pennsylvania State Univ. (USA). . . . [9802-50]

11:10 am: **Wireless nanosensor system for diagnosis of sleep disorders**, Vijay K. Varadan, The Pennsylvania State Univ. (USA) . . . . . [9802-51]

11:30 am: **Real-time monitoring of drowsiness through wireless nanosensor systems**, Mouli Ramasamy, Vijay K. Varadan, The Pennsylvania State Univ. (USA) . . . . . [9802-52]

Conference End.

**CONFERENCE 9803**

Sessions 13A and 13B run concurrently.

**SESSION 13A**

**LOCATION: GRAND D  
THU 10:30 AM TO 11:50 AM**

**Applications of Acoustic  
and Ultrasonics for  
SHM**

Session Chairs: **Wieslaw M. Ostachowicz**, The Szwedalski Institute of Fluid-Flow Machinery (Poland); **Andrew R. Burton**, Univ. of Michigan (USA)

10:30 am: **Energy harvesting from hydraulic lines using piezoelectric cylinders**, Aditya Nanda, M. Amin Karami, Univ. at Buffalo (USA) . . . . . [9803-109]

10:50 am: **Corrosion monitoring using high-frequency guided waves**, Paul Fromme, Univ. College London (United Kingdom) . . . . . [9803-110]

11:10 am: **Visualization of hidden disbonding in spent nuclear fuel storage systems using air-coupled ultrasonics**, Homin Song, John S. Popovics, Univ. of Illinois (USA) . . . . . [9803-111]

11:30 am: **Experimental investigations on seismic damage detection of high concrete dams with embedded PZT sensor network**, Xin Feng, Yu Zhang, Dalian Univ. of Technology (China); Shuang Hou, South China Univ. of Technology (China); Tong Zhu, Jing Zhou, Dalian Univ. of Technology (China) . . . . . [9803-112]

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

**SESSION 13B**

**LOCATION: CATALUNA A  
THU 10:30 AM TO 11:50 AM**

**Monitoring and Control  
of Fluid-Structure  
Interaction**

Session Chairs: **Akira Mita**, Keio Univ. (Japan); **Michael K. Philen**, Virginia Polytechnic Institute and State Univ. (USA)

10:30 am: **Analysis and characterization of structurally embedded vascular antennas using liquid metals**, Jeffrey W. Baur, Air Force Research Lab. (USA); Robyn L. Bradford, Geoffrey J. Frank, Univ. of Dayton Research Institute (USA); Darren J. Hartl, Air Force Research Lab. (USA); Gregory Huff, Hong Pan, Lisa Smith, Texas A&M Univ. (USA) . . . . . [9803-113]

10:50 am: **Characterization of hydrophobic nanoporous particle liquids for energy absorption**, Yi Hsu, Yingtao Y. Liu, The Univ. of Oklahoma (USA) [9803-114]

11:10 am: **Dynamic monitoring of compliant bodies impacting the water surface through local strain measurements**, Filippo Ubertini, Univ. degli Studi di Perugia (Italy); Chiara Biscarini, UNESCO Chair Water Resources Management and Culture (Italy) and Univ. per Stranieri di Perugia (Italy); Elio Jannelli, Univ. degli Studi di Napoli Parthenope (Italy); Riccardo Panciroli, Univ. degli Studi Niccolò Cusano (Italy); Stefano Ubertini, Univ. degli Studi della Tuscia (Italy) . . . . . [9803-115]

11:30 am: **Fundamental study on smart wave mitigation structure using array of rods**, Hiroshi Asanuma, Shinya Okabe, Chiba Univ. (Japan) . . . . . [9803-116]

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

**CONFERENCE 9804**

**SESSION 15**

**LOCATION: MARQUIS 2  
THU 10:30 AM TO 11:50 AM**

**Time Reversal,  
Nonlinear, and Inverse  
Problems**

Session Chair: **Genda Chen**, Missouri Univ. of Science and Technology (USA)

10:30 am: **Development of a nonlinear baseline phased array technique**, Michele Meo, Univ. of Bath (United Kingdom) . . . . . [9804-53]

10:50 am: **Modified time reversal imaging of a closed crack based on nonlinear scattering**, Philippe Blanloeuil, The Univ. of Queensland (Australia); Jed A. Guinto, Chun Wang, Sir Lawrence Wackett Aerospace Research Ctr. (Australia); Martin Veidt, The Univ. of Queensland (Australia) . . . [9804-54]

11:10 am: **Fast and accurate analytical model to solve inverse problem in SHM using Lamb wave propagation**, Banibrata Poddar, Victor Giurgiutiu, Univ. of South Carolina (USA) . . . . . [9804-55]

11:30 am: **The nondestructive evaluation of high-temperature conditioned concrete in conjunction with acoustic emission and x-ray computed tomography**, Yu-Min Su, National Kaohsiung Univ. of Applied Sciences (Taiwan); Tsung-Chin Hou, National Cheng Kung Univ. (Taiwan) . . . . . [9804-56]

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

**CONFERENCE 9805**

Sessions 13A and 13B run concurrently.

**SESSION 13A**

**LOCATION: MARQUIS 1  
THU 10:30 AM TO 11:50 AM**

**Signal Processing and  
Damage Detection**

Session Chairs: **Andrei N. Zagrai**, New Mexico Institute of Mining and Technology (USA); **Harsh K. Baid**, AlphaSTAR Corp. (USA)

10:30 am: **Probabilistic uncertainty quantification of wavelet-transform-based structural health monitoring features**, Aral Sarrafi, Zhu Mao, Univ. of Massachusetts Lowell (USA) . . . . [9805-60]

10:50 am: **Advantages of correlation methods for high resolution SHM with ultrasonic waves**, Wolfgang Grill, Gerhard Birkelbach, ASI Analog Speed Instruments GmbH (Germany) . . . . . [9805-61]

11:10 am: **Flaw characterization of functionally graded materials through acoustic mapping**, Rais Ahmad, California State Univ., Northridge (USA); Steve James, Aerojet Rocketdyne (USA) . . . . . [9805-62]

11:30 am: **A novel defect detection technique based on automatic detection of potential background**, Masoumeh Aminzadeh, Thomas Kurfess, Georgia Institute of Technology (USA) . . . . [9805-63]

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

**SESSION 13B**

**LOCATION: MARQUIS 3  
THU 10:30 AM TO 11:50 AM**

**Practical Considerations  
of SHM**

Session Chairs: **Michael D. Todd**, Univ. of California, San Diego (USA); **Zhenhua Tian**, Univ. of South Carolina (USA)

10:30 am: **Study on electromechanical impedance characteristics of part of structures made of CFRP**, Pawel H. Malinowski, Tomasz Wandowski, Szymon R. Opoka, Piotr Fiborek, The Szwedalski Institute of Fluid-Flow Machinery (Poland); Wieslaw M. Ostachowicz, The Szwedalski Institute of Fluid-Flow Machinery (Poland) and Warsaw Univ. of Technology (Poland) . . . . [9805-64]

10:50 am: **Rapid evaluation of mechanical boundary conditions using impedance based structural health monitoring**, Ryan A. Kettle, Steven R. Anton, Tennessee Technological Univ. (USA) . . . . . [9805-65]

11:10 am: **Development of novel general equation for multistage epicyclic gearset with corrected teeth: fixed-speed approach**, Piotr Kijanka, Adam Jablonski, Kajetan Dziedzic, AGH Univ. of Science and Technology (Poland) . . . . . [9805-66]

11:30 am: **Verification of recursive probabilistic integration method for probabilistic fatigue life management using non-destructive inspections**, Tzikang Chen, Chi-Yu Shiao, U.S. Army Research Lab. (USA) . . . . . [9805-67]

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



CONFERENCE 9798

Sessions 10A, 10B and 11A run concurrently.

SESSION 10A

LOCATION: GRAND A/B  
THU 1:20 PM TO 3:00 PM

**Ionic EAP Materials and Actuators II**

Session Chairs: **Markus Henke**, TU Dresden (New Zealand); **Thomas Wallmersperger**, TU Dresden (Germany)

1:20 pm: **Large deformation ionic polymer-metal composites actuators based on porous Nafion membranes**, Dongxu Zhao, Dichen Li, Yanjie Wang, Meng Luo, Hualing Chen, Xi'an Jiaotong Univ. (China) . . . . . [9798-70]

1:40 pm: **Encapsulation of ionic electro-active polymers: reducing the interaction with environment**, Paul Jaakson, Tarmo Tamm, Veiko Vunder, Alvo Aabloo, Univ. of Tartu (Estonia) . . . . . [9798-71]

2:00 pm: **Behavior of ionic conducting IPMC actuators in simulated space conditions**, Adelyne Fannir, Cédric Plesse, Tran-Minh Giao Nguyen, Univ. de Cergy-Pontoise (France); Elisabeth Laurent, Laurent Cadiergues, Ctr. National d'Études Spatiales (France); Frédéric Vidal, Univ. de Cergy-Pontoise (France) . . . . . [9798-72]

2:20 pm: **Performance improvement of IPMC flow sensors with a biologically inspired cupula structure**, Hong Lei, Montassar A. Sharif, Michigan State Univ. (USA); Derek A. Paley, Univ. of Maryland, College Park (USA); Matthew McHenry, Univ. of California, Irvine (USA); Xiaobo Tan, Michigan State Univ. (USA) . . . . . [9798-73]

2:40 pm: **3D printing of IPMC actuators: characterization and application in soft robotics**, James D. Carrico, Kam K. Leang, The Univ. of Utah (USA) . . . . . [9798-74]

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

SESSION 10B

LOCATION: MARQUIS 7  
THU 1:20 PM TO 4:50 PM

**Haptic, Tactile, and Other Sensors**

Session Chairs: **Kyle Van Volkinburg**, Univ. of California, Irvine (USA); **Miriam Biedermann**, Fraunhofer-Institut für Angewandte Polymerforschung (Germany)

1:20 pm: **Online parameter identification algorithm for DEAP-based sensors and self-sensing concepts**, Thorben Hoffstadt, Kai Bokermann, Jürgen Maas, Ostwestfalen-Lippe Univ. of Applied Sciences (Germany) . . . . . [9798-75]

1:40 pm: **Dielectric elastomer strain and pressure sensing enables reactive fluidic artificial muscles**, Allan J. Veale, Iain A. Anderson, The Univ. of Auckland (New Zealand) and Auckland Bioengineering Institute (New Zealand); Sheng Quan Xie, The Univ. of Auckland (New Zealand) . . . . . [9798-76]

2:00 pm: **From land to water: bringing dielectric elastomer sensing to the underwater realm**, Christopher R. Walker, Auckland Bioengineering Institute (New Zealand); Iain A. Anderson, Auckland Bioengineering Institute (New Zealand) and The Univ. of Auckland (New Zealand) and StretchSense (New Zealand) . . . . . [9798-77]

2:20 pm: **Applications of pressure-sensitive dielectric elastomer sensors**, Holger Böse, Fraunhofer-Institut für Silicatforschung (Germany) . . . . . [9798-78]

2:40 pm: **Non-verbal communication through sensor fusion**, Andreas Tairych, Daniel Xu, The Univ. of Auckland (New Zealand); Benjamin M. O'Brien, StretchSense (New Zealand); Iain A. Anderson, The Univ. of Auckland (New Zealand) and Auckland Bioengineering Institute (New Zealand) and StretchSense (New Zealand) . . . . . [9798-79]

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

CONFERENCE 9799

Sessions 14A and 14B run concurrently.

SESSION 14A

LOCATION: GRAND E  
THU 1:20 PM TO 3:00 PM

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

Session Chairs: **Gyuhae Park**, Chonnam National Univ. (Korea, Republic of); **Jinsong Leng**, Harbin Institute of Technology (China)

1:20 pm: **Piezoelectric energy harvesting of SMA-epoxy composites**, Qingqing Lu, Jian Sun, Liwu Liu, Yanju Liu, Jinsong Leng, Harbin Institute of Technology (China) . . . . . [9799-85]

1:40 pm: **Nonlinear dynamics of magnetically coupled beams for multimodal vibration energy harvesting**, Issam Abed, FEMTO-ST (France) and Univ. Tunis El Manar (Tunisia); Najib Kacem, Nouredine Bouhaddi, FEMTO-ST (France); Mohamed Lamjed Bouazizi, Preparatory Institute for Engineering Nabeul (Tunisia) and Prince Sattam Bin Abdulaziz Univ. (Saudi Arabia) . . . . . [9799-86]

2:00 pm: **Nonlinear modeling of MEMS piezoelectric energy harvesters**, Yi-Chung Shu, T. W. Huang, Y. C. Wang, Sun Chiu Lin, Wen-Jong Wu, National Taiwan Univ. (Taiwan) . . . . . [9799-87]

2:20 pm: **Improved nonlinear energy harvester with optimized magnetic force**, Wei Deng, Ya S. Wang, Stony Brook Univ. (USA) . . . . . [9799-88]

2:40 pm: **Exploiting material softening in hard PZTs for resonant bandwidth enhancement**, Stephen M. Leadenham, Adriane Moura, Alper Erturk, Georgia Institute of Technology (USA) . . . . . [9799-89]

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

SESSION 14B

LOCATION: MARQUIS 8  
THU 1:40 PM TO 3:00 PM

**Modeling, Optimization, Signal Processing, Sensing, Control, and Design of Integrated Systems II**

Session Chairs: **Roger Ohayon**, Conservatoire National des Arts et Métiers (France); **Farhan S. Gandhi**, Rensselaer Polytechnic Institute (USA)

1:40 pm: **Robustness of a multimodal piezoelectric damping involving the electrical analogue of a plate**, Boris Lossouarn, Conservatoire National des Arts et Métiers (France); Kenneth A. Cunefare, Georgia Institute of Technology (USA); Mathieu Aucejo, Jean-François Deü, Conservatoire National des Arts et Métiers (France) . . . . . [9799-90]

2:00 pm: **Input space-dependent controller for multi-hazard mitigation**, Liang Cao, Simon Laflamme, Iowa State Univ. of Science and Technology (USA) . . . . . [9799-91]

2:20 pm: **Tunable acoustic metamaterial with piezoelectric back plate by utilizing negative capacitance circuit**, Jiawen Xu, Univ. of Connecticut (USA); Guoliang Huang, Univ. of Missouri School of Medicine (USA); Jiong Tang, Univ. of Connecticut (USA) . . . . . [9799-92]

2:40 pm: **Model identification of galferol magnetostrictive actuators for precise positioning control**, Ashraf Saleem, Mojtaba Ghodsi, Abdullah Ozer, Mostefa Mesbah, Sultan Qaboos Univ. (Oman) . . . . . [9799-93]

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

CONFERENCE 9803

Sessions 14A and 14B run concurrently.

SESSION 14A

LOCATION: GRAND D  
THU 1:20 PM TO 3:00 PM

**Smart Material Solutions for Control Applications**

Session Chairs: **Haiping Huang**, The Univ. of Texas at Arlington (USA); **R. Andrew Swartz**, Michigan Technological Univ. (USA)

1:20 pm: **Structural integrated sensor and actuator systems for active flow control**, Christian Behr, Martin Schwerter, Technische Univ. Braunschweig (Germany); Peter Wierach, Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany); Michael Sinapius, Technische Univ. Braunschweig (Germany) . . . . . [9803-117]

1:40 pm: **Micro acoustic resonant chambers for heating/agitating/mixing**, Stewart Sherrit, Nobuyuki Takano, Aaron C. Noell, Anita M. Fisher, Frank Grunthaner, Jet Propulsion Lab. (USA) . . . . . [9803-118]

2:00 pm: **Nonlinear adaptive piezoelectric circuit for stiffness control**, Tarcisio M. Silva, Carlos De Marqui Jr., Univ. de São Paulo (Brazil) . . . . . [9803-119]

2:20 pm: **A small-scale study of magneto-rheological track vibration isolation system**, Rui Li, Chongqing Univ. (China); Wenjun Mu, Chongqing Univ. of Posts and Telecommunications (China); Luyang Zhang, Chongqing Univ. (China) . . . . . [9803-120]

2:40 pm: **An SMA-based redundant actuation locking device for rotary feed structure using self-locking principle**, Xiaoyu Qin, Xiaojun Yan, Xiaoyong Zhang, Dianyin Hu, BeiHang Univ. (China); Weibing Wang, Lianghai Li, Beijing Research Institute of Telemetry (China) . . . . . [9803-121]

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

SESSION 14B

LOCATION: CATALUNA A  
THU 1:20 PM TO 3:00 PM

**Advances in Wireless Monitoring Technology**

Session Chair: **Yiqing Ni**, The Hong Kong Polytechnic Univ. (Hong Kong, China)

1:20 pm: **A water quality monitoring and level control system based on wireless sensor networks**, Ali Abou-Elnour, Hyder Khaleeq, Ajman Univ. of Science & Technology (United Arab Emirates) . . . . . [9803-122]

1:40 pm: **An investigation on wireless sensors for asset management and health monitoring of civil structures**, Mustafa O. Furkan, Qiang Mao, John DeVitis, Drexel Univ. (USA); Paul Sumitro, SmartSensys (USA); Matteo Mazzotti, A. Emin Aktan, Franklin L. Moon, Ivan Bartoli, Drexel Univ. (USA); Fred Faridazar, Federal Highway Administration (USA) . . . . . [9803-123]

2:00 pm: **A hybrid system identification methodology for wireless structural health monitoring systems**, Kosmas Dragos, Kay Smarsly, Bauhaus Univ. Weimar (Germany) . . . . . [9803-124]

2:20 pm: **Design of external sensors board based on Bluetooth interface of smart phones for structural health monitoring system**, Yan Yu, Xuefeng Zhao, Yaping Zhou, Jinping Ou, Dalian Univ. of Technology (China) . . . . . [9803-125]

2:40 pm: **A wirelessly programmable actuation and sensing system for structural health monitoring**, James Long, Oral Buyukozturk, Massachusetts Institute of Technology (USA) . . . . . [9803-126]

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

CONFERENCE 9804

SESSION 16

LOCATION: MARQUIS 2  
THU 1:20 PM TO 3:00 PM

**Thermal NDE**

Session Chairs: **Peter J. Shull**, The Pennsylvania State Univ. (USA); **Theodoros E. Matikas**, Univ. of Ioannina (Greece)

1:20 pm: **A method to measure and estimate normalized contrast in infrared flash thermography**, Ajay M. Koshti, NASA Johnson Space Ctr. (USA) . . . . . [9804-57]

1:40 pm: **Mechanical damage assessment by means of thermo-electrical lock-in thermography**, Evangelos Z. Kordatos, Sheffield Hallam Univ. (United Kingdom); Dimitrios A. Exarchos, Theodoros E. Matikas, Univ. of Ioannina (Greece) . . . . . [9804-58]

2:00 pm: **Thermal monitoring and characterization of SLM-produced parts using high resolution two-wavelength pyrometry**, Mohamad Mahmoudi, Gustavo Tapia, Alaa H. Elwany, Texas A&M Univ. (USA) . . . . . [9804-59]

2:20 pm: **Thermal correlation analysis of a long-span suspension bridge static responses**, Linren Zhou, Zhiguang Wang, South China Univ. of Technology (China); Yong Xia, The Hong Kong Polytechnic Univ. (Hong Kong, China); James M. W. Brownjohn, Univ. of Exeter (United Kingdom) . . . . . [9804-60]

2:40 pm: **Crack detection of metallic surfaces through finite element modeling of thermosonic NDT process**, Mohammad Riahi, Iran Univ. of Science and Technology (Iran, Islamic Republic of) . . . . . [9804-61]

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

CONFERENCE 9805

Sessions 14A and 14B run concurrently.

SESSION 14A

LOCATION: MARQUIS 1  
THU 1:20 PM TO 3:00 PM

**Innovative Sensing and Novel Instruments**

Session Chairs: **Wolfgang Grill**, ASI Analog Speed Instruments GmbH (Germany); **Xiaoning Jiang**, North Carolina State Univ. (USA)

1:20 pm: **A bio-inspired self-sensing composite UAV wing with structural and flight awareness capabilities**, Fotios Kopsaftopoulos, Raphael Nardari, Yu-Hung Li, Pengchuan Wang, Fu-Kuo Chang, Stanford Univ. (USA) . . . . . [9805-68]

1:40 pm: **Structural health monitoring with ultrasonic detection of stress and strain**, Julian Grill, Wolfgang Grill, ASI Analog Speed Instruments GmbH (Germany) . . . . . [9805-69]

2:00 pm: **Sensing human physiological response using wearable carbon nanotube-based fabrics**, Long Wang, Univ. of California, Davis (USA); Kenneth J. Loh, Univ. of California, San Diego (USA); Helen S. Koo, Univ. of California, Davis (USA) . . . . . [9805-70]

2:20 pm: **Fiberoptic sensor for flow and viscosity measurement**, Wei-Chih Wang, Jonathan Leung, Univ. of Washington (USA) . . . . . [9805-71]

2:40 pm: **Enhanced damage detection of multiple-rivet-hole lap joint cracks using global analytical with local FEM simulation**, Md. Yeasin Bhuiyan, Univ. of South Carolina (USA); Yanfeng Shen, Univ. of Michigan (USA); Victor Giurgutiu, Univ. of South Carolina (USA) . . . . . [9805-113]

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

SESSION 14B

LOCATION: MARQUIS 3  
THU 1:20 PM TO 3:00 PM

**Use of Sensor Technologies for Condition Assessment of Highway Infrastructure**

Session Chair: **Hoda Azari**, Federal Highway Administration Turner Fairbank Highway Research Ctr. (USA)

1:20 pm: **A curvature based approach using long-gage fiber optic sensors**, Kaitlyn S. Kliever, Branko Glisic, Princeton Univ. (USA) . . . . . [9805-73]

1:40 pm: **Identification of steady-state structural temperature distributions to facilitate a temperature driven method of structural health monitoring**, John Reilly, Princeton Univ. (USA) . . . . . [9805-74]

2:00 pm: **Field testing of Martlet wireless sensing system on an in-service prestressed concrete highway bridge**, Xi Liu, Xinjun Dong, Yang Wang, Georgia Institute of Technology (USA) . . . . . [9805-75]

2:20 pm: **Validation of long-term measurements from FBG sensors**, Hiba Abdel-Jaber, Branko Glisic, Princeton Univ. (USA) . . . . . [9805-76]

2:40 pm: **Identifying minute damage in composite bridge structures using the location of neutral axis and finite element analysis**, Xi Li, Branko Glisic, Princeton Univ. (USA) . . . . . [9805-77]

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

CONFERENCE 9798

Sessions 10A, 10B and 11A run concurrently.

SESSION 11A

LOCATION: GRAND A/B  
THU 3:30 PM TO 4:50 PM

**New EAP Materials, Processes, and Fabrication Techniques IV**

Session Chairs: **Qibing Pei**, Univ. of California, Los Angeles (USA); **Frédéric Vidal**, Univ. de Cergy-Pontoise (France)

3:30 pm: **Interface design for DEAP-based stack-actuators considering various application cases**, Helge Bochmann, Benedikt von Heckel, Ostwestfalen-Lippe Univ. of Applied Sciences (Germany); Thorben Hoffstadt, Jürgen Maas, Ostwestfalen-Lippe Univ. of Applied Sciences (Germany) . . . . . [9798-84]

3:50 pm: **Neural network modelling and model predictive control of ionic electroactive polymer actuators**, Sunjai Nakshatharan Shanmugam, Andres Punning, Alvo Aabloo, Univ. of Tartu (Estonia). . . . . [9798-85]

4:10 pm: **Silicones with enhanced permittivity for dielectric elastomer actuators**, Simon J. Dünki, Frank A. Nüesch, Empa (Switzerland) and Ecole Polytechnique Fédérale de Lausanne (Switzerland); Dorina M. Opris, Empa (Switzerland) . . . . [9798-86]

4:30 pm: **In-suite monitoring of mechanic and electronic instabilities: phase transitions and complex stiffness**, Matthias Kollosche, Univ. Potsdam (Germany); Ujjaval Gupta, National Univ. of Singapore (Singapore); Guggi Kofod, Inmold Biosystems A/S (Denmark); Zhigang Suo, Harvard Univ. (USA); Jian Zhu, National Univ. of Singapore (Singapore) . . . [9798-87]

SESSION 10B

Continued

3:30 pm: **Fluid flow sensing and control with ionic polymer-metal composites**, Tyler P. Stalbaum, Kwang Jin Kim, Univ. of Nevada, Las Vegas (USA) . . . . . [9798-80]

3:50 pm: **Tactile display enabled by selective patterning of integrated stretchable heaters on shape memory polymer membranes**, Nadine Besse, Samuel Rosset, Herbert R. Shea, Ecole Polytechnique Fédérale de Lausanne (Switzerland) . . . . . [9798-81]

4:10 pm: **Dielectric elastomer for stretchable sensors: influence of the design and material properties**, Claire Jean-Mistral, Loïc Vial, Sophie Iglesias, Sébastien Pruvost, Jannick Duchet-Rumeau, Simon Chesné, Institut National des Sciences Appliquées de Lyon (France) . . . . . [9798-82]

4:30 pm: **Tactile sensor integrated dielectric elastomer actuator for simultaneous actuation and sensing**, Kevin Kadooka, Hiroya Imamura, Minoru Taya, Univ. of Washington (USA) . [9798-83]

Conference End.

CONFERENCE 9799

Sessions 15A and 15B run concurrently.

SESSION 15A

LOCATION: GRAND E  
THU 3:30 PM TO 5:50 PM

**Energy Harvesting and Scavenging: Applications**

Session Chairs: **Mehrdad N. Ghasemi-Nejhad**, Univ. of Hawai'i (USA); **Ya S. Wang**, Stony Brook Univ. (USA)

3:30 pm: **Gauging the feasibility of a downhole energy harvesting system through a proof-of-concept study**, Eric J. Kjolosing, Michael D. Todd, Univ. of California, San Diego (USA). . . . . [9799-95]

3:50 pm: **Hybrid piezo-pyroelectric effects in energy harvesting from pavements with ferroelectric materials**, Junliang Tao, Jie Hu, The Univ. of Akron (USA); Guangxi Wu, Case Western Reserve Univ. (USA)[9799-96]

4:10 pm: **A review of piezoelectric-based electrical energy harvesting methods and devices for munitions**, Jahangir Rastegar, Dake Feng, Omnitek Partners, LLC (USA); Carlos M. Pereira, U.S. Army Armament Research, Development and Engineering Ctr. (USA). . . . . [9799-97]

4:30 pm: **Opportunities for energy harvesting in automobile factories**, Elijah I. Adegoke, Robert M. Edwards, Will G. Whittow, Loughborough Univ. (United Kingdom); Axel Bindel, High Speed Sustainable Manufacturing Institute (United Kingdom) . . . . . [9799-98]

4:50 pm: **Smart nanogrid system for disaster mitigation employing deployable renewable energy harvesting**, Mehrdad N. Ghasemi-Nejhad, Brenden Minei, Reza Ghorbani, Univ. of Hawai'i (USA) . [9799-99]

5:10 pm: **The effects of dimensional parameters on fatigue life, sensing, and energy harvesting of an embedded PZT in a total knee replacement**, Mohsen Safaei, Steven R. Anton, Tennessee Technological Univ. (USA) . . . . . [9799-100]

5:30 pm: **Energy harvesting in pavement from passing vehicles with piezoelectric composite plate for ice melting**, Farjana Faisal, Nan Wu, Univ. of Manitoba (Canada); Kartik Kapoor, Pandit Deendayal Petroleum Univ. (India) . . . . . [9799-101]

SESSION 15B

LOCATION: MARQUIS 8  
THU 3:30 PM TO 5:50 PM

**Magneto Rheological Systems**

Session Chairs: **Seung-Bok Choi**, Inha Univ. (Korea, Republic of); **Majid Behrooz**, Univ. of Nevada, Reno (USA)

3:30 pm: **Investigation on the effect of MR elastomer based adaptive tuned vibration absorbers on noise transmission through circular elastic plates**, Masoud Hemmatian, Ramin Sedaghati, Concordia Univ. (Canada) . . . . . [9799-102]

3:50 pm: **Design of Magneto-rheological mount for cabin of heavy equipment vehicles**, Soon-Yong Yang, Seung-Bok Choi, Inha Univ. (Korea, Republic of) . . . . . [9799-103]

4:10 pm: **A fail-safe liquid spring controllable magnetorheological damper for three-dimensional earthquake isolation system**, Sevki Cesmecci, Faramarz Gordaninejad, Univ. of Nevada, Reno (USA) . . . . . [9799-104]

4:30 pm: **Development and experimentation of a prosthetic knee with magnetorheological fluid**, Alan Suarez, The M. Nguyen, Saurabh Bapat, California State Univ., Fresno (USA) . . . . . [9799-105]

4:50 pm: **A new resonance based method for the measurement of magnetic field intensity**, Suresh Kaluvan, Seung-Bok Choi, Inha Univ. (Korea, Republic of) . . [9799-106]

5:10 pm: **Investigation of energy-efficient MRF-based clutches for hybrid powertrains**, Christian Hegger, Jürgen Maas, Ostwestfalen-Lippe Univ. of Applied Sciences (Germany) . . . . . [9799-107]

5:30 pm: **Methods for real-time compensation of hysteresis in MR actuators caused by the magnetically fluid control**, Jürgen Maas, Christian Hegger, Felix Willich, Ostwestfalen-Lippe Univ. of Applied Sciences (Germany) . . . . . [9799-108]

Conference End.



CONFERENCE 9803

Sessions 15A and 15B run concurrently.

SESSION 15A

LOCATION: GRAND D  
THU 3:30 PM TO 5:50 PM

**Acoustic and Ultrasonic Waves: Models and Experiments**

Session Chairs: **Irving J. Oppenheim**, Carnegie Mellon Univ. (USA); **Jung-Wuk Hong**, KAIST (Korea, Republic of)

3:30 pm: **A guided ultrasonic imaging approach in isotropic plate structures using edge reflections**, Arvin Ebrahimkhanlou, Salvatore Salamone, The Univ. of Texas at Austin (USA) . . . [9803-127]

3:50 pm: **Microcrack modeling and simulation for nonlinear wave modulation**, SangEon Lee, Su Yeong Jin, Jung-Wuk Hong, KAIST (Korea, Republic of) [9803-128]

4:10 pm: **Compensating temperature-induced ultrasonic phase and amplitude changes**, Peng Gong, Carnegie Mellon Univ. (USA); Thomas R. Hay, TechKnowServ Corp. (USA); David W. Greve, Carnegie Mellon Univ. (USA); Warren R. Junker, Consultant (USA); Irving J. Oppenheim, Carnegie Mellon Univ. (USA) . . . . . [9803-129]

4:30 pm: **Reconstruction of acoustic sources in heterogeneous elastic solids**, Chanseok Jeong, Stephen Lloyd, The Catholic Univ. of America (USA) . [9803-130]

4:50 pm: **Enhanced nonlinear crack-wave interactions for damage detection in composite laminates**, Lukasz J. Pieczonka, Kajetan Dzedziech, Andrzej P. Klepka, Piotr Kijanka, Wieslaw J. Staszewski, AGH Univ. of Science and Technology (Poland) . . . . . [9803-131]

5:10 pm: **Wide-band elasto-acoustic cloaking in homogeneous media**, Hannah R. Chang, Matteo Carrara, Massimo Ruzzene, Georgia Institute of Technology (USA) . . . . . [9803-132]

5:30 pm: **Ultrasonic guided wave detection of scatterers on large "clad steel" plates**, Peng Gong, Carnegie Mellon Univ. (USA); Joel B. Harley, The Univ. of Utah (USA); Mario Bergés, Carnegie Mellon Univ. (USA); Warren R. Junker, Consultant (USA); David W. Greve, Irving J. Oppenheim, Carnegie Mellon Univ. (USA) . . . . [9803-133]

SESSION 15B

LOCATION: CATALUNA A  
THU 3:30 PM TO 5:50 PM

**Advances in FBG Sensing**

Session Chair: **Xiaoyi Bao**, Univ. of Ottawa (Canada); **Andrew R. Swartz**, Michigan Technological Univ. (USA)

3:30 pm: **Planar waveguide Bragg grating sensors for composite monitoring**, Nuria Teigell Beneitez, Jeroen Missinne, Yuting Shi, Gabriele Chiesura, Geert Luyckx, Joris Degrieck, Geert Van Steenberge, Univ. Gent (Belgium) . . . . . [9803-134]

3:50 pm: **Sensitivity of contact-free fiber Bragg grating sensor to ultrasonic Lamb wave**, Junghyun Wee, Kara J. Peters, Brian Wells, Philip Bradford, North Carolina State Univ. (USA) . . . . . [9803-135]

4:10 pm: **Experimental investigation on acousto-ultrasonic sensing using polarization-maintaining fiber Bragg gratings**, Curtis E. Banks, NASA Marshall Space Flight Ctr. (USA); Gang Wang, The Univ. of Alabama in Huntsville (USA) . . . . . [9803-136]

4:30 pm: **A sliding mode based observer to identify faults in FBG sensors embedded in composite structures**, Simone Cinquemani, Gabriele Cazzulani, Marco Ronchi, Politecnico di Milano (Italy) . . . . . [9803-137]

4:50 pm: **A 6-axis optical fiber Bragg grating force-torque sensor for haptic end-effectors**, Cheol Kim, Chan-hee Lee, Kyungpook National Univ. (Korea, Republic of) . . . . . [9803-138]

5:10 pm: **Limits to acoustic sensing and modal decomposition using FBGs**, Patrick Norman, Claire E. Davis, Cédric Rosalie, Nik Rajic, Defence Science and Technology Group (Australia) . . . . . [9803-139]

5:30 pm: **Dynamic Fiber Bragg grating sensor interrogation using resonance Fourier domain mode-locked wavelength-swept laser**, Jin Woo Park, Chungnam National Univ. (Korea, Republic of); Bong Wan Lee, FIBERPRO, Inc. (Korea, Republic of); Min Yong Jeon, Chungnam National Univ. (Korea, Republic of) . . . . . [9803-140]

Conference End.

CONFERENCE 9804

SESSION 17

LOCATION: MARQUIS 2  
THU 3:30 PM TO 5:50 PM

**Sensors and Sensing Networks**

Session Chairs: **Ming L. Wang**, Northeastern Univ. (USA); **Fan Wu**, Shanghai Jiao Tong Univ. (China)

3:30 pm: **Design, test, and field validation of scour monitoring sensors with automatically pointing-up system**, Yan Tang, Yizheng Chen, Zhaochao Li, Yi Bao, Chanrui Guo, Genda Chen, Missouri Univ. of Science and Technology (USA) . . . [9804-62]

3:50 pm: **Monitoring and estimating soil physical properties using piezoceramic transducer**, Ruolin Wang, Tongxiao Peng, Daopei Zhu, Wuhan Univ. (China); Ming L. Wang, Northeastern Univ. (USA) . . [9804-63]

4:10 pm: **Non-destructive testing of critical infrastructure with giant magneto resistive sensors**, Arvid Hunze, Joseph Bailey, Gennady Sidorov, Robinson Research Institute (New Zealand); Phil Bondurant, Tony Mactutus, Qi2 (USA) . . . . . [9804-64]

4:30 pm: **Crack identification for reinforced concrete using PZT based smart rebar active sensing diagnostic network**, Fan Wu, Ningning Song, Shanghai Jiao Tong Univ. (China) . . . . . [9804-65]

4:50 pm: **Wake-up transceivers for structural health monitoring**, Timo Kumberg, Leonhard M. Reindl, Univ. of Freiburg (Germany) . . . . . [9804-66]

5:10 pm: **Automated NDT for concrete delamination detection using MEMS microphone array**, Suyun Ham, Jinying Zhu, Univ. of Nebraska-Lincoln (USA) . . . . . [9804-67]

5:30 pm: **Numerical study on the mechanism of interface debonding detection for CFST with PZT**, Bin Xu, Hongbing Chen, Bing Li, Lele Luan, Hunan Univ. (China); Song Xia, Xi'an Jiaotong Univ. (China) . . . . . [9804-68]

Conference End.

CONFERENCE 9805

Sessions 15A and 15B run concurrently.

SESSION 15A

LOCATION: MARQUIS 1  
THU 3:30 PM TO 6:10 PM

**Novel Instruments and Innovative Sensing**

Session Chairs: **Wei-Chih Wang**, Univ. of Washington (USA); **Henrique L. Reis**, Univ. of Illinois at Urbana-Champaign (USA)

3:30 pm: **Effects of asphalt rejuvenators on thermal and mechanical properties of asphalt pavements**, Nicholas Farace, Zhe Sun, William G. Buttlar, Henrique L. Reis, Univ. of Illinois at Urbana-Champaign (USA) . . . . . [9805-78]

3:50 pm: **Reflective SOA fiber cavity adaptive laser source for measuring dynamic strains**, Heming Wei, Northwestern Univ. (USA) and Dalian Univ. of Technology (China); Yinian Zhu, Sridhar Krishnaswamy, Northwestern Univ. (USA) . . . . . [9805-79]

4:10 pm: **Ultrasonic imaging using wave structure-based weights and global matched coefficients**, Simone Sternini, Thompson V. Nguyen, Francesco Lanza di Scalea, Univ. of California, San Diego (USA) . . . . . [9805-80]

4:30 pm: **Performing modal analysis for multi-metric measurements: a discussion**, Rohan N. Soman, Katarzyna Majewska, Maciej Radzienski, Polish Academy of Sciences (Poland); Wieslaw M. Ostachowicz, Polish Academy of Sciences (Poland) and Warsaw Univ. of Technology (Poland) . . . . . [9805-81]

4:50 pm: **Underwater camera with depth measurement**, Wei-Chih Wang, Chi-Leung Tsui, Univ. of Washington (USA) . . . . [9805-82]

5:10 pm: **Piezoelectric-based smart sensing system for I-type steel structural health monitoring**, Chen Zhang, Haifeng Zhang, Univ. of North Texas (USA); Tzuyang Yu, Xingwei Wang, Univ. of Massachusetts Lowell (USA) . . . . . [9805-83]

5:30 pm: **Photonic crystal fiber based chloride chemical sensors for corrosion monitoring**, Heming Wei, Northwestern Univ. (USA) and Dalian Univ. of Technology (China); Chuanyi Tao, Yinian Zhu, Sridhar Krishnaswamy, Northwestern Univ. (USA) . . . . . [9805-84]

5:50 pm: **Nonlinear phased array imaging**, Jack Potter, Anthony J. Croxford, Univ. of Bristol (United Kingdom) . . . . . [9805-85]

SESSION 15B

LOCATION: MARQUIS 3  
THU 3:30 PM TO 5:50 PM

**NDE and Rapid Global Assessment of Highway Bridges**

Session Chair: **Hoda Azari**, Federal Highway Administration Turner Fairbank Highway Research Ctr. (USA)

3:30 pm: **Low-cost, quantitative assessment of highway bridges through the use of unmanned aerial vehicles**, Andrew Ellenberg, Antonios Koutsos, Franklin L. Moon, Ivan Bartoli, Drexel Univ. (USA) . . . . . [9805-86]

3:50 pm: **Single model parameter estimation response to distortions of typical highway bridges**, David Masceri, Franklin L. Moon, Drexel Univ. (USA) . . . . . [9805-88]

4:10 pm: **Towards the large scale structural identification of highway bridges: applications of a rapid modal testing system**, John DeVitis, David Masceri, A. Emin Aktan, Franklin L. Moon, Drexel Univ. (USA) . . . . . [9805-89]

4:30 pm: **Comparison of air-coupled GPR data analysis results determined by multiple analysts**, Nicole Martino, Roger Williams Univ. (USA); Kenneth Maser, Infrasense, Inc. (USA) . . . . . [9805-90]

4:50 pm: **Similarities and differences in bare concrete deck deterioration curves from periodical multi NDE technology surveys**, Nenad Gucunski, Jinyoung Kim, Kien Dinh, Rutgers, The State Univ. of New Jersey (USA) . . . . . [9805-91]

5:10 pm: **A device for remotely tap-testing difficult-to-access structures using aerial robots**, David D. Mascareñas, Los Alamos National Lab. (USA) . . . . . [9805-92]

5:30 pm: **Detecting structural damage by motion magnified video**, Yongchao Yang, David D. Mascareñas, Los Alamos National Lab. (USA) . . . . . [9805-93]

Conference End.

# INDEX OF AUTHORS, CHAIRS, AND COMMITTEE MEMBERS

Bold = SPIE Member

## A

**A., Vimala Juliet** [9802-30] S10

Aabloo, Alvo [9798-35] S7A,  
[9798-48] S8A, [9798-55] S8B,  
[9798-56] S8B, [9798-71] S10A,  
[9798-85] S11A, [9798-91]  
SPTues

Abdel-Jaber, Hiba [9805-76] S14B  
Abdelnaby, Mohammed A. [9799-  
23] S6

**Abdul-Aziz, Ali** [9804-5] S2, 9806  
Program Committee, [9806-  
25] S7

Abe, Mei [9802-17] S6, [9802-29]  
S10

Abed, Issam [9799-86] S14A

Abo Ras, Mohamed [9806-17] S5

Abou-Elnour, Ali [9803-122] S14B

Abueh, Yeka J. [9804-10] S3

Acernese, Fausto [9799-120]  
SPTue, [9803-101] S11B, [9803-  
162] SPTue

Achenbach, Jan D. [9798-502]  
SPlen

Acuña-Benavente, Jaime E.  
[9803-147] SPTue

Adachi, Kazuhiko [9803-1] S1A

Adamczyk, Maciej [9805-39] S9

Adams, Douglas [9803-43] S6A

Adegoke, Elijah I. [9799-98] S15A

Adhikari, Sailesh [9803-92] S11A

Adhikari, Sondipon [9799 S9B  
Session Chair, [9799-44] S9B,  
[9802-13] S5

**Adibi, Ali** [9798-504] SPlen

Adler, Peter [9797-4] S3

**Aggarwal, Mohan D.** [9806-37]  
SPTue

Aggelis, Dimitrios G. [9806-43]  
SPTue, [9806-44] SPTue

Aghakhani, Amirreza [9806-12] S3

Agnes, Gregory S. 9799 Program  
Committee

Aguirre-Tostado, Francisco  
Servando [9801-18] S4

Ahamed, Parbhej [9802-23] S9

Ahmad, Dilshad [9798-33] S6B

Ahmad, Fauzia [9805-32] S7

Ahmad, Rais [9805-62] S13A

Ahmadian, Mehdi [9799 Program  
Committee

Ahmed, Kabir [9801-22] S5

Ahmed, Kumkum [9800-4] S1

Ahmed, Riaz [9797-28] S10

Ahmed, Saad [9798-120] SPTues

Ahn, Jaeho [9798-53] S8B

Ahn, Yong San [9800-17] S4,  
[9800-26] S7

Aimmanee, Sontipee [9803-1]  
S1A, [9803-33] S4B

Akle, Barbar J. 9798 Program  
Committee, 9798 S7A Session  
Chair, [9798-36] S7A

Aktan, A. Emin [9803-123] S14B,  
[9804-81] SPTue, [9805-87]  
S15B, [9805-89] S15B

Akther, Asma [9802-3] S2, [9802-  
63] SPTue

Alafogianni, Panagiota [9806-23]  
S6

Alam, Khurshid [9800-7] S2

Alamdari, Mehrisadat Makki  
[9803-95] S11A

Alampalli, Sandeep [9803-42] S5B

Alampalli, Sharada [9803-41] S5B,  
[9803-42] S5B

Alampalli, Sreenivas [9803-41]  
S5B

Alarifi, Ibrahim M. [9804-91]  
SPTue, [9806-49] S10

Alebrahim, Reza [9805-27] S6

Alguri, K. Supreet [9805-106]  
SPTue

Alhandawi, Khalil [9803-145]  
SPTue, [9803-52] S6B

Alharbi, Abdulaziz [9804-91]  
SPTue, [9806-49] S10

Al-Hossain, Aktaruzzaman [9802-  
14] S5

Aliabadi, Mohammad H. [9803-  
167] SPTue

Al-Irsyad, Tunku Ishak 9798  
Program Committee

Allen, Nicole [9798-19] S5

AlMaadeed, Mariam [9799-77]  
S13A

Almasri, Mahmoud F. [9802-49]  
S15, [9805-50] S11

Alomari, Al-Muatasim [9806-37]  
SPTue

Al-Yahmadi, Amur [9800-7] S2,  
[9804-51] S13

Amendola, Gianluca [9803-172]  
SPTue, [9803-83] S10A

**Amin, Moeness G.** [9805-32] S7

Aminzadeh, Masoumeh [9804-50]  
S13, [9805-63] S13A

Amiryani, Milad [9804-51] S13

Amitay, Michael [9801-1] S1,  
[9801-3] S1, [9801-4] S1

Amjad, Umar [9805-37] S8

Amjadian, Mohsen [9799-48] S9B

Ammar, Hany Rizk [9806-47]  
SPTue

Amoroso, Francesco [9801-5] S2,  
[9801-6] S2, [9803-172] SPTue

**An, Yun-Kyu** [9803-94] S11A

Anandan, Sudharshan [9803-72]  
S9A

Anderson, Eric H. 9799 Program  
Committee

Anderson, Iain A. 9798 Program  
Committee, [9798-2] S1, [9798-  
24] S6A, [9798-25] S6A, [9798-  
4] S1, [9798-76] S10B, [9798-77]  
S10B, [9798-79] S10B

Andrade, Monica Jung de [9799-  
131] SPTue

Andre, Julia [9803-15] S2B

Andrews, William [9800-18] S5

Annaldas, Venu Gopal Madhav  
[9803-68] S8A

Ansari, Saeed [9801-28] SPTue

Anthony, Tatiana M. [9797-32]  
SPTue

Anton, Steven R. 9799 Program  
Committee, 9799 S11A Session  
Chair, [9799-100] S15A,  
[9799-63] S11A, 9801 Program  
Committee, [9805-65] S13B

Arafa, Mustafa [9799-23] S6

Arai, Masanori [9802-17] S6,  
[9802-19] S7

Arakawa, Takeshi [9798-99]  
SPTues

Arbe, Daniel [9804-5] S2

Armstrong, Daniel P. [9798-5] S2,  
[9798-94] SPTues

Arockiarajan, Arunachalaksi  
[9803-105] S12A

Arritt, Brandon J. 9801 Program  
Committee

Arwin, Hans 9797 Program  
Committee

Asadollahi, Parisa [9803-16] S2B

Asai, Takehiko [9799-80] S13A

Asaka, Kinji 9798 Program  
Committee, [9798-29] S6B,  
[9798-91] SPTues, [9798-99]  
SPTues

Asanuma, Hiroshi 9799 Program  
Committee, 9803 Program  
Committee, 9803 S4B Session  
Chair, 9803 S7A Session Chair,  
[9803-1] S1A, [9803-116] S13B,  
[9803-178] SPTue, [9803-33]  
S4B, [9803-34] S4B, [9803-59]  
S7A, [9806-38] SPTue

Ascione, George [9798-19] S5

Asdrubali, Francesco [9800-34]  
S8

Ashworth, Sharon [9798-37] S7A  
Asmatulu, Eylem [9801-29] S4

Asmatulu, Ramazan [9799-141]  
SPTue, [9800-51] S8, [9802-  
65] SPTue, [9802-66] SPTue,  
[9804-91] SPTue, [9806-48]  
SPTue, [9806-49] S10

Asnani, Vivake M. [9799-9] S2,  
[9801-26] S5

Assouar, Badreddine [9805-45]  
S10

**Asundi, Anand Krishna** [9803-  
68] S8A

Atwood, Donald K. [9803-108]  
S12B

Au, Francis T. K. [9805-6] S2

Aucejo, Mathieu [9799-66] S11B,  
[9799-90] S14B

Aw, Kean C. [9798-14] S4

Azad, Ali Imani [9803-187] SPTue

Azari, Hoda 9805 S14B Session  
Chair, 9805 S15B Session Chair

Azarmi, Fardad [9803-53] S7A

Aziz, Shazed Md [9798-31] S6B

Azpitarte, Itxasne [9797-6] S3

## B

Baader, Jakob [9799-47] S9B

Baaklini, George Y. 9806 Program  
Committee

Badescu, Mircea [9801-10] S3

Bagchi, Ashutosh [9805-96]  
SPTue

Bai, Xian-Xu [9797-34] SPTue,  
[9799-128] SPTue, [9799-75]  
S12B

**Baid, Harsh K.** 9805 S13A  
Session Chair

Baig, Muneer [9806-47] SPTue

Bailey, Joseph [9804-64] S17

Baird, Christopher S. [9806-18] S5

Baji, Avinash [9797-13] S4

Bajoria, Kamalkishor M. [9799-29]  
S7, [9799-65] S11B

Baker, Melissa [9798-501] SPlen

**Banadaki, Yaser M.** [9802-2] S2,  
[9802-9] S4

Bandyopadhyay, Alak [9806-37]  
SPTue

Banerjee, Sauvik [9803-93] S11A

Banerjee, Sourav [9797-28] S10,  
9805 Program Committee,  
9805 S6 Session Chair, [9805-  
21] S5

Banerji, Srishti [9805-96] SPTue

**Bani-Hani, Muath A.** [9803-9]  
S2A

Banks, Curtis E. [9803-136] S15B

Bao, Jingjing [9805-56] S12A

Bao, Xiaoci [9801-10] S3, [9803-  
97] S11B

Bao, Xiaoyi 9803 Program  
Committee, 9803 S15B Session  
Chair

Bao, Yi [9803-44] S6A, [9804-62]  
S17

Bao, Yuequan [9805-100] SPTue

Bapat, Saurabh [9799-105] S15B,  
[9799-132] SPTue

Barazanchy, Darun [9804-9] S2

**Bar-Cohen, Yoseph** 9797  
Program Committee, 9798  
Conference Chair, 9798 S1  
Session Chair, [9801-10] S3,  
9805 Program Committee,  
[9805-36] S8, SC634

Barizuddin, Syed [9802-49] S15

Barkoula, Nektaria-Marianthi  
[9806-23] S6

Barone, Fabrizio [9799-120]  
SPTue, [9803-101] S11B, [9803-  
162] SPTue

Barszcz, Tomasz [9806-16] S5

Bartl, Michael H. 9797 Program  
Committee

Bartoli, Ivan [9803-123] S14B,  
[9804-36] S10, [9804-81]  
SPTue, [9805-86] S15B

Basdogan, Ipek [9806-12] S3

Bassani, Paola [9799-33] S7

Bates, Simon [9799-7] S2

**Batra, Ashok K.** [9806-37] SPTue

Bauer, Matthias [9801-2] S1

**Bauer, Siegfried G.** 9798  
Program Committee, 9798 S2  
Session Chair, [9798-4] S1

Baughman, Ray H. 9798 Program  
Committee, [9799-131] SPTue

Baumgartner, Werner [9797-36]  
SPTue

Baur, Jeffrey W. [9803-113] S13B

Baxevanis, Theocharis [9800-11]  
S3

Bayat, Alireza [9800-30] S7

Bayati, Ilmas [9803-88] S10B

Baz, Amr M. 9799 Program  
Committee

Beard, Charles E. [9797-4] S3

Beck, James L. [9803-62] S7B

Bekas, Dimitrios [9804-33] S8,  
[9804-86] SPTue

Bélanger, Pierre [9804-22] S7,  
[9804-7] S2

Ben Atillah, Hassene [9800-22]  
S6

Ben-David, Moti [9798-16] S4

Bennett, Caroline R. [9803-99]  
S11B

Benzerger, Amine [9800-10] S3

**Berbyuk, Viktor** [9806-4] S2

Bergés, Mario [9803-133] S15A

**Bergmann, Ralf B.** 9804 Program  
Committee

Bertagne, Christopher L. [9799-32]  
S7

Besse, Nadine [9798-81] S10B

Bhakta, Raj [9803-26] S3B

Bhalla, Suresh [9803-92] S11A,  
[9805-110] SPTue, [9805-111]  
SPTue

Bhatt, Ramakrishna T. [9806-25]  
S7

Bhattacharjee, Bishwajit [9805-111]  
SPTue

Bhattacharyya, Abhijit 9800  
Program Committee

Bhuiyan, Md Yeasin [9805-113]  
S14A

Bhusan, Gian [9797-42] SPTue

Bi, Siwen [9803-20] S3A, [9803-67]  
S8A, [9803-71] S9A, [9804-26]  
S7

Biedermann, Miriam 9798 S10B  
Session Chair, [9798-44] S7B

Bielefeldt, Brent R. [9800-10] S3

Biggs, Daniel B. [9800-12] S3

Bijudas, Christudas R. [9803-96]  
S11A, [9805-35] S7

Bikis, Christos [9797-11] S4

Bilgen, Onur [9797-24] S8

Billon, Kevin [9799-6] S2

Bindal, Abhinav [9805-111] SPTue

Bindel, Axel [9799-98] S15A

Birkelbach, Gerhard [9805-61]  
S13A

Biscarini, Chiara [9803-115] S13B

Biswas, Subir [9803-89] S11A

Blanloeuil, Philippe [9804-14] S4,  
[9804-54] S15



# INDEX OF AUTHORS, CHAIRS, AND COMMITTEE MEMBERS

Bold = SPIE Member

- Boisen, Anja 9802 Program Committee  
Boivin, Guillaume [9804-22] S7  
Bokermann, Kai [9798-75] S10B  
Bolhassani, Mohammad [9804-36] S10  
Bolognani, Denise [9803-61] S7B  
Bond, Ian P. [9797-22] S8, [9799-84] S13B, [9804-32] S8  
Bond, Leonard J. 9806 Program Committee  
Bondurant, Phil [9804-64] S17  
Bonnetfont, Guillaume [9806-23] S6  
Borisovna, Alena [9802-8] S4  
Borkowski, Luke [9803-79] S9B  
Böse, Holger 9798 S8B Session Chair, [9798-78] S10B  
Boström, Anders [9806-4] S2  
Bouazizi, Mohamed Lamjed [9799-86] S14A  
Bouda, Václav 9798 Program Committee  
Bouhaddi, Noureddine [9799-86] S14A  
Bradford, Philip [9803-135] S15B  
Bradford, Robyn L. [9803-113] S13B  
Braghin, Francesco [9799-25] S6, [9799-50] S10A, [9799-69] S11B, [9803-58] S7A  
Braley, John B. [9805-87] S15B, [9805-88] S15B, [9805-89] S15B  
Brantley, Christina L. 9802 Program Committee, 9802 S7 Session Chair, [9802-1] S1  
Bri, Diann E. 9799 Program Committee, 9799 S4 Session Chair, 9801 Program Committee  
Breuer, Ulf [9801-15] S3  
Bridgelall, Raj [9803-108] S12B, [9803-51] S6B  
Brinkerhoff, Ryan [9799-16] S3  
Broderick, Neil G. R. [9802-56] SPTue  
Brooks, Chris [9803-103] S11B  
Browder, Cindy [9800-18] S5  
Brown, Hugh R. [9798-31] S6B  
**Browne, Alan L.** 9801 Conference CoChair, 9801 S2 Session Chair, 9801 S3 Session Chair  
Brownjohn, James M. W. [9804-60] S16  
Brubaker, Cole [9803-43] S6A  
Bryant, Matthew 9799 S9A Session Chair, [9799-38] S8B, [9799-39] S9A, [9799-41] S9A, [9799-81] S13B  
Bucca, Giuseppe [9803-155] SPTue  
Buonocore, Salvatore [9803-35] S5A  
Buoso, Stefano [9799-82] S13B  
Burton, Andrew R. 9803 S13A Session Chair, 9803 S3B Session Chair, 9803 S4A Session Chair, [9803-29] S3B  
Buscema, Marzia [9797-41] SPTue  
Butsfield, James [9798-20] S5  
Butler, Nathan S. [9803-82] S10A  
Buttlar, William G. [9805-38] S9, [9805-78] S15A  
Butz, Janis [9798-115] SPTues  
Buyukozturk, Oral [9803-126] S14B, [9805-10] S3, [9805-12] S3  
Byeon, Jong Hyun [9806-6] S2
- C**  
Cabeza, Luisa Fernanda [9806-2] S1  
Cadiergues, Laurent [9798-72] S10A  
Cakmak, Enes [9798-5] S2  
Calla, Daniele [9804-29] S8  
Campbell, Bryan [9803-14] S2B  
Cao, Chengyu [9803-32] S4A, [9803-71] S9A  
Cao, Jiawei [9798-59] S9A  
Cao, Junyi [9799-27] S6, [9806-13] S3  
Cao, Liang [9799-91] S14B  
Cao, Rongxiang [9799-127] SPTue, [9806-40] SPTue  
Cao, Weili [9799-127] SPTue, [9806-40] SPTue  
**Cappello, Carlo** [9803-61] S7B  
Capriotti, Margherita [9803-31] S4A  
Carman, Gregory P. [9798-500] SPlen, 9799 Program Committee, 9800 Program Committee  
Carpi, Federico 9798 Program Committee, [9798-20] S5, [9798-4] S1  
Carr, Gary 9804 Program Committee, [9804-34] S9  
Carrara, Matteo [9803-132] S15A  
Carrico, James D. [9798-74] S10A  
Castaldo, Veronica Lucia [9806-2] S1  
Castaño, Nicolas [9803-26] S3B  
Castellanos, Sebastian [9804-12] S3  
Cattaneo, Alessandro [9803-27] S3B, [9803-3] S1B  
Cazzulani, Gabriele 9799 S11B Session Chair, [9799-50] S10A, [9799-68] S11B, [9799-69] S11B, [9803-137] S15B, [9803-50] S6B, [9803-58] S7A, [9803-88] S10B  
Cesmeçi, Sevki [9799-104] S15B  
Cesnik, Carlos E. S. [9805-23] S6, [9805-30] S7  
Chabok, Hamid Reza [9801-20] S4  
**Chahl, Javan S.** [9797-1] S1  
Challita, Elio [9798-36] S7A  
Chan, Chuan-Kai [9803-63] S7B  
Chan, John [9806-5] S2  
Chan, Wilfred K. [9801-3] S1  
Chan, Woei-Leong [9797-15] S6  
Chandra, Suresh 9798 Program Committee  
Chandrasekaran, Srinivasan [9804-40] S11  
Chandrashekhara, K. [9803-72] S9A  
Chang, Chia-Ming [9803-65] S7B  
Chang, Chih Chen 9803 Program Committee, [9803-38] S5A  
Chang, Fu-Kuo [9803-18] S3A, 9805 Program Committee, [9805-68] S14A  
Chang, Hannah R. [9803-132] S15A  
Chang, Longfei [9798-102] SPTues, [9798-106] SPTues  
Chaplya, Pavel M. 9800 Program Committee  
Chatterjee, Punnag [9799-41] S9A  
**Chattopadhyay, Aditi** [9800-42] S10, [9803-79] S9B, [9805-59] S12B, [9806-22] S6  
Chaudhry, Muhammad Salman [9800-37] S9  
**Chaudhuri, Anurag** [9803-156] SPTue, [9803-158] SPTue  
Chaunsali, Rajesh [9805-43] S10  
Cheilakou, Eleni [9806-46] SPTue  
Chen, Bin [9798-20] S5  
Chen, Changru [9805-55] S11  
Chen, Chien-An [9799-117] SPTue  
Chen, Chin-Tsun [9803-86] S10B  
Chen, Genda 9803 Program Committee, 9803 S6A Session Chair, [9803-44] S6A, 9804 Program Committee, 9804 S15 Session Chair, [9804-62] S17  
Chen, Guofeng [9799-130] SPTue  
Chen, Hao [9802-56] SPTue  
Chen, Hao [9797-39] SPTue  
Chen, Hongbing [9804-68] S17  
Chen, Hualing [9798-100] SPTues, [9798-102] SPTues, [9798-70] S10A  
Chen, Kai-Jhong [9801-11] S3  
Chen, Lan [9805-9] S2  
Chen, Liqun [9799-135] SPTue  
Chen, Peng [9799-128] SPTue  
**Chen, Peter C.** 9801 Program Committee  
Chen, Renwen [9799-136] SPTue  
Chen, Shen-En 9804 Program Committee  
Chen, Shiwei [9799-133] SPTue  
Chen, Tzikang [9805-67] S13B  
Chen, Xiaoming [9799-130] SPTue  
Chen, Xiaoming [9804-76] SPTue  
Chen, Xing [9805-54] S11  
Chen, Xinxing [9803-38] S5A  
Chen, Xiuguo [9804-47] S12  
Chen, Yangyang [9805-108] SPTue, [9805-44] S10, [9805-46] S10  
Chen, Yizheng [9803-44] S6A, [9804-62] S17  
**Chen, Yu** [9799-1] S1  
Chen, Zhicheng [9805-100] SPTue  
Cheng, Baokai [9803-179] SPTue  
Cheng, Chia-Chi [9804-19] S6  
Cheng, Li [9803-74] S9A  
Cheng, Tao-Ming [9804-19] S6  
Cheng, Tingyu [9798-21] S5  
Cheng, Wei [9797-34] SPTue  
Cheng, Yong [9805-55] S11  
Cheon, Cheolbyung [9798-95] SPTues  
Chesné, Simon [9798-82] S10B  
Cheung, Ronald C. M. [9799-83] S13B  
**Chiadini, Francesco** 9797 Program Committee  
**Chiang, Chih-Hung** [9804-19] S6, [9804-20] S6, [9804-52] S14, [9804-75] SPTue  
Chiesura, Gabriele [9803-134] S15B  
Chilles, James S. [9804-32] S8  
Chithambaram, Thailammai [9804-40] S11  
Cho, Eun Sang [9803-166] SPTue  
Cho, Kyeong Ho [9798-50] S8A  
Cho, Min-Young [9802-6] S4  
Cho, Nam-Ihn [9798-95] SPTues  
Choeichom, Pongpol [9802-58] SPTue  
Choi, Hyouk Ryeol 9798 Program Committee, [9798-111] SPTues, [9798-112] SPTues, [9798-50] S8A  
Choi, Jae-Young [9798-112] SPTues  
Choi, Jin-Yeong [9800-27] S7  
Choi, Jun-Ho [9798-53] S8B  
**Choi, Sang H.** 9802 Conference CoChair, 9802 S13 Session Chair, 9802 S3 Session Chair, [9802-11] S5, [9802-12] S5, [9802-42] S14, [9802-43] S14  
Choi, Sang Kyu [9799-28] S7  
Choi, Sang-Hoon [9799-10] S3, [9804-18] S6  
Choi, Seung-Bok 9799 Program Committee, 9799 S15B Session Chair, [9799-103] S15B, [9799-106] S15B, [9799-118] SPTue, [9799-125] SPTue, [9799-126] SPTue, [9799-31] S7, [9799-51] S10A, [9802-6] S4  
Cholakova, D. [9798-124] SPTues  
Chou, Yuan-Fang [9801-11] S3  
**Chowdhuri, Abhishek Prabir** [9803-156] SPTue, [9803-158] SPTue  
Christenson, Richard [9803-66] S7B  
Chu, Ki Sum [9803-8] S2A  
Ciampa, Francesco [9804-29] S8  
Cinquemani, Simone [9799-33] S7, [9799-68] S11B, [9800-45] SPTue, [9801-27] SPTue, [9801-28] SPTue, [9803-137] S15B, [9803-88] S10B  
Ciocanel, Constantin 9800 Program Committee, 9800 S8 Session Chair, [9800-15] S3, [9800-18] S5  
Ciufolini, Ignazio [9803-170] SPTue  
Clark, William W. 9799 Program Committee  
Clarke, David R. [9798-43] S7B  
**Clayton, Dwight A.** [9804-49] S13  
Clingman, Dan J. [9801-3] S1, [9801-4] S1  
**Cloud, Gary Lee** [9800-35] S9, [9804-27] S8  
Collet, Manuel [9799-6] S2  
Collins, Justin [9800-1] S1, [9800-3] S1  
Colonius, Tim [9806-36] S10  
Comanns, Philipp [9797-36] SPTue  
**Comot, Pierre** [9804-7] S2  
**Concilio, Antonio** [9801-6] S2, [9801-7] S2, [9803-83] S10A  
Cook, Ireana [9797-26] S9  
Cooper, Jonathan E. [9799-83] S13B  
Corbaci, Mert [9798-69] S9B  
Costa, Andrea [9799-109] S5, [9799-68] S11B, [9803-181] SPTue  
Cotana, Franco [9800-34] S8, [9806-2] S1  
Coustols, Eric [9801-2] S1  
Croxford, Anthony J. [9804-32] S8, 9805 Program Committee, 9805 S12A Session Chair, [9805-85] S15A  
Cruz, Alejandro [9804-12] S3  
Cruz-Gonzalez, Tizoc [9798-61] S9A  
Cui, Fangsen [9800-49] SPTue, [9803-176] SPTue  
Cunefare, Kenneth A. [9799-26] S6, [9799-90] S14B  
Cylinder, David [9798-19] S5  
Czekanski, Aleksander [9800-37] S9
- D**  
Dai, Kaoshan [9804-15] S4  
Dai, Zhendong [9798-54] S8B  
D'Alessandro, Antonella [9800-34] S8, [9803-28] S3B, [9803-46] S6A  
Dalchow, Michael 9806 Program Committee  
Dalla, Panagiota Aikaterini T. [9804-89] SPTue, [9806-41] SPTue  
Dalvi, Aditi [9804-16] S4, [9805-7] S2  
D'Amico, Nicolas [9804-72] SPTue  
Damti, Shirley M. [9801-21] S4  
Dao, Cac Minh [9805-37] S8  
Dao, Kiet T. [9805-37] S8  
Dao, Thanh Duc [9799-30] S7



# INDEX OF AUTHORS, CHAIRS, AND COMMITTEE MEMBERS

**Bold = SPIE Member**

- Dapino, Marcelo J.** 9799 S2  
Session Chair, [9799-9] S2,  
9800 Program Committee, 9801  
Program Committee, [9801-14]  
S3, [9801-25] S5, [9801-26] S5,  
[9803-73] S9A
- Das, Apurba Kumar [9803-28] S3B
- Das, Saptarshi [9803-89] S11A
- Dassios, Konstantinos G. [9806-  
23] S6
- Datta, Siddhant [9800-42] S10,  
[9806-22] S6
- Dauson, Erin R. [9805-49] S11
- Davis, Claire E. [9803-139] S15B,  
[9803-55] S7A
- Davison, Timothy [9797-37] SPTue
- Day, John [9802-43] S14
- De Marqui, Carlos [9799-2] S1,  
[9803-119] S14A, [9803-84]  
S10A
- Debiasi, Marco [9797-15] S6
- deBotton, Gal 9798 Program  
Committee
- Degrieck, Joris [9803-134] S15B
- Delfin, Diego I. [9799-79] S13A
- Deng, Fodan [9803-51] S6B,  
[9803-53] S7A
- Deng, Wei [9799-88] S14A
- Deng, Wen [9803-7] S2A
- Deng, Zhangxian [9801-26] S5
- Denkov, N. [9798-124] SPTues
- Desai, Niranjan 9805 S7 Session  
Chair, [9805-112] SPTue
- Deü, Jean-François [9799-66]  
S11B, [9799-90] S14B
- DeVitis, John [9803-123] S14B,  
[9804-81] SPTue, [9805-89]  
S15B
- DeVries, Lawrence K. [9800-27] S7
- Dhawan, S. K. [9805-111] SPTue
- Dhingra, Shefali [9806-27] S7
- Dhingra, Sunil [9797-42] SPTue
- Dias, Rasika [9801-18] S4, [9801-  
19] S4, [9802-7] S4
- Díaz Montiel, Paulina [9804-83]  
SPTue
- Dicker, Michael P. M. [9797-22] S8
- Dickstein, Leah P. [9803-3] S1B
- Dimino, Ignazio [9801-6] S2,  
[9801-7] S2, [9803-172] SPTue,  
[9803-83] S10A
- Ding, Hu [9799-135] SPTue
- Dinh, Kien [9805-91] S15B
- Diodati, Gianluca [9801-7] S2
- Do, Xuan Phu [9799-126] SPTue
- Donaldson, Steven [9806-17] S5
- Dong, Bo [9803-89] S11A
- Dong, Shuai [9800-9] S2, [9803-  
47] S6A
- Dong, Xinjun [9803-78] S9B,  
[9805-75] S14B
- Dong, Yongkang [9803-75] S9A
- dos Santos e Lucato, Sergio Luis  
9800 Program Committee
- Downey, Austin R. J. [9803-28]  
S3B
- Dragos, Kosmas [9803-124] S14B
- Drinkwater, Bruce Walton [9797-  
10] S4
- Dry, Carolyn 9797 Program  
Committee, 9797 S10 Session  
Chair, [9797-25] S9, [9797-7]  
S3, 9800 S9 Session Chair,  
[9800-29] S7, [9800-32] S7,  
[9801-13] S3
- Du, Jianming [9799-17] S4
- Dubey, Kashyap K. [9797-42]  
SPTue
- Dubuc, Brennan [9805-29] S7
- Duchet-Rumeau, Jannick [9798-  
82] S10B
- Duduta, Mihai [9798-43] S7B
- Duenki, Simon J. [9798-86] S11A
- Dulieu-Barton, Janice M. [9805-  
47] S10
- Dumont, Joseph H. [9803-27] S3B
- Duzik, Adam J. [9802-11] S5,  
[9802-12] S5
- Dzenis, Yuris A. [9797-44] SPTue
- Dziedzic, Kajetan [9803-131]  
S15A, [9805-26] S6, [9805-41]  
S9, [9805-66] S13B
- E**
- Ebendorff-Heidepriem, Heike  
[9803-55] S7A
- Ebert, Reinhard** [9804-17] S5
- Ebrahimkhanlou, Arvin** [9803-  
127] S15A
- Ecke, Wolfgang** 9803 Program  
Committee, 9803 S9A Session  
Chair
- Edwards, Eugene** 9802 Program  
Committee, 9802 S10 Session  
Chair, [9802-1] S1
- Edwards, Robert M. [9799-98]  
S15A
- Ehrenhofer, Adrian [9800-41] S10
- Elahinia, Mohammad H. [9797-12]  
S4, [9802-32] S11, [9802-64]  
SPTue, [9803-84] S10A
- El-Dweik, Majed [9802-49] S15
- Elhaddad, Wael M. [9803-85]  
S10B
- Ellenberg, Andrew [9805-86] S15B
- Elwany, Alaa H. [9804-59] S16
- Engel, Leeya [9798-16] S4
- Erickson, Jon [9797-29] S10
- Erickson, Lisa R. [9799-32] S7
- Erturk, Alper** 9799 Conference  
CoChair, 9799 S1 Session  
Chair, [9799-2] S1, [9799-26]  
S6, [9799-3] S1, [9799-40] S9A,  
[9799-77] S13A, [9799-89]  
S14A, [9806-12] S3
- Escalona, Luis [9804-83] SPTue
- Eshghinejad, Ahmadreza [9800-  
43] S10
- Eskew, Edward** [9803-143] SPTue
- Etouney, Mohammed M. 9803  
S5B Session Chair, [9803-41]  
S5B, [9803-42] S5B, 9804  
Program Committee
- Exarchos, Dimitrios A. [9804-58]  
S16, [9804-89] SPTue, [9806-  
41] SPTue
- F**
- Faidley, LeAnn E. 9800 Program  
Committee
- Faisal, Farjana [9799-101] S15A
- Faisal, Md. Shahnewaz Sabit  
[9806-48] SPTue
- Fakih, Mohammad Ali [9803-95]  
S11A
- Falk, Daniel [9798-17] S4
- Fang, Hongbin [9799-37] S8B
- Fang, Houfei [9799-17] S4
- Fang, Xin [9805-101] SPTue
- Fannir, Adelyne [9798-72] S10A
- Fantozzi, Gilbert [9806-23] S6
- Farace, Nicholas [9805-78] S15A
- Faridazar, Fred [9803-123] S14B
- Farinholt, Kevin M. 9801 Program  
Committee
- Farrar, Charles R. [9803-27] S3B
- Farrow, Ian R. [9799-7] S2
- Fasolt, Bettina [9798-119] SPTues
- Fateh, Mahmood [9799-11] S3,  
[9803-49] S6B, [9804-23] S7
- Faul, Charl F. J. [9797-22] S8
- Feigenbaum, Heidi P. [9800-15] S3
- Felli, Ferdinando [9803-1] S1A,  
[9803-59] S7A
- Feng, Dake [9799-97] S15A, [9803-  
100] S11B
- Feng, Xin [9803-112] S13A
- Feng, Zaichun C. [9805-50] S11
- Fernández Otero, Toribio 9798  
Program Committee
- Fiborek, Piotr [9805-64] S13B
- Fisher, Anita M. [9803-118] S14A
- Fisher, Timothy [9806-36] SPTue
- Flack, Matthew A. [9798-123]  
SPTues
- Flatau, Alison B. 9799 Program  
Committee, 9803 Program  
Committee
- Floreano, Dario [9798-52] S8B
- Flynn, Eric B. [9804-44] S12
- Fontana, Marco 9798 S6A Session  
Chair, [9798-27] S6A, [9798-7]  
S2
- Foroughi, Javad [9798-31] S6B
- Förster-Zügel, Florentine [9798-  
104] SPTues, [9798-115] SPTues
- Frank, Geoffrey J. [9803-113] S13B
- Franke, Jörg [9798-64] S9B
- Franke, Markus [9798-105] SPTues
- Frasch, Duncan [9797-37] SPTue
- Freckler, Talitha [9803-43] S6A
- Frediani, Gabriele [9798-4] S1
- Friswell, Michael I. [9799-44] S9B
- Fröb, Hartmut [9798-105] SPTues
- Fromme, Paul [9803-110] S13A,  
9805 Program Committee,  
9805 S4 Session Chair, 9805  
S5 Session Chair, [9805-28] S7
- Frost, Susan A. 9797 Program  
Committee
- Fu, Ji [9803-106] S12A
- Fu, Xinlei [9799-57] S11A
- Fuerst, Tyler [9798-19] S5
- Fujii, Toru [9800-28] S7
- Fujitani, Ryohei [9800-28] S7
- Furkan, Mustafa O. [9804-81]  
SPTue, [9803-123] S14B
- Furukawa, Hidemitsu** [9800-4]  
S1, 9802 Program Committee,  
[9802-15] S6, [9802-17] S6,  
[9802-18] S7, [9802-19] S7,  
[9802-20] S7, [9802-23] S9,  
[9802-26] S9, [9802-29] S10
- Furumachi, Shogo [9806-33] S10
- Furuya, Yasubumi [9803-1] S1A
- G**
- Gaiennie, Jack [9797-29] S10
- Galea, Steve C. [9803-103] S11B,  
[9803-22] S3A
- Gallagher, John A.** 9800 S2  
Session Chair, [9800-2] S1
- Gallardo, Daniele [9801-1] S1
- Gallone, Giuseppe [9798-4] S1
- Gallucci, Sergio [9798-19] S5
- Gandhi, Farhan S. 9799 Program  
Committee, 9799 S14B Session  
Chair
- Gandhi, Prasanna S. [9797-40]  
SPTue
- Gandhi, Uma [9799-31] S7
- Gandhi, Varun G. M. [9799-61]  
S11A
- Ganesan, Sanchanna [9802-30]  
S10
- Gang, Han-Gyeol [9799-125]  
SPTue
- Gangone, Michael [9803-152]  
SPTue
- Gao, Sunde [9803-160] SPTue
- Gao, Xiaoyuan [9802-38] S13
- Gao, Xinjun [9803-148] SPTue
- Gao, Yunli [9803-185] SPTue
- Gawronski, Mateusz [9805-17] S4
- Gbaguidi, Audrey [9798-34] S6B
- Ge, Cong [9799-64] S11A
- Gei, Massimiliano [9798-4] S1
- Geier, Sebastian M.** [9802-40]  
S13, [9803-81] S10A
- Geiyer, Daniel [9799-19] S5
- Gelinck, Gerwin H. [9798-18] S4
- Gelo, Nikolas J. [9803-107] S12B,  
[9803-48] S6B
- Gentile, Charles A. [9798-19] S5
- Georgakis, Christos [9803-15] S2B
- Gerhard, Reimund** 9798 S5  
Session Chair, [9798-23] S6A
- Ghafoorianfar, Nima [9800-5] S2
- Ghasemi, Majid [9804-78] SPTue
- Ghasemi-Nejhad, Mehrdad N.**  
9799 Program Committee, 9799  
S15A Session Chair, [9799-99]  
S15A, [9803-1] S1A
- Ghods, Mohammad Hadi [9800-7]  
S2
- Ghods, Mojtaba** [9799-93] S14B,  
[9800-45] SPTue, [9800-7] S2,  
[9800-8] S2, [9801-27] SPTue,  
[9801-28] SPTue, [9804-51] S13
- Ghorbani, Reza [9799-99] S15A
- Ghosh Dastider, Shibajyoti [9802-  
49] S15
- Ghosh, Tushar K. [9798-5] S2
- Giappino, Stefano [9799-109] S5
- Giaralis, Agathoklis [9799-53]  
S10B, [9803-39] S5B
- Gibriil, Magdi [9802-21] S7
- Giffney, Timothy J. [9798-14] S4
- Giles, Robert H.** [9806-18] S5
- Ginzburg, Dmitri [9797-38] SPTue
- Giordano, Gerardo [9799-120]  
SPTue, [9803-101] S11B, [9803-  
162] SPTue
- Giri, Paritosh [9803-175] SPTue
- Giurgiutiu, Victor** Meeting VIP,  
9799 Program Committee,  
[9803-54] S7A, [9804-55] S15,  
[9804-9] S2, 9805 Program  
Committee, 9805 S9 Session  
Chair, [9805-113] S14A, [9805-  
56] S12A
- Gkoktsi, Kyriaki [9803-39] S5B
- Glisic, Branko 9803 Program  
Committee, 9803 S5B Session  
Chair, [9805-73] S14B, [9805-  
76] S14B, [9805-77] S14B
- Godaba, Hareesh [9798-59] S9A
- Godinez-Azcuaga, Valery F. 9804  
Program Committee
- Golato, Andrew L. [9805-32] S7
- Goldsberry, Alexander [9798-6] S2
- Gomez Pizano, Daniel [9799-54]  
S10B
- Gong, Jin [9802-19] S7
- Gong, Ling [9797-31] SPTue
- Gong, Peng [9803-129] S15A,  
[9803-133] S15A
- Gong, Xiao-Yan 9801 Program  
Committee
- Goo, Nam Seo [9797-9] S4, 9799  
S7 Session Chair, [9799-18]  
S4, [9799-30] S7, [9800-17] S4,  
[9800-26] S7
- Gopalakrishnan, S. 9802 Program  
Committee, [9802-22] S8,  
[9802-25] S9, 9805 Program  
Committee, 9805 S12B Session  
Chair
- Gopalarathnam, Ashok [9803-102]  
S11B
- Gordaninejad, Faramarz** 9799  
Program Committee, [9799-104]  
S15B, 9800 S7 Session Chair,  
[9800-30] S7, 9803 Program  
Committee, 9803 S2B Session  
Chair, [9803-12] S2B
- Gorgin, Rahim [9805-33] S7

# INDEX OF AUTHORS, CHAIRS, AND COMMITTEE MEMBERS

Bold = SPIE Member

- Goulbourne, Nakhiah C. 9799 Program Committee, 9799 S8B Session Chair, 9800 Conference Chair, 9800 S1 Session Chair
- Grabowski, Krzysztof [9803-24] S3B, [9805-17] S4
- Gregory, Kelvin B. [9805-49] S11
- Greve, David W. [9803-129] S15A, [9803-133] S15A, [9805-49] S11
- Griffin, Steven F. 9801 Conference Chair, 9801 S1 Session Chair, 9801 S5 Session Chair
- Grigaliunas, Viktoras [9802-59] SPTue
- Grill, Julian [9805-69] S14A
- Grill, Wolfgang** 9805 Conference CoChair, 9805 S1 Session Chair, 9805 S14A Session Chair, [9805-61] S13A, [9805-69] S14A
- Grotepaß, Tanja [9798-115] SPTues
- Groves, Roger M.** [9804-28] S8
- Grunthaner, Frank J. [9803-118] S14A
- Gu, Guo-Ying [9798-32] S6B
- Gucunski, Nenad 9804 Program Committee, [9805-91] S15B
- Guha, Anurup [9805-35] S7
- Guiel, Roger [9800-15] S3
- Guinto, Jed A. [9804-54] S15
- Guo, Chanrui [9804-62] S17
- Gupta, Ashok [9805-110] SPTue
- Gupta, Gautam [9803-27] S3B
- Gupta, Ujjaval [9798-32] S6B, [9798-87] S11A
- Gurka, Martin [9801-15] S3, [9801-9] S2
- Guyomar, Daniel J. 9799 Program Committee, 9805 Program Committee
- Gyekenyesi, Andrew L. 9804 Conference CoChair, 9804 S2 Session Chair, 9804 S8 Session Chair
- H**
- Ha, Ngoc San [9797-9] S4, [9799-18] S4, [9799-30] S7
- Ha, Tae-Jun [9802-54] SPTue
- Hablani, Surbhi [9798-19] S5
- Haddad Khodaparast, Hamed [9799-44] S9B
- Hafezi, Mohammad Hadi** [9805-25] S6, [9805-27] S6
- Hagenbeek, Michiel [9804-28] S8
- Haghdoust, Pouya [9799-33] S7
- Hahn, Gregory G. [9799-138] SPTue
- Hahn, Heidi A. [9803-3] S1B
- Haji Hosseinloo, Ashkan [9799-59] S11A
- Hakim, Issa A. A. [9806-17] S5
- Hall, Jeffery L. [9801-10] S3
- Hallén-Grufman, Katarina [9798-57] S8B
- Halvorsen, Einar [9799-49] S10A
- Ham, Junsu [9803-166] SPTue
- Ham, Sang Yong [9799-28] S7
- Ham, Suyun [9804-24] S7, [9804-67] S17
- Hamburg, Edgar [9798-35] S7A, [9798-56] S8B
- Hamdy, Hany S. [9805-97] SPTue
- Hamid, Ahmad A. [9804-36] S10
- Hammami, Saber [9798-28] S6A
- Hammel, Emily [9803-183] SPTue
- Han, Byeong-Hee [9806-28] S8
- Han, Chulhee [9799-51] S10A
- Han, Hyo Seung [9798-111] SPTues
- Han, Jae-Hung** [9797-35] SPTue, 9799 Program Committee, 9799 S13B Session Chair, [9799-137] SPTue
- Han, Ruicong [9804-74] SPTue
- Han, Soonhung [9803-80] S9B
- Han, Yilong [9797-14] S5
- Han, Yue [9799-20] S5
- Hand, James [9799-20] S5
- Hanish Nithin, Anu [9806-7] S2
- Hanke, Ulrik [9799-49] S10A
- Hao, Menglong [9806-39] SPTue
- Haq, Mahmoodul [9800-35] S9, [9804-27] S8
- Haran, Shivan [9802-14] S5
- Hardman, William [9804-8] S2
- Harley, Joel B. [9803-133] S15A, [9805-106] SPTue
- Harne, Ryan L. 9799 S5 Session Chair, [9799-20] S5, [9799-8] S2
- Hartl, Darren J. [9799-32] S7, 9800 Program Committee, 9800 S3 Session Chair, [9800-10] S3, [9803-113] S13B
- Hasan, Samiul [9797-11] S4
- Hashimoto, Riho [9797-39] SPTue
- Hau, Steffen [9798-12] S3
- Haus, Henry [9798-104] SPTues
- Hay, Thomas R. [9803-129] S15A
- He, Jiaze [9804-31] S8
- He, Qingsong [9798-54] S8B
- Headings, Leon M. [9801-25] S5
- Healy, Gregory P. [9805-49] S11
- Heath, Callum J. C. [9799-84] S13B
- Hedric, Andrew [9804-15] S4
- Hefzy, Mohamed Samir [9802-32] S11
- Hegde, Bharathkumar [9803-104] S11B
- Hegger, Christian [9799-107] S15B, [9799-108] S15B
- Hehr, Adam J. [9801-14] S3, [9803-73] S9A
- Heilmann, Peter 9806 Program Committee
- Helmicki, Arthur J. [9804-16] S4, [9805-7] S2
- Hemmatian, Masoud [9799-102] S15B
- Hemmet Abiri, Elham [9803-85] S10B
- Henderson, Benjamin K.** 9803 Program Committee
- Henke, Markus 9798 S10A Session Chair, [9798-2] S1
- Hieber, Simone E. [9797-11] S4
- Hihara, Lloyd [9803-1] S1A
- Hilbich, Daniel 9802 Program Committee
- Hilbich, Daniel D. [9802-27] S10
- Hinojosa, Moises [9802-8] S4
- Hirai, Kenta [9805-11] S3
- Hirayama, Yuki [9803-34] S4B, [9806-38] SPTue
- Hirose, Mitsuhiro [9803-70] S8B
- Hitchner, Robert [9798-19] S5
- Hodges, Deidra [9799-79] S13A
- Hodgins, Micah W. [9798-119] SPTues
- Hoell, Simon [9806-19] S5
- Hoffman, Dan [9798-19] S5
- Hoffstadt, Thorben [9798-122] SPTues, [9798-75] S10B, [9798-84] S11A
- Hojjat, Yousef [9800-45] SPTue, [9801-27] SPTue, [9801-28] SPTue, [9804-51] S13
- Holness, Frederick Benjamin** [9798-46] S8A
- Homer, Martin [9798-26] S6A
- Honarvar, Farhang [9804-51] S13
- Hong, Chenkai [9803-148] SPTue
- Hong, Gwangwook [9802-48] S15
- Hong, Jung-Wuk 9803 Program Committee, 9803 S15A Session Chair, [9803-128] S15A
- Hong, Seok Bin [9800-17] S4, [9800-26] S7
- Hong, Seung-Chan [9799-15] S3
- Hong, Yu [9803-78] S9B
- Hongu, Junichi [9799-121] SPTue
- Horiuchi, Tetsuya [9798-91] SPTues
- Hoshyarmanesh, Hamidreza [9800-7] S2
- Hou, Shuang [9803-112] S13A
- Hou, Tsung-Chin [9804-46] S12, [9804-56] S15
- Hoult, Neil A. 9803 Program Committee
- Housley, Kevin [9801-4] S1
- Howden, Stephen [9806-30] S8
- Howell, Geoffrey P. [9805-47] S10
- Hsieh, Yu-Chieh [9806-34] S10
- Hsu, Jui-Mei [9801-11] S3
- Hsu, Keng-Tseng [9804-19] S6, [9804-75] SPTue
- Hsu, Yi [9803-114] S13B
- Hu, Dianying [9799-36] S8A, [9803-121] S14A
- Hu, Gengkai [9805-55] S11
- Hu, Jie [9799-96] S15A
- Hu, Minyi [9805-107] SPTue
- Hu, Wei [9798-60] S9A
- Hu, Weitong [9804-74] SPTue
- Huang, Chi-Luen [9804-19] S6
- Huang, Guoliang [9799-92] S14B, 9805 Program Committee, 9805 S10 Session Chair, 9805 S11 Session Chair, [9805-108] SPTue, [9805-44] S10, [9805-46] S10
- Huang, Haiying** 9803 Program Committee, 9803 S14A Session Chair, [9803-36] S5A
- Huang, Hui [9802-60] SPTue
- Huang, Jie** [9803-179] SPTue
- Huang, Shieh-Kung [9803-65] S7B, [9803-86] S10B
- Huang, T. W. [9799-87] S14A
- Huang, Xiaoqiang [9798-63] S9B
- Huang, Ying 9803 Program Committee, 9803 S7A Session Chair, [9803-51] S6B, [9803-53] S7A
- Huang, Yishuo [9804-20] S6, [9804-75] SPTue
- Huang, Yong [9803-62] S7B
- Huang, Zhenhua 9804 S3 Session Chair, 9804 S4 Session Chair, [9804-15] S4
- Huang, Zhilong [9798-21] S5
- Hubbard, James E.** Meeting VIP
- Hübler, Moritz [9801-15] S3, [9801-9] S2
- Hudson, Emma J. [9799-70] S11B
- Huff, Daniel [9803-79] S9B
- Huff, Gregory H. [9803-113] S13B
- Huffer, Fred W. [9803-90] S11A
- Hugo, Ron [9806-32] S9
- Hunt, Victor J. [9804-16] S4, [9805-7] S2
- Hunter, Ian W. [9798-121] S8A
- Hunze, Arvid [9804-64] S17
- Hussain, Naveed [9798-501] SPlen
- Huston, Dryver R.** 9804 Program Committee, [9804-2] S1
- Huynh, Thanh-Canh [9799-10] S3, [9804-38] S10
- Hwang, Dae-Hyeon [9799-137] SPTue
- Hwang, Gisuk [9802-65] SPTue
- Hwang, Hyun-Sik [9800-20] S5
- Hwang, Tae [9798-113] SPTues, [9798-38] S7A, [9798-39] S7A, [9798-66] S9B
- Hyde, Tupper 9799 Program Committee
- I**
- Iba, Daisuke [9799-121] SPTue, [9803-161] SPTue
- Ibrahim, Alwathiqbellah [9806-11] S3
- Ieropoulos, Ioannis [9798-58] S9A
- Iervolino, Onorio [9797-38] SPTue, [9799-116] SPTue
- Iglesias, Sophie [9798-82] S10B
- Ikeda, Tadashige [9800-48] SPTue
- Illenberger, Patrin K.** [9798-25] S6A
- Imamura, Hiroya [9798-41] S7B, [9798-83] S10B
- Inman, Daniel J.** 9799 Program Committee, 9800 Program Committee, [9806-13] S3
- Iravani, Pejman [9798-117] SPTues
- Ismail, Yahya A. 9798 Program Committee
- J**
- Jaakson, Paul [9798-71] S10A
- Jablonski, Adam [9805-66] S13B, [9806-16] S5
- Jafari, Bahman [9805-94] SPTue
- Jager, Edwin W. H. 9798 Program Committee, 9798 S7B Session Chair, [9798-17] S4, [9798-57] S8B
- James, Steve [9805-62] S13A
- Jang, Jae-Kyeong [9799-137] SPTue
- Jang, Joon Hyeok [9800-17] S4, [9800-26] S7
- Jang, Kwang-Yeop** [9799-123] SPTue
- Jang, Seon Jun [9799-24] S6
- Jang, Shinae 9803 Program Committee, 9803 S2B Session Chair, [9803-14] S2B, [9803-143] SPTue, [9803-66] S7B
- Jannelli, Elio [9803-115] S13B
- Janusas, Giedrius** 9798 Program Committee, [9802-59] SPTue
- Jape, Sameer [9800-11] S3
- Jaskowiak, Martha H. [9806-25] S7
- Jean-Mistral, Claire [9798-28] S6A, [9798-4] S1, [9798-82] S10B
- Jenkins, Tyler [9799-38] S8B
- Jennings, Kane [9803-43] S6A
- Jeon, Jun Young [9799-13] S3
- Jeon, Junyoung [9802-54] SPTue
- Jeon, Min Yong** [9803-140] S15B, [9806-6] S2
- Jeong, Chanseok [9803-130] S15A
- Jeong, Jong-Hyun [9803-107] S12B
- Jeong, Seongwoon [9803-40] S5B
- Jeong, Soon Cheol [9798-111] SPTues
- Jhang, Jia-Jyun [9804-20] S6
- Jia, Ao [9799-36] S8A
- Jia, Buyu [9805-16] S3
- Jia, Hongduo [9797-31] SPTue
- Jia, Shuhai [9798-102] SPTues
- Jiang, Hao** [9804-47] S12
- Jiang, Jiechao [9802-7] S4
- Jiang, Longtao [9800-39] S9
- Jiang, Peng [9799-75] S12B
- Jiang, Shanying [9803-146] SPTue
- Jiang, Shuidong [9799-17] S4
- Jiang, Xiaoning** [9803-102] S11B, 9804 Program Committee, 9805 Program Committee, 9805 S14A Session Chair
- Jiang, Zhaoshuo** [9803-66] S7B
- Jiao, Bo [9803-160] SPTue
- Jin, Chenhao [9803-66] S7B
- Jin, Seung-Seop [9803-76] S9B
- Jin, Su Yeong [9803-128] S15A



# INDEX OF AUTHORS, CHAIRS, AND COMMITTEE MEMBERS

**Bold = SPIE Member**

Jing, Lin [9799-27] S6  
Jo, Eun-byul [9802-3] S2  
**Jo, Hongki** [9803-107] S12B,  
[9803-153] SPTue, [9803-30]  
S3B, [9803-48] S6B  
Johannes, Manfred 9806 Program  
Committee  
Johanson, Urmaz [9798-35] S7A,  
[9798-55] S8B, [9798-56] S8B  
Johnson, Connor D. 9799 Program  
Committee  
Johnson, Erik A. 9803 S10B  
Session Chair, [9803-85] S10B  
Johnson, Nancy L. 9801 Program  
Committee  
Johnston, Joel [9805-59] S12B  
Jomni, Fathi [9798-28] S6A  
**Joshi, Bhriгу** [9803-92] S11A  
Jung, George [9803-22] S3A  
Jung, Hosang [9798-50] S8A  
Jung, Hwee Kwon [9801-12] S3  
Jung, Hyung-Jo 9799 Program  
Committee, 9799 S6 Session  
Chair, [9799-24] S6, 9803 S9B  
Session Chair, [9803-76] S9B  
Jung, Jaemin [9799-35] S8A  
Jung, Sungmoon [9803-90] S11A  
Junker, Warren R. [9803-129]  
S15A, [9803-133] S15A

## K

Kaal, William [9798-4] S1  
Kaasik, Friedrich [9798-56] S8B  
Kacem, Najib [9799-86] S14A  
Kadlec, Alec [9800-24] S6  
Kadooka, Kevin [9798-41] S7B,  
[9798-83] S10B  
Kaduskar, Shreya S. [9799-29] S7  
Kaewchingduang, Rattanapond  
[9799-113] SPTue  
Kafy, Abdullahil [9802-3] S2,  
[9802-63] SPTue  
Kake, Fumika [9803-171] SPTue  
Kakkur, Shantnu [9801-23] S5  
Kaluvan, Suresh [9799-106] S15B,  
[9799-31] S7  
Kameyama, Toshiki [9802-26] S9  
Kamimoto, Takahiro [9803-161]  
SPTue  
Kamillah, Marc 9800 Program  
Committee  
Kandasamy, Ramkumar [9800-49]  
SPTue, [9803-176] SPTue  
Kang, Donghoon [9804-43] S11

Kang, Doo In [9798-111] SPTues  
Kang, To [9799-13] S3  
Kapoor, Kartik [9799-101] S15A  
Karaca, Haluk E. 9800 Program  
Committee  
Karami, M. Amin [9803-109] S13A,  
[9803-9] S2A  
Karim, Hasanul [9799-79] S13A  
Karpenko, Oleksii Y. [9800-35] S9,  
[9804-27] S8  
Karthus, Olaf 9797 Program  
Committee  
Kauffman, Jeffrey L. 9799 S11B  
Session Chair, [9799-19] S5,  
[9799-71] S11B  
Kaur, Amardeep [9803-151] SPTue,  
[9803-72] S9A  
Kawakami, Masaru [9802-17] S6,  
[9802-18] S7, [9802-19] S7,  
[9802-20] S7, [9802-23] S9,  
[9802-26] S9, [9802-29] S10  
Keddis, Sherif [9799-43] S9A  
Keller, Kevin [9803-3] S1B  
Kenny, Josè M. [9803-46] S6A  
Keogh, Patrick S. [9798-117]  
SPTues  
Kessler, Seth S. [9804-8] S2  
Kettle, Ryan A. [9805-65] S13B  
Khalidi, A. [9798-124] SPTues  
Khalidi, Alexandre [9798-17] S4  
Khaleeq, Hyder [9803-122] S14B  
Khalili, Nazanin [9800-50] S6  
Khaloo, Ali [9804-35] S10, [9805-  
94] SPTue  
Khan, Asif [9802-53] SPTue  
Khan, Waseem S. [9806-49] S10  
Kharisov, Boris [9801-18] S4,  
[9801-19] S4, [9802-7] S4  
Kharissova, Oxana V. [9801-18]  
S4, [9801-19] S4, [9802-7] S4,  
[9802-8] S4  
Kharkovskiy, Sergey [9803-175]  
SPTue  
Khazaeli, Shervin [9805-96] SPTue  
Khimchenko, Anna [9797-11] S4  
Khine, Michelle [9799-34] S7  
Khodabandeloo, Babak [9803-153]  
SPTue  
Khomenko, Anton [9800-35] S9,  
[9804-27] S8  
Khosla, Ajit 9802 Program  
Committee, 9802 S4 Session  
Chair, 9802 S6 Session Chair,  
[9802-10] S5  
Khosraviani, Mohammad Javad  
[9804-78] SPTue

Kiefer, Rudolf [9798-48] S8A  
Kijanka, Piotr [9803-131] S15A,  
[9805-26] S6, [9805-41] S9,  
[9805-66] S13B, [9806-16] S5  
Kim, Bae-Yeon [9798-89] SPTues  
Kim, Byungchul [9803-169] SPTue  
Kim, Cheol [9803-138] S15B  
Kim, Chun-Gon [9805-105] SPTue  
Kim, Daewon [9798-34] S6B,  
[9806-21] S6  
Kim, Eunho [9805-103] SPTue,  
[9805-43] S10  
Kim, Gi-Woo [9802-6] S4  
Kim, Hee Ju [9803-166] SPTue,  
[9803-169] SPTue, [9804-69]  
SPTue  
Kim, Heung Soo [9802-53] SPTue  
**Kim, Hyun Wook** [9799-124]  
SPTue  
Kim, Hyun-Chan [9802-34] S12,  
[9802-35] S12, [9802-37] S12,  
[9802-63] SPTue  
Kim, Il-Sik [9806-28] S8  
Kim, In-ho [9799-24] S6  
Kim, Jaehwan 9802 Conference  
CoChair, 9802 S12 Session  
Chair, [9802-3] S2, [9802-34]  
S12, [9802-35] S12, [9802-36]  
S12, [9802-37] S12, [9802-38]  
S13, [9802-63] SPTue  
Kim, Jaehwan [9798-42] S7B  
Kim, Jeong-Tae [9799-10] S3,  
9803 Program Committee,  
[9804-18] S6, [9804-38] S10  
Kim, Jeong-Woong [9802-36] S12  
Kim, Jin-Gyun [9800-17] S4,  
[9800-26] S7  
Kim, Jin-Hyuk [9805-105] SPTue  
Kim, Jin-Tae [9798-95] SPTues  
Kim, Jinwook [9803-102] S11B  
Kim, Jinyoung [9805-91] S15B  
Kim, Ji-Sik [9802-6] S4  
Kim, Jongsung [9802-42] S14  
Kim, Joo-Hyung [9802-48] S15  
Kim, Junhee 9803 Program  
Committee  
Kim, Ju-Won [9804-43] S11  
**Kim, Kwang Jin** 9798 Program  
Committee, 9798 S9A Session  
Chair, [9798-113] SPTues,  
[9798-38] S7A, [9798-39] S7A,  
[9798-45] S8A, [9798-66] S9B,  
[9798-80] S10B, 9800 Program  
Committee, 9800 S1 Session  
Chair, [9800-47] SPTue  
Kim, Min Hyuck [9802-42] S14,  
[9802-45] S14, [9802-47] S15

Kim, Namgyu [9804-41] S11,  
[9804-82] SPTue  
Kim, Sang-Youn [9802-35] S12,  
[9802-38] S13  
Kim, Se Young [9799-28] S7  
Kim, Sung Joon [9798-112]  
SPTues  
Kim, Tae Heon [9803-166] SPTue,  
[9803-169] SPTue, [9804-69]  
SPTue  
Kim, Tae Heun [9799-18] S4  
Kim, Tae-Hwan [9799-10] S3,  
[9804-18] S6, [9804-38] S10  
Kim, Taeyang [9803-102] S11B  
Kim, Teajin [9802-24] SPTue  
Kim, UiKyum [9798-111] SPTues  
Kim, Yong Hyun [9803-174] SPTue  
Kimberley, Jamie [9803-26] S3B  
Kimura, Mutsumi [9798-41] S7B  
Kinlen, Patrick [9798-123] SPTues  
Kintscher, Markus [9803-81] S10A  
Kiremidjian, Anne S. [9803-15]  
S2B, [9803-60] S7B  
Kirschmeier, Benjamin [9799-39]  
S9A  
Kjolsing, Eric J. [9799-76] S12B,  
[9799-95] S15A  
Klepka, Andrzej P. [9803-131]  
S15A, [9805-39] S9  
Kliwer, Kaitlyn S. [9805-73] S14B  
Knez, Kyle P. [9803-107] S12B  
Knez, Mato 9797 Conference  
CoChair, 9797 S2 Session  
Chair, 9797 S9 Session Chair,  
[9797-6] S3  
Ko, Hyun-u [9802-34] S12, [9802-  
35] S12, [9802-37] S12, [9802-  
38] S13  
Ko, Yee Song [9798-49] S8A  
Kobayashi, Sou [9797-39] SPTue  
Kofod, Guggi [9798-4] S1, [9798-  
87] S11A  
Koga, Yuki [9799-110] SPTue  
Koh, Adrian 9798 S9B Session  
Chair, [9798-13] S3  
**Kolle, Mathias** 9797 S8 Session  
Chair, [9797-17] S7  
Kollosche, Matthais [9798-4] S1,  
[9798-20] S5, [9798-87] S11A  
Kolluru, V.L. Subramaniam [9805-  
109] SPTue  
Komurasaki, Kimiya 9802 Program  
Committee  
Konduru, Vamsi Krishna [9798-34]  
S6B  
Kong, Xiangxiong [9803-99] S11B

Kongkaew, Wanar [9798-96]  
SPTues  
Kontsos, Antonios [9804-36] S10,  
[9805-86] S15B  
Koo, Bonsung [9800-42] S10  
Koo, Helen S. [9805-70] S14A  
Koo, Ja Choon [9798-112] SPTues,  
[9798-50] S8A  
Koo, Jeong-Hoi [9799-24] S6  
Kopsaftopoulos, Fotis [9803-18]  
S3A, [9805-68] S14A  
**Kordatos, Evangelos Z.** [9804-  
58] S16  
Kordatou, Theodoti Z. [9806-42]  
SPTue  
Koricho, Ermias G. [9800-35] S9,  
[9804-27] S8  
Kornbluh, Roy D. [9798-4] S1  
Kornev, Kostya 9797 S4 Session  
Chair, [9797-4] S3  
Koseko, Tatsuro [9803-34] S4B  
**Koshti, Ajay M.** [9804-57] S16  
**Koskelo, EliseAnne C.** [9804-44]  
S12  
Kostecki, Roman [9803-55] S7A  
Kotal, Moumita [9798-42] S7B  
Kovacs, Gabor M. 9798 Program  
Committee, [9798-116] SPTues  
**Krishnaswamy, Sridhar** [9802-  
55] SPTue, 9805 Program  
Committee, [9805-79] S15A,  
[9805-84] S15A  
Kroening, Michael 9806 Program  
Committee  
Kroner, Elmar [9797-20] S7  
Krueger, Peter [9806-31] S9  
Krüger, Hartmut [9798-44] S7B  
Krutz, Gary W. [9798-110] SPTues  
Kruusmaa, Maarja 9798 Program  
Committee  
Krylov, Slava [9798-16] S4  
Kshad, Mohamed Ali E. [9800-16]  
S4  
Kudela, Pawel [9805-2] S1, [9805-  
24] S6  
**Kudva, Jayanth N.** Symposium  
Chair, 9801 Program  
Committee  
**Kujawinska, Malgorzata** [9803-  
141] SPTue  
Kumagai, Hiroaki [9802-19] S7,  
[9802-29] S10  
Kumar Agrawal, Anil [9799-48]  
S9B  
Kumar, Amrita 9801 Program  
Committee

Kumar, Prasoon [9797-40] SPTue  
Kumberg, Timo [9804-66] S17  
Kundu, Tribikram Symposium  
Chair, 9805 Conference Chair,  
9805 S1 Session Chair, [9805-  
18] S4, [9805-25] S6, [9805-27]  
S6, [9805-37] S8  
Kurata, Masahiro 9803 Program  
Committee  
Kurfess, Thomas R. [9804-50]  
S13, [9805-63] S13A  
Kurian, Agee S. [9798-14] S4  
Kwon, Dong-Jun [9800-27] S7  
Kwon, Heejung [9805-105] SPTue  
Kwon, Il-Bum [9806-28] S8,  
[9806-6] S2  
Kwon, Roy H. [9800-50] S6

## L

La, Thanh-Giang [9798-8] S2  
Lafamme, Simon 9799 S10B  
Session Chair, [9799-91] S14B,  
9803 Program Committee,  
9803 S6A Session Chair,  
[9803-28] S3B, [9803-46] S6A,  
[9803-99] S11B, 9804 Program  
Committee  
Lagoudas, Dimitris C. 9800  
Program Committee, 9800 S3  
Session Chair, [9800-11] S3,  
[9800-13] S3  
**Lakhtakia, Akhlesh** 9797  
Conference CoChair, 9797 S3  
Session Chair, 9797 S5 Session  
Chair, 9797 S6 Session Chair,  
[9797-19] S7  
Lam, Yan Pui [9803-4] S1B  
Lamkin-Kennard, Kathleen [9798-  
69] S9B  
Lan, Lan [9799-17] S4  
Landgraf, Maximilian [9798-64]  
S9B  
Landis, Chad M. 9800 Program  
Committee  
Lanza di Scalea, Francesco  
[9799-11] S3, 9803 Program  
Committee, [9803-31] S4A,  
[9803-49] S6B, [9804-23] S7,  
9805 Program Committee,  
[9805-80] S15A  
Lassen, Benny [9798-4] S1  
**Lattanzi, David** [9804-35] S10,  
[9805-94] SPTue



Lau, Denvid 9804 Program Committee, 9804 S11 Session Chair, 9804 S12 Session Chair, 9804 S13 Session Chair, [9804-48] S12, [9804-88] SPTue

Lau, Gih-Keong [9798-65] S9B, [9798-8] S2

Laurent, Elisabeth [9798-72] S10A

Law, Kincho H. [9803-40] S5B, [9803-87] S10B

Lawand, Lydia [9803-145] SPTue, [9803-52] S6B

Laws, Michael [9803-21] S3A

Le, Edward [9802-33] S12

**Le, Viet Q.** [9804-25] S7, [9804-3] S1

Leadenham, Stephen M. [9799-26] S6, [9799-40] S9A, [9799-77] S13A, [9799-89] S14A

Leamy, Michael J. [9805-19] S5

Leang, Kam K. [9798-74] S10A, 9800 Program Committee

Lecce, Leonardo [9801-5] S2

Lecis, Nora [9799-25] S6, [9799-33] S7

Leckey, Cara A. C [9805-4] S1

Lee, Bong Wan [9803-140] S15B

Lee, Chang Seop [9799-18] S4

Lee, Chang Won [9801-12] S3

Lee, Chan-hee [9803-138] S15B

Lee, Christopher L. [9797-32] SPTue

Lee, Dasom [9799-35] S8A

Lee, Deuk Yong [9798-89] SPTues, [9798-95] SPTues

Lee, Dong Jun [9803-94] S11A

Lee, Dong-Chan [9798-66] S9B

Lee, Dong-Gun [9799-123] SPTue, [9799-124] SPTue

Lee, Ho-Geun [9802-6] S4

Lee, Hyeong Jae [9805-36] S8

Lee, Hyeong Jae [9806-36] S10

Lee, James [9799-123] SPTue

Lee, Jameson Y. [9800-47] SPTue

Lee, Jea Uk [9800-38] S9, [9802-4] S2, [9803-149] SPTue

Lee, Jim [9798-14] S4

Lee, Juho [9799-137] SPTue

Lee, Jung-Ryul 9799 S3 Session Chair, [9799-137] SPTue, [9799-15] S3

Lee, Jung-Yong [9798-53] S8B

Lee, Junmin [9802-24] SPTue

Lee, Kang Eun [9803-149] SPTue

Lee, Kunik 9802 Program Committee

Lee, Kwani [9803-174] SPTue

Lee, Myung jun [9799-13] S3

Lee, SangEon [9803-128] S15A

Lee, Seongmin [9802-31] S11

Lee, Seung-Woo [9803-107] S12B

Lee, Soobum [9801-22] S5, [9806-35] S10

Lee, Sung-Min [9806-26] S7

Lee, Uhn 9802 Program Committee, [9802-42] S14

Lee, Wonoh [9800-38] S9, [9802-4] S2, [9803-149] SPTue

Lee, Woo Il [9799-35] S8A

Lei, Haochuan [9803-4] S1B

Lei, Hong [9798-109] SPTues, [9798-73] S10A

Lei, Zhenda [9798-107] SPTues

**Leng, Jinsong** 9798 Program Committee, 9798 S6A Session Chair, [9798-10] S3, [9798-22] S5, [9798-93] SPTues, 9799 S14A Session Chair, [9799-85] S14A

Leo, Donald J. 9800 Program Committee, 9801 Program Committee

Leo, Karl [9798-105] SPTues

Leon, Lider [9800-1] S1

Lesov, I. [9798-124] SPTues

Leung, Jonthan [9805-71] S14A

Leung, Vanessa Y. F. [9797-21] S8, 9798 S6B Session Chair, [9798-67] S9B, [9798-68] S9B

Levy, Cesar [9803-184] SPTue

Lewis, Derek A. [9801-10] S3

Li, Bin [9803-186] SPTue

Li, Bin [9800-9] S2

Li, Bing [9804-68] S17

Li, Bo [9798-102] SPTues, [9798-11] S3

Li, Chi [9798-101] SPTues

Li, Dichen [9798-70] S10A

Li, Dongsheng [9804-84] SPTue

Li, Faxin [9803-106] S12A

Li, Fengwu [9805-9] S2

Li, Guorui [9798-103] SPTues, [9798-21] S5, [9798-51] S8A

Li, Heng [9798-106] SPTues

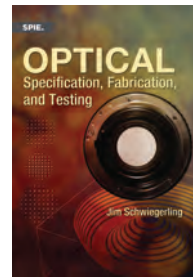
Li, Hui 9803 Program Committee, 9803 S7B Session Chair, [9803-17] S3A, [9803-62] S7B, [9803-75] S9A, [9804-73] SPTue, [9805-100] SPTue

Li, Hui [9806-39] SPTue

Li, Jian [9803-16] S2B, [9803-99] S11B, [9805-107] SPTue

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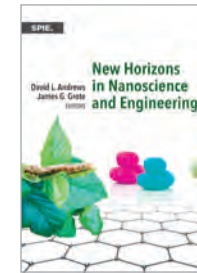
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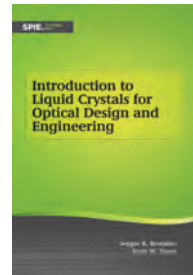
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# INDEX OF AUTHORS, CHAIRS, AND COMMITTEE MEMBERS

Bold = SPIE Member



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- Li, Jianguy 9800 Program  
Committee, 9800 S5 Session  
Chair, [9800-21] S5, [9800-43]  
S10
- Li, Kaiyuan [9799-4] S1, [9803-7]  
S2A
- Li, Lianghai [9803-121] S14A
- Li, Mingchu [9804-11] S3, [9804-  
74] SPTue
- Li, Quan [9799-74] S12A
- Li, Rong [9797-31] SPTue
- Li, Rui [9799-111] SPTue, [9799-  
133] SPTue, [9803-120] S14A,  
[9803-164] SPTue
- Li, Songsong [9804-76] SPTue
- Li, Suchao [9799-122] SPTue,  
[9803-144] SPTue
- Li, Suyi [9799-37] S8B
- Li, Tiefeng** [9798-101] SPTues,  
[9798-103] SPTues, [9798-21]  
S5, [9798-51] S8A
- Li, Xi [9805-77] S14B
- Li, Xiaoning [9797-33] SPTue
- Li, Xinxin 9802 Program  
Committee
- Li, Yaguang [9802-35] S12, [9802-  
36] S12, [9802-38] S13
- Li, Yong [9805-45] S10
- Li, Yongzhe [9799-18] S4
- Li, Yu-Hung [9803-18] S3A, [9805-  
68] S14A
- Li, Zhaochao [9804-62] S17
- Liang, Dong [9805-95] SPTue
- Liang, Gang [9799-12] S3
- Liang, Junrui 9799 Program  
Committee, 9799 S13A Session  
Chair, [9799-64] S11A
- Liang, Li [9803-186] SPTue
- Liang, Yiming [9798-101] SPTues,  
[9798-103] SPTues, [9798-51]  
S8A
- Liao, Wei-Hsin 9799 Program  
Committee, 9799 S11A Session  
Chair, [9799-57] S11A, 9803  
Program Committee, [9803-8]  
S2A
- Liao, Yanjian 9802 Program  
Committee
- Liao, Yizheng [9803-15] S2B,  
[9803-60] S7B
- Liebig, Andrew [9800-18] S5
- Liew, Hyunjeong [9802-45] S14
- Liffland, Stephanie [9798-19] S5
- Lih, Shyh-Shiuh [9805-36] S8
- Lim, Sungyeop [9803-80] S9B
- Lin, Bin [9803-54] S7A, [9804-85]  
SPTue, [9806-30] S8
- Lin, Chi-Chang [9799-45] S9B
- Lin, Hua-Tay [9806-26] S7
- Lin, Qianyu [9801-23] S5
- Lin, Sun Chiu [9799-87] S14A
- Lin, Ting-Kai [9806-34] S10
- Lin, Weiwei** [9803-184] SPTue
- Lin, Yirong [9799-79] S13A
- Lipowski, Mathias [9801-2] S1
- Lis, Jerzy [9803-19] S3A
- Litchford, Ron [9802-5] S3
- Liu, Bo [9799-128] SPTue
- Liu, Chao [9798-60] S9A
- Liu, Haili [9799-64] S11A
- Liu, Hong [9804-10] S3
- Liu, Jiayu [9798-100] SPTues
- Liu, Jinhong 9806 Program  
Committee
- Liu, Junjie [9798-51] S8A, [9798-  
63] S9B
- Liu, Liwu [9798-22] S5, [9798-93]  
SPTues, [9799-85] S14A
- Liu, Minghanbo [9802-61] SPTue
- Liu, Peipei [9805-40] S9
- Liu, ShengSheng [9799-27] S6
- Liu, Shiyuan** [9804-47] S12
- Liu, Xi [9803-78] S9B, [9805-75]  
S14B
- Liu, Xiaotong [9803-159] SPTue,  
[9803-165] SPTue
- Liu, Yanju [9798-10] S3, [9798-22]  
S5, [9798-93] SPTues, [9799-  
85] S14A
- Liu, Yilun [9799-45] S9B
- Liu, Yingtao Y. [9803-114] S13B
- Liu, Yuqian [9803-32] S4A, [9803-  
71] S9A
- Liu, Yu-Wei [9804-46] S12
- Liu, Zheng** [9804-30] S8
- Llewellyn-Jones, Thomas M.  
[9797-10] S4
- Lloyd, Stephen [9803-130] S15A
- Lo, Tommy [9804-90] S10
- Loh, Chin-Hsiung 9803 Program  
Committee, 9803 S7B Session  
Chair, [9803-60] S7B, [9803-63]  
S7B, [9803-86] S10B
- Loh, Kenneth J.** 9803 Program  
Committee, 9803 S11B  
Session Chair, 9804 Program  
Committee, [9805-70] S14A
- Long, James [9803-126] S14B
- Lopp, Garrett K. [9799-71] S11B
- Lormor, Stephen [9805-47] S10
- Lossouarn, Boris [9799-66] S11B,  
[9799-90] S14B
- Love, Norman [9799-79] S13A
- Low, Hong Yee [9797-13] S4
- Loyola, Bryan R.** 9803 Program  
Committee
- Lu, Qingqing [9798-10] S3, [9799-  
85] S14A
- Lu, Xuanming [9797-33] SPTue
- Luan, Lele [9804-68] S17
- Lucas, Michael [9797-1] S1
- Luo, Meng [9798-70] S10A
- Luyckx, Geert [9803-134] S15B
- Lynch, Christopher S. 9800  
Program Committee
- Lynch, Jerome P.** [9797-26]  
S9, 9803 Conference Chair,  
[9803-29] S3B, [9803-40] S5B,  
[9803-70] S8B, 9804 Program  
Committee, 9805 Program  
Committee
- Lyu, Xiongfei [9798-22] S5, [9798-  
93] SPTues

## M

- Ma, David T. [9803-10] S2A
- Ma, Linlin [9806-30] S8
- Ma, Tong [9803-32] S4A, [9803-71]  
S9A
- Maas, Jürgen [9798-122] SPTues,  
[9798-75] S10B, [9798-84] S11A,  
[9799-107] S15B, [9799-108]  
S15B
- Mace, Brian R. [9799-135] SPTue
- Macke, David C. [9803-151] SPTue
- MacLeod, Marc [9799-81] S13B
- Macutis, Tony [9804-64] S17
- Madan, Alok [9805-110] SPTue
- Madawala, Udaya K. [9798-25]  
S6A
- Madden, John D. W. 9798  
Program Committee, SC634
- Madinei, Hadi [9799-44] S9B
- Magnifico, Marco [9801-5] S2,  
[9801-6] S2, [9803-83] S10A
- Maheshwari, Muneesh** [9803-68]  
S8A
- Mahmoodi, S. Nima [9799-72]  
S11B
- Mahmoudi, Mehdi [9804-51] S13
- Mahmoudi, Mohamad [9804-59]  
S16
- Mahrholz, Thorsten [9802-40] S13
- Main, John A. [9798-503] SPlen
- Maio, Leandro [9805-31] S7
- Majewska, Katarzyna [9805-81]  
S15A
- Majumder, Mainak [9797-40]  
SPTue

# INDEX OF AUTHORS, CHAIRS, AND COMMITTEE MEMBERS

Bold = SPIE Member

- Makino, Masato [9802-26] S9  
**Mal, Ajit K.** [9805-58] S12B  
Malakooti, Mohammad H. [9799-73] S12A, [9800-20] S5, [9800-36] S9  
Maleckis, Kaspars [9797-44] SPTue  
Malesa, Marcin [9803-141] SPTue  
Malfense Fierro, Gian Piero [9804-29] S8, [9804-45] S12  
Malinowski, Pawel H. [9805-24] S6, [9805-64] S13B  
Malowany, Krzysztof [9803-141] SPTue  
Manka, Michal [9803-23] S3A  
Manoharan, Vignesh [9806-21] S6  
Mantilla López, Juan S. [9799-54] S10B  
Mao, Chenxi [9803-144] SPTue  
Mao, Guoyong [9798-63] S9B  
Mao, Qiang [9803-123] S14B, [9804-81] SPTue  
Mao, Yongfang [9805-98] SPTue  
Mao, Zhu [9805-60] S13A  
Marathe, Meeshawn S. [9799-139] SPTue  
Marchi, Alexandria N. [9803-27] S3B  
Marian, Laurentiu [9799-53] S10B  
Mariani, Stefano [9803-31] S4A, [9804-23] S7  
Mark, Patrick [9798-19] S5  
Martin, David [9803-21] S3A  
Martin, Robert [9806-18] S5  
**Martinez-Castro, Rosana E.** [9803-14] S2B  
Martino, Nicole [9805-90] S15B  
**Martin-Palma, Raúl Jose** 9797 Conference Chair, 9797 S1 Session Chair, 9797 S7 Session Chair  
Martowicz, Adam [9803-23] S3A, [9805-41] S9  
Marulanda, Johannio [9804-12] S3  
Mascareñas, David D. 9799 Program Committee, 9799 S6 Session Chair, 9803 Program Committee, 9803 S12A Session Chair, 9803 S1B Session Chair, [9803-27] S3B, [9803-3] S1B, [9805-92] S15B, [9805-93] S15B  
Masceri, David R. [9805-88] S15B, [9805-89] S15B  
Maser, Kenneth R. [9805-90] S15B  
**Masson, Patrice** [9804-6] S2  
Masuda, Arata [9797-39] SPTue, [9799-110] SPTue, [9799-22] S5  
Materazzi, Annibale Luigi [9800-34] S8, [9803-46] S6A  
**Matikas, Theodoros E.** Symposium Chair, 9803 Program Committee, 9803 S11A Session Chair, 9804 Program Committee, 9804 S16 Session Chair, [9804-58] S16, [9804-89] SPTue, 9806 Conference CoChair, 9806 S10 Session Chair, 9806 S9 Session Chair, [9806-23] S6, [9806-41] SPTue, [9806-42] SPTue, [9806-43] SPTue, [9806-46] SPTue  
Matysek, Marc [9798-4] S1  
May, Daniel [9806-17] S5  
Maziz, Ali [9798-17] S4, [9798-57] S8B  
Mazzocchi, Fabrizio [9799-50] S10A  
Mazzotti, Matteo [9803-123] S14B, [9804-81] SPTue  
McAdam, Grant [9803-55] S7A  
McCrea, John [9805-59] S12B  
McCullagh, James [9799-80] S13A  
McCulloch, Toni [9804-41] S11, [9804-82] SPTue  
McGovern, Megan E. [9805-38] S9  
McHenry, Matthew [9798-73] S10A  
McKnight, Geoffrey P. 9801 Program Committee  
Mehdipour, Iman [9799-25] S6  
Mei, Jun [9805-104] SPTue, [9805-51] S11  
Mei, Wenbin [9799-36] S8A  
Meier, Philip [9798-122] SPTues  
Meixler, Lewis D. [9798-19] S5  
Melvin, Dyan [9803-153] SPTue  
Melz, Tobias 9801 Program Committee  
Memmolo, Vittorio [9805-3] S1, [9805-31] S7  
**Mendez, Alexis** [9803-56] S7A  
Menicovich, David [9801-1] S1  
Meo, Michele [9797-38] SPTue, [9799-116] SPTue, [9804-29] S8, [9804-45] S12, [9804-53] S15  
Merkel, Ulrich [9798-105] SPTues  
Mesbah, Mostefa [9799-93] S14B  
Meyendorf, Norbert G. 9803 Program Committee, 9803 S3A Session Chair, 9806 Conference Chair, 9806 S10 Session Chair, 9806 S3 Session Chair, 9806 S5 Session Chair, 9806 S9 Session Chair, [9806-17] S5, [9806-20] S6, [9806-31] S9  
Meyer, Michael [9801-2] S1  
Miao, Hongchen [9800-25] S6  
Miceli, Marybeth [9799-16] S3  
Michael, Duncan M. [9797-32] SPTue  
Michaelis, Alexander 9806 Program Committee, 9806 S1 Session Chair, [9806-20] S6  
Michaels, Jennifer E. 9805 Program Committee, [9805-1] S1  
Michaels, Thomas E. [9805-1] S1  
Michel, Silvain A. [9798-4] S1  
Milani, Damiano [9803-181] SPTue  
Miller, Karen A. [9803-27] S3B  
Min, Jae-Hong [9803-107] S12B, [9803-48] S6B  
Min, Seung-Ki [9802-34] S12  
Minei, Brenden [9799-99] S15A  
Mirsadeghi, Seyed Mehdi [9806-32] S9  
Mirshekari, Mostafa [9803-4] S1B  
Mirvakili, Seyed Mohammad [9798-121] S8A  
Mirzaabedini, Sohrab [9799-60] S11A  
Mirzaeifar, Reza [9797-12] S4, [9800-14] S3  
**Mishra, Spandan** [9803-90] S11A  
Missinne, Jeroen [9803-134] S15B  
Miszczyński, Mateusz [9803-19] S3A  
**Mita, Akira** 9803 Program Committee, 9803 S13B Session Chair, [9803-171] SPTue, [9803-6] S1B, [9805-11] S3, [9805-13] S3, [9805-14] S3, [9805-99] SPTue  
Mitra, Mira [9805-22] S5  
Miura, Nanako [9799-112] SPTue, [9799-55] SPTue  
**Mo, Zonglai** [9802-56] SPTue  
Moeinkhah, Hossein [9798-88] SPTues  
Möeßinger, Holger [9798-104] SPTues  
Mohammadi Ghazi, Reza [9805-10] S3  
Mohite, Aditya D. [9803-27] S3B  
Mokhtari, Soroush [9804-37] S10, [9805-5] S2  
Monaco, Ernesto [9805-3] S1, [9805-31] S7  
Monner, Hans Peter [9799-83] S13B, [9803-81] S10A  
Monro, Tanya M. [9803-55] S7A  
Moon, Franklin L. [9803-123] S14B, [9805-86] S15B, [9805-87] S15B, [9805-88] S15B, [9805-89] S15B  
Moon, Hyungpil [9798-112] SPTues, [9798-50] S8A  
Moon, Sungnam [9799-35] S8A  
Moretti, Giacomo [9798-27] S6A  
Moriwaki, Ichiro [9799-121] SPTue, [9803-161] SPTue  
Moshier, Monty [9799-16] S3  
Mossi, Karla M. 9800 Program Committee  
Moura, Adriane [9799-89] S14A  
Moy, Leon [9798-19] S5  
Mpalaskas, Anastasios C. [9806-43] SPTue, [9806-44] SPTue  
Mrad, Nezhir [9804-30] S8  
Mrlik, Miroslav [9799-77] S13A  
Mu, Wenjun [9803-120] S14A  
Mujumdar, Prasanna M. [9805-22] S5  
Mukherjee, Sushovan [9802-25] S9  
Müller, Bernhard [9804-28] S8  
**Müller, Bert** 9797 Program Committee, [9797-11] S4, [9797-21] S8, [9797-41] SPTue, [9798-116] SPTues, [9798-67] S9B, [9798-68] S9B  
Mun, Seongcheol [9802-34] S12  
Murat, Bibi I. S. [9805-28] S7  
Müsse, Annika [9797-27] S9  
Mustapha, Samir [9803-95] S11A  
**Myers, Oliver J.** 9804 Program Committee  
**N**  
Na, Won-Bae 9805 Program Committee  
Naficy, Sina [9798-31] S6B  
Naga, Naofumi [9800-4] S1  
Nagayama, Tomonori 9803 Program Committee  
Naguib, Hani E. 9800 Conference CoChair, 9800 S2 Session Chair, [9800-16] S4, [9800-19] S5, [9800-23] S6, [9800-50] S6  
Nakakoji, Hayato [9799-55] SPTue  
Nakamura, Morimasa [9799-121] SPTue, [9803-161] SPTue  
Nakshatharan, Sunjai [9798-55] S8B, [9798-85] S11A  
**Nam, Jae-Do** [9798-50] S8A  
Nam, Jungsoo [9798-66] S9B  
Nam, Yong-Youn [9800-17] S4  
Nanda, Aditya [9803-109] S13A  
Narayanan, Arun [9805-109] SPTue  
Nardari, Raphael [9805-68] S14A  
Narwal, Abhijeet [9797-23] S8  
Nasr Esfahani, Ehsan [9800-21] S5  
Nasr Esfahani, Sajedah [9797-12] S4  
Nasrollahi, Amir [9803-7] S2A  
Neely, Lincoln [9797-29] S10  
Neerukatti, Rajesh Kumar [9803-79] S9B  
Nelson, Levi [9799-16] S3  
Nemat-Nasser, Siavouche 9798 Program Committee  
Newell, Brittany [9798-110] SPTues  
Newton, Rielly G. [9799-63] S11A  
Ngo, Khai [9799-117] SPTue  
Nguyen, Anh Tuan [9797-35] SPTue  
Nguyen, Cuong H. [9799-49] S10A  
Nguyen, Dien [9803-189] S7A  
Nguyen, Dung Sy [9799-118] SPTue  
Nguyen, Hoa [9797-37] SPTue  
Nguyen, Quoc-Viet [9797-15] S6  
Nguyen, Thao [9799-34] S7  
Nguyen, The M. [9799-105] S15B, [9799-132] SPTue  
Nguyen, Thompson V. [9804-23] S7, [9805-80] S15A  
Nguyen, Tien Dat [9798-111] SPTues  
Nguyen, Tran-Minh-Giao [9798-72] S10A  
Nguyen, Tuan-Cuong [9799-10] S3, [9804-18] S6, [9804-38] S10  
Ni, Yiqing 9803 Program Committee, 9803 S14B Session Chair  
Nickels, Kevin [9797-37] SPTue  
Niezrecki, Christopher 9801 Program Committee, [9804-39] S10, 9805 Program Committee, 9805 S5 Session Chair, [9806-18] S5  
Nishimura, Isao [9799-56] S10B  
Nissle, Sebastian [9801-15] S3, [9801-9] S2  
Njoroge, Ian [9803-43] S6A  
Noble, Nick [9797-29] S10  
Nodarse, Robert [9798-19] S5  
Noell, Aaron C. [9803-118] S14A  
**Noh, Haeyoung** 9803 Program Committee, 9803 S1B Session Chair, [9803-4] S1B, [9803-5] S1B  
Norman, Patrick [9803-139] S15B  
Norouzi, Mehdi [9804-16] S4, [9805-7] S2  
Nowak, Stephan [9798-4] S1  
Nüesch, Frank A. [9798-49] S8A, [9798-86] S11A  
Nurhazli, Nur Azmira Elena [9804-14] S4  
Nyawako, Donald S. [9799-70] S11B  
**O**  
Oates, William S. 9800 S10 Session Chair, [9800-1] S1, [9800-3] S1, SC1188  
O'Brien, Benjamin M. [9798-24] S6A, [9798-4] S1, [9798-79] S10B  
Ogawa, Ami [9803-6] S1B  
Oh, Hyunseok [9802-24] SPTue  
Oh, Il-Kwon [9798-42] S7B, [9798-53] S8B, 9802 Program Committee, [9802-39] S13  
Oh, Jung-Hwan [9802-39] S13  
O'Handley, Robert C. 9800 Program Committee  
Ohashi, Takahiro [9798-108] SPTues  
Ohayon, Roger 9799 Program Committee, 9799 S14B Session Chair  
Oka, Kosuke [9800-48] SPTue  
Okabe, Shinya [9803-1] S1A, [9803-116] S13B, [9803-178] SPTue, [9803-34] S4B  
Okada, Koji [9802-18] S7, [9802-20] S7  
Okoli, Okenwa O. [9803-183] SPTue



# INDEX OF AUTHORS, CHAIRS, AND COMMITTEE MEMBERS

Bold = SPIE Member

- Okubo, Kazuya [9800-28] S7  
Olawale, David O. [9803-183] SPTue  
Omenzetter, Piotr 9804 Program Committee, 9804 S3 Session Chair, 9804 S4 Session Chair, 9804 S6 Session Chair, [9804-13] S4, 9806 Program Committee, 9806 S4 Session Chair, [9806-19] S5, [9806-7] S2  
Omid, Ehsan [9799-72] S11B  
Ong, Hui-Yng [9798-65] S9B  
Opoka, Szymon R. [9805-64] S13B  
**Oppenheim, Irving J.** 9803 Program Committee, 9803 S15A Session Chair, [9803-129] S15A, [9803-133] S15A, [9805-49] S11  
Oppermann, Martin [9806-31] S9  
Opris, Dorina M. [9798-49] S8A, [9798-86] S11A  
Ortega, Beatriz [9801-18] S4, [9802-8] S4  
Osmani, Bekim [9798-116] SPTues, [9798-67] S9B, [9798-68] S9B  
Ostachowicz, Wieslaw M. 9803 Program Committee, 9803 S13A Session Chair, 9805 Program Committee, 9805 S12B Session Chair, 9805 S7 Session Chair, [9805-2] S1, [9805-24] S6, [9805-64] S13B, [9805-81] S15A, 9806 S6 Session Chair, [9806-15] S4  
Ota, Takafumi [9802-20] S7  
Ott, Benjamin M. [9797-27] S9  
Ou Yang, QingHua [9803-165] SPTue  
Ou, Jinping 9803 Program Committee, [9803-125] S14B, [9804-11] S3, [9804-74] SPTue  
Ouisse, Morvan [9799-6] S2  
Ounaies, Zoubeida [9798-120] SPTues, 9800 Program Committee, 9800 S5 Session Chair, [9800-22] S6  
Owusu Twumasi, Jones [9804-25] S7, [9804-26] S7, [9804-3] S1  
Ozawa, Sayuki [9805-99] SPTue  
Ozer, Abdullah [9799-93] S14B, [9800-7] S2, [9800-8] S2  
Ozer, Ozkan 9799 S10A Session Chair, [9799-52] S10A  
Ozevin, Didem 9804 Program Committee, [9804-8] S2  
**P**  
Packo, Pawel [9803-19] S3A, [9803-24] S3B, [9805-17] S4, [9805-19] S5, [9805-26] S6  
Page, C. [9803-189] S7A  
**Pai, Perngjin F.** 9805 Program Committee, 9805 S2 Session Chair  
Paipetis, Alkiviadis [9804-33] S8, [9804-86] SPTue  
Pakzad, Shamim N. 9803 Program Committee  
Palacios, Rafael [9799-82] S13B  
Palagummi, Sri Vikram [9799-62] S11A  
**Palevicius, Arvydas** [9802-59] SPTue  
Palevicius, Paulius [9802-59] SPTue  
Paley, Derek A. [9798-73] S10A  
Palmieri, Frank L. [9803-102] S11B  
Palmre, Viljar [9798-39] S7A, [9798-45] S8A, [9800-47] SPTue  
Pan, Chieh-Chen [9804-19] S6  
Pan, Hong [9803-113] S13B  
Pan, Hui [9799-75] S12B  
Pan, Shijia [9803-4] S1B, [9803-5] S1B  
Panciroli, Riccardo [9803-115] S13B  
Pandey, Akash [9803-105] S12A  
Pang, John Hock Lye [9803-68] S8A  
Paolozzi, Antonio [9803-1] S1A, [9803-170] SPTue, [9803-59] S7A  
Papadakis, Vassilis M. [9804-28] S8  
Paradee, Nophawan [9799-119] SPTue  
Paris, Claudio [9803-170] SPTue, [9803-59] S7A  
Park, Cheol Hoon [9799-28] S7  
Park, Choon-Su [9806-28] S8  
Park, Gyuhae 9799 Conference Chair, 9799 S1 Session Chair, 9799 S12A Session Chair, 9799 S14A Session Chair, [9799-13] S3, 9801 Program Committee, 9801 S4 Session Chair, [9801-12] S3  
Park, Harold 9798 S4 Session Chair, [9798-9] S3  
Park, Hoon Cheol [9797-16] S6  
Park, Jae-Hyung [9804-38] S10  
Park, Jin Woo [9803-140] S15B  
Park, Jin-Ho [9799-13] S3  
Park, Jinkyoo [9803-87] S10B  
Park, Joung-Man [9800-27] S7  
Park, Jungwoo [9798-50] S8A  
Park, Junwoo [9798-111] SPTues  
Park, Ki-Tae [9803-166] SPTue, [9803-169] SPTue, [9804-69] SPTue  
Park, Kyeongtaek [9803-188] SPTue  
Park, Seunghee 9803 Program Committee, [9804-43] S11  
Park, Simon [9806-32] S9  
Park, Sungho [9799-35] S8A  
Park, Won Hyun [9805-18] S4  
Park, Yurim [9805-105] SPTue  
Pascal, Kevin [9798-110] SPTues  
Paschew, Georgi [9798-105] SPTues  
Patil, Mayuresh J. [9799-42] S9A  
Patoor, Etienne 9800 Program Committee  
Patra, Karali [9798-33] S6B  
Patra, Subir [9805-21] S5  
Patterson, Brendan A. [9800-20] S5  
Pavlis, Erricos C. [9803-170] SPTue  
Peckens, Courtney [9797-26] S9  
Pecora, Rosario [9801-5] S2, [9801-6] S2, [9803-172] SPTue, [9803-83] S10A  
Pegan, Jonathan [9799-34] S7  
**Pei, Qibing** 9798 Program Committee, 9798 S11A Session Chair, [9798-4] S1, [9798-6] S2, [9798-60] S9A, SC634  
Pei, Yongmao [9804-4] S1, [9805-42] S9, [9805-54] S11  
Peikolainen, Anna-Liisa [9798-48] S8A  
Pelrine, Ron [9798-4] S1  
Peng, Tongxiao [9803-177] SPTue, [9804-63] S17  
Pereira, Carlos M. [9799-97] S15A  
Petcharoen, Karat [9798-92] SPTues  
**Peters, Kara J.** 9803 Program Committee, 9803 S8A Session Chair, 9803 S9A Session Chair, [9803-135] S15B, [9803-2] S1A, 9806 Conference CoChair, 9806 S2 Session Chair, 9806 S7 Session Chair, 9806 S8 Session Chair  
Pflueger, Jeffery B. [9797-32] SPTue  
Phan, Hoang Vu [9797-16] S6  
Phasuksom, Katesara [9802-57] SPTue  
Phenisee, Sean E. [9805-103] SPTue  
Philen, Michael K. 9803 Program Committee, 9803 S13B Session Chair  
Pieczonka, Lukasz J. [9803-131] S15A, [9805-39] S9  
Piekarczyk, Artur [9803-141] SPTue  
Pinto, Fulvio [9797-38] SPTue  
Piselli, Cristina [9806-2] S1  
Pisello, Anna Laura [9800-34] S8, [9806-2] S1  
Plesse, Cédric [9798-124] SPTues, [9798-72] S10A  
Poddar, Banibrata [9804-55] S15, [9805-56] S12A  
Pometto, Suellen [9797-4] S3  
Popovics, John S. [9803-111] S13A  
Porfiri, Maurizio 9797 Program Committee  
Potter, Jack [9805-85] S15A  
Potter, Kevin D. [9799-84] S13B  
Poulin, Alexandre [9798-15] S4  
Poursaee, Amir [9803-45] S6A  
Powlesland, Ian G. [9803-22] S3A  
Prabhakaran, Jayesh [9803-96] S11A  
**Pradhan, Aswini K.** 9802 Program Committee  
Preciado, Monica [9804-12] S3  
Price, Aaron D. 9798 S4 Session Chair, [9798-40] S7B, [9798-46] S8A  
Prillaman, Daniel [9798-19] S5  
Pruvost, Sébastien [9798-82] S10B  
Pu, Qianhui [9803-78] S9B  
Punning, Andres [9798-35] S7A, [9798-55] S8B, [9798-85] S11A  
Purdy, Geraldine M. [9803-27] S3B  
Purtov, Julia [9797-20] S7  
**Q**  
Qi, Zhong-Qiang [9805-6] S2  
Qian, Hui [9799-129] SPTue, [9803-148] SPTue  
Qian, Li-Jun [9797-34] SPTue, [9799-128] SPTue, [9799-75] S12B  
Qiao, Jing [9800-39] S9  
Qin, Xiaoyu [9803-121] S14A  
Qin, Yi [9805-98] SPTue  
Qing, Xinlin 9805 Program Committee, [9805-95] SPTue  
Qiu, Jinhao [9803-74] S9A  
**Qiu, Qiwen** [9804-48] S12, [9804-88] SPTue  
Qiu, Yu [9798-6] S2, [9798-60] S9A  
Qu, Shaoxing [9798-63] S9B  
Qu, Wenzhong [9799-130] SPTue  
Quaegebeur, Nicolas [9804-6] S2  
Quigley, Elizabeth [9806-22] S6  
**R**  
Raad, Bahram [9802-64] SPTue  
Radu, Valentin 9798 Program Committee  
Radzienski, Maciej [9805-2] S1, [9805-81] S15A  
Rafert, James B. [9803-108] S12B  
Rai, Ashwin [9800-42] S10  
Rajadas, Abhishek [9803-79] S9B  
Rajagopal, Ram [9803-15] S2B, [9803-60] S7B  
Rajaram, Satish [9804-36] S10  
Rajic, Nik [9803-103] S11B, [9803-139] S15B, [9803-22] S3A  
Rallini, Marco [9803-46] S6A  
Ramasamy, Mouli 9802 S15 Session Chair, 9802 S9 Session Chair, [9802-44] S14, [9802-46] S14, [9802-52] S16  
Randriamahazaka, Hyacinthe 9798 S8A Session Chair  
Randriamahazaka, Hyacinthe [9798-29] S6B  
Rantz, Robert K. [9801-24] S5  
Rasmussen, Lenore 9798 S7B Session Chair, [9798-19] S5  
**Rastegar, Jahangir** [9799-97] S15A, [9803-100] S11B  
Rastgaar Aagaah, Mohammad 9799 Program Committee  
Rathod, Vivek T. [9803-23] S3A  
Raut, Hemant K. [9797-13] S4  
Ravandi, Amir G. [9805-96] SPTue  
Ravindran, Akila [9799-31] S7  
Razzaghi-Kashani, Mehdi 9798 Program Committee  
**Reagan, Daniel R.** [9804-39] S10  
Rechenbach, Björn [9798-4] S1  
Reich, Gregory Symposium Chair, [9803-69] S8B, [9803-82] S10A  
Reilly, Jack [9805-74] S14B  
Reindl, Leonhard M. [9804-66] S17  
Reis, Henrique L. 9805 Program Committee, 9805 S15A Session Chair, 9805 S2 Session Chair, [9805-38] S9, [9805-78] S15A  
Reitelschöfer, Sebastian [9798-64] S9B  
Ren, Fei [9806-5] S2  
**Ren, Long** [9799-136] SPTue  
Ren, Zhi [9798-6] S2, [9798-60] S9A  
Resta, Ferruccio [9799-68] S11B, [9803-155] SPTue, [9803-181] SPTue, [9803-50] S6B  
**Reynolds, Paul** [9799-70] S11B, 9803 Program Committee  
Riahi, Mohammad [9804-61] S16, [9804-70] SPTue, [9804-71] SPTue  
Riascos, Carlos [9799-46] S9B  
Ricci, Fabrizio [9805-3] S1, [9805-31] S7  
Richards, W. Lance 9801 Program Committee  
Richter, Andreas [9798-105] SPTues, [9800-41] S10  
Riemenschneider, Johannes [9799-83] S13B  
Ripamonti, Francesco [9803-155] SPTue, [9803-50] S6B  
Rizzo, Piervincenzo [9799-4] S1, [9803-7] S2A, 9805 Program Committee  
Robinson, Ethan [9803-3] S1B  
**Rodrigues de Oliveira Zanini, Plinio** [9798-26] S6A  
Rodriguez Lopez, Ricardo [9803-161] SPTue  
Roh, Yongrae 9802 Conference CoChair, [9802-31] S11  
Romano, Rocco [9799-120] SPTue, [9803-101] S11B, [9803-162] SPTue  
Romero, Michael [9803-26] S3B  
Ronchi, Marco [9803-137] S15B  
Rony Shagor, Rifath Mahmud [9800-51] S8  
Rosalie, Cédric [9803-139] S15B  
Rose, Francis [9804-54] S15  
Rosenblum, Jean-Pierre [9801-2] S1  
Rosenthal, Sandra J. [9803-43] S6A  
Rosset, Samuel [9798-15] S4, [9798-4] S1, [9798-52] S8B, [9798-81] S10B



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# INDEX OF AUTHORS, CHAIRS, AND COMMITTEE MEMBERS

**Bold = SPIE Member**

- Rossiter, Jonathan M. [9797-22] S8, 9798 Program Committee, 9798 S8B Session Chair, [9798-26] S6A, [9798-58] S9A
- Rossman, Chase [9798-34] S6B
- Rostron, Paul [9803-52] S6B
- Rotenberg, Yonatan [9803-184] SPTue
- Roundy, Shad [9801-23] S5, [9801-24] S5
- Roy Mahapatra, Debiprosad** 9802 Program Committee
- Roy, Avirup** [9803-156] SPTue, [9803-158] SPTue
- Ru, Jie [9798-102] SPTues
- Ruan, Tao [9803-45] S6A
- Ruffin, Paul B.** 9802 Program Committee, [9802-1] S1
- Ruzzene, Massimo 9803 Program Committee, [9803-132] S15A, [9804-6] S2
- Ryu, Donghyeon** 9803 S3B Session Chair, [9803-26] S3B
- Ryu, Joo-Young [9804-18] S6
- S**
- S., Dinesh N. [9803-104] S11B
- Saberi, Abouhamed [9798-37] S7A
- Sachdeva, Payal [9805-15] S3
- Sadeghian, Hesam [9801-27] SPTue
- Sadoullet-Reboul, Emeline [9799-6] S2
- Safaei, Mohsen [9799-100] S15A
- Saharan, Lokesh [9797-30] S10
- Saini, Abhishek [9798-33] S6B
- Saini, Aditya [9803-102] S11B
- Saito, Akira** 9797 Program Committee
- Saito, Azusa [9802-17] S6, [9802-18] S7, [9802-20] S7
- Sakai, Kazuyuki [9802-17] S6, [9802-19] S7, [9802-29] S10
- Sakaly, Rokas [9802-59] SPTue
- Salahuddin, Mohammad [9802-65] SPTue
- Salamone, Salvatore [9803-127] S15A, [9805-29] S7
- Salazar-Ferro, Andres [9803-56] S7A
- Saleem, Ashraf [9799-93] S14B, [9800-7] S2, [9800-8] S2
- Salmanpour, Mohammad S. [9803-167] SPTue
- Salvino, Liming W. 9803 Program Committee
- Sambuco, Sara [9800-34] S8
- Sandberg, Eric [9798-19] S5
- Sandt, Joseph D. [9797-17] S7
- Sanford, Larry D. [9802-45] S14
- Sano, Shigenori [9798-108] SPTues
- Santhanam, Sridhar [9805-32] S7
- Sarker, MD Rashedul Hasan [9799-79] S13A
- Sarrafi, Aral [9805-60] S13A
- Sasamoto, Akira 9804 Program Committee
- Sassoon, Aaron M. [9801-4] S1
- Sater, Janet M. 9801 Program Committee
- Sato, Hiroshi [9806-38] SPTue
- Sato, Takeru [9799-22] S5
- Scarpa, Fabrizio [9799-6] S2
- Scarselli, Gennaro [9797-38] SPTue
- Schaal, Christoph [9805-58] S12B
- Scheidler, Justin J. [9799-9] S2, [9801-26] S5
- Schlaak, Helmut F. [9798-104] SPTues, [9798-115] SPTues
- Schoenberg, Andrew [9806-18] S5
- Schomer, John J. [9803-73] S9A
- Schreckengost, Ronald D. [9803-7] S2A
- Schueller, Martin [9801-2] S1
- Schulz, Georg [9797-11] S4
- Schwerter, Martin [9803-117] S14A
- Schwesinger, Norbert 9799 Program Committee, 9799 S10A Session Chair, [9799-43] S9A
- Scruggs, Jeffrey T. 9799 S13A Session Chair, [9799-80] S13A, 9803 Program Committee
- Sedaghati, Ramin [9799-102] S15B
- Seelecke, Stefan S. [9798-119] SPTues, [9798-12] S3
- Seidel, Gary D. 9800 S6 Session Chair, [9800-31] S7
- Seikh, Asiful [9806-47] SPTue
- Sekiguchi, Akio [9800-8] S2
- Semperlotti, Fabio** 9803 Program Committee, 9803 S5A Session Chair, [9803-35] S5A, [9805-53] S11
- Sen, Mihir [9803-35] S5A
- Senake Ralalage, Buddhi Wimarshana [9804-79] SPTue
- Sengezer, Engin** [9800-31] S7
- Seok, Ilwoo [9802-14] S5
- Seong, Dong Gi [9803-149] SPTue
- Sethi, Manik S. [9797-32] SPTue
- Shabbir, Faisal [9804-13] S4
- Shacham-Diamand, Yosi [9798-16] S4
- Shafer, Michael W. [9799-138] SPTue
- Shahinpoor, Mohsen [9798-37] S7A, [9803-1] S1A
- Shahriar, Shaimum [9799-79] S13A
- Shan, Baohua [9803-185] SPTue
- Shane, Dylan [9803-43] S6A
- Shankwitz, Timothy J. [9800-36] S9
- Sharif Khodaei, Zahra [9803-167] SPTue
- Sharif, Montassar A. [9798-109] SPTues, [9798-73] S10A
- Sharifi, Safura [9802-2] S2, [9802-9] S4
- Sharma, Ashutosh [9805-15] S3
- Sharma, Sandeep [9805-15] S3
- Sharma, Shruti [9805-15] S3
- Shaw, John A.** [9800-12] S3
- Shayesteh Moghaddam, Narges [9802-64] SPTue
- Shayesteh Moghaddam, Narges [9797-12] S4
- Shea, Herbert R. 9798 S2 Session Chair, 9798 S9A Session Chair, [9798-15] S4, [9798-4] S1, [9798-52] S8B, [9798-81] S10B
- Shen, Qi [9798-39] S7A, [9798-45] S8A, [9798-66] S9B, [9800-47] SPTue
- Shen, Yanfeng [9805-23] S6
- Shen, Yanfeng [9805-113] S14A
- Shen, Yu [9803-185] SPTue
- Sherrit, Stewart [9801-10] S3, [9803-118] S14A, [9803-97] S11B, [9806-36] S10
- Sheth, Rubik B. [9799-32] S7
- Sheykholeslami, Mohammad Reza [9800-45] SPTue, [9800-7] S2, [9801-27] SPTue, [9801-28] SPTue
- Shi, HaoTian Harvey [9800-19] S5, [9800-23] S6
- Shi, Yuting [9803-134] S15B
- Shiao, Chi-Yu [9805-67] S13B
- Shimazu, Kelli N. [9797-32] SPTue
- Shin, Pyeong-Su [9800-27] S7
- Shintake, Jun [9798-52] S8B
- Shiryayev, Oleg [9803-145] SPTue, [9803-52] S6B
- Shishir, Md. I. [9802-3] S2
- Shohag, Md Abu S. [9803-183] SPTue
- Shoja, Siavash [9806-4] S2
- Shrestha, Pratik [9805-105] SPTue
- Shu, Yi-Chung 9799 Program Committee, [9799-87] S14A
- Shuai, Qi [9799-12] S3
- Shukla, Himanshu [9799-42] S9A
- Shull, Peter J. 9804 Conference CoChair, 9804 S10 Session Chair, 9804 S16 Session Chair
- Shuvo, Mohammad Arif I. [9799-79] S13A
- Sidorov, Gennady [9804-64] S17
- Siesakul, Bamrung Tau [9803-39] S5B
- Sikdar, Shirsendu [9803-93] S11A
- Silva, Tarcisio M. [9799-2] S1, [9803-119] S14A
- Sim, Sung-Han 9803 Program Committee
- Sinapius, Michael [9802-40] S13, [9803-117] S14A
- Sindoni, Giampiero [9803-170] SPTue
- Singh, Caesar 9804 Program Committee
- Sinha, Mayukh** [9803-156] SPTue, [9803-158] SPTue
- Sinke, Jos [9804-28] S8
- Sirivat, Anuvat 9798 Program Committee, [9798-92] SPTues, [9798-96] SPTues, [9798-97] SPTues, [9798-98] SPTues, [9799-113] SPTue, [9799-119] SPTue, [9802-57] SPTue, [9802-58] SPTue
- Sjoblom, Kurt [9804-81] SPTue
- Skliarov, Volodymyr V. [9806-24] S6, [9806-29] S8
- Skov, Anne Ladegaard 9798 Program Committee
- Skow, Ellen A. [9799-26] S6
- Skrzypczak, Pawel [9803-141] SPTue
- Slowik, Irma** [9798-105] SPTues
- Smarsly, Kay [9803-124] S14B
- Smela, Elisabeth 9798 S3 Session Chair, [9798-1] S1
- Smith, Lisa [9803-113] S13B
- Smith, Patrice [9797-3] S2
- Smith, Ralph C. 9800 Program Committee, 9800 S7 Session Chair, [9800-1] S1, [9800-3] S1, SC1188
- Smithard, Joel [9803-22] S3A
- Smoukov, Stoyan K. [9798-124] SPTues
- Smudde, Christine [9803-43] S6A
- Sobczyk, Martin [9798-30] S6B
- Sodano, Henry A.** 9799 Program Committee, 9799 S8A Session Chair, [9799-73] S12A, 9800 S6 Session Chair, [9800-20] S5, [9800-36] S9
- Sohn, Hoon** 9803 Conference CoChair, 9803 S1A Session Chair, 9803 S2A Session Chair, [9803-11] S2A, [9803-40] S5B, 9805 Program Committee, 9805 S8 Session Chair, 9805 S9 Session Chair, [9805-40] S9
- Sohn, Jung Woo [9799-125] SPTue
- Solarte Benavides, Alexander [9799-54] S10B
- Soman, Rohan N. [9805-81] S15A
- Son, Siwon [9798-89] SPTues, [9798-95] SPTues
- Son, Young Su [9799-28] S7
- Song, Gangbing [9799-129] SPTue, [9803-148] SPTue
- Song, Homin [9803-111] S13A
- Song, Kwang-Yong [9803-174] SPTue
- Song, Kyo D.** 9802 Conference CoChair, [9802-42] S14, [9802-43] S14
- Song, Min Geun [9798-50] S8A
- Song, Ningning [9804-65] S17
- Song, Sangho [9802-36] S12, [9802-37] S12
- Song, Wei 9803 Program Committee, 9803 S6B Session Chair, [9803-64] S7B
- Song, Yang [9803-91] S11A
- Sorini, Chris [9805-59] S12B
- Sosa, Edward [9801-16] S3
- Sousa, Vagner C. [9803-84] S10A
- Southward, Steve 9799 Program Committee
- Spaggiari, Andrea [9801-8] S2
- Spears, John H. [9800-36] S9
- Spencer, Billie F. 9803 Program Committee
- Spinks, Geoffrey M. [9798-31] S6B
- Spontak, Richard J. 9798 S7A Session Chair, [9798-5] S2, [9798-94] SPTues
- Srinivasan, S. M. [9799-139] SPTue, [9800-44] S10
- Srivastava, Ashok** 9802 Program Committee, [9802-2] S2, [9802-9] S4
- Srivastava, Shashank [9803-92] S11A, [9805-110] SPTue, [9805-111] SPTue
- Stafford, Randy [9806-26] S7
- Stalbaum, Tyler P. [9798-39] S7A, [9798-45] S8A, [9798-80] S10B
- Stanley, R. J. [9801-21] S4
- Stanway, Roger 9799 Program Committee
- Staszewski, Wieslaw Jerzy 9803 Program Committee, 9803 S10A Session Chair, [9803-131] S15A, [9803-24] S3B, 9805 Program Committee, [9805-17] S4, [9805-19] S5, [9805-26] S6, [9805-39] S9, [9805-41] S9
- Stebe, Kathleen [9797-18] S7
- Stepinski, Tadeusz [9803-19] S3A, [9803-23] S3A
- Sternini, Simone [9803-31] S4A, [9804-23] S7, [9805-80] S15A
- Stevenson, Tim [9803-21] S3A
- Stewart, Frank [9798-110] SPTues
- Stewart, Mark [9798-20] S5
- Strathman, Joseph [9803-151] SPTue
- Su, Ji** 9798 Program Committee, 9798 S8A Session Chair, [9803-1] S1A
- Su, Quang [9806-11] S3
- Su, Weihua [9803-69] S8B, [9803-82] S10A
- Su, Yu-Min 9804 Program Committee, 9804 S11 Session Chair, 9804 S12 Session Chair, 9804 S13 Session Chair, 9804 S7 Session Chair, [9804-46] S12, [9804-56] S15
- Su, Zhongqing 9805 Program Committee, 9805 S3 Session Chair, [9805-20] S5
- Suarez, Alan [9799-105] S15B, [9799-132] SPTue
- Subramani, Krishna B. [9798-5] S2
- Subramanian, Nithya [9800-42] S10
- Sugino, Christopher [9799-40] S9A
- Suhr, Jonghwan [9798-66] S9B, 9800 Program Committee
- Sumitro, Paul [9803-123] S14B
- Sun, Hao [9805-12] S3



# INDEX OF AUTHORS, CHAIRS, AND COMMITTEE MEMBERS

Bold = SPIE Member

Sun, Hongwei [9798-107] SPTues,  
[9802-62] SPTue, [9803-150]  
SPTue  
Sun, Hongxin [9799-114] SPTue  
Sun, Hu [9803-163] SPTue  
Sun, Jian [9799-85] S14A  
Sun, Shilong [9799-134] SPTue  
Sun, Xiaorong [9803-66] S7B  
Sun, Xiaoyi [9804-85] SPTue,  
[9806-30] S8  
Sun, Xiuting [9799-115] SPTue  
Sun, Yu-Chen [9800-23] S6  
Sun, Zhe [9805-78] S15A  
Sunarsa, Timotius Yonathan  
[9805-40] S9  
Sundaresan, Vishnu Baba 9800  
Program Committee  
Suo, Zhigang [9798-87] S11A  
Suzuki, Satoshi [9799-56] S10B  
Suzuki, Yu [9805-14] S3  
Svennersten, Karl [9798-57] S8B  
Swartz, R. Andrew 9803 Program  
Committee, 9803 S14A  
Session Chair, [9803-147]  
SPTue, [9803-77] S9B  
Sylvestre, Alain [9798-28] S6A

**T**

Tabassian, Rassoul [9802-39] S13  
Tadesse, Yonas [9797-23] S8,  
[9797-30] S10, 9798 S9B  
Session Chair, [9798-3] S1,  
[9799-131] SPTue, [9806-9] S3  
Tahara, Kenji [9798-99] SPTues  
Taheri Andani, Mohsen [9797-12]  
S4  
Tai, Steffen [9805-58] S12B  
**Tairych, Andreas** [9798-79]  
S10B  
Takagi, Kentaro [9798-108]  
SPTues, [9798-91] SPTues,  
[9798-99] SPTues  
Takahashi, Masaki [9799-112]  
SPTue, [9803-6] S1B  
Takamatsu, Kyuichiro [9802-18]  
S7, [9802-20] S7  
Takano, Nobuyuki [9803-118]  
S14A, [9803-97] S11B  
Takeda, Nobuo 9805 Program  
Committee  
Tallman, Tyler 9803 S10A Session  
Chair, 9803 S5A Session Chair,  
[9803-37] S5A

Tamm, Tarmo [9798-71] S10A  
Tan, David [9799-2] S1, [9799-3]  
S1, [9799-40] S9A  
Tan, Xiaobo [9798-109] SPTues,  
[9798-73] S10A  
Tang, Fujian [9803-44] S6A  
Tang, Jiong 9799 Program  
Committee, 9799 S10B  
Session Chair, [9799-12] S3,  
[9799-78] S13A, [9799-92]  
S14B, [9804-21] S6, [9806-8]  
S2  
**Tang, Lihua** 9799 S5 Session  
Chair, [9799-135] SPTue,  
[9799-20] S5  
Tang, Qixiang [9804-25] S7,  
[9804-26] S7, [9804-3] S1,  
[9804-80] SPTue  
Tang, Yan [9803-44] S6A, [9804-  
62] S17  
Tao, Chuanyi [9802-55] SPTue,  
[9805-84] S15A  
Tao, Dongwang [9804-73] SPTue  
Tao, Jialiang [9798-22] S5  
**Tao, Junliang** [9799-96] S15A  
Tao, Yi [9805-98] SPTue  
Tapia, Gustavo [9804-59] S16  
Tarabini, Marco [9800-45] SPTue  
Tase, Taishi [9802-18] S7, [9802-  
20] S7  
Tawk, Charbel [9798-36] S7A  
Taya, Minoru 9798 Program  
Committee, [9798-41] S7B,  
[9798-83] S10B  
Taylor, James [9798-19] S5  
Taylor, John [9797-14] S5  
Tcholakova, S. [9798-124] SPTues  
Tefft, Edward C. [9799-63] S11A  
**Teigell Beneitez, Nuria** [9803-  
134] S15B  
Terry, Theodore B. [9797-3] S2  
Thangkitthanachoke, Paweenuch  
[9798-97] SPTues  
Thapa Magar, Kaman S. [9803-  
82] S10A  
Thierry, Olivier [9799-66] S11B  
Thomson, Peter [9799-46] S9B,  
[9799-54] S10B, [9804-12] S3  
Thummarungsan, Natlita [9798-  
98] SPTues  
Tian, Feng [9802-32] S11  
Tian, Zhenhua [9804-85] SPTue,  
9805 S13B Session Chair,  
[9805-4] S1, [9806-30] S8  
Tieu, Mindy [9797-32] SPTue  
Timmons, Alan [9804-8] S2

Tippabattini, Jayaramudu [9802-  
38] S13  
Tjin, Swee C. [9803-68] S8A  
Todd, Michael D. 9799 S12B  
Session Chair, [9799-76]  
S12B, [9799-95] S15A, 9803  
Program Committee, 9803  
S11A Session Chair, 9805  
Program Committee, 9805  
S13B Session Chair  
Toghi Eshghi, Amin [9806-35] S10  
Toles, Matthew [9805-43] S10  
Tolliver, Denver [9803-108] S12B  
Tomaraei, Golnaz N. [9797-4] S3  
Tomasini, Gisella [9799-109] S5,  
[9803-181] SPTue  
Tomizuka, Masayoshi 9803  
Program Committee  
**Topasna, Daniela M.** [9802-61]  
SPTue  
Topasna, Gregory A. [9802-61]  
SPTue  
Töpfer, Tino [9798-116] SPTues,  
[9798-67] S9B, [9798-68] S9B  
Torbol, Marco [9803-188] SPTue  
Torii, Nobuhiro [9800-48] SPTue  
Tosi, Luis Phillippe [9806-36] S10  
Towfighian, Shahrzad [9799-1] S1,  
[9806-11] S3  
Trabia, Sarah [9798-113] SPTues,  
[9798-38] S7A, [9798-39] S7A,  
[9798-45] S8A, [9798-66] S9B  
Tragazikis, Ilias K. [9804-89]  
SPTue, [9806-41] SPTue,  
[9806-42] SPTue  
Trask, Richard S. [9797-10] S4,  
[9799-7] S2  
Travas-Sejdic, Jadranka [9798-14]  
S4  
Trujillo, Blaine [9805-57] S12A  
Tse, Peter W. [9799-134] SPTue  
Tseng, Ching-Hung [9802-61]  
SPTue  
Tseng, I-Hsiang 9798 Program  
Committee  
Tsui, Chi-Leung [9805-82] S15A  
Tu, Dianlong [9805-101] SPTue,  
[9805-52] S11  
Turitsyn, Konstantin [9799-59]  
S11A  
Tyler, J. Philip [9805-47] S10

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SPIE is the international society  
for optics and photonics.

# INDEX OF AUTHORS, CHAIRS, AND COMMITTEE MEMBERS

Bold = SPIE Member

## U

Ubertini, Filippo 9800 S4 Session Chair, [9800-34] S8, [9803-115] S13B, [9803-28] S3B, [9803-46] S6A  
Ubertini, Stefano [9803-115] S13B  
Uchiyama, Naoki [9798-108] SPTues  
Udpa, Lalita [9800-35] S9, [9804-27] S8  
Ueda, Tohru [9803-157] SPTue  
Ueno, Toshiyuki [9806-10] S3  
Uhl, Tadeusz [9803-19] S3A, [9803-24] S3B, 9805 Program Committee, 9805 S6 Session Chair, [9805-17] S4, [9805-19] S5, [9805-39] S9  
Um, Moon-Kwang [9803-149] SPTue  
Urann, Marcus [9797-17] S7  
Usta, Aybala [9799-141] SPTue

## V

Vähä-Heikkilä, Tauno 9802 Program Committee  
Vahdati, Nader [9803-145] SPTue, [9803-52] S6B  
Vaidya, Umesh [9803-28] S3B  
Vakilzadeh, Majid Khorsand [9803-62] S7B  
Valenza, Logan [9798-19] S5  
Valner, Robert [9798-48] S8A  
van Breemen, Albert J. J. M. [9798-18] S4  
van de Kamp, Bram [9799-83] S13B  
van der Velden, Stephen P. [9803-103] S11B, [9803-22] S3A  
Van Hemelrijck, Danny [9806-43] SPTue  
Van Steenberge, Geert [9803-134] S15B  
Van Tran, Thu [9799-141] SPTue  
Van Volkinburg, Kyle R. 9798 S10B Session Chair, [9798-16] S4, [9799-34] S7  
Vanli, O. Arda [9803-90] S11A

**Varadan, Vijay K.** 9802 Conference Chair, 9802 S1 Session Chair, 9802 S11 Session Chair, 9802 S16 Session Chair, 9802 S2 Session Chair, 9802 S5 Session Chair, 9802 S8 Session Chair, [9802-16] S6, [9802-44] S14, [9802-46] S14, [9802-50] S16, [9802-51] S16, [9802-52] S16  
Vasic, Dejan [9806-45] SPTue  
Vasista, Srinivas [9799-83] S13B  
**Veale, Allan J.** [9798-76] S10B  
Vedantam, S. [9800-44] S10  
Veidt, Martin [9804-14] S4, [9804-54] S15  
Velazquez, Antonio [9803-147] SPTue, [9803-77] S9B  
Vendittozzi, Cristian [9803-170] SPTue, [9803-59] S7A  
Venkataraman, Satchi [9804-83] SPTue  
Venkataraman, Gowtham [9801-25] S5  
Verma, Luv [9800-44] S10  
Vertechy, Rocco 9798 Program Committee, 9798 S5 Session Chair, [9798-27] S6A, [9798-7] S2  
Vial, Loïc [9798-82] S10B  
Vickers, William [9803-21] S3A  
Vidal, Frédéric 9798 Conference CoChair, 9798 Program Committee, 9798 S1 Session Chair, 9798 S11A Session Chair, 9798 S3 Session Chair, [9798-124] SPTues, [9798-72] S10A  
Vido, Lionel [9806-45] SPTue  
Volovick, Avner [9801-7] S2  
Vukusic, Peter [9797-17] S7  
Vunder, Veiko [9798-56] S8B, [9798-71] S10A

## W

Wada, Masato [9802-26] S9  
Wagner, Hermann [9797-27] S9, [9797-36] SPTue  
Wales, Christopher [9799-83] S13B  
Walkemeyer, Phil [9806-36] S10  
**Walker, Christopher R.** [9798-77] S10B

Wallace, Gordon G. 9798 Program Committee  
Wallmersperger, Thomas 9798 Program Committee, 9798 S10A Session Chair, [9798-30] S6B, [9800-41] S10  
Walter, David [9806-17] S5  
Wan, Yan 9804 Program Committee  
Wandowski, Tomasz [9805-24] S6, [9805-64] S13B  
Wang, Caiping [9797-31] SPTue, [9800-9] S2  
Wang, Chun H. [9804-54] S15  
Wang, Dai-Hua 9799 Program Committee  
Wang, Gang [9803-136] S15B  
Wang, Hong [9806-26] S7, [9806-5] S2  
Wang, Hongyan [9799-78] S13A  
Wang, Jy-An J. [9806-5] S2  
Wang, Kai [9805-20] S5  
Wang, Kon-Well 9799 Program Committee, 9799 S2 Session Chair, [9799-37] S8B, [9799-8] S2, 9803 Conference CoChair, 9803 S1A Session Chair  
Wang, Lei [9805-8] S2  
Wang, Lei [9798-54] S8B  
Wang, Linan [9804-11] S3  
**Wang, Long** [9805-70] S14A  
Wang, Miao [9801-25] S5  
**Wang, Ming L.** 9803 Program Committee, 9803 S2A Session Chair, 9803 S6B Session Chair, [9803-177] SPTue, 9804 Program Committee, 9804 S17 Session Chair, [9804-63] S17  
Wang, Niannian [9804-11] S3  
Wang, Peiyu [9804-4] S1  
Wang, Peng [9803-17] S3A  
Wang, Peng [9798-63] S9B  
Wang, Pengchuan [9805-68] S14A  
Wang, Rongqiao [9799-36] S8A  
Wang, Ruolin [9803-177] SPTue, [9804-63] S17  
Wang, Shifa [9800-24] S6  
Wang, W.-C. 9802 Program Committee  
Wang, Wei [9799-27] S6  
Wang, Wei [9803-186] SPTue  
Wang, Weibing [9803-121] S14A  
**Wang, Wei-Chih** [9802-33] S12, 9805 Program Committee, 9805 S15A Session Chair, [9805-71] S14A, [9805-82] S15A

Wang, Wei-Chih 9805 S12A Session Chair  
Wang, Weiming [9802-60] SPTue  
Wang, Wentao [9803-17] S3A  
Wang, Xiaojie [9797-31] SPTue, [9799-133] SPTue, [9800-9] S2, [9803-47] S6A  
**Wang, Xingwei** 9803 Program Committee, 9803 S3A Session Chair, [9803-20] S3A, [9803-32] S4A, [9803-67] S8A, [9803-71] S9A, 9804 Program Committee, [9804-26] S7, [9805-83] S15A  
Wang, Xiuyong [9799-114] SPTue  
Wang, Xuan [9798-101] SPTues  
Wang, Y. C. [9799-87] S14A  
**Wang, Ya S.** 9799 S15A Session Chair, [9799-64] S11A, [9799-88] S14A  
Wang, Yang 9803 Program Committee, 9803 S10B Session Chair, 9803 S8B Session Chair, [9803-78] S9B, [9803-87] S10B, 9804 Program Committee, [9805-75] S14B  
Wang, Yanjie [9798-100] SPTues, [9798-102] SPTues, [9798-70] S10A  
Wang, Ying [9804-15] S4  
Wang, Yishou [9805-95] SPTue  
**Wang, Yuzhe** [9798-59] S9A, [9798-62] S9A  
Wang, Zhiguang [9804-60] S16  
Wankhade, Rajan [9799-65] S11B  
Ward, Kevin P. [9803-184] SPTue  
Warrant, Eric J. [9797-2] S2  
Washington, Gregory N. [9798-16] S4, 9799 S7 Session Chair, [9799-34] S7  
Wassenaar, Jelmer [9801-15] S3  
Watanabe, Yuta [9802-29] S10  
**Watkins, Steve E.** [9801-21] S4, [9803-151] SPTue, [9803-72] S9A  
Watt, Richard K. 9802 Program Committee  
Waugh, Rachael C. [9805-47] S10  
Weaver, Paul M. [9797-22] S8  
Wee, Junghyun [9803-135] S15B  
Wegener, Michael [9798-44] S7B  
Wei, Heming [9802-55] SPTue, [9805-79] S15A, [9805-84] S15A  
Weigel, Perez [9801-2] S1  
Weiss, Florian M. [9798-116] SPTues, [9798-67] S9B, [9798-68] S9B

Wellman, Laurie L. [9802-45] S14  
Wells, Brian [9803-135] S15B  
Wen, Jihong [9805-101] SPTue, [9805-52] S11  
Wen, Yintang [9804-87] SPTue  
**Wereley, Norman M.** 9799 Program Committee  
Wheeler, Rob W. [9800-13] S3  
Whitcomb, John D. [9799-32] S7  
White, Edward V. 9801 Program Committee  
Whittow, Will G. [9799-98] S15A  
Wickenheiser, Adam M. [9799-61] S11A  
Wiech, Przemyslaw [9803-141] SPTue  
Wiedemann, Martin [9803-81] S10A  
Wierach, Peter [9802-40] S13, [9803-117] S14A, [9803-81] S10A  
Williams, Westin B. [9805-1] S1  
Willich, Felix [9799-108] S15B  
Wilson, L. [9803-189] S7A  
Winands, Kai [9797-36] SPTue  
Wines, Thomas [9803-21] S3A  
Winfield, Jonathan [9798-58] S9A  
Wohl, Christopher J. [9803-102] S11B  
Wohlfender, Fabian [9798-67] S9B  
Woike, Mark R. [9804-5] S2  
Woo, Sihyeong [9802-24] SPTue  
Wood, Robert J. [9798-43] S7B  
Wright, Cody A. [9797-24] S8  
Wu, Chiyang [9804-75] SPTue  
Wu, Fan [9803-91] S11A, 9804 Program Committee, 9804 S17 Session Chair, [9804-65] S17  
Wu, Gaohui [9800-39] S9  
Wu, Guangxi [9799-96] S15A  
Wu, H. Felix 9804 Conference CoChair, 9804 S2 Session Chair, 9804 S8 Session Chair  
Wu, Jie [9805-107] SPTue  
Wu, Lianjun [9799-131] SPTue  
Wu, Liuliu [9804-37] S10, [9805-5] S2  
Wu, Nan [9803-20] S3A, [9803-67] S8A, [9803-71] S9A, [9804-26] S7  
Wu, Nan [9799-101] S15A, [9804-79] SPTue  
Wu, Shengmin [9804-20] S6  
**Wu, Wen-Jong** [9799-87] S14A, [9806-34] S10  
Wu, Ying [9805-104] SPTue, [9805-51] S11

Wu, Yucheng [9798-106] SPTues  
Wu, Zhanjun [9805-33] S7  
Wu, Zhen [9799-8] S2  
Wu, Zhigang [9799-17] S4  
Wunderlich, Christian [9806-1] S1  
Wynne, Rosalind M. 9803 Program Committee, 9803 S11B Session Chair, 9803 S12B Session Chair

## X

Xia, Huakang [9799-136] SPTue  
Xia, Song [9804-68] S17  
Xia, Tian 9804 Program Committee, 9804 S1 Session Chair, 9804 S10 Session Chair, [9804-1] S1, [9804-2] S1  
Xia, Yong [9804-60] S16  
Xia, Zongyang [9802-41] S13  
**Xiao, Hai** [9803-179] SPTue, [9803-72] S9A  
Xiao, Li [9799-130] SPTue  
Xie, Sheng Quan [9798-76] S10B  
Xie, Yuhang [9798-21] S5, [9798-101] SPTues, [9798-103] SPTues, [9798-51] S8A  
Xiong, Liuyang [9799-135] SPTue  
Xu, Bin [9804-68] S17  
Xu, Daniel [9798-79] S10B  
Xu, Hao [9805-42] S9  
Xu, Hao [9803-74] S9A  
Xu, Jian [9799-115] SPTue, [9799-37] S8B, [9801-17] S4, [9803-146] SPTue  
Xu, Jian [9803-30] S3B  
Xu, Jiawen [9799-92] S14B  
Xu, Weiliang (Peter) [9797-33] SPTue, [9802-56] SPTue  
Xu, Xiang [9806-39] SPTue  
Xue, Tiancheng [9801-23] S5

## Y

Yadav, Susheel K. [9805-37] S8  
Yamaguchi, Takashi [9799-112] SPTue  
Yan, Quansheng [9805-107] SPTue, [9805-16] S3  
Yan, Xiaojun [9803-121] S14A  
Yan, Yao [9801-17] S4

# INDEX OF AUTHORS, CHAIRS, AND COMMITTEE MEMBERS

Bold = SPIE Member

- Yanaseko, Tetsuro** [9803-1] S1A, [9803-34] S4B, [9806-38] SPTue
- Yang, Jinkyu** 9805 Program Committee, 9805 S10 Session Chair, 9805 S11 Session Chair, [9805-103] SPTue, [9805-43] S10, [9805-48] S11
- Yang, Soon Yong [9799-103] S15B, [9799-126] SPTue
- Yang, Suyoung [9803-11] S2A
- Yang, Wei [9799-1] S1
- Yang, Xu [9798-54] S8B
- Yang, Xuxu [9798-101] SPTues, [9798-103] SPTues, [9798-21] S5, [9798-51] S8A
- Yang, Yongchao [9805-93] S15B
- Yao, Shanshan [9805-55] S11
- Yasuda, Hiromi [9805-48] S11
- Yazdandoost, Fatemeh [9800-14] S3
- Yazdanpanah Moghadam, Peyman [9804-6] S2
- Ye, Lin [9803-95] S11A
- Yelve, Nitesh P. [9805-22] S5
- Yeoh, Jason [9804-91] SPTue
- Yih, T. C. 9802 Program Committee
- Yin, Jia [9799-67] S11B
- Yin, Jianfei [9805-101] SPTue, [9805-52] S11
- Yoffe, Alexander [9800-6] S2
- Yoon, Dong-Jin 9806 Program Committee, [9806-28] S8
- Yoon, Hargsoon 9802 Program Committee, [9802-42] S14, [9802-43] S14, [9802-45] S14, [9802-47] S15
- Yoon, Hwan-Sik 9802 S14 Session Chair
- York, Alexander [9798-119] SPTues, [9798-12] S3
- Yorozu, Ayanori [9803-6] S1B
- Youn, Byeng D. [9802-24] SPTue
- Younis, Mohammad [9806-11] S3
- Yu, Chih-Peng [9804-52] S14
- Yu, Haiwu [9797-31] SPTue
- Yu, Jiabin [9800-1] S1
- Yu, Lingyu [9803-54] S7A, 9804 Program Committee, [9804-85] SPTue, 9805 Program Committee, 9805 S3 Session Chair, 9805 S4 Session Chair, [9805-4] S1, [9806-30] S8
- Yu, Min [9798-54] S8B
- Yu, Tzuyang** 9804 Conference Chair, 9804 S1 Session Chair, 9804 S14 Session Chair, 9804 S5 Session Chair, 9804 S7 Session Chair, 9804 S9 Session Chair, [9804-25] S7, [9804-26] S7, [9804-3] S1, [9804-39] S10, [9804-72] SPTue, [9804-80] SPTue, [9805-83] S15A
- Yu, Woong-Ryeol [9799-30] S7, 9800 S10 Session Chair, [9800-17] S4, [9800-26] S7
- Yu, Xiaolin [9805-16] S3
- Yu, Yan** [9802-60] SPTue, [9803-125] S14B, [9803-160] SPTue, [9804-11] S3, [9804-74] SPTue
- Yuan, Fuh-Gwo** [9799-62] S11A, 9804 Program Committee, [9804-31] S8
- Yuan, Lei** [9803-72] S9A
- Yuan, Yuan [9806-8] S2
- Yuan, Yue [9799-58] S11A
- Yuji, Jun-ichiro [9803-157] SPTue
- Yukse, Nuh S. [9802-49] S15, [9805-50] S11
- Yun, Chung-Bang 9803 Program Committee
- Yun, Gun-Jin [9803-187] SPTue
- Yun, Hae-Bum A. [9804-37] S10, [9804-41] S11, [9804-82] SPTue, [9805-5] S2
- Yun, Sangho [9802-48] S15
- Yun, Young-Min [9802-37] S12
- Z**
- Zagrai, Andrei N. 9805 Program Committee, 9805 S13A Session Chair, 9805 S8 Session Chair, [9805-57] S12A
- Zahedi, Farshad [9803-36] S5A
- Zbyrad, Paulina [9803-19] S3A, [9803-24] S3B
- Zentai, George 9805 Program Committee
- Zhai, Lindong [9802-36] S12
- Zhang, Chao [9803-74] S9A
- Zhang, Chen [9803-20] S3A, [9805-83] S15A
- Zhang, Chuanwei [9804-47] S12
- Zhang, Haifeng [9799-60] S11A, [9803-20] S3A, [9805-83] S15A
- Zhang, Hui [9803-10] S2A
- Zhang, Hui [9805-30] S7
- Zhang, Lu [9804-8] S2
- Zhang, Luyang [9803-120] S14A
- Zhang, Meng [9798-54] S8B
- Zhang, Pei [9803-4] S1B, [9803-5] S1B
- Zhang, Qiangqiang [9806-39] SPTue
- Zhang, Qiming M. 9798 Program Committee
- Zhang, Runan [9798-117] SPTues
- Zhang, Shengli [9804-21] S6
- Zhang, Shu [9799-115] SPTue
- Zhang, Xiaoxiao [9799-136] SPTue
- Zhang, Xiaoyong [9799-36] S8A, [9803-121] S14A
- Zhang, Yang [9803-160] SPTue
- Zhang, Yilan [9803-40] S5B
- Zhang, Ying [9802-41] S13
- Zhang, Yu [9804-1] S1, [9804-2] S1
- Zhang, Yu [9803-112] S13A
- Zhang, Yunfeng 9803 Program Committee
- Zhang, Yuyan [9804-87] SPTue
- Zhang, Ze [9799-133] SPTue
- Zhang, Zhiming [9803-51] S6B
- Zhao, Dahai [9799-129] SPTue
- Zhao, Dongxu [9798-70] S10A
- Zhao, Honggang [9805-52] S11
- Zhao, Limei [9804-87] SPTue
- Zhao, Ping [9800-24] S6
- Zhao, Xuefeng** [9803-125] S14B, [9803-160] SPTue, [9804-11] S3, [9804-74] SPTue
- Zhao, Yagebai [9803-144] SPTue
- Zhao, Yanying [9799-67] S11B
- Zheng, Yuebin [9805-33] S7
- Zhou, Jing [9803-112] S13A
- Zhou, Jingcheng [9803-20] S3A, [9803-67] S8A, [9803-71] S9A, [9804-26] S7
- Zhou, Li [9803-159] SPTue, [9803-165] SPTue
- Zhou, Linren [9804-60] S16, [9805-9] S2
- Zhou, Ming 9802 Program Committee
- Zhou, Shengxi [9799-27] S6, [9806-13] S3
- Zhou, Wensong [9803-17] S3A, [9803-75] S9A
- Zhou, Xiaoming [9805-55] S11
- Zhou, Yang [9799-17] S4
- Zhou, Yaping [9803-125] S14B
- Zhou, Zhi [9799-73] S12A, [9800-36] S9
- Zhu, Daopei [9804-63] S17
- Zhu, Hongfei [9805-53] S11
- Zhu, Jiahua [9803-187] SPTue
- Zhu, Jian 9798 Program Committee, 9798 S6B Session Chair, [9798-32] S6B, [9798-59] S9A, [9798-62] S9A, [9798-87] S11A
- Zhu, Jianxiong [9805-50] S11
- Zhu, Jinying [9804-24] S7, [9804-67] S17
- Zhu, Rui [9805-108] SPTue, [9805-44] S10
- Zhu, Tong [9803-112] S13A
- Zhu, Wenge** [9803-179] SPTue
- Zhu, Xuan [9799-11] S3, [9803-49] S6B
- Zhu, Yinian [9802-55] SPTue, [9805-79] S15A, [9805-84] S15A
- Zhu, Yong [9803-102] S11B
- Zhu, Zicai [9798-106] SPTues, [9798-91] SPTues
- Zhuang, Yitao [9803-18] S3A
- Ziaiefar, Hamidreza [9804-51] S13
- Ziehl, Paul H. 9804 Program Committee
- Zivan, Lior [9801-7] S2
- Zollfrank, Cordt [9797-5] S3
- Zondaka, Zane [9798-35] S7A, [9798-48] S8A
- Zonta, Daniele 9803 Program Committee, 9803 S9B Session Chair, [9803-61] S7B
- Zou, Chengzhe** [9803-186] SPTue
- Zou, Li [9803-8] S2A
- Zou, Zhanan [9798-63] S9B
- Zumbuehl, Andreas [9797-41] SPTue
- Zuo, Lei 9799 Program Committee, 9799 S9B Session Chair, [9799-117] SPTue, [9799-45] S9B, [9799-58] S11A
- Zuzuarregui, Ana [9797-6] S3
- Zylka, Pawel 9798 Program Committee



# GENERAL INFORMATION

## REGISTRATION

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### Onsite Registration and Badge Pick-up Hours

*Location: Grand Ballroom Foyer*

*Sunday 20 March . . . . . 8:00 am to 5:00 pm*

*Monday 21 March . . . . . 7:00 am to 5:00 pm*

*Tuesday 22 March . . . . . 7:30 am to 4:00 pm;  
5:30 pm to 7:00 pm*

*Wednesday 23 March . . . . . 7:45 am to 4:00 pm*

*Thursday 24 March . . . . . 7:45 am to 11:00 am*

### Conference Registration

Includes admission to all conference sessions, plenaries, panels, and poster sessions, Welcome Reception, coffee breaks, and a choice of online proceedings.

### Course and Workshop Registration

Courses and workshops are priced separately. Course-only registration includes your selected course(s), course notes, coffee breaks, and admittance to the exhibition. Course prices include applicable taxes. Onsite, please go to SPIE Registration after you pick up your badge.

### SPIE Member, SPIE Student Member, and Student Pricing

- SPIE Members receive conference and course registration discounts. Discounts are applied at the time of registration.
- SPIE Student Members receive a 50% discount on all courses.
- Student registration rates are available only to undergraduate and graduate students who are enrolled full-time and have not yet received their Ph.D. A student ID number or proof of student status is required with your registration. Post-docs may not register as students.

### 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

*Location: 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.

### 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 \$50 service charge for processing refunds. Requests for refunds must be received by **10 March 2016**; 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

*Location: Marquis Ballroom Foyer*

*Monday through 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

*Location: Marquis 4 & 5*

*Tuesday 22 March . . . . . 10:00 am to 4:00 pm*

Poster presenters may set up between 10:00 am and 4:00 pm on Tuesday 22 March. Presenters who have not set up by 4:00 pm 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 23 March.

## ONSITE SERVICES

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### Internet Access

*Location: Grand Ballroom Foyer*

Complimentary wired Internet access is available; attendees can hook up their laptops or use provided workstations.

Wifi access can be rented through the facility Business Center.

### SPIE Book Display

*Location: Registration Area*

The SPIE Book Display is your source for the latest SPIE Press Books, Proceedings, and Education and Professional Development materials. Browse and place your order for the latest SPIE Books.

### Business Center

*Location: JW Marriott Lobby; Hours as posted*

Services include wifi rental, copy service, fax service, messenger service, internet printing, notary public, overnight deliver/pickup, post/parcel and translator.

### Urgent Message Line

An urgent message line is available during registration hours: +1 360 410 8160

### Lost and Found

*Location: SPIE Cashier; Registration Hours*

Found items will be kept at SPIE Cashier until the end of the meeting and then turned over to JW Marriott Las Vegas Resort & Spa +1 702 869 7777.

## FOOD AND BEVERAGE SERVICES

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### Coffee Breaks

*Location: Marquis Ballroom Foyer*

Complimentary coffee will be served twice daily, at 10:00 am and 3:00 pm. Check individual conference listings for exact times and locations.

### Food & Refreshments for Purchase

*Location: Valencia Ballroom*

Hot and cold snacks, hot entrees, deli sandwiches, salads, and pastries are available for purchase. Cash and credit cards accepted.

### JW Marriott Las Vegas Resort & Spa

**Ceres** - American, Open for breakfast

**Starbucks®** - Coffee House, Open for breakfast, lunch and dinner

**Spiedini Ristorante** - Italian, Open for dinner

**JC's Irish Pub** - Pub, Open for lunch and dinner

**Shizen Japanese Restaurant** - Japanese, Open for dinner

**221** - Tapas, Open for dinner

**Waterside Grille** - American, Open for lunch

**Rampart Buffet** - International, Open for lunch and dinner

**Carmel Room** - Mediterranean, Open for dinner

**Promenade Café** - American, Open for breakfast, lunch and dinner

## HOTEL

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SPIE Smart Structures/NDE 2016 conference is being held at its new location:

**JW Marriott Las Vegas Resort & Spa** (4 STAR HOTEL)

221 N Rampart Blvd, Las Vegas, NV 89145

(702) 869-7777; [www.jwmarriott.com](http://www.jwmarriott.com)

# 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.

## 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.

## SPIE Safe Meeting and Misconduct Policy

SPIE is a professional, not-for-profit society committed to providing valuable and safe conference and exhibition experiences. SPIE is dedicated to equal opportunity and treatment for all its members, meeting attendees, staff, and contractors. Attendees are expected to be respectful to other attendees, SPIE staff, and contractors. Harassment and other misconduct will not be tolerated; violators will be addressed promptly and seriously. Consequences up to and including expulsion from the event as appropriate will be implemented immediately.

The SPIE anti-harassment policy can be found at <http://spie.org/policy>.

## Reporting of Unethical or Inappropriate Behavior

SPIE is an organization with strong values of responsibility and integrity. Our Harassment Policy, Ethics Statement, and Code of Professional Conduct contain general guidelines for behavior and for conducting business with the highest standards of ethics.

Onsite at a SPIE meeting, contact any SPIE Staff member with concerns or questions for thorough follow-up. If you feel in immediate danger, please dial 911 for police intervention.

SPIE has established a confidential reporting system for staff and all meetings participants to raise concerns about possible unethical or inappropriate behavior within our community. Complaints may be filed by phone at +1-888-818-6898 or at [www.SPIE.ethicspoint.com](http://www.SPIE.ethicspoint.com) and, if preferred, may be made anonymously.

## 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.

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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.

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## 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 manuscript (minimum 6 pages, maximum 20 pages) for any accepted oral, invited, keynote, or poster presentation will be submitted for publication in the *Proceedings of SPIE* in the SPIE Digital Library. 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 *Proceedings of SPIE* in the 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.

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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.

## Unauthorized Solicitation Policy

Unauthorized solicitation 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.

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## Symposium Collections

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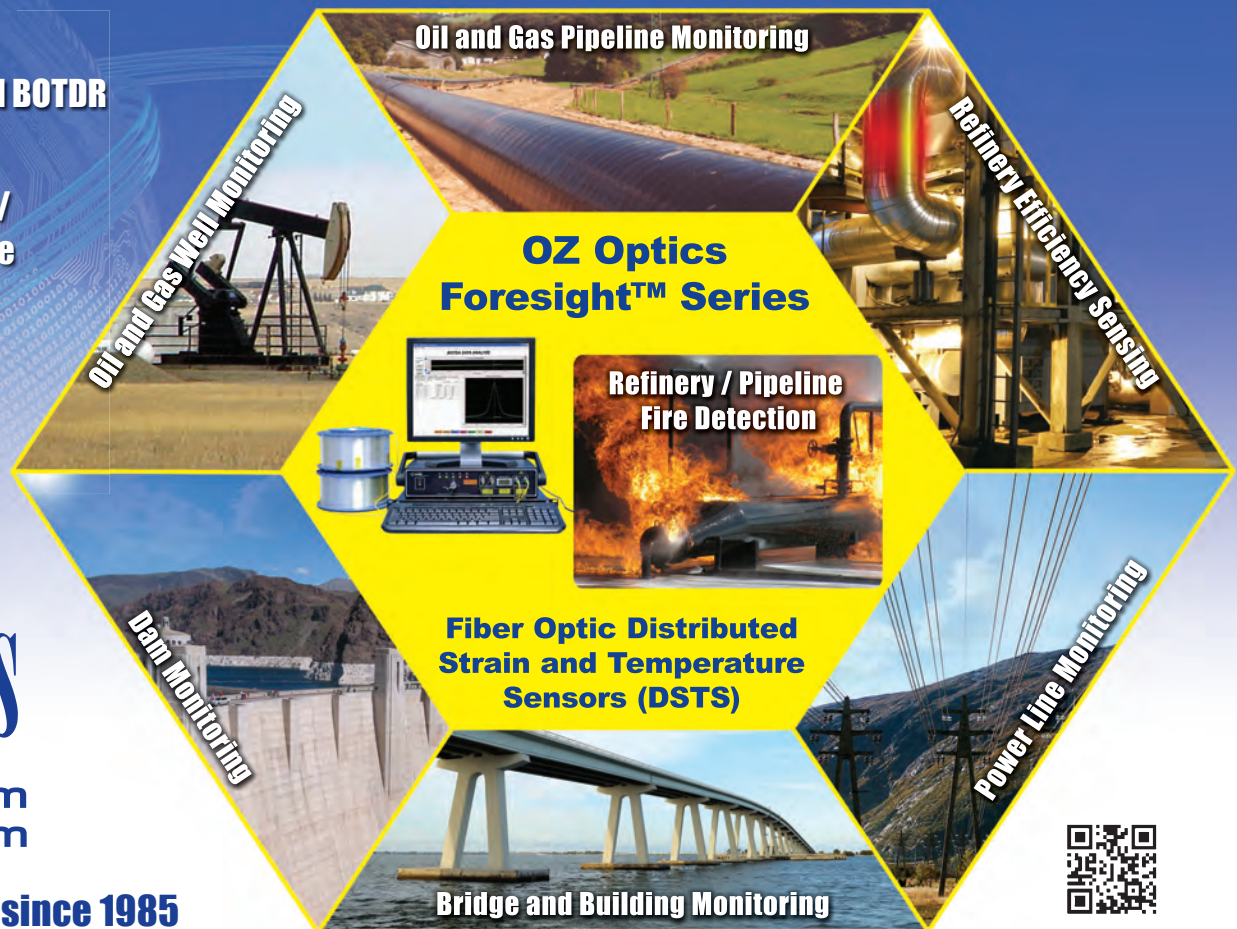


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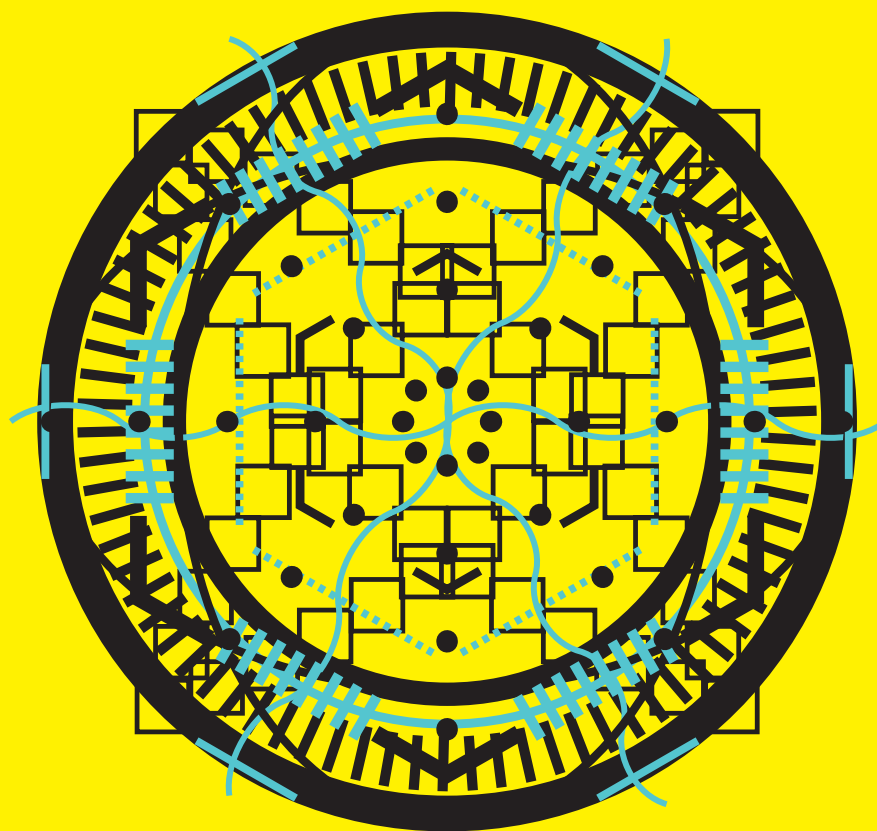


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