

2017

SMART STRUCTURES NDE

TECHNICAL PROGRAM

Portland Marriott Downtown Waterfront Hotel
Portland, Oregon, USA

Conferences & Course: 25-29 March 2017

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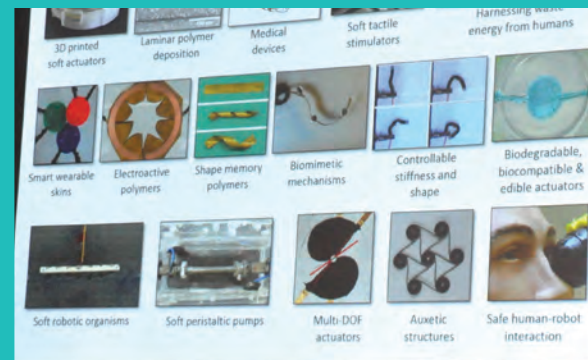
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SPIE Smart Structures/NDE is the largest international meeting on smart materials, sensor networks, non-destructive evaluation (NDE) and structural health monitoring. Over 700 researchers and engineers from 40+ countries gather to share insights on these emerging technologies and industry developments.

Energy harvesting
Soft robotics
Civil infrastructure
Energy systems
Damage detection
Bioinspiration/biomimetics

Wearable sensor systems
Multifunctional and composite materials
Shape-memory alloys and polymers
Smart materials for aerospace and automotive
3D printing with smart materials
Electroactive polymers (EAP)



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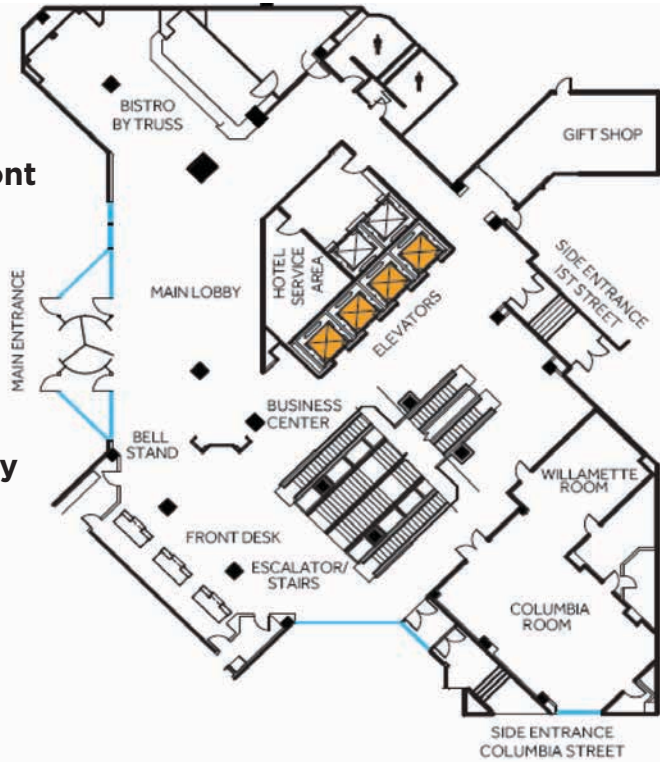
TECHNICAL CONFERENCES

10162 Bioinspiration, Biomimetics, and Bioreplication VII (Knez)	26-40
10163 Electroactive Polymer Actuators and Devices (EAPAD) XIX (Bar-Cohen)	26-62
10164 Active and Passive Smart Structures and Integrated Systems XI (Park)	26-62
10165 Behavior and Mechanics of Multifunctional Materials and Composites XI (Goulbourne)	26-52
10166 Industrial and Commercial Applications of Smart Structures Technologies XI (Clingman)	26-28
10167 Nano-, Bio-, Info-Tech Sensors and 3D Systems (Varadan)	26-58
10168 Sensors and Smart Structures Technologies for Civil, Mechanical, and Aerospace Systems (Lynch)	27-62
10169 Nondestructive Characterization and Monitoring of Advanced Materials, Aerospace, and Civil Infrastructure, and Transportation XI (Wu)	27-63
10170 Health Monitoring of Structural and Biological Systems XI (Kundu)	27-63
10171 Smart Materials and Nondestructive Evaluation for Energy Systems III (Meyendorf)	27-53
10172 A Tribute Conference Honoring Daniel Inman (Leo, Tarazaga)	27-63

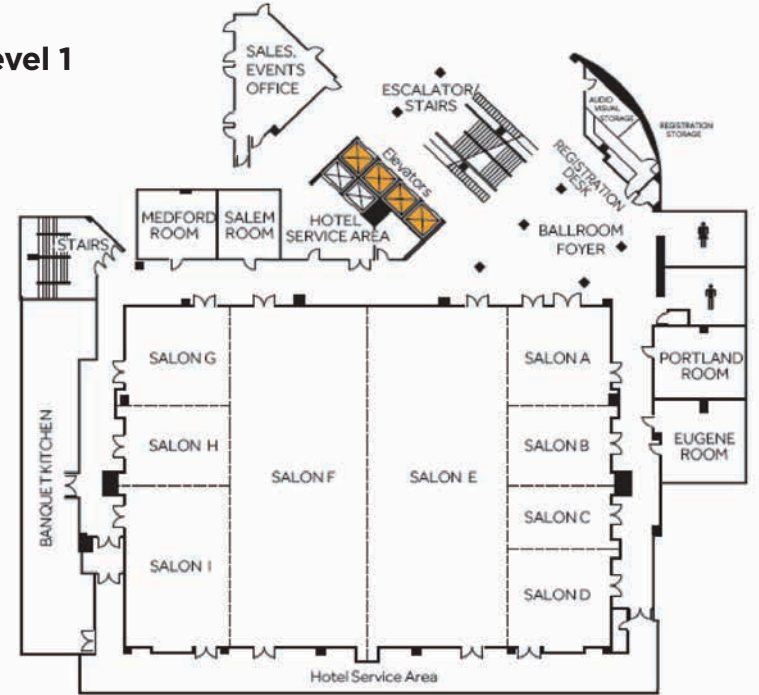
HOTEL FLOOR PLAN

Marriott Portland
Downtown Waterfront

Main Lobby



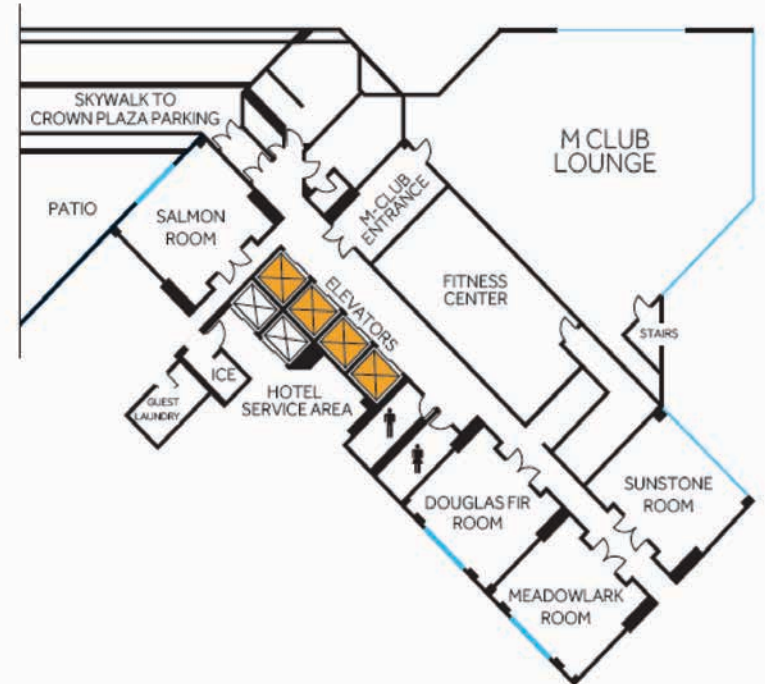
Lower Level 1



2nd Floor



3rd Floor



Welcome

The Organizing Committee of SPIE's 24th Annual International Symposium on Smart Structures and Material Systems + Nondestructive Evaluation and Health Monitoring invites you to attend this year's meeting. 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 eleven 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. Welcome to Portland! It should be an exciting week.

2017 SYMPOSIUM CHAIRS:



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NextGen Aeronautics, Inc.
(USA)



Theodoros E. Matikas
Univ. of Ioannina (Greece)

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Raúl J. Martín-Palma, Univ. Autónoma de Madrid (Spain)

Theodoros E. Matikas, Univ. of Ioannina (Greece)

Norbert G. Meyendorf, Iowa State Univ. of Science and Technology (USA)

Hani E. Naguib, Univ. of Toronto (Canada)

Gyuhae Park, Chonnam National Univ. (Korea, Republic of)

Kara J. Peters, North Carolina State Univ. (USA)

Yongrae Roh, Kyungpook National Univ. (Korea, Republic of)

Jonathan M. Rossiter, Univ. of Bristol (United Kingdom)

Peter J. Shull, The Pennsylvania State Univ. (USA)

Hoon Sohn, KAIST (Korea, Republic of)

Kyo D. Song, Norfolk State Univ. (USA)

Pablo A. Tarazaga, Virginia Polytechnic Institute and State Univ. (USA)

Vijay K. Varadan, The Pennsylvania State Univ. (USA)

Kon-Well Wang, Univ. of Michigan (USA)

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

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

SPIE.

SPIE is the international society for optics and photonics, an educational not-for-profit organization founded in 1955 to advance light-based science and technology. The Society serves nearly 264,000 constituents from approximately 166 countries, offering conferences and their published proceedings, continuing education, books, journals, and the SPIE Digital Library in support of interdisciplinary information exchange, professional networking, and patent precedent. SPIE provided more than \$4 million in support of education and outreach programs in 2016.

For more information, visit www.SPIE.org.

Cooperating organization

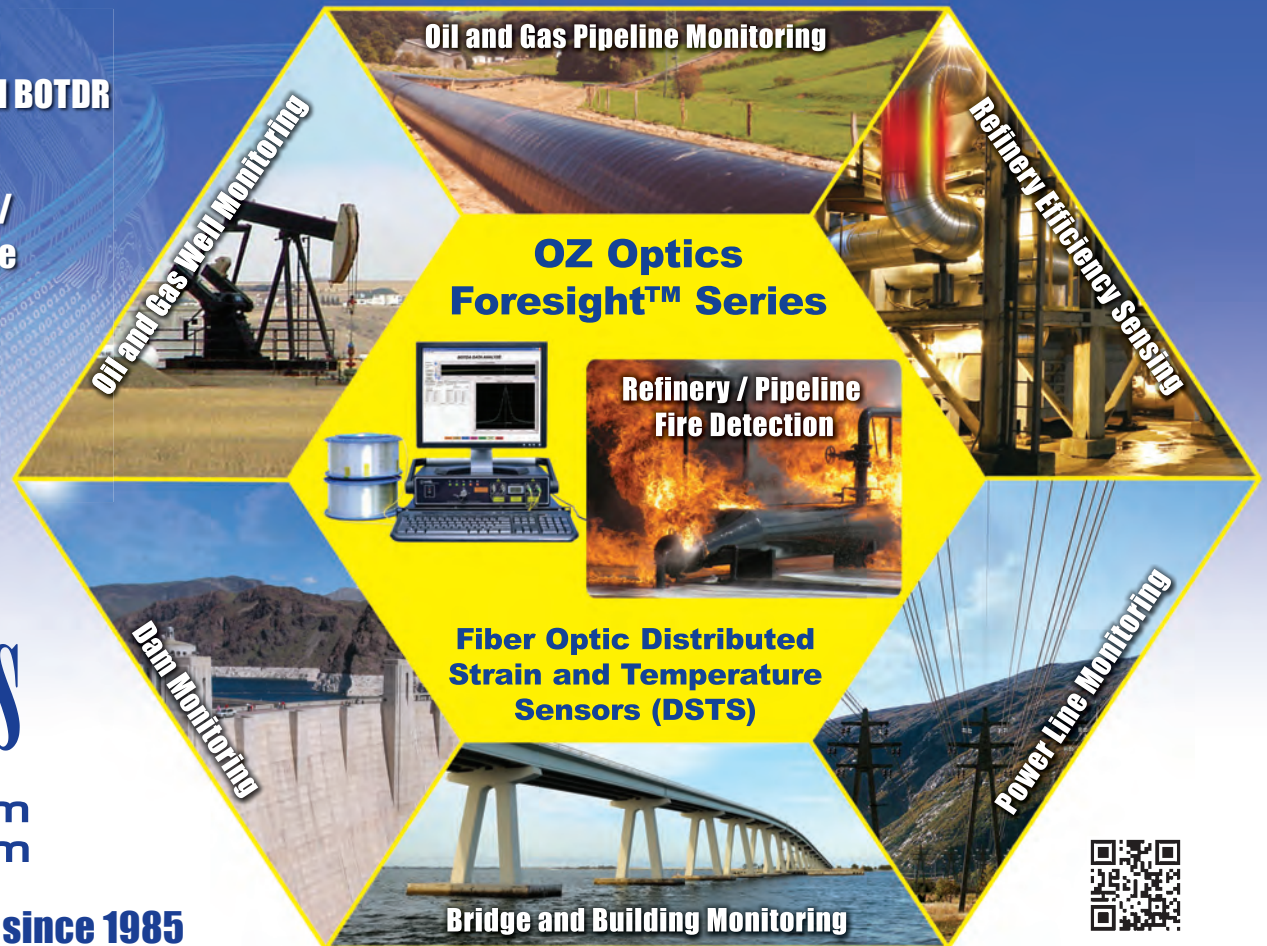


DAILY SCHEDULE

SATURDAY 25 MARCH	SUNDAY 26 MARCH	MONDAY 27 MARCH	TUESDAY 28 MARCH	WEDNESDAY 29 MARCH
SPECIAL EVENTS	<p>2017 NDE Lifetime Achievement Award Presentation and 2017 SSM Lifetime Achievement Award Presentation, 8:15 to 8:30 am, p. 11</p> <p><i>Plenary Presentation: EAP Artificial Muscle Actuators for Bio-Inspired Intelligent Social Robotics</i> (Hanson) 8:30 to 9:15 am, p. 6</p> <p><i>Plenary Presentation: Plant Nanobionic Materials for Thermally Active, Soft, Artificial Skins</i> (Daraio) 9:15 to 10:00 am, p. 6</p> <p><i>EAPAD Keynote Presentation: Electroactive polymers for healthcare and biomedical applications</i> (Bauer) 10:30 to 11:10 am, p. 8</p> <p>All-Symposium Welcome Reception, 6:00 to 7:30 pm, p. 8</p>	<p>2017 SPIE Fellow Recognition, 8:20 to 8:30 am, p. 11</p> <p><i>Plenary Presentation: Predictive Simulation of Structural Health Monitoring</i> (Giurgiutiu) 8:30 to 9:15 am, p. 7</p> <p><i>Plenary Presentation: Adaptive Structures: A Personal Historical Perspective</i> (Hubbard) 9:15 to 10:00 am, p. 7</p> <p>Poster Viewing, 10:00 am to 4:00 pm, p. 9</p> <p><i>Nano-, Bio-, Info-Tech Sensors and 3D Systems Keynote Presentation: Epidermal electronic systems for sensing and therapy</i> (Lu) 10:10 to 10:50 am, p. 9</p> <p><i>Tutorial: Applications of Uncertainty Analysis in Smart Materials and Adaptive Structures</i>, (Smith, Oates), 10:30 am to 3:00 pm, p. 9</p> <p>Lunch with the Experts - A Student Networking Event, 12:30 to 1:30 pm, p. 10</p> <p>SPIE Best Student Paper Session, 1:30 to 4:00 pm, p. 9</p> <p>3D Printing Demonstration Session (Khosla, Furukana) 4:00 to 6:00 pm, p. 16-17</p> <p>Poster Session/Reception, 6:00 to 7:30 pm, p. 9</p>	<p>SPIE Best Student Paper Awards, EAP-in-Action Demonstration Award Presentation, and Bioinspiration, Biomimetics, and Bioreplication Best Student Paper Award Presentation: In Memory of H. Don Wolpert, 8:10 to 8:30 am, p. 11</p> <p><i>Plenary Presentation: NDE for the 21st Century: Industry 4.0 Requires NDE 4.0</i> (Meyendorf) 8:30 to 9:15 am, p. 7</p> <p><i>Plenary Presentation: A Smart Structural Dynamics Strategy for Testing Tomorrow's Structures</i> (Ewins) 9:15 to 10:00 am, p. 8</p> <p>Poster Viewing, 10:00 am to 4:00 pm, p. 9</p> <p>Daniel Inman Tribute Luncheon, 12:00 to 3:00 pm, p. 10</p>	
	COURSE			
	SC634 Electroactive Polymer Actuators and Devices , 1:30 pm to 5:30 pm, p. 18			
CONFERENCES	Conf. 10162 Bioinspiration, Biomimetics, and Bioreplication VII (Knez), p. 26-40			
	Conf. 10163 Electroactive Polymer Actuators and Devices (EAPAD) XIX (Bar-Cohen), p. 26-62			
	Conf. 10164 Active and Passive Smart Structures and Integrated Systems XI (Park), p. 26-62			
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			Conf. 10172 A Tribute Conference Honoring Daniel Inman (Leo, Tarazaga), p. 27-63	

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Plenary Sessions

Sunday 26 March 2017 · 8:15 to 10:00 AM
Location: Salon E

8:15 to 8:30 am:

AWARDS



2017 NDE Lifetime Achievement Award
presented to **Jianmin Gu**, Tufts Univ.
(USA)



2017 SSM Lifetime Achievement Award
presented to **Ralph Smith**, North Carolina
State Univ. (USA)

Award winner biographies available p. 11.

8:30 to 9:15 am:

EAP ARTIFICIAL MUSCLE ACTUATORS FOR BIO-INSPIRED INTELLIGENT SOCIAL ROBOTICS



David Hanson

Hanson Robotics Ltd. (USA)

Abstract: Bio-inspired intelligent robots are coming of age in both research and industry, propelling market growth for robots and A.I. However, conventional motors limit bio-inspired robotics. EAP actuators and sensors could improve the simplicity, compliance,

physical scaling, and offer bio-inspired advantages in robotic locomotion, grasping and manipulation, and social expressions. For EAP actuators to realize their transformative potential, further innovations are needed: the actuators must be robust, fast, powerful, manufacturable, and affordable. This presentation surveys progress, opportunities, and challenges in the author's latest work in social robots and EAP actuators, and proposes a roadmap for EAP actuators in bio-inspired intelligent robotics.

Biography: **Dr. David Hanson** has built a worldwide reputation for creating the world's most humanlike, empathetic robots, endowed with remarkable expressiveness, aesthetics and interactivity. He has produced many renowned, one-of-a-kind robot characters that have received massive media and public acclaim.

Dr. Hanson publishes regularly in materials science, artificial intelligence, cognitive science, and robotics journals, including SPIE, IEEE, the *International Journal of Cognitive Science*, *IROS*, *AAAI* and *AI* magazine. He has been featured in numerous popular media outlets including *New York Times*, *Popular Science*, *Scientific American*, the BBC and CNN. He has been labeled a "genius" by both *PC Magazine* and *WIRED*, and has earned awards from NASA, NSF, AAAI, Tech Titans' Innovator of the Year, and Cooper Hewitt Design Triennial.

At Walt Disney Imagineering, Dr. Hanson worked as both a sculptor and a technical consultant. He has spoken at venues including IEEE, SPIE, AAAI, DARPA, MIT, Dartmouth, Brown, Google, Sandia Labs, UCSD and AAAS annual meeting. Dr. Hanson received his BFA from Rhode Island School of Design in film/animation/video, and his Ph.D. from the University of Texas at Dallas in interactive arts and engineering.

9:15 to 10:00 am:

PLANT NANOBIOTIC MATERIALS FOR THERMALLY ACTIVE, SOFT, ARTIFICIAL SKINS



Chiara Daraio

California Institute of Technology (USA)

Abstract: Bionic materials are a class of materials that aims to preserve, enhance, and exploit properties of living systems for engineering purposes. In most cases, however, creating synthetic materials that reproduce or surpass the performance of

natural materials has been elusive. We fabricate synthetic materials that combine carbon nanoparticles in a matrix of plant cells, to create new temperature sensors with record-breaking responsivity. We extract the active molecule, pectin, responsible for the temperature sensitivity in plants, to create ultra-sensitive, flexible membranes that can map temperature changes from a distance. These materials augment properties of synthetic skins for robotics and prosthesis, and can find applications in consumer electronics or NDE.

Biography: **Prof. Chiara Daraio** received her undergraduate degree in Mechanical Engineering from the "Marche" Polytechnic University, Italy (2001). She received her M.S. (2003) and Ph.D. degrees (2006) in Materials Science and Engineering from the University of California, San Diego. She joined the Aeronautics and Applied Physics departments of the California Institute of Technology (Caltech) in fall of 2006 and was promoted full professor in 2010. From January 2013 to August 2016, she joined the department of Mechanical and Process Engineering at ETH Zürich, with a chair in Mechanics and Materials. She resumed her professorship at Caltech in August 2016. She received a Presidential Early Career Award (PECASE) from the White House in 2012, was elected as a Sloan Research Fellow in 2011 and received an ONR Young Investigator Award in 2010. She is also a winner of the NSF CAREER award (2009), of the Richard Von Mises Prize (2008) and received the Hetenyi Award from the Society for Experimental Mechanics (2015). She was selected by *Popular Science* magazine among the "Brilliant 10" (2010). She serves as an Associate Editor for the journal *Extreme Mechanics Letters*. She published over 100 peer-reviewed papers, two book chapters and several patents (<http://www.mechmat.ethz.ch/index.html>).

Monday 27 March · 8:20 to 10:00 AM
Location: Salon E

8:20 to 8:30 am:

2017 SPIE Fellow Recognition
presented to **Hani E. Naguib**, Univ. of Toronto (Canada)

8:30 to 9:15 am

PREDICTIVE SIMULATION OF STRUCTURAL HEALTH MONITORING



Victor Giurgiutiu

Univ. of South Carolina (USA)

Abstract: Predictive simulation of the structural health monitoring (SHM) process has a crucial role in the efficient design of effective SHM systems. Predictive simulation is part of the forward problem which calculates the sensor signals that would be

recorded for a given structural state and a given excitation. The inverse problem, which is more difficult, has to estimate the structural state from known excitation and known measured signals. This inverse problem is usually solved through an optimization process in which the forward problem is run repeatedly for many times. A fast and accurate forward problem that has adequate sensitivity to damage presence while being insensitive to confounding factors is highly desirable for an efficient solution of the inverse problem. Several examples derived from work performed in the laboratory for active materials and smart structures (LAMSS) of the University of South Carolina, USA will be presented and discussed. The presentation will end with conclusions and suggestions for future work.

Biography: **Victor Giurgiutiu** is Professor of Mechanical Engineering at the University of South Carolina and Director of the Laboratory for Active Materials and Smart Structures (LAMSS). He is the author of Structural Health Monitoring with Piezoelectric Wafer Active Sensors (Elsevier Academic Press, 2nd Ed.) as well as other 6 books, 16 book chapters, and over 100 archival journal articles. He has recently completed his duty as chair of this SPIE Symposium on Smart Structures and NDE. He was recognized with Structural Health Monitoring Person of the Year Award 2003 and Nondestructive Evaluation Lifetime Achievement Award 2016. Fellow of the Royal Aeronautical Society (RAeS), Fellow of ASME, and Associate Fellow of AIAA. Special Issues Editor to the *Structural Health Monitoring – An International Journal* (Sage, UK). Associate Editor to the *Aeronautical Journal of RAeS*.

9:15 to 10:00 am:

ADAPTIVE STRUCTURES: A PERSONAL HISTORICAL PERSPECTIVE



James E. Hubbard

Univ. of Maryland, College Park (USA)

Abstract: After more than 30 years of practice in the field Dr. Hubbard shares highlights of his personal journey in the field of Adaptive Structures. From its beginning with applications to Large Space Structures during the Star Wars era to the evolution of

Morphing Aircraft, smart materials, sensors and actuators it continues to spark and feed the imagination of researchers and the public at large. The field has truly become multidisciplinary spanning the disciplines of materials, mechanics, controls and design and attracts young talent from around the world.

Biography: **Dr. James Hubbard** began his career as a Marine Engineer in 1971 licensed to operate steam and diesel engines (unlimited horsepower) by the United States Coast Guard. In this role he served in Vietnam as a contractor to the US Military Sealift Command. He later received B.S., M.S. and PhD degrees from the Massachusetts Institute of Technology and served there as an Assistant Professor. His area of expertise is Adaptive Structures where he has been awarded 24 patents US and Worldwide, all in adaptive structure technology. He is a Fellow in the AIAA and ASME and a member of the National Academy of Engineers.

Tuesday 28 March · 8:10 to 10:00 AM
Location: Salon E

8:10 to 8:30 am:

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

8:30 to 9:15 am:

NDE FOR THE 21ST CENTURY: INDUSTRY 4.0 REQUIRES NDE 4.0



Norbert Meyendorf

Iowa State Univ. (USA)

Abstract: Industry 4.0 stands for the fourth industrial revolution that is ongoing at present. Industry 4.0 is a terminology preferred used in Europe to characterize the integration of production and communication technologies, the so called “smart factory”.

The first industrial revolution was the mechanization of work. The second was mass production and the assembly line. While the third revolution was the computer integrated manufacturing. Industry 4.0 encompasses the complete networking of all industrial areas. Lowering costs and efficient in-time production will be possible also for low numbers of very unique parts for example by additive manufacturing (3D printing). A significant aspect is also quality and maintainability of these sometimes unique structures and components. NDE has to follow these trends, not only by adapting NDE techniques to the new technologies, but also introducing the capability of cyber systems into the inspection and maintenance processes. The requirements and challenges for this new technological area will be discussed. Chances for applications of new technologies and systems for NDE will be demonstrated online.

Biography: **Dr. Norbert Meyendorf** is professor in the Aerospace Engineering at the Iowa State University and deputy director of the Center for Nondestructive Evaluation in Ames, Iowa since January 2016. Before moving to Ames he was department head and branch director at the Fraunhofer institute for Nondestructive Testing in Germany for more than 20 years and Professor at the University of Dayton, Ohio and the University of Technology in Dresden, Germany for more than 10 years. He has edited several books, is author or coauthor of numerous journal articles and is editor in chief of the *Journal of NDE* published by Springer. He was chair of the SPIE symposium Smart Structures and NDE for 4 years and since 2001 every year chair or co-chair of a Conference within this symposium.

PLENARY SESSIONS

9:15 to 10:00 am:

A SMART STRUCTURAL DYNAMICS STRATEGY FOR TESTING TOMORROW'S STRUCTURES



David J. Ewins

Imperial College London (United Kingdom)

Abstract: All structures for which dynamic behaviour is a primary consideration require application of advanced methods of both theoretical and experimental structural dynamics. Specifically, advances in predictive methods of simulation (especially in the

numerical analysis aspects) can demand matching advances in testing to provide commensurate accuracy and coverage of the validation of their output. Acquisition of an improved prediction capability is usually accompanied by an increase in expectations and demands for greater reliability in the predicted behaviour. As a direct result, progress in testing and simulation must advance in step and improvements in testing can often be achieved by smarter implementation of contemporary test procedures based on interpretation of the more advanced models used for their design. This lecture presents an integrated test-analysis strategy for ensuring that next-generation structures of all types exhibit much improved reliability in their structural performance.

Biography: **David Ewins** studied at Imperial College London and at Cambridge University. He was based at Imperial throughout his career, as Professor of Vibration Engineering since 1983, working throughout his career in collaboration with Rolls-Royce. He also spent 8 years part-time at Bristol University and has been Visiting Professor in the USA, France, Switzerland and Singapore. He is a Fellow of the Royal Society, the Royal Academy of Engineering and the Society of Experimental Mechanics. He received the 2015 ASME Jacob P Den Hartog Award for lifetime achievements in Vibration Engineering.

SPECIAL AND TECHNICAL EVENTS



All-Symposium Welcome Reception

Sunday 26 March · 6:00 to 7:30 pm

Location: Truss

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

EAPAD Keynote Presentation

Sunday 26 March · 10:30 to 11:10 am

Location: Salon E

ELECTROACTIVE POLYMERS FOR HEALTHCARE AND BIOMEDICAL APPLICATIONS



Siegfried Bauer, Johannes Kepler Univ. Linz (Austria)

Abstract: Electroactivity was noticed early in biological substances, including proteins, polynucleotides and enzymes, even piezo- and pyroelectricity was found in wool, hair, wood, bone and tendon. I will start the presentation with hydroxyapatite - a material full of surprises. Hydroxyapatite forms about

60 to 70 % of the mass of human and animal bone. In early investigations of piezo- and pyroelectricity in bone it was believed that the observed effects stem from the polar collagen component of bone, since hydroxyapatite was believed to be isostructural with the centrosymmetric apatite. Surprisingly later on a noncentrosymmetric structure was found, together with quite strong piezo- and pyroelectricity in this natural material. Although there is still a strong debate about the physiological importance of electroactive effects in biological materials, this example shows how widespread electroactive phenomena are in natural materials. Let's draw inspiration from nature

and widen the utilization of electroactive polymers towards (mobile) healthcare and biomedical applications. Ferroelectrets, internally charged polymer foams with a strong piezoelectric thickness coefficient are already employed in biomedical sensing, for example as blood pressure and pulse sensor, as vital signs monitor or for the detection of tonic-clonic seizures. Piezo- and pyroelectric polymers are booming in printed electronics research, providing electronic skin the ability to "feel" pressure and temperature changes, or to generate electrical energy from vibrations and motions, even from contractile and relaxation motions of the heart and lung. Dielectric elastomers on the other hand are pioneered by stretchsense as wearable motion capture sensors, monitoring pressure, stretch, bend and shear, quantifying comfort in sports and healthcare. On the cellular level, electroactive polymer arrays are used to study mechanotransduction of individual cells. Most recent efforts are devoted to implantable electroactive biomedical devices. Already with the currently available science and technology, we are at the verge of witnessing the demonstration of truly complex bionic systems. Without much doubt, the future of electroactive polymer materials is bright.

Biography: **Siegfried Bauer** studied physics at the University of Karlsruhe, where he graduated with the Master in 1986. In 1990 he received a PhD in physics from the same university. From 1992 - 1995 he was a senior scientist at the Heinrich Hertz Institute for Telecommunication Engineering in Berlin. In 1996 he received the Habilitation degree from the University of Potsdam. From 1997 -2002 he was an associate professor at the Johannes Kepler University in Linz, Austria; he became a full professor and head of the Soft Matter Physics Department in 2002. He is an associate editor of *Applied Physics Reviews* and a member of the editorial board of *Advanced Science*, *Advanced Materials Technologies*, *Applied Physics A*, the *IEEE Transactions on Dielectrics and Electrical Engineering* and *Proceedings A of the Royal Society*. He received several awards for his work, including the Karl Scheel prize of the Physical Society of Berlin in 1997, a pioneer of smart production award from the Austrian Society for Environment and Technology in 2010, and an ERC Advanced Investigators Grant in 2011. In 2016 he has been elevated to IEEE Fellow for contributions to the understanding and applications of electroactive polymer dielectrics. His research, published in more than 160 refereed scientific papers, centers on soft materials for sensors, transducers, flexible and stretchable electronics.

Nano-, Bio-, Info-Tech Sensors and 3D Systems Keynote Presentation

Monday 27 March · 10:10 to 10:50 am
Location: Salon A

EPIDERMAL ELECTRONIC SYSTEMS FOR SENSING AND THERAPY



Nanshu Lu, The Univ. of Texas at Austin (USA)

Abstract: Epidermal electronics is a class of noninvasive, skin-conformable, stretchable sensors and electronics capable of continuous and long-term physiological sensing and clinical therapy. We have invented a cost and time effective, completely dry, benchtop “cut-and-paste” method for the green, freeform and portable manufacture of epidermal

electronics within minutes. We have applied the “cut-and-paste” method to manufacture epidermal electrodes, hydration and temperature sensors, conformable power-efficient heaters, as well as cuffless continuous blood pressure monitors out of metal thin films, 2D materials, and piezoelectric polymer sheets. We will demonstrate four examples of our epidermal sensing and therapeutic devices in this talk.

Biography: **Dr. Nanshu Lu** received her PhD from Harvard and is now Assistant Professor at the University of Texas at Austin. Her research on stretchable and bio-integrated electronics have received more than 4000 citations and have brought her numerous prestigious awards such as TR 35, NSF CAREER, and YIP from AFOSR and ONR.

Tutorial: Applications of Uncertainty Analysis in Smart Materials and Adaptive Structures

Monday 27 March · 10:30 am to 3:00 pm
Location: Salmon

Instructors: **Ralph Smith**, North Carolina State Univ. (USA) and **William Oates**, Florida State Univ. (USA)

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.

In the first part of the tutorial, we will provide an overview of Bayesian statistics 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. To illustrate the uncertainty propagation techniques, we will demonstrate the construction of 95% prediction intervals for PZT models at a given applied field.

As part of the tutorial, participants will have the opportunity to run case studies using MATLAB, if they have a local license on their laptop. 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. All tutorial code will be available online for later use by participants not having a local MATLAB license.

This introductory tutorial is intended for graduate students, industrial practitioners, and academic professionals who are interested in quantifying uncertainty in material and structural models in light of experiments or higher fidelity model predictions.

The tutorial is open to all registered attendees on a first-come first-serve basis. Seating is limited.



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.

SPIE Best Student Paper Session

Monday 27 March · 1:30 to 4:00 pm
Location: Hawthorn

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

Poster Session/Reception

Monday 27 March · 6:00 to 7:30 pm
Location: Lower Level Exhibition Hall

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

ADDITIONAL POSTER VIEWING

Monday 27 March · 10:00 am to 4:00 pm
Tuesday 28 March · 10:00 am to 4:00 pm

SPECIAL AND TECHNICAL EVENTS

A Tribute Conference Honoring Daniel Inman

Wednesday 29 March
Location: Mt. Hood

Registered attendees are invited to come celebrate and honor Daniel Inman as a pioneer in the field of smart materials. Dr. Inman has made fundamental advances in several areas, such as self-sensing actuation, energy harvesting, structural health monitoring, and morphing structures. Perhaps more importantly, though, he has inspired many others in the field of smart materials through his teaching, his mentoring, his collegiality, and his outstanding sense of humor. Presentations in this tribute conference will highlight his contributions to the field. Visit pages 57-63 to view the conference program.

Daniel Inman Tribute Luncheon

Tuesday, 28 March · 12:00 pm to 3:00 pm
Location: Mt. Hood

Attendees are welcome to enjoy a banquet lunch with friends and colleagues of Daniel Inman. Lunch will be followed by an opportunity for guests to share accolades and cherished memories of our honored guest. Tickets are \$60 per person.

Lunch with the Experts - A Student Networking Event

Monday 27 March · 12:30 pm to 1:30 pm
Location: Mt. Hood

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



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AWARD EVENTS

Sunday 26 March · 8:15 to 8:30 am
Location: Salon E

2017 NDE Lifetime Achievement Award



Jianmin Qu, Tufts Univ. (USA)

Biography: **Jianmin Qu** is Karol Family Professor and Dean of School of Engineering at Tufts University, where he holds an appointment in the department of Mechanical Engineering. Dr. Qu received his Ph.D. and Master's degrees from Northwestern University in theoretical and applied mechanics. Prior to joining Tufts, Dr. Qu was a Walter P. Murphy Professor in the McCormick School of Engineering and Applied Science at Northwestern University from 2009 to 2015. Before returning to his alma mater in 2009, Dr. Qu was on the faculty of the School of Mechanical Engineering at the Georgia Institute of Technology from 1989 to 2009.

2017 SSM Lifetime Achievement Award



Ralph C. Smith, North Carolina State Univ. (USA)

Biography: **Ralph C. Smith** joined the North Carolina State University faculty in 1998 and, in 2014, was named a Distinguished Professor of Mathematics at NCSU. He is co-author of the research monograph *Smart Material Structures: Modeling, Estimation and Control* and author of the books *Smart Material Systems: Model Development and Uncertainty Quantification: Theory, Implementation, and Applications*. He is on the editorial board of the *Journal of Intelligent Material Systems and Structures* and the *SIAM/ASA Journal on Uncertainty Quantification* and was Chair of the 2003 and 2004 SPIE Smart Structures/NDE conference on Modeling, Signal Processing, and Control.

Monday, 27 March · 8:20 to 8:30 am
Location: Salon E

2017 SPIE Fellow Recognition



Hani E. Naguib, Univ. of Toronto (Canada)

Biography: **Hani E. Naguib** is one of the leading scientists working on smart and multifunctional materials development and characterization. He is best known for his research on the design and development of electro-active polymers used for flexible and wearable electronics in biomedical and energy applications including sensors, actuators, and energy storage and harvesting devices. He and his group have developed new shape memory materials and foam devices for uses in biomedical applications such as prosthetics and drug-delivery systems. Two novel smart-based hybrid actuators have been designed and developed in his lab. He has given extensive service to the scientific community, serving in many leadership capacities for multiple professional societies, including the American Society of Mechanical Engineers, the Society of Plastics Engineers, the Canadian Society of Mechanical Engineers, and the Materials Information Society. Naguib is active in teaching mechanical and materials engineering, developing both undergraduate and graduate curricula. He has also served as the associate chair for undergraduate studies for the Department of Mechanical and Industrial Engineering at the University of Toronto. He has made many contributions to SPIE. In the area of smart materials and structures, he has contributed to the community by organizing sessions and presenting numerous papers. He has contributed manuscripts and presentations, and he has chaired multiple sessions of the SPIE Smart Structures and Non Destructive Testing Conference. He also has served as co-chair of the conference on Behavior of Multifunctional Materials. He has published work in the *Journal of Medical Imaging*. Naguib has received many honors and awards. He is a member of the Royal Society of Canada and a fellow of the Society of Plastics Engineers, the American Society of Mechanical Engineers, the Institute of Materials, Minerals, and Mining, and the Canadian Society of Mechanical Engineers.

Tuesday, 28 March · 8:10 to 8:30 am
Location: Salon E

SPIE Best Student Paper Award

SPIE is sponsoring the best student paper contest. Papers will be presented in a special session on Tuesday 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 VII conference chairs will present the Best Student Paper Award from their conference.

Sponsored by



EAP-in-Action Demonstration Awards

As part of the EAPAD conference of the SPIE Smart Structures/NDE symposia, the EAP-in-Action Demonstration Session has been held over the past 18 years. In an effort to encourage excellence in developing the Electroactive Polymers (EAP) demonstrations and accelerate the transition of EAPs to practical and commercial technologies, award certificates will be issued as of the 2017 SPIE Smart Structures/NDE symposium. A judging committee, consisting of leading EAP experts, will select the award winners among the presenters at the EAP-in-Action Demonstration Session. The judges will assess the presenters' performance as well as the quality and content of the demos. The top ranked three will be recognized and will be awarded certificates.

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19th Annual EAP-in-Action Session and Demonstrations

Sunday 26 March · 4:30 to 5:45 pm · Location: Salon E



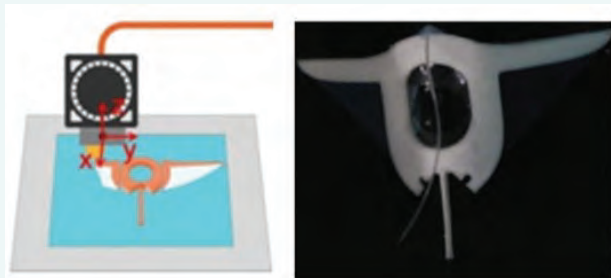
Session Chair:
Joseph Bar-Cohen
Jet Propulsion Lab. (USA)

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:

Soft robot group with multiple materials and configurations

Jing Dai, Banguan Liu, Feiyu Chen, Sukai Wang, Zhiqiang Fu, Tiefeng Li, Zhejiang Univ. (China)



Soft robotics and smart structures will be demonstrated that are made of multiple soft active materials, and can be fabricated by

3D printing method. Driven by dielectric elastomer, the robot shows excellent performances in large actuation and fast response. Using a common compact power and control electronics, various configurations of soft robot can be designed as actuated modules. Smart structures made of temperature active tough hydrogel will also demonstrate as actuators of bio-medical applications. The operation principles may guide the further design of soft robots for various applications.

Applications of smart deformable polymers

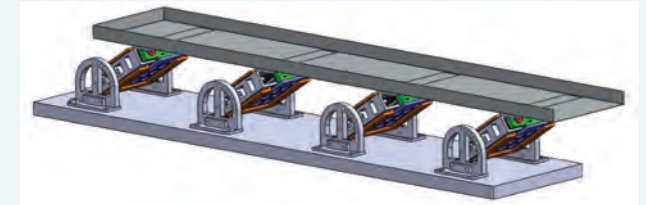
Liwu Liu, Jinrong Li, Fengfeng Li, Xiongfei Lv, Xin Lan, Yanju Liu, Jinsong Leng, Harbin Institute of Technology (China)



This demonstration will show smart polymers in action taking advantage of their being light weight, fast response, and large deformation. These advantages make them attractive for applications in smart bionics, aerospace, biomedicine and other fields. The demonstration will include the applications of EAP, shape memory polymer (SMP) and pneumatic artificial muscle (PAM), such as soft robot, soft continuum manipulator, smart release device, adaptive eyewear frame and other deformable structures.

DEA-driven vibratory feeder

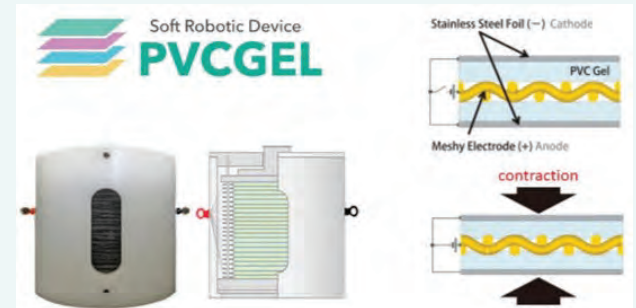
Steffen Hau, Mathias Hoffmann, Stefan Seelecke, Saarland Univ. (Germany)



Vibratory feeders are widely used in part handling technology for transport, aligning and/or feeding parts to a certain process. Currently they are driven by electro-magnetic actuators and unbalance motors, which do not allow arbitrary vibration profiles or changes of amplitude / frequency during operation. Dielectric elastomer actuator (DEA) show potential to overcome these drawbacks. A fully functional DEA driven vibratory feeder transporting small goods will be demonstrated, showing DEAs potential in this new field of application. Picture is showing a CAD model of the feeder consisting of transport channel (grey) with four actuator modules underneath.

Multilayered PVC gel artificial muscle

Minoru Hashimoto, Yi Li, Aya Suzuki, Hanako Niwa, Rina Yokotsuka, Shinshu Univ. (Japan)



Multilayered contraction type PVC gel actuator was developed using stainless mesh electrodes having many positive characteristics. This include being soft and lightweight, with stable actuation in air and with high output. It is activated by applying voltage of 400V, and the displacement of 60-layer artificial muscles is ~3.0mm, with contraction strain of ~10%, and the maximum output force is ~50kPa. The response rate is 9Hz, and the current is about 0.45mA.

EAP-in-Action Demonstrations continue next 2 pages.

19TH ANNUAL EAP-IN-ACTION SESSION AND DEMONSTRATIONS *continued*

Biomimetic robot system for plumbing tests

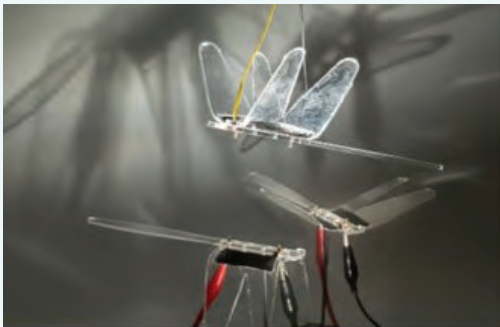
Tempuu Siva, Teruo Toyoda, and Fujio Mine, Haloworld Inc., Fukushima (Japan)



A tubular inchworm robot mechanism that is driven by electroactive polymer and air pressure will be presented. This robot will be equipped with a camera to allow testing the plumbing of the decommissioned Fukushima Daiichi Nuclear Power Plant. The robot is capable of traversing thru the many elbow sections along the more than several hundred meter plumbing. The use of the EAP actuation mechanism allows for smooth operation through the curvatures along the plumbing path.

Multilocation sensing on one input/output and EAP zoo

Patrin Illenberger, Katie Wilson, Andreas Tairych, Chris Walker, Antoni Harbuz and Iain Anderson, Auckland Bioengineering Institute (New Zealand)



The Biomimetics Lab presents:

1. The multisensor shirt that can measure stretch at several locations from one input/output

2. The Electroactive polymer zoo: we present the latest self-regulating crawling caterpillars and wing-flapping dragonflies fabricated from printed polymer and electrode. No need for electronics!

New EAP products

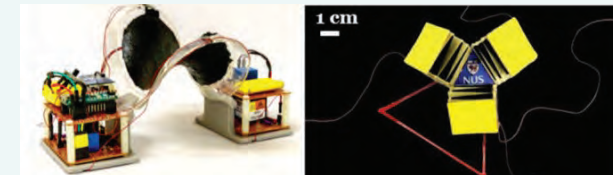
Markus Henke, StretchSense, Ltd. (New Zealand)



What's new in wearable electroactive polymer sensing and energy harvesting

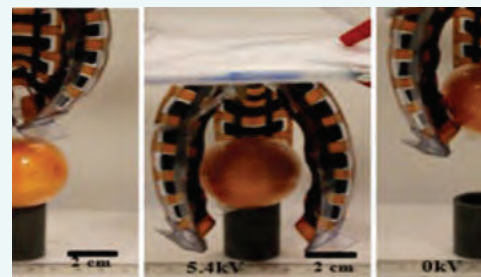
Soft untethered robots

Godaba Hareesh, Jiawei Cao, Jian Zhu, Nanyang Technological Univ. (Singapore)



Soft untethered robot will be demonstrated that mainly consists of a deformable robotic body and two paper-based feet (Figure 1). Based on the optimal mechanical design, the robot is capable of achieving autonomous movements. In addition, an origami-based soft robot will be demonstrated (Figure 2)

Dielectric elastomer grippers using tensioned arch flexures



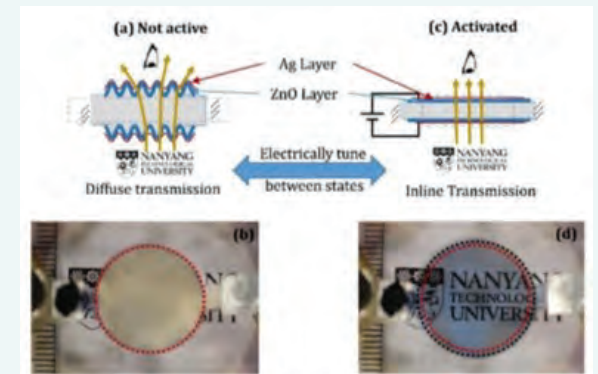
Anansa S. Ahmed and Lau Gih Keong, Nanyang Technological Univ. (Singapore)

The following are going to be demonstrated:

1. Versatile DEA grippers with enhanced tip angle deflection and blocked force due to tension arch flexure structure
2. Grippers capable of grasping and lifting a variety of objects including highly deformable materials without damage.

Electrically tuning transparency by wrinkling of ZnO/Ag thin film

Milan Shrestha, Rosmin Elsa Mohan, Anansa Ahmed, Anand Asundi, Gih-Keong Lau, Nanyang Technological Univ. (Singapore)

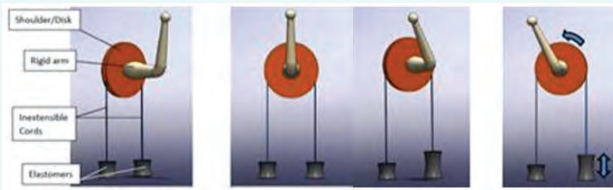


This demonstration unit consists of transparency tunable device. It works based on wrinkling and unfolding a ZnO/Ag-coated elastomer substrate using a dielectric elastomer actuator (DEA). Initially, the membrane is at wrinkled state and the device is opaque. An object placed underneath the membrane will not be visible. When the DEA device is electrically activated, the wrinkles are flattened turning the device to a transparent membrane and the object placed behind the device becomes clearly visible. Reversible tuning between the two states can be obtained electrically for a large number of cycles.

A stackable and configurable antagonistic actuator system for a wrestling arm

Koh Soo Jin Adrian, Stoyan Smoukov, Ang Marcelo H. Jr., Vy Khanh Vo Tran, Anup Teejo Mathew, Lionel Chong, Lester Leong, National Univ. of Singapore (Singapore) and Cambridge Univ. (United Kingdom)

19TH ANNUAL EAP-IN-ACTION SESSION AND DEMONSTRATIONS



Two stackable loudspeaker-type dielectric elastomer actuator (DEA) modules which have continuous-tuneable movement by voltage will be demonstrated. When voltage is continuously switched between two DEA modules, the linear motion will be transferred to the controllable rotation of the arm with the extra mechanical design. During operation, a voltage is applied across the elastomer on the right, causing it to expand and “relax”. The elastomer on the left contracts due to tension in itself, pulling on the disc and rotating the arm anti-clockwise. No voltage is applied across the left elastomer. The force exerted by the left elastomer is determined by the pre-stretching done mechanically. A discharge circuit also be included to remove the charge stored in DE membrane immediately once turning off voltage to get faster actuation, hence increases the power for the arm.

PetaPicoVoltron: an open-source portable high-voltage supply

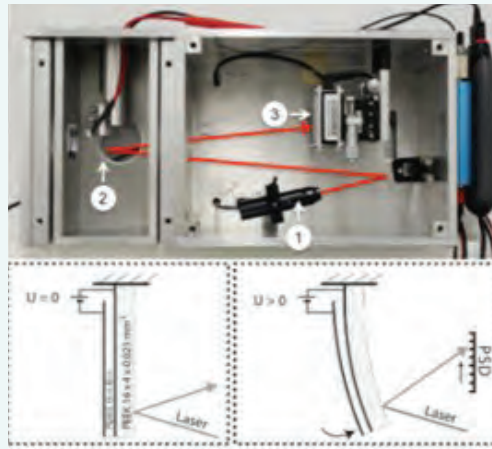
Samuel Rosset and Samuel Schlatter, EPFL (Switzerland)



A portable high voltage power supply (HVPS) will be demonstrated that is specifically designed to drive DEAs. Its output DC voltages is up to 5kV with a resolution of 0.1% of full scale, and can generate square wave signals from 1mHz to 1kHz with a slew rate faster than 15V/ μ s. It has a user friendly GUI enabling easy interaction with the HVPS, and using LabView library makes it simple to integrate the power supply with other instruments. The circuit layout and the software have been released as an open-source project, for anyone to use and improve.

Apparatus for measuring the actuation forces of DEAs via cantilever bending

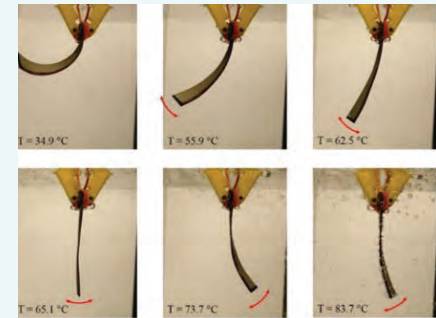
Bekim Osmani, Tino Topper, Burt Miller, Univ. of Basel (Switzerland)



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. Light from a laser (1) reflects off from a DEA-based cantilever (2). When a DC-voltage is applied, the cantilever bends (bottom schematic). A position sensitive detector (3) measures the resulting deflection of the laser beam.

Development of an origami soft robot using multiple shape memory ionic polymer-metal composite

Qi Shen, Sarah Trabia, Tyler Stalbaum, Taeseon Hwang, Robert Hunt, Zakai Olsen, Kwang Kim, Univ. of Nevada, Las Vegas (USA)



The multiple-shape-memory ionic polymer-metal composite (MSM-IPMC) actuator is used to demonstrate complex 3D deformation. The MSM-IPMC has two characteristics, which are the electro-mechanical actuation effect and the thermal-mechanical shape memory effect. The bending, twisting, and oscillating motions of the actuator could be controlled simultaneously or separately by means of thermal-mechanical and electro-mechanical transactions. Using the MSM-IPMC, a soft biomimetic robot was developed that has origami structure. The multiple shape memory effect enables the robot to change its shape and in return enables the robot to move forward in water. This work may bring inspiration for designing new soft robotic systems with the MSM-IPMC actuators.

Synthetic Muscle: shape-morphing and sensing EAP-based materials and actuators

Lenore Rasmussen, Ras Labs LLC (USA)



The operation of the latest Synthetic Muscle™ based actuators will be demonstrated. These are actuators that contract and expand, attenuate impact, and sense pressure. Actuation will be performed underwater, on land with suitable elastomeric coatings, and impact (mechanical pressure) resistance demonstrated. Also, prosthetic liner prototype with self-adjusting EAP based pads and sensing robotic gripper will also be demonstrated.

3D Printing Demonstration Session

Monday 27 March · 4:00 to 6:00 pm
Location: Salon F



Session Chairs:

Ajit Khosla,
Yamagata Univ. (Japan)



Hidemitsu Furukawa,
Yamagata Univ. (Japan)

This demonstration session is a part of conference 10167 on Nano-, Bio-, and Info-Tech Sensors and 3D Systems and will cover new 3D printing technologies such as soft robotics, molecular models, and food.

Each demonstration will include a brief oral talk describing the technology. All registered attendees are welcome.

TENTATIVE DEMONSTRATIONS:

The flexibility controlling study for 3D printed splint

Jianyou Li, Hiroya Tanaka, Keio Univ. (Japan)

The concept of 3D printed splint appeared in few years ago, and its light weight and ventilation can improve the comfortableness for patients. In this study, two main techniques to control the infilling densities and printing temperature are applied on printing splint prototype. The gradual increasing of infilling density from splint outside to inside would turn the partial strength from hard to flexible. Besides, higher printing temperature can also achieve stronger hardness after cooling. Such structural can provide high strength in outside surface to keep the immovable function, and give flexible touch of inside surface to decrease friction on the patient's skin.

3D printing and IoT for personalized everyday objects in nursing and healthcare

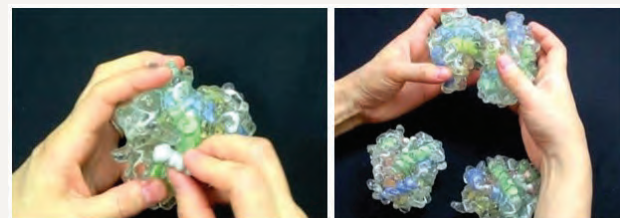
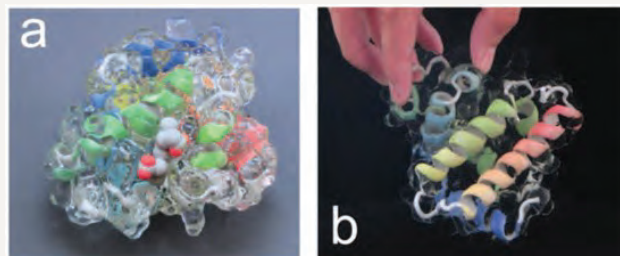
Yoshihiro Asano, Hiroya Tanaka, Shoko Miyagawa, Junki Yoshioka, Keio Univ. (Japan)

Today, 3D printing in medical use are mainly focusing on the symptom itself, not on everyday lives of patients. However, with life span extending, many of us will live a life with chronic disease for long time. To support their lives, we use 3D printing for making

everyday objects from a nursing / healthcare perspective. In our project, we invited many kinds of people such as engineers, nurses and patients to our research activity and found methodologies for collaboration. Also we're developing the IoT sensing system, which monitor activities of 3D printed objects remotely.

3D printing of protein molecules

Masaru Kawakami, Hidemitsu Furukawa, Yamagata Univ. (Japan)



Protein molecules play many critical roles in our body. They have large and complex structures, and understanding of the relationship between their structures and biological functions is a crucial key for biology and medicines. At the present, to conceptualize structures of proteins, we rely on computer graphics of their three-dimensional (3D) structure. On the other hand, physical models can convey "intuitive" understanding, and that is really useful for education and even for peer discussion. The first author Kawakami invented a new molecular model called "Kawakami model", which is a soft, transparent handleable model, can be fabricated by 3D printing and transparent silicone resin. A full-color printed amino acid chain structure is embedded in the silicone body. The silicone body represents the molecular surface of a protein molecule. Users can simultaneously feel the molecular surface, view through the main chain structure, and even manually simulate molecular docking. This model is already commercialized and available upon request. So far many Kawakami models have already been shipped and being used as effective discussion tools for the classroom/laboratory, exhibition in museums/institutes, and outreach activities. In this session, some Kawakami models will be presented, and demonstration of "hands-on" protein-ligand docking and protein-protein interaction will be performed.

Smart walking stick for blind people: an application of 3D printer

Faidur Rahman, Md. Allama Ikbal, Univ. of Rajshahi (Bangladesh); Md. Hasnat Kabir Hidemitsu Furukawa, Yamagata Univ. (Japan)

A prototype of the smart walking stick has been designed and characterized for the people who are visually impaired. The proposed system was designed into two stages, i.e. hardware and software. Two ultrasonic sonar sensors were used to detect in front obstacle and street surface obstacle such as a manhole. The distance between sensor and the obstacle is calculated by the received signal. The calculated distance value is compared with the pre-defined value and determines whether the obstacle is present or not. An Up-Mini 3D printer was used to print the sensor holders which were mounted on the walking stick. Therefore, the sensors were fixed in the right position. Another sensor was used for the detecting the water on the walking street. The performance for detecting the obstacles and water indicate the merit of the smart walking stick.

3D gel printing and applications

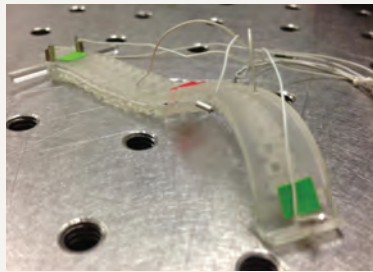
Kazuyuki Sakai, Masato Wada, Kyuuchiro Takamatsu, Azusa Saito, Ajit Khosla, Masaru Kawakami, Hidemitsu Furukawa, Yamagata Univ. (Japan)



We have developed 3D gel printer from 8 years ago. Around two thousand years ago, high strength gels were invented by Japanese researchers. However, it was difficult to process high strength gels (Fig. 1), because gel is soft material and complex synthesis procedures are needed. In SWEL, we develop a new type of high strength gels (ICN4, P-DN5)), which can be used for 3D gel printer. Furthermore, we developed two types of 3D gel printer, "Bathtub type" and "Dispenser type" in Strategic Innovation promotion Program (SIP) supported by cabinet office, government of Japan. Figure 2 shows 3D models made by high strength gels. Not only 3D gel printer, we have studied another processing methods using laser cutter, using mold. Figure 3 shows 3D gel printers. Another side of important specific of high-strength gel is low friction. Taking this advantage, we have studied gel-sheet, gel-O-ring, and so on. The apparatus of Fig.4 is gel friction meter to measure friction and/or toughness of the gel. This is also supported by the national project named "Green Tribology Innovation Network" in the area of Advanced Environmental Materials, Green Network of Excellence (GRENE). We will show samples made by high strength gels in the demo session.

Caterpilike: a soft-bodied 3D printed robot inspired by caterpillars

Takuya Umedachi, The Univ. of Tokyo (Japan)



Caterpilike is a soft-bodied 3-d printed robot inspired by caterpillars. Caterpillars are excellent living models to extract the mechanical and control design principles for soft-bodied robots, since they produce adaptive and resilient behaviors by orchestrating the large degrees of freedom in

their bodies (no explicit skeletons) with small numbers of neurons. Compared with traditional robotic systems consisting of hard-rigid components, the robot generates crawling locomotion driven by a few actuators by exploiting the continuum large-deformation of the soft material. We believe that such body design is important to endow a robotic system to have high an affinity with our living and natural environments.

3D printing in social education: Eki-Fab and student PBL

Masato Makino, Azusa Saito, Mai Kodama, Kyuuichiro Takamatsu, Hideaki Tamate, Kazuyuki Sakai, Masato Wada, Ajit Khosla, Masaru Kawakami, Hidemitsu Furukawa, Yamagata Univ. (Japan)



Additive manufacturing or 3D printer is one of the most innovative material processing methods. We are considering that 3D printing human resources would be needed in the world in the future. To educate the abilities of the digital fabrication, we have the public digital space "Eki-Fab" for junior and high school students and Project Based Learning (PBL) class for bachelor course students. Eki-Fab is held on Saturday in the 2nd floor of the Yonezawa train station. In the "Eki-Fab", anybody can study the utilizing of 3D printer and its related modeling technics under the instruction of staff in Yamagata University. In the PBL class, we have the class every Thursday. The students get the techniques of the digital fabrication through the PBL.

3D printing for food

Mai Kodama, Azusa Saito, Masato Makino, Ajit Khosla, Masaru Kawakami, Hidemitsu Furukawa, Yamagata Univ. (Japan)



We have been developing a new food by using the 3D printer in cooperation with local companies. Now, we would like to introduce two types of new products was realized in this effort as shown in Fig.1 and Fig.2. Fig.1 is a jelly with the form of a carp. This jelly is melted if you soak it in the hot water, so you can eat it as a soup. Fig. 2 is a jelly with the form of a lantern. Since this jelly does not melt even at high temperatures, you can eat as warm jelly. These jellies were formed by molds made by using the 3D printer as shown in Fig. 3. We made the jellies with the form of a carp and a lantern, because locals likes carps and lanterns. Carp has been eaten for a long time following economical instructions of the then governor. Because our local area receives a lot of snow in the region, there is a festival to make a lot of snow lanterns. If the practical application of the 3D printer is advanced, everyone can make the original food easily, and everyone may enable obtaining enjoyment of eating.

Direct material weaving by G-code manipulation

Soko Koda, Hiroya Tanaka, Keio Univ. (Japan)

Polymer-based blood vessel models with micro-temperature sensors in EVE

Mizue Mizoshiri, Yasuaki Ito, Takeshi Hayakawa, Junpei Sakurai, Seiichi Ikeda, Fumihito Arai, Seiich Hata, Nagoya Univ. (Japan)

3D printing of wearable fractal based sensor systems for neurocardiology and healthcare

Vijay K. Varadan, Mouli Ramasamy, The Pennsylvania State Univ. (USA)

Neurocardiology is the pathophysiological interplay of nervous and cardiovascular systems. The communication between the heart and brain has revealed various methodologies in healthcare that could be investigated to study the heart-brain interactions and other cardiovascular and neurological diseases. A textile-based wearable nanosensor system in the form of e-bra, e-shirt, e-headband, e-brief, underwear etc., was presented in SPIE conferences earlier for noninvasive recording of EEG and EKG, and showing the correlation between the brain and heart signals. In this paper, the technology is expanded further using fractal based geometries using 3D printing system for low-cost and flexible wearable sensor systems for healthcare.

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Electroactive Polymer Actuators and Devices

SC634

Course Level: Introductory · CEU: 0.4

MEMBER \$360.00; NON-MEMBER \$410.00;
STUDENT MEMBER \$239.00

Saturday 25 March 2017 · 1:30 PM to 5:30 PM

This course will provide an overview of the field of EAP covering the state of the art, challenges and potential. Three general classes of polymer materials are described, namely those that involve ionic mechanisms (Ionic EAP including gels), field activated materials (Electronic EAP) and torsional actuators (typically thermally or electrothermally driven). The basic mechanisms responsible for the active 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 and sensors in systems, mechanisms and smart structures for industrial and medical applications.

LEARNING OUTCOMES

identify EAP based available and emerging actuators/sensors learn the fundamentals of electroactive behavior in leading EAP materials describe the capabilities, limitations and benefits of electroactive polymers become familiar with fabrication processes review mechanical analysis and design principles associated with EAP assess the applicability of current EAP actuators while accounting for their limitations describe the future prospects of EAP materials as actuators and their applications

INTENDED AUDIENCE

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

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.

INSTRUCTORS

John David 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>

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

Geoffrey M. Spinks, is a Professor of Materials Engineering at the University of Wollongong, Australia. His research interests focus on new materials and manufacturing methods for artificial muscles, soft robotics and wearable robotics. <http://globalchallenges.uow.edu.au/the-team/UOW156626.html>

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GENERAL INFORMATION

REGISTRATION

Onsite Registration and Badge Pick-up Hours

Lower Level 1

Saturday 25 March 11:00 am to 5:00 pm

Sunday 26 March 7:00 am to 5:00 pm

Monday 27 March 7:30 am to 4:00 pm;
5:30 pm to 7:00 pm

Tuesday 28 March 7:45 am to 4:00 pm

Wednesday 29 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 volume or online proceedings collection.

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.

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For credentialed press and media representatives only. Please email contact information, title, and organization to media@spie.org.

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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.

Receipt 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.

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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

Speaker Check-In and Preview Station

Lower Level 1 Foyer

Sunday through Wednesday. 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

Lower Level 2

Monday 27 March

Poster presenters may set up between 10:00 am and 4:00 pm on Monday 27 March. Presenters who have not set up by 4:00pm on Monday will be considered a “no show” and their manuscript will not be published. Presenters must remove their posters on Tuesday 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 Tuesday 28 March.

GENERAL INFORMATION

ONSITE SERVICES

Internet Access

Complimentary wired Internet access is available near SPIE registration; attendees can hook up their laptops or use provided workstations.

Attendees staying at the Marriott Hotel can receive discounted guestroom WiFi for \$2 per day and is free if you sign up as a Marriott Reward member.

The Marriott Lobby has complimentary WiFi and two computers for Boarding Pass printing, 15min online access and a printer.

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- The Marriott has two computers in the lobby for Boarding Pass printing, 15min online access and a printer.

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Registration Area

The SPIE Bookstore is your source for the latest SPIE Press Books, Proceedings, and Education and Professional Development materials. Browse and purchase the latest SPIE Books.

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Found items will be kept at SPIE Cashier until the end of the meeting and then turned over to the Marriott Hotel.

FOOD AND BEVERAGE SERVICES

Coffee Breaks

Lower Level 2

Complimentary coffee will be served twice daily, at 10:00 am and 3:00 pm. Check individual conference listings for exact times and locations.

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Hot and cold entrees, salads, and drinks are available for purchase in the Lobby Bistro and Truss American. Cash and credit cards accepted.

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CONFERENCE SESSION SCHEDULE

	CONFERENCE 10162 Bioinspiration, Biomimetics, and Bioreplication VII	CONFERENCE 10163 Electroactive Polymer Actuators and Devices (EAPAD) XIX	CONFERENCE 10164 Active and Passive Smart Structures and Integrated Systems XI	CONFERENCE 10165 Behavior and Mechanics of Multifunctional Materials and Composites XI	CONFERENCE 10166 Industrial and Commercial Applications of Smart Structures Technologies XI	CONFERENCE 10167 Nano-, Bio-, Info-Tech Sensors and 3D Systems
Sunday 26 March	<p>10:30 am to 10:40 am Welcome <i>(Knez)</i></p> <p>Session 1 Sun 10:40 am to 11:50 am Flight <i>(Knez)</i></p> <p>Session 2 Sun 1:00 pm to 3:00 pm Mechanobiology and Drug Delivery <i>(Lakhtakia)</i></p> <p>Session 3 Sun 3:30 pm to 6:00 pm Materials <i>(Martín-Palma)</i></p>	<p>Session 1 Sun 10:30 am to 11:50 am EAP as Emerging Actuators <i>(Bar-Cohen, Rossiter)</i></p> <p>Session 2 Sun 1:20 pm to 3:20 pm Sensors Using EAP Materials <i>(Bauer, Kim)</i></p> <p>4:30 pm to 5:45 pm EAP-in Action Demonstration Session <i>(Bar-Cohen)</i></p>	<p>Session 1 Sun 10:30 am to 12:10 pm Energy Harvesting and Scavenging I: Modeling <i>(Erturk, Bryant)</i></p> <p>Session 2 Sun 1:20 pm to 3:00 pm Smart Sensing and Signal Processing for Diagnostics <i>(Park, di Scalea)</i></p> <p>Session 3 Sun 3:30 pm to 5:50 pm Piezo-based Materials and Systems <i>(Konh, Tarazagaa)</i></p>	<p>Session 1 Sun 10:30 am to 12:10 pm Advances in Piezoelectric Materials <i>(Goulbourne, Naguib)</i></p> <p>Session 2 Sun 1:20 pm to 3:00 pm Ferroelectric Materials <i>(Sodano)</i></p> <p>Session 3 Sun 3:30 pm to 5:30 pm Shape Memory Materials I <i>(Hartl, Lagoudas)</i></p>	<p>Session 1 Sun 10:30 am to 11:50 am Energy Harvesting/Sensors I <i>(Calkins)</i></p> <p>Session 2 Sun 1:20 pm to 3:00 pm Energy Harvesting/Sensors II <i>(Clingman)</i></p> <p>Session 3 Sun 3:30 pm to 5:00 pm Smart Materials and Applications I <i>(Konh)</i></p>	<p>Session 1 Sun 10:30 am to 12:30 pm Wearable Technology and Healthcare <i>(Varadan)</i></p> <p>Session 2 Sun 1:30 pm to 2:10 pm 3D Printing <i>(Khosla)</i></p> <p>Session 3 Sun 2:10 pm to 3:10 pm 3D Printing and Applications I <i>(Khosla)</i></p> <p>Session 4 Sun 3:40 pm to 4:20 pm Nanosensors and Systems I <i>(Varadan)</i></p> <p>Session 5 Sun 4:20 pm to 6:20 pm Fabrication and Characterization of Nanosensors and Structures I <i>(Kim)</i></p>
Monday 27 March	<p>Session 4 Mon 10:30 am to 11:50 am Characterization <i>(Müller)</i></p> <p>Session 5 Mon 1:40 pm to 3:00 pm Mechanisms and Models <i>(Saito)</i></p> <p>Session 6 Mon 3:30 pm to 5:40 pm Functional Surfaces <i>(Mazzolai)</i></p> <p>5:40 pm to 6:00 pm Poster Pops</p>	<p>Session 3 Mon 10:30 am to 11:50 am Design Methods of Producing EAP Mechanisms <i>(Skov, Koh)</i></p> <p>Session 4 Mon 1:20 pm to 3:00 pm Performance Characterization of Various EAP Materials <i>(Kim, Smoukov)</i></p> <p>Session 5 Mon 3:30 pm to 5:50 pm Artificial Muscle for Soft Robotics <i>(Kim, Porfiri)</i></p>	<p>Session 4 Mon 10:30 am to 12:10 pm Aircraft and Morphing Systems <i>(Han, Inman)</i></p> <p>Session 5 Mon 1:20 pm to 3:00 pm Passive and Active Vibration Isolation Systems I <i>(Ouisse, Zuo)</i></p> <p>Session 6 Mon 3:30 pm to 5:50 pm SMA-based Materials and Systems <i>(Goo, Wang)</i></p>	<p>Session 4 Mon 10:30 am to 11:50 am Metamaterials <i>(Ounaies, von Lockette)</i></p> <p>Session 5 Mon 1:20 pm to 3:00 pm Nanocomposites Materials Applications <i>(Oates, Sundaresan)</i></p> <p>Session 6 Mon 3:20 pm to 6:00 pm Multifunctional Composites <i>(Ciocanel, Kim)</i></p>	<p>Session 4 Mon 10:30 am to 11:30 am Smart Materials and Applications II <i>(Konh)</i></p> <p>Session 5 Mon 1:00 pm to 2:40 pm Smart Materials and Applications III <i>(Lynch)</i></p>	<p>Session 6 Mon 10:30 am to 11:00 am Keynote Session <i>(Varadan)</i></p> <p>Session 7 Mon 11:00 am to 12:20 pm Nanosensors and Systems II <i>(Kim)</i></p> <p>Session 8 Mon 1:50 pm to 2:30 pm Quantum and Nanoengineering <i>(Song)</i></p> <p>Session 9 Mon 2:30 pm to 3:30 pm Energy Storage and Power <i>(Song)</i></p> <p>Session 10 Mon 4:00 pm to 6:00 pm 3D Printing Demonstration Session <i>(Khosla, Furukawa)</i></p>

CONFERENCE SESSION SCHEDULE

CONFERENCE 10168 Sensors and Smart Structures Technologies for Civil, Mechanical, and Aerospace Systems	CONFERENCE 10169 Nondestructive Characterization and Monitoring of Advanced Materials, Aerospace, and Civil Infrastructure XI	CONFERENCE 10170 Health Monitoring of Structural and Biological Systems XI	CONFERENCE 10171 Smart Materials and Nondestructive Evaluation for Energy Systems III
<p>Session 1 Sun 10:30 am to 11:50 am Keynote Session <i>(Sohn, Wang)</i></p> <p>Session 2 Sun 1:00 pm to 3:00 pm Ultrasonic Inspection Methods for SHM <i>(Hong, Peters)</i></p>	<p>Session 1 Sun 10:30 am to 11:50 am Radar NDE/NDT I <i>(Yu, Xia)</i></p> <p>Session 2 Sun 1:20 pm to 2:00 pm Radar NDE/NDT II <i>(Yu, Xia)</i></p> <p>Session 3 Sun 2:00 pm to 3:00 pm UAV-based Health Monitoring <i>(Wan, Yu)</i></p>	<p>Session 1 Sun 10:30 am to 12:10 pm Composite Monitoring I <i>(Kundu, Fromme)</i></p> <p>Session 2 Sun 1:20 pm to 3:00 pm Composite Monitoring II <i>(Rizzo, Ricci)</i></p>	
<p>Session 3 Sun 3:30 pm to 5:50 pm Thin Film Sensing Systems <i>(Ryu, Loh)</i></p>	<p>Session 4 Sun 3:20 pm to 6:00 pm Aerospace and Advanced Materials NDE/NDT <i>(Shull, Zhang)</i></p>	<p>Session 3 Sun 3:20 pm to 6:00 pm Metamaterial I <i>(Huang, Yang)</i></p>	
<p>Session 4 Mon 10:30 am to 11:50 am Vision-based Sensing for Structural Health Monitoring <i>(Jahanshahi, Torbol)</i></p> <p>Session 5 Mon 1:20 pm to 3:00 pm Monitoring Strategies for Civil Infrastructure <i>(Huston, Hoult)</i></p>	<p>Session 5 Mon 10:30 am to 12:00 pm Special Session in Transportation: DOE National Laboratories Presentations I <i>(Feng, Sun)</i></p> <p>Session 6 Mon 1:20 pm to 3:00 pm Special Session in Transportation: DOE National Laboratories Presentations II <i>(Sun, Feng)</i></p>	<p>Session 4 Mon 10:30 am to 11:50 am Metamaterial II <i>(Yang, Huang)</i></p> <p>Session 5 Mon 1:20 pm to 3:00 pm Advancements in Modeling <i>(Banerjee, Qing)</i></p>	<p>Session 1 Mon 10:30 am to 11:50 am Energy Storage and Harvesting I <i>(Woike)</i></p> <p>Session 2 Mon 1:20 pm to 3:00 pm Energy Storage and Harvesting II <i>(Woike)</i></p>
<p>Session 6 Mon 3:30 pm to 5:50 pm Novel Sensing Technologies I <i>(Sohn, Ryu)</i></p>	<p>Session 7 Mon 3:20 pm to 4:40 pm Special Session in Transportation: DOE National Laboratories Presentations III <i>(Liu, Singh)</i></p> <p>Session 8 Mon 4:40 pm to 6:00 pm Special Session in Transportation: DOE National Laboratories Presentations IV <i>(Singh, Liu)</i></p>	<p>Session 6 Mon 3:20 pm to 6:00 pm Bioinspired SHM and Biomaterial Monitoring <i>(Wang, Jiang)</i></p>	<p>Session 3 Mon 3:30 pm to 5:30 pm Wind Energy <i>(Kappatos)</i></p>

CONFERENCE SESSION SCHEDULE

	CONFERENCE 10163 Electroactive Polymer Actuators and Devices (EAPAD) XIX		CONFERENCE 10164 Active and Passive Smart Structures and Integrated Systems XI		CONFERENCE 10165 Behavior and Mechanics of Multifunctional Materials and Composites XI	CONFERENCE 10167 Nano-, Bio-, Info-Tech Sensors and 3D Systems
Tuesday 28 March	<p>Session 6A Tue 10:30 am to 12:10 pm EAP Actuators <i>(Kovacs, Keplinger)</i></p> <p>Session 7A Tue 1:40 pm to 3:00 pm 3D Printing as a Fabrication Method <i>(Oates, Lee)</i></p>	<p>Session 6B Tue 10:30 am to 12:10 pm EAP Based on Dielectric Elastomers I <i>(Spontak, Akle)</i></p> <p>Session 7B Tue 1:40 pm to 3:00 pm Ionic EAP Materials <i>(Anderson, Rosset)</i></p>	<p>Session 7 Tue 10:30 am to 12:10 pm Passive and Active Vibration Isolation Systems II: Metamaterials <i>(Erturk, Li)</i></p> <p>Session 8 Tue 1:40 pm to 3:00 pm Biological-inspired Systems <i>(Wang, Roundy)</i></p>		<p>Session 7 Tue 10:30 am to 11:50 am Self Healing and 3D Printing <i>(Dapino)</i></p> <p>Session 8 Tue 1:20 pm to 3:00 pm Photoresponsive Materials <i>(Smith)</i></p>	<p>Session 11 Tue 10:30 am to 11:10 am Nanosensors and Systems III <i>(Varadan)</i></p> <p>Session 12 Tue 11:10 am to 12:10 pm 3D Printing and Applications II <i>(Varadan)</i></p> <p>Session 13 Tue 1:30 pm to 2:10 pm Nanosensors and Systems IV <i>(Varadan)</i></p>
	<p>Session 8A Tue 3:30 pm to 6:10 pm Analysis and Modeling EAP Actuators Performance <i>(Madden, Lau)</i></p>	<p>Session 8B Tue 3:30 pm to 6:10 pm EAP Materials Fabrication Methods and Processes I <i>(Pei, Spinks)</i></p>	<p>Session 9 Tue 3:20 pm to 6:20 pm EAP Materials Fabrication and Scavenging II: Broadband/ Nonlinear <i>(Harne, Tang)</i></p>		<p>Session 9 Tue 3:30 pm to 5:30 pm Shape Memory Materials II <i>(Lee)</i></p>	<p>Session 14 Tue 2:10 pm to 6:10 pm 3D Printing and Applications III <i>(Khosla)</i></p>
Wednesday 29 March	<p>Session 9A Wed 8:00 am to 10:00 am Applications of EAP Actuators to Robotic Mechanisms I <i>(Rasmussen, Rossiter)</i></p> <p>Session 10A Wed 10:30 am to 11:50 am Applications of EAP Actuators to Various Mechanisms III <i>(Böse, Henke)</i></p> <p>Session 11A Wed 1:20 pm to 3:00 pm Use of EAP in the Form of Fibers and Textile <i>(Li, Spontak)</i></p>	<p>Session 9B Wed 8:00 am to 10:00 am Applications of EAP Actuators to Various Mechanisms II <i>(Müller, Lau)</i></p> <p>Session 10B Wed 10:30 am to 11:50 am Applications of EAP Actuators to Various Mechanisms IV <i>(Liu, Zhu)</i></p> <p>Session 11B Wed 1:20 pm to 3:00 pm EAP Based on Dielectric Elastomers II <i>(Vertechy, Leang)</i></p>	<p>Session 10A Wed 8:00 am to 10:00 am Energy Harvesting and Scavenging III: Applications <i>(Liao, Tadesse)</i></p> <p>Session 11A Wed 10:30 am to 12:10 pm Energy Harvesting and Scavenging IV: General <i>(Youn)</i></p> <p>Session 12A Wed 1:20 pm to 3:00 pm Passive and Active Vibration Isolation Systems IV <i>(Gordaninejad, Kim)</i></p>	<p>Session 10B Wed 8:40 am to 10:00 am Magneto Rheological Systems I: Haptics <i>(Choi, Hung)</i></p> <p>Session 11B Wed 10:30 am to 12:10 pm Passive and Active Vibration Isolation Systems III: Piezoelectric <i>(Tang, Kauffman)</i></p> <p>Session 12B Wed 1:40 pm to 3:00 pm Modeling, Optimization, Signal Processing, Control, and Design of Integrated Systems I <i>(Li)</i></p>		<p>Session 15 Wed 9:10 am to 10:10 am Graphene Nanostructure <i>(Varadan)</i></p> <p>Session 16 Wed 10:40 am to 12:20 pm Fabrication and Characterization of Nanosensors and Structures II <i>(Varadan)</i></p>
	<p>Session 12A Wed 3:30 pm to 5:50 pm Applications of EAP Actuators to Various Mechanisms V <i>(Leng, Mirvakili)</i></p>	<p>Session 12B Wed 3:30 pm to 5:50 pm EAP Materials Fabrication Methods and Processes II <i>(Rossiter, Kim)</i></p>	<p>Session 13A Wed 3:30 pm to 5:50 pm Magneto Rheological Systems II <i>(Sedaghati, Hegger)</i></p>	<p>Session 13B Wed 3:30 pm to 4:30 pm Modeling, Optimization, Signal Processing, Control, and Design of Integrated Systems II <i>(Li, Alipour)</i></p>		

CONFERENCE SESSION SCHEDULE

CONFERENCE 10168 Sensors and Smart Structures Technologies for Civil, Mechanical, and Aerospace Systems		CONFERENCE 10169 Nondestructive Characterization and Monitoring of Advanced Materials, Aerospace, and Civil Infrastructure XI		CONFERENCE 10170 Health Monitoring of Structural and Biological Systems X		CONF. 10171 Smart Materials and Nondestructive Evaluation for Energy Systems III	CONF. 10172 A Tribute Conference Honoring Daniel Inman
<p>Session 7A Tue 10:30 am to 12:10 pm Structural Health Monitoring for Structural and Geotechnical Systems <i>(Loh, Mascareñas)</i></p> <p>Session 8A Tue 1:40 to 3:00 pm Sensing Human Occupants in Buildings <i>(Noh, Yuan)</i></p>	<p>Session 7B Tue 10:30 am to 12:10 pm Multifunctional Materials for Structural Health Monitoring <i>(Lafamme, Porfiri)</i></p> <p>Session 8B Tue 1:40 pm to 3:00 pm Novel Sensing Technologies III <i>(Zonta, Huang)</i></p>	<p>Session 9 Tue 10:30 am to 12:10 pm Civil Infrastructures NDE/SHM I <i>(Chen, Su)</i></p> <p>Session 10 Tue 1:40 pm to 3:00 pm Civil Infrastructures NDE/SHM II <i>(Loh, Lau)</i></p>		<p>Session 7 Tue 10:30 am to 12:30 pm Real-time Sensing and Testing at Extreme Environments <i>(Uhl, Zagrai)</i></p> <p>Session 8A Tue 1:40 pm to 3:00 pm Metamaterial III <i>(Semperlotti, Nouh)</i></p>	<p>Session 8B Tue 1:40 pm to 3:00 pm Guided Waves I: Civil Infrastructures Monitoring <i>(di Scalea, Sohn)</i></p>	<p>Session 4 Tue 10:30 am to 11:50 am NDE of Energy Components and Systems <i>(Meyendorf)</i></p> <p>Session 5 Tue 1:20 pm to 4:30 pm NDE and Monitoring of Energy Components and Systems <i>(Abdul-Aziz)</i></p>	
<p>Session 9A Tue 3:30 pm to 6:10 pm Novel Sensing Technologies II <i>(Loh, Wynne)</i></p>	<p>Session 9B Tue 3:30 pm to 6:10 pm Fiber Optic Sensors for Structural Health Monitoring <i>(Chen, Huang)</i></p>	<p>Session 11 Tue 3:40 pm to 6:20 pm Civil Infrastructures NDE/SHM III <i>(Clayton, Feng)</i></p>		<p>Session 9A Tue 3:30 pm to 6:10 pm Metamaterial IV <i>(Nouh, Semperlotti)</i></p>	<p>Session 9B Tue 3:30 pm to 6:10 pm Guided Waves II: Measurement, Damage Detection, and Scattering <i>(Gopalakrishnan, Todd)</i></p>		
<p>Session 10A Wed 8:00 am to 10:00 am Monitoring Strategies for Bridges <i>(Huang, Rice)</i></p> <p>Session 11A Wed 10:30 am to 12:10 pm Ultrasonic Methods <i>(Lynch, Anton)</i></p> <p>Session 12A Wed 1:20 pm to 3:00 pm Health Assessment of Metallic Structures <i>(Swartz, Salamone)</i></p>	<p>Session 10B Wed 8:40 am to 10:00 am Energy Saving and Harvesting Methods for Sensors <i>(Mascareñas, Cunefare)</i></p> <p>Session 11B Wed 10:30 am to 12:10 pm Control of Large-scale Structures <i>(Asanuma, Sim)</i></p> <p>Session 12B Wed 1:40 pm to 4:50 pm Novel Sensing Technologies IV <i>(Park, Chang)</i></p>	<p>Session 12A Wed 8:00 am to 11:50 am Ultrasonic/Acoustic Emission Technologies I <i>(Jiang, Ozevin)</i></p> <p>Session 13A Wed 1:20 pm to 3:00 pm Ultrasonic/Acoustic Emission Technologies II <i>(Ozevin, Jiang)</i></p>	<p>Session 12B Wed 8:00 am to 10:20 am Modeling and Simulation <i>(Omenzetter, Myers)</i></p> <p>Session 12C Wed 10:50 am to 12:10 pm Piezoelectric Sensing Technologies <i>(Yu, Su)</i></p> <p>Session 13B Wed 1:40 pm to 3:00 pm Other Sensing Technologies <i>(Su, Yu)</i></p>	<p>Session 10A Wed 8:00 am to 10:00 am Nonlinear Techniques <i>(Staszewski, Su)</i></p> <p>Session 11A Wed 10:30 am to 11:50 am Acoustic Emission <i>(Giurgiutiu, Krishnaswamy)</i></p> <p>Session 12A Wed 1:20 pm to 3:00 pm Civil Infrastructure I: Measurement Optimization and Application <i>(Reis, Koshti)</i></p>	<p>Session 10B Wed 8:00 am to 10:00 am Modeling for Metamaterial and Guided Waves <i>(Ostachowicz, Yu)</i></p> <p>Session 11B Wed 10:30 am to 11:50 am Guided Waves III: Advanced Material Monitoring <i>(Sohn, Desai)</i></p> <p>Session 12B Wed 1:20 pm to 3:00 pm Optical and Thermal Techniques for Civil Infrastructure Monitoring <i>(Niezrecki, Mao)</i></p>		<p>Session 1 Wed 9:00 am to 10:10 am The Role of Humor in Academics <i>(Leo)</i></p> <p>Session 2 Wed 10:40 am to 12:00 pm How to Climb the Academic Career Ladder: Three Universities <i>(Wang)</i></p> <p>Session 3 Wed 1:10 pm to 2:50 pm How Many Books is Too Many? <i>(Anton)</i></p>
<p>Session 13 Wed 3:30 pm to 5:50 pm System Identification and Damage Detection Methods <i>(Semperlotti, Loh)</i></p>		<p>Session 14 Wed 3:30 pm to 4:50 pm Vision-based NDE/SHM <i>(Zheng, Yuan)</i></p> <p>Session 15 Wed 4:50 pm to 6:10 pm NDE/SHM for Wind Turbines, Tunnels, and Buildings Applications <i>(Zheng, Yuan)</i></p>		<p>Session 13A Wed 3:20 pm to 6:20 pm Civil Infrastructure II: Materials and Structures <i>(Fromme, Reis)</i></p>	<p>Session 13B Wed 3:30 pm to 5:50 pm Emerging and Futuristic Techniques and Issues <i>(Ostachowicz, Croxford)</i></p>		<p>Session 4 Wed 3:20 pm to 4:40 pm The Art of Retaining Old Friends <i>(Sodano)</i></p> <p>Session 5 Wed 4:40 pm to 6:00 pm Knowing When to Retire <i>(Tarazaga)</i></p>

CONFERENCE 10162

Sunday–Monday
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**Bioinspiration,
Biomimetics, and
Bioreplication VII**

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

Conference Co-Chairs: **Akhlesh Lakhtakia**, The Pennsylvania State Univ. (USA); **Raúl J. Martín-Palma**, Univ. Autónoma de Madrid (Spain)

Program Committee: **Javaan S. Chahl**, Univ. of South Australia (Australia); **Francesco Chiadini**, Univ. degli Studi di Salerno (Italy); **Carolyn Dry**, Natural Process Design, Inc. (USA); **Olaf Karthaus**, Chitose Institute of Science and Technology (Japan); **Mathias Kolle**, Massachusetts Institute of Technology (USA); **Kostya Kornev**, Clemson Univ. (USA); **Bert Müller**, Basel Univ. Hospital (Switzerland); **Akira Saito**, Osaka Univ. (Japan); **Kathleen Stebe**, Univ. of Pennsylvania (USA); **Eric J. Warrant**, Lund Univ. (Sweden); **Cordt Zollfrank**, Technische Univ. München (Germany)

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CONFERENCE 10163

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

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

Conference Co-Chair: **Jonathan M. Rossiter**, Univ. of Bristol (United Kingdom)

Program Committee: **Barbar J. Akle**, Lebanese American Univ. (Lebanon); **Iain A. Anderson**, The Univ. of Auckland (New Zealand); **Tunku Ishak Al-Irsyad**, Univ. Teknologi MARA (Malaysia); **Kinji Asaka**, National Institute of Advanced Industrial Science and Technology (Japan); **Pavol Bauer**, Technische Univ. Delft (Netherlands); **Siegfried G. Bauer**, Johannes Kepler Univ. Linz (Austria); **Ray H. Baughman**, The Univ. of Texas at Dallas (USA); **Václav Bouda**, Czech Technical Univ. in Prague (Czech Republic); **Federico Carpi**, Univ. degli Studi di Firenze (United Kingdom); **Suresh Chandra**, Institute of Technology, Banaras Hindu Univ. (India); **Hyouk Ryeol Choi**, Sungkyunkwan Univ. (Korea, Republic of); **Gal deBotton**, Ben-Gurion Univ. of the Negev (Israel); **Toribio Fernández Otero**, Univ. Politécnica de Cartagena (Spain); **Yahya A. Ismail**, A'Shargiyah Univ. (Oman); **Edwin W. H. Jager**, Linköping Univ. (Sweden); **Giedrius Janusas**, Kaunas Univ. of Technology (Lithuania); **Kwang Jin Kim**, Univ. of Nevada, Las Vegas (USA); **Gabor M. Kovacs**, EMPA (Switzerland); **Maarja Kruusmaa**, Univ. of Tartu (Estonia); **Jinsong Leng**, Harbin Institute of Technology (China);

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CONFERENCE 10164

Sunday–Wednesday
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**Active and Passive
Smart Structures
and Integrated
Systems XI**

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

Conference Co-Chairs: **Alper Erturk**, Georgia Institute of Technology (USA); **Jae-Hung Han**, KAIST (Korea, Republic of)

Program Committee: **Mehdi Ahmadian**, Virginia Polytechnic Institute and State Univ. (USA); **Steven R. Anton**, Tennessee Technological Univ. (USA); **Hiroshi Asanuma**, Chiba Univ. (Japan); **Diann E. Brei**, Univ. of Michigan (USA); **Matthew Bryant**, North Carolina State Univ. (USA); **Gregory P. Carman**, Univ. of California, Los Angeles (USA); **Seung-Bok Choi**, Inha Univ. (Korea, Republic of); **Alison B. Flatau**, Univ. of Maryland, College Park (USA); **Mehrdad N. Ghasemi-Nejhad**, Univ. of Hawai'i (USA); **Victor Giurgiutiu**, Univ. of South Carolina (USA); **Nam Seo Goo**, Konkuk Univ. (Korea, Republic of); **Faramarz Gordanejad**, Univ. of Nevada, Reno (USA); **Nakhiah C. Goulbourne**, Univ. of Michigan (USA); **Ryan L. L. Harne**, The Ohio State Univ. (USA); **Daniel J. Inman**, Univ. of Michigan (USA); **Hyung-Jo Jung**, KAIST (Korea, Republic of); **M. Amin Karami**, Univ. at Buffalo (USA); **Jung-Ryul Lee**, KAIST (Korea, Republic of); **Soobum Lee**, Univ. of Maryland, Baltimore County (USA); **Junrui Liang**, ShanghaiTech Univ. (China);

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CONFERENCE 10165

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

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

Conference Co-Chair: **Hani E. Naguib**, Univ. of Toronto (Canada)

Program Committee: **Abhijit Bhattacharyya**, Univ. of Arkansas at Little Rock (USA); **Gregory P. Carman**, Univ. of California, Los Angeles (USA); **Pavel M. Chaplya**, Sandia National Labs. (USA); **Constantin Ciocanel**, Northern Arizona Univ. (USA); **Marcelo J. Dapino**, The Ohio State Univ. (USA); **Sergio Luis dos Santos e Lucato**, Teledyne Scientific Co. (USA); **LeAnn E. Faidley**, Wartburg College (USA); **Darren J. Hartl**, Texas A&M Univ. (USA); **Daniel J. Inman**, Univ. of Michigan (USA); **Marc Kamlah**, Karlsruher Institut für Technologie (Germany); **Haluk E. Karaca**, Univ. of Kentucky (USA); **Kwang Jin Kim**, Univ. of Nevada, Las Vegas (USA); **Dimitris C. Lagoudas**, Texas A&M Univ. (USA); **Chad M. Landis**, The Univ. of Texas at Austin (USA); **Kam K. Leang**, Univ. of Nevada, Reno (USA); **Hyeong Jae Lee**, Jet Propulsion Lab. (USA); **Donald J. Leo**, Virginia Polytechnic Institute and State Univ. (USA); **Jiangyu Li**, Univ. of Washington (USA); **Christopher S. Lynch**, Univ. of California, Los Angeles (USA); **Karla M. Mossi**, Virginia Commonwealth Univ. (USA); **Robert C. O'Handley**, Massachusetts Institute of Technology (USA);

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CONFERENCE 10166

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

Conference Chair: **Dan J. Clingman**, Boeing Research and Technology (USA)

Program Committee: **Steven R. Anton**, Tennessee Technological Univ. (USA); **Diann E. Brei**, Univ. of Michigan (USA); **Peter C. Chen**, NASA Goddard Space Flight Ctr. (USA); **Marcelo J. Dapino**, The Ohio State Univ. (USA); **Kevin M. Farinholt**, Luna Innovations Inc. (USA); **Xiao-Yan Gong**, Medical Implant Mechanics LLC (USA); **Steven F. Griffin**, The Boeing Co. (USA); **Nancy L. Johnson**, General Motors Corp. (USA); **Jayanth N. Kudva**, NextGen Aeronautics, Inc. (USA); **Amrita Kumar**, Acellent Technologies, Inc. (USA); **Jung-Ryul Lee**, KAIST (Korea, Republic of); **Donald J. Leo**, The Univ. of Georgia (USA); **Geoffrey P. McKnight**, HRL Labs., LLC (USA); **Tobias Melz**, Fraunhofer-Institut für Betriebsfestigkeit und Systemzuverlässigkeit (Germany); **Christopher Niezrecki**, Univ. of Massachusetts Lowell (USA); **Gyuhae Park**, Chonnam National Univ. (Korea, Republic of); **W. Lance Richards**, NASA Dryden Flight Research Ctr. (USA); **Janet M. Sater**, Institute for Defense Analyses (USA); **Edward V. White**, The Boeing Co. (USA)

CONFERENCE 10167

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**Nano-, Bio-, Info-
Tech Sensors and
3D Systems**

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

Conference Co-Chairs: **Hidemitsu Furukawa**, Yamagata Univ. (Japan); **Ajit Khosla**, Yamagata Univ. (Japan); **Jaehwan Kim**, Inha Univ. (Korea, Republic of); **Kyo D. Song**, Norfolk State Univ. (USA); **Sang H. Choi**, NASA Langley Research Ctr. (USA); **Yongrae Roh**, Kyungpook National Univ. (Korea, Republic of)

Program Committee: **Anja Boisen**, Technical Univ. of Denmark (Denmark); **Christina L. Brantley**, U.S. Army Research, Development and Engineering Command (USA); **Eugene Edwards**, U.S. Army Research, Development and Engineering Command (USA); **Srinivasan Gopalakrishnan**, Indian Institute of Science (India); **Seiich Hata**, Nagoya Univ. (Japan); **Taizo Hayashida**, JSR Corp. (Japan); **Daniel Hilbich**, International Space Univ. (France); **Mamoru Kawakami**, Yamagata Univ. (Japan); **Kimiya Komurasaki**, The Univ. of Tokyo (Japan); **Hideki Kyogoku**, Kindai Univ. (Japan); **Kunik Lee**, Federal Highway Administration Turner Fairbank Highway Research Ctr. (USA); **Uhn Lee M.D.**, Gachon Univ. Gil Medical Ctr. (Korea, Republic of); **Xinxin Li**, Shanghai Institute of Microsystem and Information Technology (China); **Yanjian Liao**, Chongqing Univ. (China); **Go Murasawa**, Yamagata Univ. (Japan); **Hani E. Naguib**, Univ. of Toronto (Canada); **Ilkwon Oh**, KAIST (Korea, Republic of);

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CONFERENCE 10168

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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 Ecke**, 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, San Diego (USA); **Bryan R. Loyola**, Sandia National Labs. (USA); **David Dennis Lee Mascarenas**, Los Alamos National Lab. (USA); **Theodore E. Matikas**, Univ. of Ioannina (Greece);

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CONFERENCE 10169

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Nondestructive Characterization and Monitoring of Advanced Materials, Aerospace, and Civil Infrastructure, and Transportation XI

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

Conference Co-Chairs: **Andrew L. Gyekenyesi**, Ohio Aerospace Institute (USA); **Peter J. Shull**, The Pennsylvania State Univ. (USA); **Tzu-Yang Yu**, Univ. of Massachusetts Lowell (USA)

Program Committee: **Gary Carr**, Federal Railroad Administration (USA); **Chia-Ming Chang**, National Taiwan Univ. (Taiwan); **Genda Chen**, Missouri Univ. of Science and Technology (USA); **Chih-Hung Chiang**, Chaoyang Univ. of Technology (Taiwan); **Dwight A. Clayton**, Oak Ridge National Lab. (USA); **Kaoshan Dai**, Tongji Univ. (China); **Reinhard Ebert**, Fraunhofer-Institut für Optronik, Systemtechnik und Bildauswertung (Germany); **Zhenhua Huang**, Univ. of North Texas (USA); **Dryver R. Huston**, The Univ. of Vermont (USA); **Xiaoning Jiang**, North Carolina State Univ. (USA); **Ajay M. Koshti**, NASA Johnson Space Ctr. (USA); **Dennid Lau**, City Univ. of Hong Kong (Hong Kong, China); **Shiyuan Liu**, Huazhong Univ. of Science and Technology (China); **Kenneth J. Loh**, Univ. of California, San Diego (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);

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CONFERENCE 10170

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Health Monitoring of Structural and Biological Systems XI

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

Conference Co-Chair: **Paul Fromme**, Univ. College London (United Kingdom)

Program Committee: **Hoda Azari**, US Dept. of Transportation (USA); **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); **Victor Giurgiutiu**, Univ. of South Carolina (USA); **Srinivasan Gopalakrishnan**, Indian Institute of Science (India); **Wolfgang Grill**, Univ. Leipzig (Germany); **Guoliang Huang**, Univ. of Missouri (USA); **Xiaoning Jiang**, North Carolina State Univ. (USA); **Ajay M. Koshti**, NASA Johnson Space Ctr. (USA); **Sridhar Krishnaswamy**, Northwestern Univ. (USA); **Francesco Lanza di Scalea**, Univ. of California, San Diego (USA); **Zhu Mao**, Univ. of Massachusetts Lowell (USA); **Christopher Niezrecki**, Univ. of Massachusetts Lowell (USA); **Wieslaw M. Ostachowicz**, The Szwedzki Institute of Fluid-Flow Machinery (Poland); **Xinlin Qing**, Xiamen Univ. (China); **Henrique L. Reis**, Univ. of Illinois at Urbana-Champaign (USA); **Fabrizio Ricci**, Univ. degli Studi di Napoli Federico II (Italy); **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); **Michael D. Todd**, Univ. of California, San Diego (USA); **Tadeusz Uhl**, AGH Univ. of Science and Technology (Poland); **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)

CONFERENCE 10171

Monday–Tuesday
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Smart Materials and Nondestructive Evaluation for Energy Systems III

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); **Nicolas P. Avdelidis**, Univ. Laval (Canada); **George Y. Baaklini**, 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); **Vassilios Kappatos**, Univ. of Southern Denmark (Denmark); **Michael Kroening**, Pontificia Univ. Católica do Rio de Janeiro (Brazil); **Michele Meo**, Univ. of Bath (United Kingdom); **Alexander Michaelis**, Fraunhofer IKTS (Germany); **Bernd Michel**, Fraunhofer-Institut für Elektronische Nanosysteme (Germany); **Piotr Omenzetter**, Univ. of Aberdeen (United Kingdom); **Tadeusz Stepinski**, AGH Univ. of Science and Technology (Poland); **Mark R. Woike**, NASA Glenn Research Ctr. (USA); **H. Felix Wu**, U.S. Dept. of Energy (USA); **Dong-Jin Yoon**, Korea Research Institute of Standards and Science (Korea, Republic of); **Lingyu Yu**, Univ. of South Carolina (USA)

CONFERENCE 10172

Wednesday
29 March 2017
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A Tribute Conference Honoring Daniel Inman

Conference Chairs: **Donald J. Leo**, The Univ. of Georgia (USA); **Pablo A. Tarazaga**, Virginia Polytechnic Institute and State Univ. (USA)

TECHNICAL CONFERENCES

CONFERENCE 10162

CONFERENCE 10163

John D. W. Madden, The Univ. of British Columbia (Canada); **Qibing Pei**, Univ. of California, Los Angeles (USA); **Thelge Chaminda Peiris**, MAS Innovation Ltd. (Sri Lanka); **Valentin Radu**, Omicron Plus S.R.L. (Romania); **Mehdi Razzaghi-Kashani**, Tarbiat Modares Univ. (Iran, Islamic Republic of); **Anuvat Sirivat**, Chulalongkorn Univ. (Thailand); **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 10164

Wei-Hsin Liao, The Chinese Univ. of Hong Kong (Hong Kong, China); **Zhu Mao**, Univ. of Massachusetts Lowell (USA); **David L. Mascareñas**, Los Alamos National Lab. (USA); **Norbert Schwesinger**, Technische Univ. München (Germany); **Yi-Chung Shu**, National Taiwan Univ. (Taiwan); **Henry A. Sodano**, Univ. of Florida (USA); **Jiong Tang**, Univ. of Connecticut (USA); **Lihua Tang**, The Univ. of Auckland (New Zealand); **Dai-Hua Wang**, Chongqing Univ. (China); **Kon-Well Wang**, Univ. of Michigan (USA); **Ya S. Wang**, Stony Brook Univ. (USA); **Norman M. Wereley**, Univ. of Maryland, College Park (USA); **Byeng D. Youn**, Seoul National Univ. (Korea, Republic of); **Lei Zuo**, Virginia Polytechnic Institute and State Univ. (USA)

CONFERENCE 10165

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

CONFERENCE 10166

CONFERENCE 10167

Aswini K. Pradhan, Norfolk State Univ. (USA); **D. Roy Mahapatra**, Indian Institute of Science (India); **Paul B. Ruffin**, Alabama A&M Univ. (USA); **Ashok Srivastava**, Louisiana State Univ. (USA); **Hiroya Tanaka**, Keio Univ. (Japan); **Tauno Vaha-Heikkila**, VTT Technical Research Ctr. of Finland (Finland); **Wei-Chih Wang**, Univ. of Washington (USA); **Hargsoon Yoon**, Norfolk State Univ. (USA); **Ming Zhou**, Suzhou Institute of Nano-tech and Nano-bionics (China)

Sunday 26 March

Sunday Plenary Session • 8:15 am to 10:00 am

Session Chairs: **Jayanth N. Kudva**, NextGen Aeronautics, Inc. (USA); **Theodore E. Matikas**, Univ. of Ioannina (Greece)

8:15 to 8:30 am:

2017 NDE Lifetime Achievement Award
presented to **Jianmin Qu**, Tufts Univ. (USA)

2017 SSM Lifetime Achievement Award
presented to **Ralph C. Smith**, North Carolina State Univ. (USA)



Plenary Presentation: 8:30 to 9:15 am

EAP artificial muscle actuators for bio-inspired intelligent social robotics (*Plenary*), David F. Hanson, Hanson Robotics, Ltd. (USA). [10163-500]



Plenary Presentation: 9:15 to 10:00 am

Plant nanobionic materials for thermally active, soft, artificial skins (*Plenary*), Chiara Daraio, California Institute of Technology (USA). [10162-500]

Coffee Break Sun 10:00 am to 10:30 am

TECHNICAL CONFERENCES

CONFERENCE 10168

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 Szwedzki 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**, Purdue Univ. (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); **Fuh-Gwo Yuan**, North Carolina State 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)

CONFERENCE 10169

Yu-Min Su, National Kaohsiung Univ. of Applied Sciences (Taiwan); **Yan Wan**, Univ. of Texas at Arlington (USA); **Ming L. Wang**, Northeastern Univ. (USA); **Yang Wang**, Georgia Institute of Technology (USA); **Tian Xia**, The Univ. of Vermont (USA); **Lingyu Yu**, Univ. of South Carolina (USA); **Fuh-Gwo Yuan**, North Carolina State Univ. (USA)

CONFERENCE 10170

CONFERENCE 10171

CONFERENCE 10172

Sunday 26 March

Sunday Plenary Session • 8:15 am to 10:00 am

Session Chairs: **Jayanth N. Kudva**, NextGen Aeronautics, Inc. (USA); **Theodore E. Matikas**, Univ. of Ioannina (Greece)

8:15 to 8:30 am:

2017 NDE Lifetime Achievement Award
presented to **Jianmin Qu**, Tufts Univ. (USA)

2017 SSM Lifetime Achievement Award
presented to **Ralph C. Smith**, North Carolina State Univ. (USA)



Plenary Presentation: 8:30 to 9:15 am

EAP artificial muscle actuators for bio-inspired intelligent social robotics (*Plenary*), David F. Hanson, Hanson Robotics, Ltd. (USA). [10163-500]



Plenary Presentation: 9:15 to 10:00 am

Plant nanobionic materials for thermally active, soft, artificial skins (*Plenary*), Chiara Daraio, California Institute of Technology (USA). [10162-500]

Coffee Break Sun 10:00 am to 10:30 am

CONFERENCE 10162

Bioinspiration, Biomimetics, and Bioreplication VII

**LOCATION: SALON D
10:30 AM TO 10:40 AM**

Welcome

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

SESSION 1

**LOCATION: SALON D
SUN 10:40 AM TO 11:50 AM**

Flight

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

10:40 am: **Foldable drones: from biology to technology** (*Invited Paper*), Dario Floreano, Stefano Mintchev, Jun Shintake, Ecole Polytechnique Fédérale de Lausanne (Switzerland) [10162-1]

11:10 am: **A parametric study on a bio-inspired continuously morphing trailing edge**, Amin Moosavian, Eun Jung Chae, Univ. of Michigan (USA); Alexander M. Pankonien, Air Force Research Lab. (USA); Daniel J. Inman, Univ. of Michigan (USA) [10162-2]

11:30 am: **Computational analysis of a flapping two different airfoils at laminar flow**, Abduljaleel Altememe, Oliver J. Myers, Clemson Univ. (USA) [10162-3]

Lunch Break Sun 11:50 am to 1:00 pm

CONFERENCE 10163

Electroactive Polymer Actuators and Devices (EAPAD) XIX

SESSION 1

**LOCATION: SALON E
SUN 10:30 AM TO 11:50 AM**

EAP as Emerging Actuators

Session Chairs: **Yoseph Bar-Cohen**, Jet Propulsion Lab. (USA); **Jonathan M. Rossiter**, Univ. of Bristol (United Kingdom)

10:30 am: **Electroactive polymers for healthcare and biomedical applications** (*Keynote Presentation*), Siegfried G. Bauer, Johannes Kepler Univ. Linz (Austria) [10163-1]

11:10 am: **From research to production** (*Invited Paper*), Gabor M. Kovacs, EMPA (Switzerland) [10163-2]

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

CONFERENCE 10164

Active and Passive Smart Structures and Integrated Systems XI

SESSION 1

**LOCATION: SALON G + H
SUN 10:30 AM TO 12:10 PM**

Energy Harvesting and Scavenging I: Modeling

Session Chairs: **Alper Erturk**, Georgia Institute of Technology (USA); **Matthew Bryant**, North Carolina State Univ. (USA)

10:30 am: **Investigation of flow induced limit cycle oscillations in tensioned ribbons**, Punng Chatterjee, Matthew Bryant, North Carolina State Univ. (USA) [10164-1]

10:50 am: **Comparison of harmonic balance and multi-scale method in characterizing the response of a monostable energy harvester**, Wei Wang, Junyi Cao, Jing Lin, Xi'an Jiaotong Univ. (China) [10164-2]

11:10 am: **A multiple degree of freedom model of piezoelectret foam in an updated multilayer stack configuration**, Edward C. Tefft IV, Steven R. Anton, Tennessee Technological Univ. (USA) [10164-3]

11:30 am: **Size effects in piezoelectric cantilevers at submicron thickness levels due to flexoelectricity**, Adriane Moura, Alper Erturk, Georgia Institute of Technology (USA) [10164-4]

11:50 am: **Uncertainty propagation in piezoelectric energy harvesting**, Heonjun Yoon, Yong Chang Shin, Soo-Ho Jo, Byeng D. Youn, Seoul National Univ. (Korea, Republic of) [10164-5]

Lunch Break Sun 12:10 pm to 1:40 pm

CONFERENCE 10165

Behavior and Mechanics of Multifunctional Materials and Composites XI

SESSION 1

**LOCATION: SALON I
SUN 10:30 AM TO 12:10 PM**

Advances in Piezoelectric Materials

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

10:30 am: **The effects of bonding layer on the high-frequency dynamic response of piezoelectric augmented structures**, Mohammad Albakri, Pablo A. Tarazaga, Virginia Polytechnic Institute and State Univ. (USA) [10165-1]

10:50 am: **Strain-powered ferroic antennas**, John P Domann, Greg P Carman, University of California, Los Angeles (USA) [10165-2]

11:10 am: **Experimental study on relaxation properties of ionic polymer-metal composites**, Bin Luo, Xi'an Jiaotong Univ. (China) [10165-3]

11:30 am: **Micro-mechanical analysis of piezo fibers composites through functional orthogonization**, Akshay Kumar, Srikanth S. Padhee, Indian Institute of Technology Ropar (India) [10165-4]

11:50 am: **Mechano-electrochemistry of soft electroactive materials and biological tissues via surface-tracked scanning electrochemical microscopy**, Vishnu Baba Sundaresan, Robert Northcutt, Vijay Venkatesh, John Parker Evans, The Ohio State Univ. (USA) [10165-5]

Lunch Break Sun 12:10 pm to 1:20 pm

CONFERENCE 10166

Industrial and Commercial Applications of Smart Structures Technologies XI

SESSION 1

**LOCATION: PEARL
SUN 10:30 AM TO 11:50 AM**

Energy Harvesting/ Sensors I

Session Chair: **Frederick Tad Calkins**, The Boeing Co. (USA)

10:30 am: **A forty-year history of fiber optic smart structures** (*Invited Paper*), Eric Udd, Columbia Gorge Research LLC (USA) [10166-1]

11:10 am: **Examination of single-substance multiphase material distribution in a cylindrical container using acoustic wavenumber spectroscopy**, John R. Rees, Eric B. Flynn, Niall M. O'Dowd, Engineering Institute, Los Alamos National Security LLC (USA) [10166-2]

11:30 am: **A piezoelectric shock-loading response simulator for piezoelectric-based device developers**, Jahangir S. Rastegar, Omnitek Partners, LLC (USA) [10166-3]

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

CONFERENCE 10167
Nano-, Bio-, Info-Tech
Sensors and 3D Systems

SESSION 1

LOCATION: SALON A
SUN 10:30 AM TO 12:30 PM

**Wearable Technology
and Healthcare**

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

10:30 am: **Can artificial intelligence (AI) provoke the revolutionary change in the medical field?** (*Keynote Presentation*), Uhn Lee, Gachon Univ. (Korea, Republic of) [10167-1]

11:10 am: **Wearable nanosensor systems and their applications in healthcare**, Mouli Ramasamy, Prashanth Kumar, Pennsylvania State Univ. (USA); Vijay K. Varadan, Pennsylvania State Univ (USA) [10167-2]

11:30 am: **Carbon nanoparticle doped micro-patternable nano-composites for wearable sensing applications**, Ajit Khosla, Yamagata Univ. (Japan) . [10167-3]

11:50 am: **Left lateral decubitus position on patients with atrial fibrillation and congestive heart failure**, Vijay K. Varadan, Prashanth Kumar, The Pennsylvania State Univ. (USA) . . [10167-4]

12:10 pm: **Ventricular arrhythmia and sudden cardiac death: catheter based sensor and mapping system of heart**, Vijay K. Varadan, The Pennsylvania State Univ. (USA); Prashanth Kumar, Mouli Ramasamy, Pennsylvania State Univ. (USA) [10167-5]

Lunch Break Sun 12:30 pm to 1:30 pm

CONFERENCE 10168
Sensors and Smart
Structures Technologies
for Civil, Mechanical, and
Aerospace Systems

SESSION 1

LOCATION: COLUMBIA
SUN 10:30 AM TO 11:50 AM

Keynote Session

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

10:30 am: **Multifunctional materials and tomographic methods for structural damage characterization** (*Keynote Presentation*), Kenneth J. Loh, Univ. of California, San Diego (USA) [10168-1]

11:10 am: **Monitoring osseointegration and developing intelligent systems** (*Keynote Presentation*), Liming W. Salvino, Office of Naval Research (USA) . . [10168-2]

Lunch Break Sun 11:50 am to 1:00 pm

CONFERENCE 10169
Nondestructive
Characterization and
Monitoring of Advanced
Materials, Aerospace, and
Civil Infrastructure XI

SESSION 1

LOCATION: EUGENE
SUN 10:30 AM TO 11:50 AM

Radar NDE/NDT I

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

10:30 am: **SAR image processing techniques for damage detection of FRP-concrete systems**, Tzu-Yang Yu, Univ. of Massachusetts Lowell (USA) [10169-1]

10:50 am: **High-resolution nondestructive testing of multilayer dielectric materials using wideband micro- and millimeter-wave synthetic aperture radar imaging**, Tae Hee Kim, Robin James, Ram M. Narayanan, The Pennsylvania State Univ. (USA) . . [10169-2]

11:10 am: **Rough ground surface clutter removal in air-coupled ground penetrating radar data using low-rank and sparse representation**, Yu Zhang, Dryver R. Huston, Tian Xia, The Univ. of Vermont (USA) [10169-3]

11:30 am: **Detecting and locating steel rebars inside concrete using synthetic aperture radar images**, Swinderjit Singh Litt, Jones Owusu Twumasi, Tzu-Yang Yu, Univ. of Massachusetts Lowell (USA) [10169-4]

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

CONFERENCE 10170
Health Monitoring of
Structural and Biological
Systems XI

SESSION 1

LOCATION: SALON B + C
SUN 10:30 AM TO 12:10 PM

Composite Monitoring I

Session Chairs: **Tribikram Kundu**, The Univ. of Arizona (USA); **Paul Fromme**, Univ. College London (United Kingdom)

10:30 am: **Portable laser-ultrasound scanner for ultrafast, non-contact, ply-by-ply imaging of inconsistencies in aircraft composites** (*Keynote Presentation*), Lukasz Ambrozinski, AGH Univ. of Science and Technology (Poland) and Univ. of Washington (USA); Ivan M. Pelivanov, Matthew O'Donnell, Univ. of Washington (USA) [10170-1]

11:10 am: **Infrared thermography to impact damaging of composite materials**, Carosena Meola, Simone Boccardi, Giovanni M. Carlomagno, Natalino Daniele Boffa, Fabrizio Ricci, Univ. degli Studi di Napoli Federico II (Italy); Giorgio Simeoli, Pietro Russo, Consiglio Nazionale delle Ricerche (Italy) [10170-2]

11:30 am: **Assessment of delamination in composite beam using infrared thermography, optical sensors, and terahertz technique**, Katarzyna M. Majewska, Rohan N. Soman, Magdalena M. Mieloszyk, The Szewalski Institute of Fluid-Flow Machinery (Poland); Wieslaw M. Ostachowicz, The Szewalski Institute of Fluid-Flow Machinery (Poland) and Warsaw Univ. of Technology (Poland) [10170-3]

11:50 am: **Shear sensing in bonded composites with cantilever beam microsensors and dual-plane DIC**, Jeffery W Baur, AFRL/RXCC (USA); Keith Slinker, Corey Kondash, AFRL/RXCC (USA) and Universal Technology Corporation (USA) [10170-4]

Lunch Break Sun 12:10 pm to 1:20 pm

CONFERENCE 10162

SESSION 2

**LOCATION: SALON D
SUN 1:00 PM TO 3:00 PM**

Mechanobiology and Drug Delivery

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

1:00 pm: **Can a robot grow? Plants give us the answer** (*Invited Paper*), Barbara Mazzolai, Andrea Degl'Innocenti, Istituto Italiano di Tecnologia (Italy) [10162-4]

1:30 pm: **Design and evaluation of a wasp-inspired steerable needle**, Marta Scali, Davey Kreeft, Paul Breedveld, Dimitra Dodou, Technische Univ. Delft (Netherlands). [10162-5]

1:50 pm: **Mosquito-inspired medical needles**, Torben A. Lenau, Technical Univ. of Denmark (Denmark); Thomas Hesselberg, Univ. of Oxford (United Kingdom); Alexandros Drakides, Technical Univ. of Denmark (Denmark) [10162-6]

2:10 pm: **Eco-friendly fabrication of nanostructured porous silicon from accumulator plants: morphological control and drug delivery** (*Invited Paper*), Jhansi Kalluri, Nguyen T. Le, Texas Christian Univ. (USA); Armando Loni, pSiMedica Ltd. (United Kingdom); Leigh T. Canham, pSiMedica Ltd. (United Kingdom) and The Univ. of Birmingham (United Kingdom); Jeffrey L. Coffey, Texas Christian Univ. (USA) [10162-7]

2:40 pm: **Liposomes: bio-inspired containers for physically triggered drug delivery**, Sofiya Matviyukiv, Marzia Buscema, Thomas Pfohl, Univ. Basel (Switzerland); Andreas Zumbühl, Univ. de Fribourg (Switzerland); Bert Müller, Univ. Basel (Switzerland) [10162-8]

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

CONFERENCE 10163

SESSION 2

**LOCATION: SALON E
SUN 1:20 PM TO 3:20 PM**

Sensors Using EAP Materials

Session Chairs: **Siegfried G. Bauer**, Johannes Kepler Univ. Linz (Austria); **Kwang Jin Kim**, Univ. of Nevada, Las Vegas (USA)

1:20 pm: **Proximity and touch sensing using deformable ionic conductors** (*Invited Paper*), John D. W. Madden, Yuta Dobashi, Mirza S. Sarwar, Eden C. Preston, Justin K. M. Wyss, The Univ. of British Columbia (Canada); Vincent Woehling, Tran-Minh-Giao Nguyen, Cédric Plesse, Frédéric Vidal, Univ. de Cergy-Pontoise (France); Sina Naficy, Geoffrey M. Spinks, Univ. of Wollongong (Australia) . . [10163-3]

2:00 pm: **Distributed sensing: multiple dielectric elastomer sensors on a single channel**, Andreas Tairych, The Univ. of Auckland (New Zealand); Iain A. Anderson, The Univ. of Auckland (New Zealand) and StretchSense (New Zealand) . . . [10163-4]

2:20 pm: **Monitoring diver health with dielectric elastomer sensors**, Christopher R. Walker, Iain A. Anderson, The Univ. of Auckland (New Zealand) [10163-5]

2:40 pm: **Dual sensing-actuation artificial muscle based on polypyrrole-carbon nanotube composite**, Johanna Schumacher, Arquimea Ingeniería, S.L.U. (Spain); Victor H. Pascual, Toribio Fernández Otero, Univ. Politécnica de Cartagena (Spain) [10163-6]

3:00 pm: **Operation tools with dielectric elastomer pressure sensors**, Holger Böse, Johannes Ehrlich, Fraunhofer-Institut für Silicatforschung ISC (Germany) [10163-7]

Coffee Break.Sun 3:20 pm to 3:50 pm

CONFERENCE 10164

SESSION 2

**LOCATION: SALON G + H
SUN 1:40 PM TO 3:00 PM**

Smart Sensing and Signal Processing for Diagnostics

Session Chairs: **Gyuhae Park**, Chonnam National Univ. (Korea, Republic of); **Francesco Lanza di Scalea**, Univ. of California, San Diego (USA)

1:40 pm: **Thermal stress characterization using the electro-mechanical impedance method**, Xuan Zhu, Francesco Lanza di Scalea, Univ. of California, San Diego (USA); Mahmood Fateh, Federal Railroad Administration (USA) [10164-6]

2:00 pm: **Investigation into the superposition of multiple mode shape composed traveling waves**, Patrick Musgrave, V. V. N. Sriram Malladi, Pablo A. Tarazaga, Virginia Polytechnic Institute and State Univ. (USA) [10164-7]

2:20 pm: **Camera image processing for automated crack detection of pressed panel products**, Hoyeon Moon, Hwee Kwon Jung, Chang Won Lee, Gyuhae Park, Chonnam National Univ. (Korea, Republic of) [10164-9]

2:40 pm: **Development of pulse-echo ultrasonic propagation imaging system and its delivery to Korea Air Force**, Seung-Chan Hong, Hasan Hamid, Ayalsew Dagnew, Jung-Ryul Lee, KAIST (Korea, Republic of). [10164-10]

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

CONFERENCE 10165

SESSION 2

**LOCATION: SALON I
SUN 1:20 PM TO 3:00 PM**

Ferroelectric Materials

Session Chair: **Henry A. Sodano**, Univ. of Florida (USA)

1:20 pm: **Numerical investigation of crack propagation direction in ferroelectric actuators**, Sergii Kozinov, Meinhard Kuna, Technische Univ. Bergakademie Freiberg (Germany) [10165-6]

1:40 pm: **A quantum-informed homogenized energy model for ferroelectric materials**, Lider Leon, Ralph C. Smith, North Carolina State Univ. (USA); William S. Oates, Paul Miles, Florida State Univ. (USA) [10165-7]

2:00 pm: **Bayesian uncertainty analysis of continuum phase field modeling in ferroelectric materials**, Paul Miles, William S. Oates, Florida State Univ. (USA); Lider Leon, Ralph C. Smith, North Carolina State Univ. (USA) [10165-8]

2:20 pm: **Model development for PZT bimorph actuators employed for micro-air vehicles**, Nikolas Bravo, Ralph C. Smith, North Carolina State Univ. (USA); John Crews, Applied Research Associates, Inc. (USA) [10165-9]

2:40 pm: **Energetics of domain structures and phase transformations in ferroelectric single crystals**, Peng Lv, Christopher Lynch, UCLA (USA) [10165-10]

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

CONFERENCE 10166

SESSION 2

**LOCATION: PEARL
SUN 1:20 PM TO 3:00 PM**

Energy Harvesting/ Sensors II

Session Chair: **Dan J. Clingman**, Boeing Research and Technology (USA)

1:20 pm: **Piezoelectric-based hybrid reserve power sources for munitions and emergency devices**, Jahangir S. Rastegar, Omnitek Partners, LLC (USA) [10166-4]

1:40 pm: **Modal analysis of a loaded tire using non-contact measurements and piezoelectric excitation**, Ipar Ferhat, Pablo A. Tarazaga, Virginia Polytechnic Institute and State Univ. (USA) . . [10166-5]

2:00 pm: **Wearable Spiral Passive Electromagnetic Sensor (SPES) glove for sign language recognition**, Onorio Iervolino, Michele Meo, Univ. of Bath (United Kingdom) [10166-6]

2:20 pm: **A new class of monolithic seismometers and accelerometers for commercial and industrial application: the UNISA folded pendulum**, Fabrizio Barone, Gerardo Giordano, Univ. degli Studi di Salerno (Italy) [10166-7]

2:40 pm: **The development of two broadband vibration energy harvesters with adaptive conversion electronics**, Dan J. Clingman, Boeing Research and Technology (USA) [10166-8]

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

CONFERENCE 10167

SESSION 2

**LOCATION: SALON A
SUN 1:30 PM TO 2:10 PM**

3D Printing

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

1:30 pm: **3D printing of soft-matter to open a new era of soft-matter MEMS/robotics** (Keynote Presentation), Hidemitsu Furukawa, Yamagata Univ. (Japan) [10167-8]

SESSION 3

**LOCATION: SALON A
SUN 2:10 PM TO 3:10 PM**

3D Printing and Applications I

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

2:10 pm: **Scalable metal additive manufacturing using optically addressable beam shaping elements**, Manyalibo J. Matthews, Gabriel M. Guss, Derrek R. Drachenberg, Christopher M. Spadaccini, Lawrence Livermore National Lab. (USA) [10167-7]

2:25 pm: **3D printing of wearable fractal based sensor systems for neurocardiology and healthcare**, Vijay K. Varadan, Mouli Ramasamy, The Pennsylvania State Univ. (USA) . . [10167-8]

2:40 pm: **3D printing and IoT for personalized everyday objects in nursing and healthcare**, Yoshihiro Asano, Hiroya Tanaka, Shoko Miyagawa, Junki Yoshioka, Keio Univ. (Japan) [10167-9]

2:55 pm: **Development of low-cost open source 3D gel printer “RepRap SWIM-ER”**, Kei Sato, Ajit Khosla, Azusa Saito, Samiul Basher, Takafumi Ota, Taishi Tase, Masaru Kawakami, Hidemitsu Furukawa, Yamagata Univ. (Japan) [10167-10]

Coffee Break Sun 3:10 pm to 3:40 pm

CONFERENCE 10168

SESSION 2

**LOCATION: COLUMBIA
SUN 1:00 PM TO 3:00 PM**

Ultrasonic Inspection Methods for SHM

Session Chairs: **Jung-Wuk Hong**, KAIST (Korea, Republic of); **Kara Peters**, North Carolina State Univ. (USA)

1:00 pm: **Effect of pressure on nonlinear ultrasonic wave modulation**, Suyeong Jin, Sang Eon Lee, Jung-Wuk Hong, KAIST (Korea, Republic of) [10168-3]

1:20 pm: **Multimodal location algorithm for Lamb waves propagating through anisotropic materials**, Abdul Rehman, Christophe A. Paget, Mark Courtier, Airbus Operations Ltd. (United Kingdom)[10168-4]

1:40 pm: **Dispersion curve extraction of Lamb waves in isotropic plates by matrix pencil method**, Che-Yuan Chang, National Institute of Aerospace (USA) and North Carolina State Univ. (USA); Fuh-Gwo Yuan, North Carolina State Univ. (USA) and National Institute of Aerospace (USA) [10168-5]

2:00 pm: **The adhesive effect on ultrasonic Lamb wave detection sensitivity of remotely-bonded fiber Bragg grating sensors**, Junghyun Wee, Drew A. Hackney, Kara J. Peters, Philip D. Bradford, North Carolina State Univ. (USA) [10168-6]

2:20 pm: **Damage identification in plate and shell structures by trilateration method using Lamb waves**, Durai Arun, CSIR-National Aerospace Labs. (India) and Visvesvaraya Technological Univ. (India); Sathyanarayana C. N., Raja S, Parthasarathi Naidu V., CSIR-National Aerospace Labs. (India) [10168-7]

2:40 pm: **Synchronous separation, seaming, sealing and sterilization (S4) using brazing for sample containerization and planetary protection**, Yoseph Bar-Cohen, Mircea Badescu, Xiaoqi Bao, Hyeong Jae Lee, Stewart Sherrit, David Freeman, Sergio Campos, Jet Propulsion Lab. (USA) [10168-135]

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

CONFERENCE 10169

SESSION 2

**LOCATION: EUGENE
SUN 1:20 PM TO 2:00 PM**

Radar NDE/NDT II

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

1:20 pm: **Application of ground-penetrating radar in bridge condition assessment**, Azin Shakibabarough, Ashutosh Bagchi, Concordia Univ. (Canada) [10169-5]

1:40 pm: **Measurement of electromagnetic properties of powder and solid metal materials for additive manufacturing**, Evgueni I. Todorov, EWI (USA) [10169-6]

SESSION 3

**LOCATION: EUGENE
SUN 2:00 PM TO 3:00 PM**

UAV-based Health Monitoring

Session Chairs: **Yan Wan**, Univ. of North Texas (USA); **Tzu-Yang Yu**, Univ. of Massachusetts Lowell (USA)

2:00 pm: **Feasibility study of buried non-metallic object detection using Unmanned Aerial Vehicle (UAV) mounted ground penetrating radar**, Yu Zhang, Dylan Burns, Dan Orfeo, The Univ. of Vermont (USA); Jonathan S. Miller, White River Technologies, Inc. (USA); Dryver R. Huston, Tian Xia, The Univ. of Vermont (USA) [10169-7]

2:20 pm: **Unmanned aerial vehicle acquisition of three-dimensional digital image correlation measurements for structural health monitoring of bridges**, Daniel R. Reagan, Alessandro Sabato, Christopher Niezrecki, Tzu-Yang Yu, Univ. of Massachusetts Lowell (USA) . . [10169-8]

2:40 pm: **The design and implementation of a remote UAV-based mobile health monitoring system**, Songwei Li, Yan Wan, The Univ. of Texas at Arlington (USA); Shengli Fu, Univ. of North Texas (USA); H. Felix Wu, U.S. Dept. of Energy (USA) [10169-9]

Coffee Break Sun 3:00 pm to 3:20 pm

CONFERENCE 10170

SESSION 2

**LOCATION: SALON B + C
SUN 1:20 PM TO 3:00 PM**

Composite Monitoring II

Session Chairs: **Piervincenzo Rizzo**, Univ. of Pittsburgh (USA); **Fabrizio Ricci**, Univ. degli Studi di Napoli Federico II (Italy)

1:20 pm: **Full-field ultrasonic inspection for a composite sandwich plate skin-core debonding detection using laser-based ultrasonics**, See Yenn Chong, Michael D. Todd, Univ. of California, San Diego (USA) [10170-5]

1:40 pm: **Assessment of damage in ‘green’ composites**, Paweł H. Malinowski, The Szwedzki Institute of Fluid-Flow Machinery (Poland); Wiesław M. Ostachowicz, The Szwedzki Institute of Fluid-Flow Machinery (Poland) and Warsaw Univ. of Technology (Poland); Fabienne Touchard, Univ. de Poitiers (France); Michel Boustie, Laurence Chocinski-Arnault, Pedro P. Gonzalez, Ecole Nationale Supérieure de Mécanique et d’Aérotechnique (France) and Institut PPRIME (France) and Ctr. National de la Recherche Scientifique (France); Laurent Berthe, Ecole Nationale Supérieure d’Arts et Métiers (France); Davi de Vasconcellos, Luigi Sorrentino, Institute for Polymers, Composites and Biomaterials (IPCB)-CNR (Italy) [10170-6]

2:00 pm: **A Constructive Nonlinear Array (CNA) method for complex crack detection in composite materials**, Gian Piero Malfense Fierro, Michele Meo, Univ. of Bath (United Kingdom) [10170-7]

2:20 pm: **SHM of composite laminates via ultrasonic internal resonance**, Michele Pasquali, Sapienza Univ. of Rome (Italy); Paolo Gaudenzi, Sapienza Univ. di Roma (Italy) [10170-8]

2:40 pm: **Evaluation of adhesively bonded composites by nondestructive techniques**, Paweł H. Malinowski, The Szwedzki Institute of Fluid-Flow Machinery (Poland); Romain Ecault, Airbus Group Innovations (France); Tomasz Wandowski, The Szwedzki Institute of Fluid-Flow Machinery (Poland); Wiesław M. Ostachowicz, The Szwedzki Institute of Fluid-Flow Machinery (Poland) and Warsaw Univ. of Technology (Poland) [10170-9]

Coffee Break Sun 3:00 pm to 3:20 pm

CONFERENCE 10162

SESSION 3

**LOCATION: SALON D
SUN 3:30 PM TO 6:00 PM**

Materials

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

3:30 pm: **Utilizing concepts of mechanics, transport, and assembly in nature: towards responsive materials** (*Invited Paper*), LaShanda Korley, Symone Alexander, Alex Jordan, Case Western Reserve Univ. (USA) [10162-9]

4:00 pm: **Improving the properties of Kevlar through atomic layer deposition**, Mato Knez, Itxasne Azpitarte, CIC nanoGUNE Consolider (Spain) . . [10162-10]

4:20 pm: **Biomimetic reactions in conducting polymers for artificial muscles: sensing working conditions**, Victor H. Pascual, Toribio Fernández Otero, Univ. Politécnica de Cartagena (Spain); Johanna Schumacher, Arquimea Ingeniería, S.L.U. (Spain) [10162-11]

4:40 pm: **Stretchable artificial muscles for soft robotic applications**, Geoffrey M. Spinks, Univ. of Wollongong (Australia) [10162-12]

5:00 pm: **Bio-inspired research in dentistry**, Bert Müller, Ali Akzorba, Fabien Bornert, Bernd Ilgenstein, Kurt Jäger, Georg Schulz, Hans Deyhle, Univ. Basel (Switzerland) [10162-13]

5:20 pm: **MEMS scale active artificial hair cell sensors inspired by the cochlear amplifier effect**, Sheyda Davaria, Pablo A. Tarazaga, Virginia Polytechnic Institute and State Univ. (USA) [10162-14]

5:40 pm: **Synthesis of biomimetic microparticles**, Olaf Karthaus, Chitose Institute of Science and Technology (Japan) [10162-15]

CONFERENCE 10163

**LOCATION: SALON E
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 pages 13-15.

CONFERENCE 10164

SESSION 3

**LOCATION: SALON G + H
SUN 3:30 PM TO 5:50 PM**

**Piezo-based Materials
and Systems**

Session Chairs: **Bardia Konh**, Univ. of Hawai'i at Manoa (USA); **Pablo A. Tarazaga**, Virginia Polytechnic Institute and State Univ. (USA)

3:30 pm: **Passive damping of carbon fiber reinforced plastic with interlaminar enhanced PZT particles dispersed epoxy resin film**, Jaemin Jung, Woo Il Lee, Dasom Lee, Gyu Hee Lee, Young Chul Shin, Seoul National Univ. (Korea, Republic of) [10164-11]

3:50 pm: **Piezoelectrically strained bistable laminates with macro fiber composites**, Andrew Lee, Amin Moosavian, Daniel J. Inman, Univ. of Michigan (USA) [10164-12]

4:10 pm: **Parametric study of fluid flow manipulation with piezoelectric macro-fiber composite flaps**, Omidreza Sadeghi, Pablo A. Tarazaga, Mark Stremmler, Shima Shahab, Virginia Polytechnic Institute and State Univ. (USA) [10164-13]

4:30 pm: **Hybrid passive-active modal networks for structural acoustic control**, Kenneth A. Cunefare, Georgia Institute of Technology (USA); Boris Lossouarn, Conservatoire National des Arts et Métiers (France); Manuel Collet, Ecole Centrale de Lyon (France) [10164-14]

4:50 pm: **Low-weight, high-stiffness glass fiber reinforced polymer beams with embedded piezoelectric fibers**, John A. Gallagher, Roselita Fragoudakis, Merrimack College (USA) [10164-15]

5:10 pm: **Evaluating the performance of an advanced smart needle prototype inside tissue**, Bardia Konh, Minji Jo, Univ. of Hawai'i at Manoa (USA) [10164-16]

5:30 pm: **Generating additional resonances: adding a twist to the split ring resonator**, Max A. Burnett, The Univ. of North Carolina at Charlotte (USA) [10164-17]

CONFERENCE 10165

SESSION 3

**LOCATION: SALON I
SUN 3:30 PM TO 5:30 PM**

**Shape Memory
Materials I**

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

3:30 pm: **Comprehensive modeling of a soft multiple-shape-memory polymer-metal composite actuator**, Qi Shen, Tyler Stalbaum, Sarah Trabia, Taeseon Hwang, Robert Hunt, Kwang Jin Kim, Univ. of Nevada, Las Vegas (USA) [10165-11]

3:50 pm: **Influence of stress concentrations on failure of shape memory alloy actuators**, Francis Phillips, Texas A&M University (USA); Dimitris C Lagoudas, Texas A&M Univ. (USA) [10165-12]

4:10 pm: **Finite element analysis of iron-based shape memory alloy structures with heterogeneous stress and strain distributions under complex thermomechanical loading profiles**, Cheikh Cisse, Wael Zaki, Khalifa Univ. of Science, Technology and Research (United Arab Emirates); Tarak Ben Zineb, Univ. de Lorraine (France) [10165-13]

4:30 pm: **Predictive modeling of actuation behavior of precipitation hardened high temperature shape memory alloys**, Jobin K Joy, Alexandros Solomou, Texas A&M University (USA); Theocharis Baxevanis, Texas A&M Univ. (USA); Dimitris C Lagoudas, Texas A&M University (USA) [10165-14]

4:50 pm: **Graphene based skins on thermally responsive composites for deicing applications**, Christopher R. Bowen, Emily Glover, Nick Gathercole, Univ. of Bath (United Kingdom); Kris Seunarine, Chris Spacie, Haydale Ltd. (United Kingdom) [10165-16]

5:10 pm: **Optimal layout of SMA layers to avoid delamination in composite smart structures**, Simone Cinquemani, Pouya Haghdoost, Nora Lecis, Antonietta Lo Conte, Politecnico di Milano (Italy) [10165-17]

CONFERENCE 10166

SESSION 3

**LOCATION: PEARL
SUN 3:30 PM TO 5:00 PM**

**Smart Materials and
Applications I**

Session Chair: **Bardia Konh**, Univ. of Hawai'i at Manoa (USA)

3:30 pm: **Piezoelectric-based actuators for improved tractor-trailer performance** (*Invited Paper*), David Menicovich, Actasys (USA); Michael Amitay, Rensselaer Polytechnic Institute (USA) and Actasys (USA); Daniele Gallardo, Actasys (USA) [10166-9]

4:00 pm: **Modeling and optimization of piezoelectric bimorph-driven synthetic jet actuators using structural-acoustic FEM**, Tianliang Yu, George A. Lesieutre, Pennsylvania State University (USA); Steven F. Griffin, Daniel P. Brzozowski, Aaron M. Sassoon, The Boeing Company (USA) [10166-10]

4:20 pm: **A self-tuning tuned mass damper**, Steven F. Griffin, The Boeing Co. (USA) [10166-11]

4:40 pm: **A three-dimensional vibration exciter for engineering testing**, Mohammadsadegh Saadatzi, Sourav Banerjee, Univ. of South Carolina (USA) [10166-12]

CONFERENCE 10167

SESSION 4

**LOCATION: SALON A
SUN 3:40 PM TO 4:20 PM**

Nanosensors and Systems I

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

3:40 pm: **Depth of field extended imaging method based on intensification of time and spatial expansion**, Lihui Wang, Tomohiko Hayakawa, Masatoshi Ishikawa, The Univ. of Tokyo (Japan). [10167-11]

4:00 pm: **Conductive polymer sensor arrays for smart orthopaedic implants**, Carolina Micolini, Frederick B. Holness, Western Univ. (Canada); James A. Johnson, Lawson Health Research Institute (Canada); Aaron D. Price, Western Univ. (Canada). [10167-12]

SESSION 5

**LOCATION: SALON A
SUN 4:20 PM TO 6:20 PM**

Fabrication and Characterization of Nanosensors and Structures I

Session Chair: **Jaehwan Kim**, INHA Univ. (Korea, Republic of)

4:20 pm: **Detection of complex molecular samples by low-cost surface enhanced raman spectroscopy (SERS) substrate**, Hsuan-Chao Hou, Louisiana State Univ. (USA); Yaser M. Banadaki, Southern Univ. and A&M College (USA); Safura Sharifi, Louisiana State Univ. (USA). [10167-13]

4:40 pm: **Optical and mechanical properties of cellulose nanopaper structures**, Dimitrios Tsalagkas, Lindong Zhai, Hyun-Chan Kim, Jaehwan Kim, Inha Univ. (Korea, Republic of) [10167-14]

5:00 pm: **Mechanical and electrical properties of carbonized tea based cellulose composite films**, Jayaramudu Tippabattini, Hyun-U Ko, Abdullahil Kafy, Yaguang Li, Jaehwan Kim, Inha Univ. (Korea, Republic of) [10167-15]

5:20 pm: **Properties of TEMPO-oxidized cellulose nanofiber by using aqueous counter collision**, Hai Van Le, Lindong Zhai, Jeong Woong Kim, Eun-Sik Choi, Jaehwan Kim, Inha Univ. (Korea, Republic of) [10167-16]

5:40 pm: **Feasibility study of cellulose nanofiber alignment by high DC magnetic field**, Hyun-Chan Kim, Jinmo Kang, Seong-Mi Byun, Asma Akther, Jaehwan Kim, Inha Univ. (Korea, Republic of) [10167-17]

6:00 pm: **Study of heart-brain interactions through EEG, ECG, and emotions**, Mouli Ramasamy, Vijay Varadan, The Pennsylvania State University (USA) [10167-18]

CONFERENCE 10168

SESSION 3

**LOCATION: COLUMBIA
SUN 3:30 PM TO 5:50 PM**

Thin Film Sensing Systems

Session Chairs: **Donghyeon Ryu**, New Mexico Institute of Mining and Technology (USA); **Kenneth J. Loh**, Univ. of California, San Diego (USA)

3:30 pm: **A robust signal processing method for quantitative high-cycle fatigue crack monitoring using soft elastomeric capacitor sensors**, Xiangxiong Kong, Jian Li, William Collins, Caroline R. Bennett, The Univ. of Kansas (USA); Simon Laflamme, Iowa State Univ. of Science and Technology (USA) [10168-8]

3:50 pm: **On the modeling and characterization of an interlocked flexible electronic skin**, Nazanin Khalili, Hani E. Naguib, Univ. of Toronto (Canada) [10168-9]

4:10 pm: **Carbon nanotube thin film strain sensor models from image analysis**, Bo Mi Lee, Kenneth J. Loh, Univ. of California, San Diego (USA) . . [10168-10]

4:30 pm: **3D printing of highly elastic strain sensors using polyurethane/multiwall carbon nanotube composites**, Josef F. Christ, Cameron J. Hohimer, Nahal Aliheidari, Amir Ameli, Changki Mo, Washington State Univ. Tri-Cities (USA) [10168-11]

4:50 pm: **Enhanced PVDF properties by multi-wall-carbon-nanotube (MWCNT) for efficient energy harvesting**, Jie Hu, Tzu-Yang Yu, Univ. of Massachusetts Lowell (USA) [10168-12]

5:10 pm: **Multifunctional mechanoluminescent composites for self-powered sensing of vibrational loadings**, Elias Pullaim, George Hoover, Dhruv Tiparti, Donghyeon Ryu, New Mexico Institute of Mining and Technology (USA) [10168-13]

5:30 pm: **Semiconductor nanomembrane based sensors for high frequency pressure measurements**, Hang Ruan, Yuhong Kang, Michelle Homer, Richard O. Claus, NanoSonic, Inc. (USA); David Mayo, Wing Ng, Virginia Polytechnic Institute and State Univ. (USA) [10168-14]

CONFERENCE 10169

SESSION 4

**LOCATION: EUGENE
SUN 3:20 PM TO 6:00 PM**

Aerospace and Advanced Materials NDE/NDT

Session Chairs: **Peter J. Shull**, The Pennsylvania State Univ. (USA); **Haifeng Zhang**, Univ. of North Texas (USA)

3:20 pm: **Ultralight 3D composite metamaterials with high defect tolerance and ductility**, Xiaoyu R. Zheng, Virginia Polytechnic Institute and State Univ. (USA) [10169-10]

3:40 pm: **Prognostic investigation of galvanic corrosion precursors in aircraft structures and their detection strategy**, Robin James, Tae Hee Kim, Ram M. Narayanan, The Pennsylvania State Univ. (USA) [10169-11]

4:00 pm: **Structural health monitoring of inflatable structures for MMOD impacts**, Muhammad Anees, Audrey Gbaguidi, Daewon Kim, Sirish Namilae, Embry-Riddle Aeronautical Univ. (USA) [10169-12]

4:20 pm: **In-field implementation of impedance-based structural health monitoring for insulated rail joints**, Mohammad Albakri, Sriram Malladi Chandrasekaran, Americo G. Woolard, Pablo A. Tarazaga, Virginia Polytechnic Institute and State Univ. (USA) [10169-13]

4:40 pm: **Characterization of the spatial piezoresistivity of inkjet-printed carbon nanotube thin films for strain-state sensing**, Patrick Gruener, Yingjun Zhao, Martin Schagerl, Johannes Kepler Univ. Linz (Austria) . . [10169-14]

5:00 pm: **Structural health monitoring of a 3D printed shape memory alloy structure via embedded fiber optic sensors**, Pedro Batista C. Leal, Bing Zhan, Alaa H. Elwany, Texas A&M Univ. (USA); Marcias J. Martinez, Clarkson Univ. (USA); Darren J. Hartl, Texas A&M Univ. (USA) [10169-15]

5:20 pm: **Carbon nanotube based structural health monitoring for fiber reinforced composite materials**, Hao Liu, Dirk Heider, Erik T. Thostenson, Ctr. for Composite Materials, Univ. of Delaware (USA) and Univ. of Delaware (USA) [10169-16]

5:40 pm: **Detecting the water absorption in glass fiber reinforced epoxy (GFRE) composite pipes via an electrical capacitance sensors**, Wael A. Altabay, Southeast Univ. (China) and Alexandria Univ. (Egypt); Mohammad Noori, California Polytechnic State Univ., San Luis Obispo (USA) and Southeast Univ. (China). [10169-17]

CONFERENCE 10170

SESSION 3

**LOCATION: SALON B + C
SUN 3:20 PM TO 6:00 PM**

Metamaterial I

Session Chairs: **Guoliang Huang**, Univ. of Missouri (USA); **Jinkyu Yang**, Univ. of Washington (USA)

3:20 pm: **An adaptive metamaterial beam with hybrid shunting circuits for extremely broadband wave control**, Yangyang Chen, Guoliang Huang, Univ. of Missouri (USA) [10170-10]

3:40 pm: **Experimental observation of wave modulation and Dirac cone in acoustic double zero index metamaterials**, Chengzhi Shi, Marc Dubois, Xuefeng Zhu, Yuan Wang, Xiang Zhang, Univ. of California, Berkeley (USA) [10170-11]

4:00 pm: **Experimental verification of topological band-transition in one-dimensional phononic crystals**, Rajesh Chaunsali, Aman R. Thakkar, Jinkyu Yang, Univ. of Washington (USA) [10170-12]

4:20 pm: **A disorder-based strategy for tunable, broadband wave attenuation**, Paolo Celli, Weiting Zhang, Davide Cardella, Stefano Gonella, Univ. of Minnesota (USA) [10170-13]

4:40 pm: **Controllable wave propagation of hybrid media with LC high-pass network**, Edgar Flores Parra, ETH Zürich (Switzerland) [10170-14]

5:00 pm: **Origami-based mechanical metamaterials with tunable frequency band structures**, Hiromi Yasuda, Riley Pratt, Jinkyu Yang, Univ. of Washington (USA) [10170-15]

5:20 pm: **Flexible metamaterials for shape-adaption acoustic manipulation**, Hongkuan Zhang, Yong Cheng, Shanshan Yao, Xiaoming Zhou, Gengkai Hu, Beijing Institute of Technology (China) . . [10170-16]

5:40 pm: **Simultaneous fatigue-life extension and crack monitoring of damaged steel structures using multifunctional carbon nanotube-based composites**, Shafique Ahmed, Univ. of Delaware (USA); Thomas Schumacher, Portland State Univ. (USA); Erik T. Thostenson, Jennifer McConnell, Univ. of Delaware (USA) [10170-128]

CONFERENCE 10162

Bioinspiration, Biomimetics, and Bioreplication VII

CONFERENCE 10163

Electroactive Polymer Actuators and Devices (EAPAD) XIX

CONFERENCE 10164

Active and Passive Smart Structures and Integrated Systems XI

CONFERENCE 10165

Behavior and Mechanics of Multifunctional Materials and Composites XI

CONFERENCE 10166

Industrial and Commercial Applications of Smart Structures Technologies XI

Monday Plenary Session · 8:20 am to 10:00 am

8:20 to 8:30 am:

- **SPIE Fellow Recognition**
Presented to
Hani E. Naguib, Univ. of Toronto (Canada)



Plenary Presentation: 8:30 to 9:15 am

Predictive simulation of structural health monitoring (*Plenary*), Victor Giurgiutiu, Univ. of South Carolina (USA) [10170-500]



Plenary Presentation: 9:15 to 10:00 am

Adaptive structures: a personal historical perspective (*Plenary*), James E. Hubbard Jr., Univ. of Maryland, College Park (USA) [10168-500]

Coffee Break Mon 10:00 am to 10:30 am

SESSION 4

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

Characterization

Session Chair: **Bert Müller**, Univ. Basel (Switzerland)

10:30 am: **A thin polymer membrane 'NanoSuit' allows living organisms to survive in the harsh conditions of electron microscopy** (*Invited Paper*), Takahiko Hariyama, Hamamatsu Univ. School of Medicine (Japan) [10162-16]

11:00 am: **Three-dimensional imaging of human tissues using recently developed methodology in high-resolution x-ray tomography**, Anna Khimchenko, Marzia Buscema, Georg Schulz, Christos Bikis, Simone E. Hieber, Bert Müller, Univ. Basel (Switzerland) [10162-17]

11:20 am: **Three-dimensional microstructure of selected animals** (*Invited Paper*), Felix Beckmann, Helmholtz-Zentrum Geesthacht (Germany) . . [10162-18]

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

SESSION 3

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

Design Methods of Producing EAP Mechanisms

Session Chairs: **Anne Ladegaard Skov**, Technical Univ. of Denmark (Denmark); **Adrian Koh**, National Univ. of Singapore (Singapore)

10:30 am: **Bottom-up approaches to multi-functional materials and artificial morphogenesis** (*Invited Paper*), Stoyan Smoukov, Univ. of Cambridge (United Kingdom) [10163-8]

11:10 am: **Parameters design of the dielectric elastomer spring-roll bending actuator**, Jinrong Li, Liwu Liu, Yanju Liu, Jinsong Leng, Harbin Institute of Technology (China) [10163-9]

11:30 am: **Integrated sensing and actuation of dielectric elastomer actuator**, Zhihang Ye, Zheng Chen, Wichita State Univ. (USA) [10163-10]

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

SESSION 4

**LOCATION: SALON G + H
MON 10:30 AM TO 12:10 PM**

Aircraft and Morphing Systems

Session Chairs: **Jae-Hung Han**, KAIST (Korea, Republic of); **Daniel J. Inman Sr.**, Univ. of Michigan (USA)

10:30 am: **Design and simulation on the morphing composite propeller**, Fanlong Chen, Qinyu Li, Liwu Liu, Xin Lan, Yanju Liu, Jinsong Leng, Harbin Institute of Technology (China) [10164-18]

10:50 am: **Experimental testing of a planform and camber morphing horizontal tail**, Lawrence L. Gamble, Daniel J. Inman, Univ. of Michigan (USA) [10164-19]

11:10 am: **Numerical and experimental study of bistable plates for morphing structures**, Francesco Nicassio, Gennaro Scarselli, Giulio Avanzini, Univ. del Salento (Italy); Giuseppe Del Core, Univ. degli Studi di Napoli Parthenope (Italy) [10164-20]

11:30 am: **Drag reduction in turbulent flow using spanwise traveling surface waves**, Patrick Musgrave, V. V. N. Sriram Malladi, Pablo A. Tarazaga, Virginia Polytechnic Institute and State Univ. (USA) [10164-21]

11:50 am: **The application of thermal morphing anisogrid smart space structures for high precision applications**, Austin Phoenix, U.S. Naval Research Lab. (USA) [10164-106]

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

SESSION 4

**LOCATION: SALON I
MON 10:30 AM TO 11:50 AM**

Metamaterials

Session Chairs: **Zoubeida Ounaies**, The Pennsylvania State Univ. (USA); **Paris von Lockette**, Rowan Univ. (USA)

10:30 am: **Design and fabrication of materials and structures with negative Poisson's ratio and negative linear compressibility**, Arash Ghaedizadeh, Jianhu Shen, RMIT Univ. (Australia); Xin Ren, RMIT Univ. (Australia) and Central South Univ. (China); Yi Min Xie, RMIT Univ. (Australia) and XIE Archi-Structure Design Co., Ltd. (China) [10165-18]

10:50 am: **Development of polymeric Ron Resch origami pattern for damping applications**, Hani E. Naguib, Mohamed Ali Emhmed Kshad, University of Toronto (Canada) [10165-19]

11:10 am: **Oder-reduced analysis of piezoelectric metamaterial considering damping and resistance effect**, Wangbai Pan, Guoan Tang, Fudan Univ. (China); Jiong Tang, Univ. of Connecticut (USA) [10165-20]

11:30 am: **Self-folding structure using light-absorption of polystyrene sheet**, Yonghee Lee, Maenghyo Cho, Seoul National Univ. (Korea, Republic of) [10165-21]

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

SESSION 4

**LOCATION: PEARL
MON 10:30 AM TO 11:30 AM**

Smart Materials and Applications II

Session Chair: **Bardia Konh**, Univ. of Hawai'i at Manoa (USA)

10:30 am: **Preliminary aeroelastic assessment of a large aeroplane equipped with a camber-morphing aileron**, Rosario Pecora, Francesco Amoroso, Maurizio Arena, Rita Palumbo, Univ. degli Studi di Napoli Federico II (Italy); Gianluca Amendola, Ignazio Dimino, Ctr. Italiano Ricerche Aerospaziali (Italy) [10166-13]

10:50 am: **Touchscreen surface based on interaction of ultrasonic guided waves with a contact impedance**, Nicolas Quaegebeur, Patrice Masson, Nicolas Beaudet, Philippe Sarret, Univ. de Sherbrooke (Canada) [10166-14]

11:10 am: **The impact of magnetorheological semi-active stabilizer bar on automobile rollover**, Xian-Xu Bai, Shi-Xu Xu, Hefei Univ. of Technology (China) [10166-15]

Lunch Break . . . Mon 11:30 am to 1:00 pm

CONFERENCE 10167

Nano-, Bio-, Info-Tech Sensors and 3D Systems

CONFERENCE 10168

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

CONFERENCE 10169

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

CONFERENCE 10170

Health Monitoring of Structural and Biological Systems XI

CONFERENCE 10171

Smart Materials and Nondestructive Evaluation for Energy Systems III

Monday Plenary Session · 8:20 am to 10:00 am

8:20 to 8:30 am:

- **SPIE Fellow Recognition**
Presented to
Hani E. Naguib, Univ. of Toronto (Canada)



Plenary Presentation: 8:30 to 9:15 am
Predictive simulation of structural health monitoring (*Plenary*), Victor Giurgiutiu, Univ. of South Carolina (USA) [10170-500]



Plenary Presentation: 9:15 to 10:00 am
Adaptive structures: a personal historical perspective (*Plenary*), James E. Hubbard Jr., Univ. of Maryland, College Park (USA) [10168-500]

Coffee Break Mon 10:00 am to 10:30 am

SESSION 6

**LOCATION: SALON A
MON 10:30 AM TO 11:00 AM**

Keynote Session

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

10:30 am: **Epidermal electronic systems for sensing and therapy** (*Keynote Presentation*), Nanshu Lu, The Univ. of Texas at Austin (USA) [10167-19]

SESSION 7

**LOCATION: SALON A
MON 11:00 AM TO 12:20 PM**

Nanosensors and Systems II

Session Chair: **Jaehwan Kim**, Inha Univ. (Korea, Republic of)

11:00 am: **Polymeric humidity sensor**, Wei-Chih Wang, Univ. of Washington (USA) and National Tsing Hua Univ. (Taiwan); Yen-Tse Cheng, National Tsing Hua Univ. (Taiwan) [10167-20]

11:20 am: **Poly ionic liquid based nano composites for smart electro-mechanical devices**, Kumkum Ahmed, Ajit Khosla, Masaru Kawakami, Hidemitsu Furukawa, Yamagata Univ. (Japan) [10167-21]

11:40 am: **Design and microfabrication of a novel structure ultra-thin PDMS microfluidic chamber**, Shuyu Wang, Stony Brook Univ. (USA) [10167-23]

12:00 pm: **Photocatalysis of titanium dioxide-carbon nanotube composites with reversible superhydrophobicity and superhydrophilicity**, Ta-I Yang, Shi-Hui Hong, Yu-Jhen Lin, Chung Yuan Christian Univ. (Taiwan); I-Hsiang Tseng, Feng Chia Univ. (Taiwan) [10167-24]

Lunch Break Mon 12:20 pm to 1:50 pm

SESSION 4

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

Vision-based Sensing for Structural Health Monitoring

Session Chairs: **Mohammad Reza Jahanshahi**, Purdue Univ. (USA); **Marco Torbol**, Ulsan National Institute of Science and Technology (Korea, Republic of)

10:30 am: **A video processing approach based on texture analysis and Bayesian decision making for autonomous crack detection in the reactor internal components of nuclear power plants**, Fu-Chen Chen, Mohammad R. Jahanshahi, Rih-Teng Wu, Purdue Univ. (USA); Chris Joffe, Electric Power Research Institute, Inc. (USA) [10168-15]

10:50 am: **Shape management method of large structure based on Octree space partitioning using terrestrial laser scanning**, Gichun Cha, Seunghye Park, Byoungjoon Yu, Sungkyunkwan Univ. (Korea, Republic of) [10168-16]

11:10 am: **Full-field structural dynamics by video motion manipulations**, Yongchao Yang, Charles Farrar, David Mascareñas, Los Alamos National Lab. (USA) [10168-17]

11:30 am: **Visual based laser speckle pattern recognition method for structural health monitoring**, Kyeongtaek Park, Marco Torbol, Ulsan National Institute of Science and Technology (Korea, Republic of) [10168-18]

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

SESSION 5

**LOCATION: EUGENE
MON 10:30 AM TO 12:00 PM**

Special Session in Transportation: DOE National Laboratories Presentations I

Session Chairs: **Zhili Feng**, Oak Ridge National Lab. (USA); **Xin Sun**, Pacific Northwest National Lab. (USA)

10:30 am: **The challenges and opportunities in lightweight materials and propulsion materials for vehicle applications** (*Keynote Presentation*), H. Felix Wu, U.S. Dept. of Energy (USA) [10169-18]

11:00 am: **Online resistance spot weld NDE using infrared thermography**, Jian Chen, Zhili Feng, Oak Ridge National Lab. (USA) [10169-19]

11:20 am: **Development of nanoparticle embedded sizing for enhanced structural health monitoring of carbon fiber composites**, Christopher C. Bowland, Amit K. Naskar, Oak Ridge National Lab. (USA) [10169-20]

11:40 am: **Structural health monitoring of compression connectors for overhead transmission lines**, Hong Wang, Jy-An J. Wang, Oak Ridge National Lab. (USA); Joseph P. Swindeman, Marian Univ. (USA) and Indiana Univ.-Purdue Univ. Indianapolis (USA); Fei Ren, Temple Univ. (USA); John Chan, Electric Power Research Institute, Inc. (USA) . . [10169-21]

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

SESSION 4

**LOCATION: SALON B + C
MON 10:30 AM TO 11:50 AM**

Metamaterial II

Session Chairs: **Jinkyu Yang**, Univ. of Washington (USA); **Guoliang Huang**, Univ. of Missouri (USA)

10:30 am: **Control of subwavelength flexural waves via kirigami-based hyperlens**, Rui Zhu, Hiromi Yasuda, Univ. of Washington (USA); Guoliang Huang, Univ. of Missouri (USA); Jinkyu Yang, Univ. of Washington (USA) [10170-18]

10:50 am: **Tunable digital metamaterial for control of elastic wave propagation**, Ziwei Wang, Kai Zhang, Beijing Institute of Technology (China) [10170-19]

11:10 am: **Isotropic transformation acoustics and applications**, Andrew Norris, Xiaoshi Su, Rutgers, The State Univ. of New Jersey (USA) [10170-20]

11:30 am: **Space-time modulations of inner-resonant metamaterials**, Hussein Nassar, Univ. of Missouri (USA); Andrew Norris, Rutgers, The State Univ. of New Jersey (USA); Guoliang Huang, Univ. of Missouri (USA) [10170-21]

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

SESSION 1

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

Energy Storage and Harvesting I

Session Chair: **Mark R. Woike**, NASA Glenn Research Ctr. (USA)

10:30 am: **Air curtain development: an energy harvesting solution for hinged doors**, Vineed Dayal, Soobum Lee, Univ. of Maryland, Baltimore County (USA) [10171-1]

10:50 am: **Experimental verification and optimization of a linear electromagnetic energy harvesting device**, Christopher Mullen, Soobum Lee, Univ. of Maryland, Baltimore County (USA) [10171-2]

11:10 am: **A study of water electrolysis using ionic polymer-metal composite for solar energy storage**, Alicia Keow, Zhihang Ye, Zheng Chen, Wichita State Univ. (USA) [10171-3]

11:30 am: **Optimized MPPT-based converter for TEG energy harvester to power wireless sensor and monitoring system in nuclear power plant**, Shaou Xing, Isil Anakok, Lei Zuo, Virginia Polytechnic Institute and State Univ. (USA) [10171-4]

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



CONFERENCE 10162

SESSION 5

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

Mechanisms and Models

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

1:20 pm: **Modeling of the burrowing mechanism by razor clam with a 3D DEM model: role of expanding frequency**, Junliang Tao, Sichuan Huang, The Univ. of Akron (USA) [10162-19]

1:40 pm: **Comparison of live stimuli and 3D printed replicas: preference tests for zebrafish**, Tommaso Ruberto, NYU Tandon School of Engineering (USA); Giovanni Polverino, Leibniz-Institut für Gewässerökologie und Binnenfischerei (Germany); Maurizio Porfiri, NYU Tandon School of Engineering (USA) . . . [10162-20]

2:00 pm: **Investigation of propulsive characteristics due to traveling waves in continuous finite media**, V.V.N. Sriram Malladi, Patrick Musgrave, Pablo A. Tarazaga, Virginia Polytechnic Institute and State Univ. (USA) [10162-21]

2:20 pm: **Zebrafish response to live predator and biologically inspired robot**, Gabrielle Cord-Cruz, Tommaso Ruberto, Daniele Neri, Changsu Kim, Maurizio Porfiri, NYU Tandon School of Engineering (USA) [10162-22]

2:40 pm: **Biomimetic liquid repellent surfaces based on self-organized honeycomb-patterned polymer films**, Hiroshi Yabu, Tohoku Univ. (Japan); Jun Kamei, Royal College of Art (United Kingdom) [10162-30]

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

CONFERENCE 10163

SESSION 4

**LOCATION: SALON E
MON 1:20 PM TO 3:00 PM**

Performance Characterization of Various EAP Materials

Session Chairs: **Seon Jeong Kim**, Hanyang Univ. (Korea, Republic of); **Stoyan Smoukov**, Univ. of Cambridge (United Kingdom)

1:20 pm: **Properties of polypyrrole polyvinylsulfate films for dual actuator: sensing systems**, Victor H. Pascual, Toribio Fernández Otero, Univ. Politécnica de Cartagena (Spain); Johanna Schumacher, Arquimea Ingeniería, S.L.U. (Spain) [10163-11]

1:40 pm: **Dynamic instability of dielectric elastomer actuators driven by a combined AC and DC electric loading**, Dhanashri M. Joglekar, Manish M. Joglekar, Indian Institute of Technology Roorkee (India) [10163-12]

2:00 pm: **Preliminary results on the fatigue life characterization of a styrenic dielectric elastomer membrane**, Yi Chen, Rocco Vertechy, Univ. degli Studi di Bologna (Italy); Marco Fontana, Scuola Superiore Sant'Anna (Italy) [10163-13]

2:20 pm: **Insights on the mechanism of piezoelectricity in P(VDF-TrFE) copolymer as a function of crystallinity by molecular dynamics simulation**, Farzin Rahmani, Sasan Nouranian, Farhad Farzbod, Univ. of Mississippi (USA) [10163-14]

2:40 pm: **A mathematical model for an integrated self priming dielectric elastomer generator**, Patrin K. Illenberger, Katherine E. Wilson, E.-F. Markus Henke, Udaya K. Madawala, Iain A. Anderson, The Univ. of Auckland (New Zealand) [10163-15]

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

CONFERENCE 10164

SESSION 5

**LOCATION: SALON G + H
MON 1:20 PM TO 3:00 PM**

Passive and Active Vibration Isolation Systems I

Session Chairs: **Morvan Ouisse**, FEMTO-ST (France); **Lei Zuo**, Virginia Polytechnic Institute and State Univ. (USA)

1:20 pm: **Wave manipulation using adaptive elastic metamaterial with piezoelectric circuitry**, Shilong Li, Jiawen Xu, Jiong Tang, Univ. of Connecticut (USA) [10164-22]

1:40 pm: **Design and experimental validation of an adaptive phononic crystal using highly dissipative polymeric material interface**, Kevin Billon, Morvan Ouisse, Emeline Sadoulet-Reboul, Gael Chevallier, Abdelkrim Khelif, FEMTO-ST (France); Manuel Collet, Lab. de Tribologie et Dynamique des Systèmes, Univ. de Lyon (France) [10164-23]

2:00 pm: **Investigations on an EAP-based tunable Helmholtz resonator**, Abbad Ahmed, FEMTO-ST (France) and Groupe d'Acoustique de l'Univ. de Sherbrooke (Canada); Morvan Ouisse, Rabenoroso Kanty, FEMTO-ST (France); Atalla Noureddine, Groupe d'Acoustique de l'Univ. de Sherbrooke (Canada) [10164-24]

2:20 pm: **Acoustic design of boundary segments in aircraft fuselages using topology optimization and a specialized acoustic pressure function**, Martin Radestock, Michael Rose, Hans Peter Monner, Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany) [10164-25]

2:40 pm: **Characterization of carbon black-filled magnetorheological elastomer under combined shear and compression loads**, Siddaiah Yarra, Majid Behrooz, Nathan Pinuelas, Blake Muzinich, Gokhan Pekcan, Faramarz Gordaninejad, Univ. of Nevada, Reno (USA) [10164-26]

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

CONFERENCE 10165

SESSION 5

**LOCATION: SALON I
MON 1:20 PM TO 3:00 PM**

Nanocomposites Materials Applications

Session Chairs: **William S. Oates**, Florida State Univ. (USA); **Vishnu Baba Sundaresan**, The Ohio State Univ. (USA)

1:20 pm: **New sensing method of dispersion and damage detection of carbon fiber/polypropylene-polyamide composites via two-dimensional electrical resistance mapping**, Joung-Man Park, Gyeongsang National Univ. (Korea, Republic of) and The Univ. of Utah (USA); Dong-Jun Kwon, Pyung-Su Shin, Jong-Hyun Kim, Gyeongsang National Univ. (Korea, Republic of); Lawrence K. DeVries, The Univ. of Utah (USA) [10165-22]

1:40 pm: **Development of carbon nanotube: cellulose composites using a simple papermaking process for multifunctional sensing applications**, Sheilla Goodman, Anthony B. Dichiaro, Univ. of Washington (USA) [10165-23]

2:00 pm: **Electrochemical and mechanical properties of a PEG based solid polymer electrolyte for power storage composites**, Constantin Ciocanel, Cindy Browder, Gerrick Lindberg, Northern Arizona Univ. (USA) [10165-24]

2:20 pm: **New conductive and high energy density air-cathode made of carbon fiber and carbon nanotubes buckypaper for electrically rechargeable zinc-air batteries**, Arturo Reza Ugalde, Univ. of Toronto (Canada); Hani E. Naguib, Univ. of Toronto (Canada) [10165-25]

2:40 pm: **Development of eletrothermal actuator (ETA) with biodegradable polymeric matrix for artificial muscle applications**, Yu-Chen Sun, Univ. of Toronto (Canada); Benjamin Leaker, Univ. of Toronto (Canada); Hani Naguib, Univ. of Toronto (Canada) [10165-26]

Coffee Break . . . Mon 3:00 pm to 3:20 pm

CONFERENCE 10166

SESSION 5

**LOCATION: PEARL
MON 1:00 PM TO 2:40 PM**

Smart Materials and Applications III

Session Chair: **Christopher S. Lynch**, Univ. of California, Los Angeles (USA)

1:00 pm: **Challenges and state of the technology for printed sensor array for structural monitoring**, Shiv Joshi, NextGen Aeronautics Inc (USA); Scott Bland, Robert DeMott, NextGen Aeronautics, Inc. (USA); Nickolas Anderson, Gregory Jursich, Univ. of Illinois at Chicago (USA) [10166-16]

1:20 pm: **Reinforcing cementitious structures by pH activated in-situ shrinking microfiber**, Sundong Kim, Patrick C. Lee, Dryver R. Huston, Ting Tan, The Univ. of Vermont (USA) [10166-17]

1:40 pm: **A portable integrated system to control the active needle**, Minji Jo, Univ. of Hawai'i at Manoa (USA); Hashem Ashrafiun, Villanova Univ. (USA); Bardia Konh, Univ. of Hawai'i at Manoa (USA) [10166-18]

2:00 pm: **Auto-Gopher-II: an autonomous wireline rotary-hammer ultrasonic drill**, Mircea Badescu, Stewart Sheritt, Hyeong Jae Lee, Xiaoqi Bao, Yoseph Bar-Cohen, Shannon P. Jackson, Jet Propulsion Lab. (USA); Kris Zacny, Gale L. Paulsen, Honeybee Robotics (USA) [10166-19]

2:20 pm: **Experimental validation of a true-scale morphing flap for large civil aircraft applications**, Rosario Pecora, Francesco Amoroso, Maurizio Arena, Maria Chiara Novello, Francesco Rea, Univ. degli Studi di Napoli Federico II (Italy) [10166-20]

Conference End.

CONFERENCE 10167

SESSION 8

**LOCATION: SALON A
MON 1:50 PM TO 2:30 PM**

Quantum and Nanoengineering

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

1:50 pm: **Potential and progress in quantum technology for NASA missions** (*Keynote Presentation*), Sang H. Choi, NASA Langley Research Ctr. (USA) [10167-25]

SESSION 9

**LOCATION: SALON A
MON 2:30 PM TO 3:30 PM**

Energy Storage and Power

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

2:30 pm: **Metallic junction thermoelectric device simulations**, Adam J. Duzik, National Institute of Aerospace (USA); Sang H. Choi, NASA Langley Research Ctr. (USA) . . . [10167-26]

2:50 pm: **Cellulose/graphene oxide composite for electrode materials of flexible energy devices**, Abdullahil Kafy, Asma Akther, Md Imrul Reza Shishir, Jaehwan Kim, Inha Univ. (Korea, Republic of) [10167-27]

3:10 pm: **Coupling effects by closely packed rectenna arrays**, Kyo D. Song, Deidra Walls, Norfolk State Univ. (USA); Sang H. Choi, NASA Langley Research Ctr. (USA); Hargsoon Yoon, Norfolk State Univ. (USA) [10167-29]

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

CONFERENCE 10168

SESSION 5

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

Monitoring Strategies for Civil Infrastructure

Session Chairs: **Dryver R. Huston**, The Univ. of Vermont (USA); **Neil Hoult**, Queen's Univ. (Canada)

1:20 pm: **Urban underground infrastructure mapping and assessment**, Dryver R. Huston, Tian Xia, Dylan Burns, Taian Fan, Dan Orfeo, Yu Zhang, The Univ. of Vermont (USA) [10168-19]

1:40 pm: **Recent developments in disaster mitigation and sustainable engineering**, Hiroshi Asanuma, Chiba Univ. (Japan) [10168-20]

2:00 pm: **Recursive subspace-based identification of linear time-varying system**, Jun-Da Chen, Chin-Hsiung Loh, National Taiwan Univ. (Taiwan). . [10168-21]

2:20 pm: **Evaluation of truss bridges using distributed strain measurements**, Kyle E. Van Der Kooi, Neil A. Hoult, Queen's Univ. (Canada) [10168-22]

2:40 pm: **A new method for detection of fatigue cracking in steel bridge girders using self-powered wireless sensors**, Hassene Hasni, Amir H. Alavi, Pengcheng Jiao, Nizar Lajnef, Michigan State Univ. (USA) [10168-23]

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

CONFERENCE 10169

SESSION 6

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

Special Session in Transportation: DOE National Laboratories Presentations II

Session Chairs: **Xin Sun**, Pacific Northwest National Lab. (USA); **Zhili Feng**, Oak Ridge National Lab. (USA)

1:20 pm: **Nondestructive evaluation techniques for thick concrete structures**, Dwight A. Clayton, Oak Ridge National Lab. (USA) [10169-22]

1:40 pm: **Understanding the thermal sciences in the electron beam melting process through in-situ process monitoring**, Michael Kirka, Oak Ridge National Lab. (USA); Jacob Raplee, Tennessee State Univ. (USA); Alex Plotkowski, The Univ. of Tennessee (USA); Ralph B. Dinwiddie, Ryan R. Dehoff, Oak Ridge National Lab. (USA); Sudarsanam babu, The Univ. of Tennessee (USA) [10169-23]

2:00 pm: **A residual stress study of cast aluminum alloy cylinder heads**, Thomas Watkins, Ke An, Amit Shyam, J. Allen Haynes, Oak Ridge National Lab. (USA) [10169-24]

2:20 pm: **High energy x-ray 3D tomography for graphite morphology characterization in cast irons for engine application**, Dileep Singh, Chihpin Chuang, John Hryn, Jonathan D. Almer, Peter Kenesei, Argonne National Lab. (USA); Richard Huff, Caterpillar Inc. (USA) [10169-25]

2:40 pm: **Ultrasonic signatures corresponding to defect localization and onset of instabilities in granular media and lattice structures**, Maruti K. Mudunuru, Vamshi K. Chillara, Satish Karra, Los Alamos National Lab. (USA); Kalyana B. Nakshatrala, Univ. of Houston (USA) [10169-26]

Coffee Break. . . . Mon 3:00 pm to 3:20 pm

CONFERENCE 10170

SESSION 5

**LOCATION: SALON B + C
MON 1:20 PM TO 3:00 PM**

Advancements in Modeling

Session Chairs: **Sourav Banerjee**, Univ. of South Carolina (USA); **Xinlin Qing**, Xiamen Univ. (China)

1:20 pm: **Parametric studies for semi-analytical modal analysis of plate-mounted resonators**, Christoph Schaal, California State Univ., Northridge (USA); Robert M'Closkey, Ajit K. Mal, Univ. of California, Los Angeles (USA) . . [10170-22]

1:40 pm: **Application of distributed point source method (DPSM) to wave propagation in anisotropic media**, Samaneh Fooladi, Tribikram Kundu, The Univ. of Arizona (USA) [10170-23]

2:00 pm: **Computational wave field modeling in anisotropic plate**, Sajan Shrestha, Sourav Banerjee, University of South Carolina (USA) [10170-24]

2:20 pm: **Optimization of multi-scale modelling of CNT/polymer composite strain sensors**, Krzysztof Grabowski, Wieslaw J. Staszewski, Tadeusz Uhl, Pawel Packo, AGH Univ. of Science and Technology (Poland). [10170-25]

2:40 pm: **Peridynamic modeling for displacement computation around an interfacial crack in a bimaterial thin plate**, Mohammad Hadi Hafezi, The Univ. of Arizona (USA); Reza Alebrahim, National Univ. of Malaysia (Malaysia); Tribikram Kundu, The Univ. of Arizona (USA) [10170-26]

Coffee Break. . . . Mon 3:00 pm to 3:20 pm

CONFERENCE 10171

SESSION 2

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

Energy Storage and Harvesting II

Session Chair: **Mark R. Woike**, NASA Glenn Research Ctr. (USA)

1:20 pm: **Synthesis, characterization, and property investigation of polyvinylidene fluoride (PVDF)-graphene nanocomposites for energy harvesting application**, Chandan Kumar, Anupama Gaur, Pralay Maiti, S. K. Rai, Indian Institute of Technology, Banaras Hindu Univ. (India). [10171-5]

1:40 pm: **Numerical modeling and analysis of a piezoelectric transducer beam for energy harvesting using an oscillating heat pipe**, Sajiree Vaidya, Oliver J. Myers, Clemson Univ. (USA); Scott M. Thompson, Nima Shamsaei, Auburn Univ. (USA); John Gabriel Monroe, Mississippi State Univ. (USA). . . [10171-6]

2:00 pm: **Battery charge and health state monitoring via ultrasonic-guided-wave-based methods using built-in piezoelectric transducers**, Purim Ladpli, Fotis Kopsaftopoulos, Raphael Nardari, Fu-Kuo Chang, Stanford Univ. (USA) [10171-7]

2:20 pm: **Electrochemical behaviors of a wearable woven textile Li-ion battery consisted of a core and wound electrode fibers coated with active materials**, Cheol Kim, Seong-Min Yun, Seung-Hwan Bang, Kyungpook National Univ. (Korea, Republic of). [10171-8]

2:40 pm: **An energy harvesting solution based on the post-buckling response of non-prismatic slender beams**, Pengcheng Jiao, Wassim Borchani, Hassene Hasni, Amir H. Alavi, Nizar Lajnef, Michigan State Univ. (USA) [10171-30]

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

CONFERENCE 10162

SESSION 6

**LOCATION: SALON D
MON 3:30 PM TO 5:40 PM**

Functional Surfaces

Session Chair: **Barbara Mazzolai**, Istituto Italiano di Tecnologia (Italy)

3:30 pm: **Bio-inspired surfaces with nano-scale structural randomness: from analysis to fabrication and applications** (*Invited Paper*), Hendrik Hölscher, Karlsruhe Institut für Technologie (Germany) [10162-24]

4:00 pm: **Blue tarantulas and dancing rainbow spiders inspire new color technologies**, Bor-Kai Hsiung, The Univ. of Akron (USA); Matthew D. Shawkey, The Univ. of Akron (USA) and Univ. Gent (Belgium); Todd A. Blackledge, The Univ. of Akron (USA) [10162-25]

4:20 pm: **Design of bioinspired chirped reflectors using a genetic algorithm**, Francesco Chiadini, Univ. degli Studi di Salerno (Italy); Vincenzo Fiumara, Univ. degli Studi della Basilicata (Italy); Antonio Scaglione, Univ. degli Studi di Salerno (Italy) [10162-26]

4:40 pm: **Substrate-free morpho-color materials fabricated by a simple mass-production process based on new principles**, Akira Saito, Osaka Univ. (Japan) and RIKEN (Japan) and Spring-8 (Japan); Jumpei Ohga, Yuji Kuwahara, Osaka Univ. (Japan) [10162-27]

5:00 pm: **Bioinspired multicontrollable metasurfaces and metamaterials**, Akhlesh Lakhtakia, Douglas E. Wolfe, Mark W. Horn, The Pennsylvania State Univ. (USA); John Mazurowski, The Pennsylvania State Univ. Electro-Optics Ctr. (USA); Arnold Burger, Fisk Univ. (USA); Partha P. Banerjee, Univ. of Dayton (USA) [10162-28]

5:20 pm: **Capillary-based grip in biological and engineered systems: a comparative review on scalability and geometry**, Peter van Assenbergh, Jay van den Berg, Paul Breedveld, Dimitra Dodou, Technische Univ. Delft (Netherlands) [10162-29]

**LOCATION: LOWER LEVEL 2
EXHIBIT HALL
5:40 PM TO 6:00 PM**

Poster Pops

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

Conference End.

CONFERENCE 10163

SESSION 5

**LOCATION: SALON E
MON 3:30 PM TO 5:50 PM**

Artificial Muscle for Soft Robotics

Session Chairs: **Kwang Jin Kim**, Univ. of Nevada, Las Vegas (USA); **Maurizio Porfiri**, NYU Tandon School of Engineering (USA)

3:30 pm: **Fused filament 3D printing of ionic polymer-metal composites for soft robotics** (*Invited Paper*), Kam K. Leang, James D. Carrico, The Univ. of Utah (USA) [10163-16]

4:10 pm: **Producing intricate IPMC shapes by means of painting and printing**, Sarah Trabia, Zakai Olsen, Taeseon Hwang, Kwang Jin Kim, Univ. of Nevada, Las Vegas (USA) [10163-17]

4:30 pm: **Study of the electrochemical capabilities of ionic polymer-metal composites using scanning electrochemical microscopy**, Craig Anderson, Sarah Trabia, Taeseon Hwang, Kwang Jin Kim, Univ. of Nevada, Las Vegas (USA) [10163-18]

4:50 pm: **IPMC-driven thrust generation: a new conceptual design**, Zakai Olsen, Kwang Jin Kim, Univ. of Nevada, Las Vegas (USA) [10163-19]

5:10 pm: **A model framework for actuation and sensing of ionic polymer-metal composites**, Tyler P. Stalbaum, Kwang Jin Kim, Univ. of Nevada, Las Vegas (USA) [10163-20]

5:30 pm: **A theoretical framework for the study of compression sensing in ionic polymer metal composites**, Valentina Volpini, Lorenzo Bardella, Andrea Rodella, Univ. degli Studi di Brescia (Italy); Youngsu Cha, Korea Institute of Science and Technology (Korea, Republic of); Maurizio Porfiri, NYU Tandon School of Engineering (USA) . . [10163-21]

CONFERENCE 10164

SESSION 6

**LOCATION: SALON G + H
MON 3:30 PM TO 5:50 PM**

SMA-based Materials and Systems

Session Chairs: **Nam Seo Goo**, Konkuk Univ. (Korea, Republic of); **Ya S. Wang**, Stony Brook Univ. (USA)

3:30 pm: **Modeling of a reinforced concrete beam using shape memory alloy as reinforcement bars**, Kamalkishor M. Bajoria, Shreya S. Kaduskar, Indian Institute of Technology Bombay (India) [10164-27]

3:50 pm: **SMA spring-based artificial muscle actuated by hot and cool water using faucet-like valve**, Cheol Hoon Park, Young Su Son, Korea Institute of Machinery & Materials (Korea, Republic of) [10164-28]

4:10 pm: **Smart Registers for Automated Building Energy Saving (SRABE)**, Zhongjie Chen, Ya S. Wang, Stony Brook Univ. (USA) . . . [10164-29]

4:30 pm: **Use of shape memory polymer composite hinges for self-deploying antenna**, Dang Khoi Le, Thanh Duc Dao, Vinh Tung Le, Nam Seo Goo, Konkuk Univ. (Korea, Republic of); Woong-Ryeol Yu, Seoul National Univ. (Korea, Republic of) [10164-30]

4:50 pm: **Characterization of coiled SMA actuators for humanoid robot**, Akshay Potnuru, Yonas Tadesse, The Univ. of Texas at Dallas (USA) [10164-31]

5:10 pm: **Finite element analyses of a dual actuated prototype of a smart needle**, Minji Jo, Bardia Konh, Univ. of Hawaii at Manoa (USA) [10164-32]

5:30 pm: **Design, fabrication, and environmental testing of shape memory alloy-based composite morphing radiator**, Christopher L. Bertagne, Jet Propulsion Lab. (USA); Matthew T. Wescott, Jeffrey S. McQuien, Texas A&M Univ. (USA); Lisa R. Erickson, NASA Johnson Space Ctr. (USA); John D. Whitcomb, Darren J. Hartl, Texas A&M Univ. (USA) [10164-33]

CONFERENCE 10165

SESSION 6

**LOCATION: SALON I
MON 3:20 PM TO 6:00 PM**

Multifunctional Composites

Session Chairs: **Constantin Ciocanel**, Northern Arizona Univ. (USA); **Kwang Jin Kim**, Univ. of Nevada, Las Vegas (USA)

3:20 pm: **The effect of nano fillers on the polymerization shrinkage kinetics and mechanical behavior of composites**, Ermias G Koricho, Georgia Southern University (USA); Anton Khomenko, General Photonics Corporation (USA); Mahmoodul haq, Michigan State University (USA) [10165-27]

3:40 pm: **Strain-dependent and hysteretic resistance of stretchable carbon nanotube networks**, Lihua Jin, Univ. of California, Los Angeles (USA); Alex Chortos, Christian Linder, Zhenan Bao, Wei Cai, Stanford Univ. (USA) . . [10165-29]

4:00 pm: **Design of thermally adaptive composite structures for damping and stiffness control**, Pauline Butaud, Gael Chevallier, Morvan Ouisse, Emmanuel Foltete, FEMTO-ST (France) . . . [10165-30]

4:20 pm: **Stress-strain and fracture toughness behaviour of composites reinforced with inhomogeneously distributed particles**, Bernd Lauke, Leibniz-Institut für Polymerforschung Dresden e.V. (Germany) [10165-31]

4:40 pm: **Influence of heating time of pyrolysis method for extracting recycled carbon fibers from wasted Prepreg on fiber breakages in its injection molded composite**, Koki Itokawa, Kazuya Okubo, Toru Fujii, Doshisha Univ. (Japan) [10165-32]

5:00 pm: **Impact resistant smart hybrid laminates**, Fulvio Pinto, Michele Meo, Francesco Rizzo, Univ. of Bath (United Kingdom) [10165-33]

5:20 pm: **Multifunctional surfaces produced using fiber debonding and pullout in composite materials**, Reza Rizvi, The Univ. of Toledo (Canada); Ali Anwer, Hani E. Naguib, Univ. of Toronto (Canada) [10165-34]

5:40 pm: **Bistable morphing composites with selectively-prestressed laminae**, Venkata Siva Chillara, Marcelo Dapino, The Ohio State Univ. (USA) [10165-28]

CONFERENCE 10167

SESSION 10

**LOCATION: SALON A
MON 4:00 PM TO 6:00 PM**

3D Printing Demonstration Session

Session Chairs: **Ajit Khosla**, Yamagata Univ. (Japan); **Hidemitsu Furukawa**, Yamagata Univ. (Japan)

This demonstration session will cover new 3D printing technologies focusing on soft robotics, molecular models, food and more. Each demonstration will include a brief oral talk describing the technology. All registered attendees are welcome.

4:00 to 4:10pm: Welcome and Introductions

The flexibility controlling study for 3D printed splint [10167-49] (See Session 14 for abstract and author details)

3D printing and IoT for personalized everyday objects in nursing and healthcare [10167-9] (See Session 3 for abstract and author details)

3D printing of wearable fractal based sensor systems for neurocardiology and healthcare [10167-8] (See Session 3 for abstract and author details)

4:40 pm: **3D printing of protein molecules**, Masaru Kawakami, Hidemitsu Furukawa, Yamagata Univ. (Japan) [10167-31]

4:50 pm: **Smart walking stick for blind people: an application of 3D printer**, Faidur Rahman, Md. Allama Iqbal, Univ. of Rajshahi (Bangladesh); Md. Hasnat Kabir, Hidemitsu Furukawa, Yamagata Univ. (Japan) [10167-32]

5:00 pm: **3D gel printing and applications**, Kazuyuki Sakai, Masato Wada, Kyuuchiro Takamatsu, Azusa Saito, Ajit Khosla, Masaru Kawakami, Hidemitsu Furukawa, Yamagata Univ. (Japan) [10167-33]

5:10 pm: **Caterpillike: a soft-bodied 3D printed robot inspired by caterpillars**, Takuya Umedachi, The Univ. of Tokyo (Japan) [10167-34]

5:20 pm: **3D printing in social education: Eki-Fab and student PBL**, Masato Makino, Azusa Saito, Mai Kodama, Kyuuchiro Takamatsu, Hideaki Tamate, Kazuyuki Sakai, Masato Wada, Ajit Khosla, Masaru Kawakami, Hidemitsu Furukawa, Yamagata Univ. (Japan) [10167-35]

5:30 pm: **3D printing for food**, Mai Kodama, Azusa Saito, Masato Makino, Ajit Khosla, Masaru Kawakami, Hidemitsu Furukawa, Yamagata Univ. (Japan) [10167-36]

5:40 pm: **Direct material weaving by G-code manipulation**, Soko Koda, Hiroya Tanaka, Keio Univ. (Japan) [10167-37]

5:50 pm: **Polymer-based blood vessel models with micro-temperature sensors in EVE**, Mizue Mizoshiri, Yasuaki Ito, Takeshi Hayakawa, Junpei Sakurai, Seiichi Ikeda, Fumihito Arai, Seiich Hata, Nagoya Univ. (Japan) [10167-38]

CONFERENCE 10168

SESSION 6

**LOCATION: COLUMBIA
MON 3:30 PM TO 5:50 PM**

Novel Sensing Technologies I

Session Chairs: **Hoon Sohn**, KAIST (Korea, Republic of); **Donghyeon Ryu**, New Mexico Institute of Mining and Technology (USA)

3:30 pm: **Heating and thermal control of brazing technique to break contamination path for potential Mars sample return**, Xiaoqi Bao, Mircea Badescu, Yoseph Bar-Cohen, Sergio Campos, Jet Propulsion Lab. (USA) [10168-24]

3:50 pm: **Variable input observer-predictor for structural health monitoring of high-rate systems**, Jonathan Hong, Applied Research Associates, Inc. (USA) and Iowa State Univ. College of Engineering (USA); Simon Laflamme, Liang Cao, Iowa State Univ. (USA); Jacob Dodson, Air Force Research Lab. (USA) [10168-25]

4:10 pm: **Accelerated damage visualization using binary search with fixed distance laser ultrasonic scanning**, Byeongjin Park, Hoon Sohn, KAIST (Korea, Republic of) [10168-26]

4:30 pm: **Physics-based structural health monitoring using the time-frequency analysis of electro-mechanical impedance signal**, Farshad Zahedi, The Univ. of Texas at Arlington (USA) [10168-27]

4:50 pm: **Strain field reconstruction on composite spars based on the identification of equivalent load conditions**, Alessandro Airoldi, Lorenzo Marelli, Paolo Bettini, Giuseppe Sala, Politecnico di Milano (Italy) [10168-28]

5:10 pm: **Inverse analysis of aerodynamic loads from strain information using structural models and neural networks**, Daichi Wada, Yohei Sugimoto, Japan Aerospace Exploration Agency (Japan) [10168-29]

5:30 pm: **A machine learning approach for damage detection of aerospace structures using self-powered sensor data**, Hadi Salehi, Saptarshi Das, Michigan State Univ. (USA); Shantanu Chakrabarty, Washington Univ. in St. Louis (USA); Subir Biswas, Rigoberto Burgueno, Michigan State Univ. (USA) [10168-30]

CONFERENCE 10169

SESSION 7

**LOCATION: EUGENE
MON 3:20 PM TO 4:40 PM**

Special Session in Transportation: DOE National Laboratories Presentations III

Session Chairs: **Gao Liu**, Lawrence Berkeley National Lab. (USA); **Dileep Singh**, Argonne National Lab. (USA)

3:20 pm: **Structural health monitoring with inverse resonance inspection**, Xin Sun, Kevin C. Lai, Pacific Northwest National Lab. (USA) [10169-27]

3:40 pm: **A comparison of different NDE signal processing techniques based on waveform entropies applied to long fiber graphite/epoxy plates having near surface defects**, Michael Larche, Mathew Prowant, Paul Bruillard, Tobias Hage, Leonard S. Fifield, Michael Hughes, Xin Sun, Pacific Northwest National Lab. (USA) [10169-28]

4:00 pm: **Non-destructive evaluation of polyolefin thermal aging using infrared spectroscopy**, Leonard S. Fifield, Pacific Northwest National Lab. (USA) and Washington State Univ. (USA); Yongsoon Shin, Kevin L. Simmons, Pacific Northwest National Lab. (USA) [10169-29]

4:20 pm: **Nondestructive evaluation of composite materials via scanning laser ultrasound spectroscopy**, Elise Anne Koskelo, Eric B. Flynn, Los Alamos National Lab. (USA) [10169-30]

SESSION 8

**LOCATION: EUGENE
MON 4:40 PM TO 6:00 PM**

Special Session in Transportation: DOE National Laboratories Presentations IV

Session Chairs: **Dileep Singh**, Argonne National Lab. (USA); **Gao Liu**, Lawrence Berkeley National Lab. (USA)

4:40 pm: **External monitoring of pressure and dimension changes for energy materials and systems**, Gao Liu, Lawrence Berkeley National Lab. (USA) [10169-31]

5:00 pm: **Synchrotron based non-destructive characterization of the dissimilar joints**, Wanli Yang, Gao Liu, Lawrence Berkeley National Lab. (USA) [10169-32]

5:20 pm: **Combinatorial materials approach to accelerate materials discovery for transportation**, Wei Tong, Lawrence Berkeley National Lab. (USA) [10169-33]

5:40 pm: **Combining density functional theory calculations, supercomputing, and data-driven methods to design new materials**, Anubhav Jain, Lawrence Berkeley National Lab. (USA) . . . [10169-34]

CONFERENCE 10170

SESSION 6

**LOCATION: SALON B + C
MON 3:20 PM TO 6:00 PM**

Bioinspired SHM and Biomaterial Monitoring

Session Chairs: **Wei-Chih Wang**, Univ. of Washington (USA); **Xiaoning Jiang**, North Carolina State Univ. (USA)

3:20 pm: **Dual-frequency transducer with a wideband PVDF receiver for contrast-enhanced, adjustable harmonic imaging**, Jinwook Kim, North Carolina State Univ. (USA); Brooks D. Lindsey, The Univ. of North Carolina at Chapel Hill (USA) and North Carolina State Univ. (USA); Sibó Li, North Carolina State Univ. (USA); Paul A. Dayton, The Univ. of North Carolina at Chapel Hill (USA) and North Carolina State Univ. (USA); Xiaoning Jiang, North Carolina State Univ. (USA) and City Univ. of Hong Kong (China) [10170-27]

3:40 pm: **Peridynamic modelling of fracture in human vertebrae**, Mohammad Hadi Hafezi, The Univ. of Arizona (USA); Reza Alebrahim, National Univ. of Malaysia (Malaysia); Tribikram Kundu, The Univ. of Arizona (USA) [10170-28]

4:00 pm: **Birefringence Fourier transform spectrometer**, Wei-Chih Wang, Univ. of Washington (USA) and National Tsing Hua Univ. (Taiwan); Peng Jyun Chen, National Tsing Hua Univ. (Taiwan) . . [10170-29]

4:20 pm: **Design, analysis, and fabrication of a piezoelectric force tray for total knee replacements**, Elias Hoummadi, Mohsen Safaei, Steven R. Antan, Tennessee Technological Univ. (USA) [10170-30]

4:40 pm: **Air-coupled acoustic radiation force source for non-contact measurement of soft media elasticity**, Lukasz Ambroziński, AGH Univ. of Science and Technology (Poland) and Univ. of Washington (USA); Ivan M. Pelivanov, Univ. of Washington (USA) and M.V. Lomonosov Moscow SU (Russian Federation); Shaozhen Song, Soon Joon Yoon, David S. Li, Liang Gao, Univ. of Washington (USA); Tueng T. Shen, Univ. of Washington (USA) and Univ. of Washington (USA); Ruikang K. Wang, Matthew O'Donnell, Univ. of Washington (USA) [10170-31]

5:00 pm: **Peridynamic theory for medical applications**, Mohammad Hadi Hafezi, The Univ. of Arizona (USA); Reza Alebrahim, National Univ. of Malaysia (Malaysia); Tribikram Kundu, The Univ. of Arizona (USA) [10170-32]

5:20 pm: **Resonant frequencies of quasi-brittle materials with sacrificial bonds and hidden lengths**, Maruti K. Mudunuru, Los Alamos National Lab. (USA); Kalyana B. Nakshatrala, Univ. of Houston (USA); Vamshi K. Chillara, Satish Karra, Los Alamos National Lab. (USA) [10170-33]

5:40 pm: **Human-based pattern recognition framework for data-driven structural health monitoring utilizing hearing receptors**, Shervin Khazaeli, Ashutosh Bagchi, Concordia Univ. (Canada); Adam S. Ziabari, McGill Univ. (Canada) [10170-34]

CONFERENCE 10171

SESSION 3

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

Wind Energy

Session Chair: **Vassilios Kappatos**, Univ. of Southern Denmark (Denmark)

3:30 pm: **Compressive sensing for fault diagnosis of rotating parts of wind turbines**, George Georgoulas, Luleå Univ. of Technology (Sweden); Mayorkinos Papaalias, The Univ. of Birmingham (United Kingdom); Vassilios Kappatos, Univ. of Southern Denmark (Denmark); Petros Karvelis, Technological Educational Institute of Epirus (Greece); George Nikolakopoulos, Luleå Univ. of Technology (Sweden); Konstantinos Salonitis, Cranfield Univ. (United Kingdom) [10171-10]

3:50 pm: **Development of an embedded thin-film strain-gauge-based SHM network into 3D-woven composite structure for wind turbine blades**, Dongning Zhao, Univ. of Ulster (United Kingdom); Micheal Forde, Bryan Weafer, ÉireComposites Teo (Ireland); Alistair McIlhagger, Edward Archer, James A. D. McLaughlin, Univ. of Ulster (United Kingdom) [10171-11]

4:10 pm: **Optimal statistical damage classification in an experimental wind turbine blade using minimum instrumentation**, Simon Hoell, Piotr Omenzetter, Univ. of Aberdeen (United Kingdom) [10171-12]

4:30 pm: **Using phase-based motion estimation technique to extract operating modal data for a wind turbine blade**, Aral Sarrafi, Peyman Poozesh, Christopher Niezrecki, Zhu Mao, Univ. of Massachusetts Lowell (USA) . . . [10171-13]

4:50 pm: **Scheduling monitoring for optimizing life-cycle costs and reliability of wind turbines**, Anu Hanish Nithin, Piotr Omenzetter, Univ. of Aberdeen (United Kingdom) [10171-14]

5:10 pm: **Multi-objective optimization for predictive control applied to large scale wind turbines**, Yuan Yuan, Pei Cao, Jiong Tang, Univ. of Connecticut (USA) [10171-15]

POSTER SESSION

Monday 27 March | 6:00 to 7:30 pm

CONFERENCE 10162

Bioinspiration, Biomimetics, and Bioreplication VII

Robotic controller, Subrat Mahapatra, Kevin Nickels, Hoa Nguyen, Trinity Univ. (USA) [10162-32]

Probing of micro and nano-rheological behavior of insect hemolymph using magnetic actuation, Pavel Aprelev, Peter H. Adler, Konstantin G. Kornev, Clemson Univ. (USA) [10162-33]

Dropwise condensation using bioinspired surfaces, Blake Naccarato, Taeseon Hwang, Kwang Jin Kim, Univ. of Nevada, Las Vegas (USA) [10162-34]

Sensitive photoreceiver based on carbon nanotube / tobacco cell composite material, Heinz C. Neitzert, Università degli Studi di Salerno (Italy); Giovanni Landi, Univ. degli Studi di Salerno (Italy) [10162-36]

CONFERENCE 10163

Electroactive Polymer Actuators and Devices (EAPAD) XIX

Fabrication of dielectric elastomer stack transducers (DEST) by liquid deposition modeling, Florian Klug, Susana Solano Arana, Helmut F. Schlaak, Technische Univ. Darmstadt (Germany) [10163-94]

Boundary-condition analysis for physics-based modeling of ionic-polymer-metal-composite electroactive polymers, Patrick S. Bass, The Citadel-The Military College of South Carolina (USA); Lin Zhang, Univ. of California, San Diego (USA); ZhongYang Cheng, Auburn Univ. (USA) [10163-95]

Sensitive plant leaf-like actuating of homogenous polyimide blend in response to water gradient, I-Hsiang Tseng, Jheng-Jia Li, Po-Ya Chang, Feng Chia Univ. (Taiwan); Ta-I Yang, Chung Yuan Christian Univ. (Taiwan) [10163-96]

Proposal of a peristaltic micropump using dielectric elastomer actuators fabricated by MEMS technology, Sang In Eom, Kosei Miyata, Kenta Asai, Joon-wan Kim, Kazuhiro Yoshida, Tokyo Institute of Technology (Japan) [10163-98]

Study on simplification of a multi-physical model of IPMC sensor generating voltage as sensing signal, Jun Takeda, Kentaro Takagi, Nagoya Univ. (Japan); Zicai Zhu, Xi'an Jiaotong Univ. (China); Kinji Asaka, National Institute of Advanced Industrial Science and Technology (Japan) [10163-99]

Experimental verification of displacement control on integrated ionic polymer-metal composite actuators with stochastic on/off controller, Keishiro Kimura, Norihiro Kamamichi, Tokyo Denki Univ. (Japan) [10163-100]

Effect of porosity of the electrodes on ionic electroactive polymer actuators, Sunjai Nakshatharan Shanmugam, Urmas Johanson, Andres Punning, Alvo Aabloo, Univ. of Tartu (Estonia) [10163-101]

Position control of twisted and coiled polymer actuator using a controlled fan for cooling, Kentaro Takagi, Takeshi Arakawa, Jun Takeda, Nagoya Univ. (Japan); Ken Masuya, Kenji Tahara, Kyushu Univ. (Japan); Kinji Asaka, National Institute of Advanced Industrial Science and Technology (Japan) [10163-103]

Elastic actuation for legged locomotion, Chongjing Cao, Andrew T. Conn, Bristol Robotics Lab. (United Kingdom) [10163-104]

Fabrication of sulfonated carbon nanotube/metal composite electrode based ionic polymer metal composite actuator, Jie Ru, Xi'an Jiaotong Univ. (China); Yanjie Wang, Hohai Univ. (China); Hualing Chen, Xi'an Jiaotong Univ. (China) [10163-105]

Temperature-responsive carbon nanotube yarn artificial muscle, Hyunsoo Kim, Seon Jeong Kim, Hanyang Univ. (Korea, Republic of) [10163-107]

A biomimetic polymer actuator based on blend membrane of polyethylene oxide and nafion, Jie Ru, Xi'an Jiaotong Univ. (China); Yanjie Wang, Hohai Univ. (China); Hualing Chen, Xi'an Jiaotong Univ. (China) [10163-108]

Compact 5 kV high-voltage power supply for dielectric elastomer actuators, Samuel Rosset, Samuel Schlatter, Herbert R. Shea, Ecole Polytechnique Fédérale de Lausanne (Switzerland) [10163-109]

Energy harvesting by dielectric elastomer generator and self-priming circuit: verification by radio transmission, Toru Ikegame, Kentaro Takagi, Nagoya Univ. (Japan); Takamasa Ito, Sumitomo Riko Co., Ltd. (Japan); Hiroki Kojima, Nagoya Univ. (Japan); Hitoshi Yoshikawa, Sumitomo Riko Co., Ltd. (Japan) [10163-110]

Nickel-based flexible, wireless, and self-propelling micromotor, Eswaran Murugasen, Jalal Ghilane, Hyacinthe Randriamahazaka, Univ. Paris 7-Denis Diderot (France) [10163-111]

Micromixer based on dielectric stack actuators for medical applications, Susana Solano Arana, Florian Klug, Helmut F. Schlaak, Technische Univ. Darmstadt (Germany) [10163-112]

IPMC-driven ciliary motion, Michelle Quizon, Kwang Jin Kim, Univ. of Nevada, Las Vegas (USA) [10163-113]

Theoretical consideration of fishing wire artificial muscle, Robert Hunt, Qi Shen, Kwang Jin Kim, Univ. of Nevada, Las Vegas (USA); Il-Kwon Oh, KAIST (Korea, Republic of) [10163-114]

Effects of ionic liquids on the performance of IPMC, Changwoon Nah, MinJung Kim, Sangwoo Park, Joohye Won, Chonbuk National Univ. (Korea, Republic of) [10163-115]

A type of uncooled infrared detectors based on PZT/P(VDF-TrFE) nanocomposites, Guanghua Hou, Harbin Institute of Technology (China) . [10163-116]

Safe human robot interaction with a flexible tactile-proximity sensor using CMCs, Hyunyoung Shin, Hyo Seung Han, Tien Dat Nguyen, Hyouk Ryeol Choi, Sungkyunkwan Univ. (Korea, Republic of) [10163-117]

Experience-based learning on determining the frictional coefficients of thermoset polymers incorporated with silicon carbide whiskers and chopped carbon fibers at different temperatures, Edward Harrison, Mohammed Alami, Naif Alzahrani, Ramazan Asmatulu, Wichita State Univ. (USA) [10163-119]

Experience-based training of engineering students on concretes reinforced by recycled carbon fibers, Cumhur Coskun, Eylem Asmatulu, Naif Alzahrani, Hatim F. Zeineddine, Vamsidhar R. Patolla, Wichita State Univ. (USA) [10163-120]

CONFERENCE 10164

Active and Passive Smart Structures and Integrated Systems XI

Magnetically-levitated nonlinear energy harvester: non-dimensional analysis and enhancement techniques, Abdullah Nammari, Hamzeh K. Bardaweel, Louisiana Tech Univ. (USA) [10164-91]

Global stabilization control of high-energy responses of a nonlinear wideband piezoelectric vibration energy harvester using a self-excitation circuit, Norihiko Kitamura, Arata Masuda, Kyoto Institute of Technology (Japan) . [10164-92]

A tri-input energy harvesting system using thermoelectric generator, electromagnetic, and piezoelectric, Isil Anakok, Owen Jong, Lei Zuo, Virginia Polytechnic Institute and State Univ. (USA) [10164-93]

Impedance modeling of electromagnetic energy harvesting system using full-wave bridge rectifier, Junrui Liang, Cong Ge, ShanghaiTech Univ. (China); Yi-Chung Shu, National Taiwan Univ. (Taiwan) [10164-94]

Design and experimental study of a velocity amplified electromagnetics vibration energy harvester, Jackson Klein, Lei Zuo, Virginia Polytechnic Institute and State Univ. (USA) [10164-95]

Scavenging energy from human limb motions, Kangqi Fan, Bo Yu, Xidian Univ. (China); Lihua Tang, The Univ. of Auckland (New Zealand) [10164-96]

Impedance analysis of piezoelectric energy harvesting system using synchronized charge extraction interface circuit, Chen Chen, Kang Zhao, Junrui Liang, ShanghaiTech Univ. (China) [10164-97]

An energy harvesting system utilizing wind pressure fluctuations on building envelope, Jae-Chan Park, In-Ho Kim, KAIST (Korea, Republic of); Seon-Jun Jang, Hoseo Univ. (Korea, Republic of); Hyung-Jo Jung, KAIST (Korea, Republic of) [10164-98]

Bandwidth improvement by a novel piece-wise generator design with extended nonlinearities, Weiqun Liu, Congzhi Liu, Bingyu Ren, Qiao Zhu, Guangdi Hu, Southwest Jiaotong Univ. (China) [10164-99]

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 Monday 27 March.

A low-frequency vibration energy harvester based on diamagnetic levitation, Yuta Kono, Arata Masuda, Kyoto Institute of Technology (Japan); Fuh-Gwo Yuan, North Carolina State Univ. (USA) [10164-100]

Tunable thermo-triboelectric energy harvesting for human body heat applications, Dong-Gun Lee, Kwang-Yeop Jang, Korea Polytechnic Univ. (Korea, Republic of); James Lee, Seoul International School (Korea, Republic of) . . . [10164-101]

Development of flow control system for the reduction of vibration on wind turbine blades, Ho-Young Kim, Ho-Hyun Kim, Jong-Seob Han, Jae-Hung Han, KAIST (Korea, Republic of) . . . [10164-102]

Active vibration control for a smart panel with enhanced acoustic performances, Francesco Ripamonti, Manuel Molgora, Politecnico di Milano (Italy) . . . [10164-103]

A highly flexible piezoelectret-fiber pressure sensor based on highly aligned P(VDF-TrFE) electrospun fibers, Jun-Yi Ke, Hsin-Jung Chu, Yu-Hsiang Hsu, Chih-Kung Lee, National Taiwan Univ. (Taiwan) [10164-104]

Dynamics of periodic spring-mass chain coupled with an electric transmission line, Edoardo Belloni, Mattia Cenedese, Francesco Braghin, Politecnico di Milano (Italy) [10164-105]

Low frequency control strategy for seismic attenuators with inertial monolithic mechanical sensors, Fabrizio Barone, Gerardo Giordano, Fausto Acernese, Rocco Romano, Univ. degli Studi di Salerno (Italy) [10164-107]

Implementation of a passive/active pendulum vibration absorber in a building-like structure, Diego Armando Flores Sanchez, Luis Alberto Zamora Campos, Univ. Politécnica de Pachuca (Mexico); Hugo F. Abundis-Fong, Univ. de Istmo (Mexico); Gerardo Silva-Navarro, Ctr. de Investigación y de Estudios Avanzados del Instituto Politécnico Nacional (Mexico); Josué Enríquez-Zárate, RTO Energy (Mexico) [10164-108]

Semi active tunable mass damper for vibration suppression in helicopters, Simone Cinquemani, Francesco Braghin, Ferruccio Resta, Politecnico di Milano (Italy) [10164-109]

Moving toward low frequencies active vibration control with inertial actuators, Simone Cinquemani, Andrea Costa, Ferruccio Resta, Politecnico di Milano (Italy) [10164-110]

A novel tuned liquid concrete wall damper for multi-hazard mitigation, Hao Wu, Liang Cao, An Chen, Simon Laflamme, Iowa State Univ. of Science and Technology (USA) [10164-111]

Light-induced and sensing capabilities of SI-ATRP modified graphene oxide particles in elastomeric matrix, Josef Osicka, Martin Cvek, Miroslav Mrlik, Tomas Bata Univ. of Zlín (Czech Republic); Marketa Ilcikova, Polymer Institute SAS (Slovakia); Vladimir Pavlinek, Tomas Bata Univ. of Zlín (Czech Republic); Jaroslav Mosnáček, Polymer Institute SAS (Slovakia)[10164-112]

Fabrication and design of novel self-biasing SMA sheet actuator, Nima Zamani, SmarterAlloys Inc. & University of Waterloo (Canada); Mohammad Ibraheem Khan, Smarter Alloys (Canada); Mir Behrad Khamesee, Univ. of Waterloo (Canada) [10164-113]

Design and analysis of hybrid morphing smart wing, Chetan Gupta, Ramesh Gupta, The Shiv Nadar Univ. (India) . . . [10164-114]

A smart-damper in vertical secondary suspension for the comfort increase in passenger trains, Francesco Ripamonti, Andrea Chiarabaglio, Ferruccio Resta, Politecnico di Milano (Italy) . . . [10164-115]

Optimization of a two-frequency-two-mode traveling-wave piezoelectric linear motor by electrode design, Sheng-Hsun Wu, Chia-Chin Li, Tsun-Hsu Chen, Wen-Jong Wu, Chih-Kung Lee, Yu-Hsiang Hsu, National Taiwan Univ. (Taiwan) . [10164-116]

Active vibration suppression of helicopter horizontal stabilizers, Simone Cinquemani, Gabriele Cazzulani, Ferruccio Resta, Politecnico di Milano (Italy) [10164-117]

Design and experimental verification of an improved magnetostrictive energy harvester, Maxim Germer, Uwe Marschner, TU Dresden (Germany); Alison B. Flatau, University of Maryland (USA) . . [10164-118]

CONFERENCE 10165

Behavior and Mechanics of Multifunctional Materials and Composites XI

FEM simulation and experimental measurement of hardness by the Superficial Rockwell HRT scale using the steel and tungsten carbide spherical indenters, Volodymyr V. Skliarov, Jakov Dovzhenko, National Scientific Ctr. "Institute of Metrology" (Ukraine); Maxim Zalohin, Kharkiv National Automobile and Highway Univ. (Ukraine) [10165-49]

Parameter influence on tensile properties of scarf-repaired composite laminates, Ding Lin, Li Zhou, Nanjing Univ. of Aeronautics and Astronautics (China) [10165-50]

Application of the FEM for modeling and prediction of the relationship between the hardness and stress of the deformed body, Volodymyr V. Skliarov, Jakov Dovzhenko, National Scientific Ctr. "Institute of Metrology" (Ukraine); Maxim Zalohin, Kharkiv National Automobile and Highway Univ. (Ukraine) [10165-51]

Comparative study on corrosion characteristics and mechanical properties of zinc-aluminum-alloy coated and zinc-coated high strength wires in stay-cables, Yang Xu, Harbin Institute of Technology (China); Fujian Zhang, CCCC Highway Consultants Co., Ltd. (China); Shunlong Li, Harbin Institute of Technology (China) [10165-52]

Development and characterization of novel light-curable composites with calcium phosphate silicate, Xiaorong Wu, Yizhi Liu, Harbin Institute of Technology (China); Tom Troczynski, The Univ. of British Columbia (Canada); Weili Xie, Harbin Medical Univ. (China) [10165-53]

High performance microwave absorption of the arc-discharge carbon nano onions, Chao Ruan, Yanju Liu, Jinsong Leng, Zhichun Zhang, Liwu Liu, Harbin Institute of Technology (China); Yongfu Lian, Heilongjiang Univ. (China) [10165-54]

The photonic crystal laser based on the silica opal structure filled with dye doped photoresist, Chie-Tong Kuo, Ting-Hui Chen, National Sun Yat-Sen Univ. (Taiwan); Shih-Hung Lin, Chung Shan Medical Univ. (Taiwan); Bing-Yau Huang, National Sun Yat-Sen Univ. (Taiwan) [10165-55]

Deformation characteristics of CFRP bi-stable composites according to negative initial curvature, Lee Hyeok, Lee Jong-Gu, Seoul National Univ. (Korea, Republic of); Ryu Junghyun, Korea Atomic Energy Research (Korea, Republic of); Maenghyo Cho, Seoul National Univ. (Korea, Republic of) [10165-56]

Scanning thermo-ionic microscopy, Ehsan Nasr Esfahani, Jiangyu Li, Univ. of Washington (USA) [10165-57]

CONFERENCE 10166

Industrial and Commercial Applications of Smart Structures Technologies XI

Reversible creation of smart nanostructures for commercial approaches, Jae Hong Park, National Nanofab Ctr (Korea, Republic of)[10166-21]

CONFERENCE 10167

Nano-, Bio-, Info-Tech Sensors and 3D Systems

Comparative study of classification algorithms for damage classification in smart composite laminates, Asif Khan, Heung Soo Kim, Dongguk Univ. (Korea, Republic of); Chang-Kyung Ryoo, Inha Univ. (Korea, Republic of) [10167-64]

Single molecule dynamics of polyproline by using AFM, Hironori Tamamushi, Masaru Kawakami, Ajit Khosla, Hidemitsu Furukawa, Yamagata Univ. (Japan) [10167-65]

Portable fiber-optic taper coupled optical microscopy platform, Weiming Wang, Yan Yu, Hui Huang, Dalian Univ. of Technology (China) [10167-66]

Development of new eardrum-inspired acoustic transducers, Gi-Woo Kim, Inha Univ. (Korea, Republic of) [10167-67]

Miniaturized accelerometer made with ZnO nanowires, Sangho Song, Jeong-Woong Kim, Hyun-Chan Kim, Young-Min Yun, Jaehwan Kim, Inha Univ. (Korea, Republic of) [10167-68]

Morphology, thermal, and dielectric properties of Hybrid PVC/ MWCNT / barium titanate nanocomposites, Elizabeth Francis, Jayaramudu Tippabattini, Eun-Sik Choi, Inha Univ. (Korea, Republic of); Sabu Thomas, Mahatma Gandhi Univ. (India); Jaehwan Kim, Inha Univ. (Korea, Republic of) [10167-69]

Design of an ultrasonic fingerprint sensor made of 1-3 piezocomposites by the finite element method, Yongrae Roh, Haejune Park, Kyungpook National Univ. (Korea, Republic of) [10167-70]

Creation of the gel low friction surface with surface machining, Masato Wada, Naoya Yamada, Ajit Khosla, Masato Makino, Masaru Kawakami, Hidemitsu Furukawa, Yamagata Univ. (Japan) [10167-71]

Application of 3D printer to food, Mai Kodama, Azusa Saito, Ajit Khosla, Masato Makino, Masaru Kawakami, Hidemitsu Furukawa, Yamagata Univ. (Japan) [10167-72]

High-sensitive terahertz sensor based on an asymmetric split-loop resonator type metamaterials, Han-Cheol Ryu, Sahmyook Univ. (Korea, Republic of); Min Yong Jeon, Chungnam National Univ. (Korea, Republic of) [10167-73]

Effects of heath treatments and UV exposures on mechanical properties of 3D printed acrylonitrile butadiene styrene specimens, Shawn M. Hughes, Mohammed Alamir, Brian Neas, Ramazan Asmatulu, Wichita State Univ. (USA) [10167-74]

Encapsulation of natural ingredient for skin protection via nanoemulsion process, Eylem Asmatulu, Naif Alzahrani, Vinay Patil, Aybala Usta, Adeesha Vanderwall, Wichita State Univ. (USA) [10167-75]

POSTER SESSION

Monday 27 March | 6:00 to 7:30 pm

CONFERENCE 10168

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

Multiplexed fiber Bragg grating sensor interrogation based on a Fourier domain mode-locked laser, Jinwoo Park, Yong Seok Kwon, Myeongock Ko, Chungnam National Univ. (Korea, Republic of); Han-Cheol Ryu, Sahmyook Univ. (Korea, Republic of); Min Yong Jeon, Chungnam National Univ. (Korea, Republic of) [10168-103]

Direct laser writing of polymer micro-ring resonator ultrasonic sensors, Heming Wei, Sridhar Krishnaswamy, Northwestern Univ. (USA) [10168-104]

Classification of composite damage from fiber Bragg grating load monitoring signals, Aydin Rajabzadeh, Richard C. Hendriks, Richard Heusdens, Roger M. Groves, Technische Univ. Delft (Netherlands) [10168-105]

Control of equipment isolation system using wavelet-based hybrid sliding mode control, Shieh-Kung Huang, National Ctr. for Research on Earthquake Engineering (Taiwan) and National Taiwan Univ. (Taiwan); Chin-Hsiung Loh, National Taiwan Univ. (Taiwan) [10168-106]

A smart washer based transducer to monitor the bolt connection looseness, Linsheng Huo, Dongdong Chen, Gangbing Song, Hongnan Li, Dalian Univ. of Technology (China) [10168-107]

Metal rubber extensometers for the measurement of large strains and creep, Katherine M. Berg, Hang Ruan, Richard O. Claus, NanoSonic, Inc. (USA) [10168-108]

Development of a slip sensor using separable bilayer with Ecoflex-NBR film, Sung Joon Kim, Ja Choon Koo, Sungkyunkwan Univ. (Korea, Republic of) [10168-109]

Design and analysis of compound flexible skin based on deformable honeycomb, Tingting Zou, Li Zhou, Nanjing Univ. of Aeronautics and Astronautics (China) [10168-110]

Design of flexible skin based on a mixed cruciform honeycomb, Jiabin Rong, Li Zhou, Nanjing Univ. of Aeronautics and Astronautics (China) [10168-111]

Vibration characteristics of an ultrasonic transducer composed of inner and outer piezoelectric discs, Chunguang Piao, JinOh Kim, Soongsil Univ. (Korea, Republic of) [10168-112]

Design and initial validation of wireless system for oil monitoring base on optical sensing unit, Yan Yu, Liqun Niu, Weiming Wang, Hui Huang, Dalian Univ. of Technology (China) [10168-113]

Design of wireless synchronous structural monitoring system for large bridges, Zhiqiang Liu, Na Li, CCCC Highway Consultants Co., Ltd. (China); Yan Yu, Dalian Univ. of Technology (China); Xingquan Mao, CCCC Highway Consultants Co., Ltd. (China); Zhitao Yang, Dalian Univ. of Technology (China) [10168-114]

Research on high-speed railway's vibration analysis checking based on intelligent mobile terminal, Peigang Li, Dalian Univ. of Technology (China) and Shanghai Univ. of Engineering Science (China); Shulin Xie, Xuefeng Zhao, Dalian Univ. of Technology (China) [10168-115]

Research on elevator ride comfort monitoring using smartphone, Yang Zhang, Dalian Univ. of Technology (China); Xiaowei Sun, Jiangsu Province Special Equipment Safety Supervision Inspection Institute (China); Zhao Xie, Wensheng Su, Jiangsu Province Special Equipment Safety Supervision Inspection Institute, Branch of Wuxi (China); Zhigang Xue, Jiangsu Province Special Equipment Safety Supervision Inspection Institute (China); Xuefeng Zhao, Dalian Univ. of Technology (China) [10168-116]

Using unmanned aerial vehicle for deployment of smart wireless sensors with autonomous landing system, Ali Abou-Elnour, Ajman Univ. of Science & Technology (United Arab Emirates) [10168-117]

Macro-fiber composites under thermal cycles for space applications, Krystal L. Acosta, Jared D. Hobeck, Univ. of Michigan (USA); Robert B. Owen, Extreme Diagnostics, Inc. (USA); Daniel J. Inman, Univ. of Michigan (USA) [10168-118]

Active mass damper system for high-rise buildings using neural oscillator and position controller: sinusoidally varying desired displacement of auxiliary mass intended for reduction of maximum control force, Daisuke Iba, Kyoto Institute of Technology (Japan); Junichi Hongu, Tottori Univ. (Japan); Takayuki Sasaki, Souhei Shima, Morimasa Nakamura, Ichiro Moriwaki, Kyoto Institute of Technology (Japan) [10168-119]

Development of sensing systems printed with conductive ink on gear surfaces: manufacturing of meander line antenna by laser-sintered silver nano-particles, Daisuke Iba, Shintaro Futagawa, Takahiro Kamimoto, Morimasa Nakamura, Nanako Miura, Takashi Iizuka, Arata Masuda, Akira Sone, Ichiro Moriwaki, Kyoto Institute of Technology (Japan) [10168-120]

Optimal control of build height utilizing optical profilometry in cold spray deposits, Michael Birnkrant, Sergey Shishkin, Abhijit Chakraborty, United Technologies Research Ctr. (USA) [10168-121]

An enhanced rhombus-type compliant mechanism with large displacement and high natural frequency, Qian Liu, Mingxiang Ling, Junyi Cao, Xi'an Jiaotong Univ. (China) [10168-122]

Reliability based optimization of an active vibration controller using evolutionary algorithms, Sajad Saraygord Afshari, Sharif Univ. of Technology (Iran, Islamic Republic of) and The Univ. of British Columbia (Canada); Seid H. Pourtakdoust, Sharif Univ. of Technology (Iran, Islamic Republic of); Rudolf Seethaler, The Univ. of British Columbia (Canada) [10168-123]

Metal rubber sensor technology to enable in-flight icing measurement, Katherine M. Berg, Jennifer H. Lalli, Richard O. Claus, NanoSonic, Inc. (USA) [10168-124]

Low frequency motion measurement of spacecrafts and satellites with inertial monolithic sensors, Fabrizio Barone, Gerardo Giordano, Fausto Acernese, Rocco Romano, Univ. degli Studi di Salerno (Italy) [10168-125]

X-ray system to visualize multiphase high viscosity fluid flow extruded from a container, Tommaso d'Agostino, Univ. of Bath (United Kingdom) [10168-126]

A study of irradiation side sampling flat panel detector with crystal silicon based x-ray CMOS image sensor, MyungSoo Kim, Giyoon Kim, Yewon Kim, Jeong Tae Lee, Gyuseong Cho, KAIST (Korea, Republic of) [10168-127]

A magnetostrictive phased array sensor using a nickel comb patch for Lamb wave-based damage detection, Byungseok Yoo, Darryll J. Pines, Univ. of Maryland, College Park (USA) [10168-128]

Prediction error variance in Bayesian model updating: a comparative study, Parisa Asadollahi, Jian Li, The Univ. of Kansas (USA); Yong Huang, California Institute of Technology (USA) and Harbin Institute of Technology (China) [10168-129]

Vibration measurement on composite material with embedded optical fiber based on phase-OTDR, Carolina Franciscangelis, Univ. Estadual de Campinas (Brazil); Walter Margulis, Acreo Swedish ICT AB (Sweden); Claudio Floridia, Joao Batista Rosolem, Felipe C. Salgado, CPQd (Brazil); Tonny Nyman, Mikael Petersson, Saab AB (Sweden); Stefan Hällstrom, KTH Royal Institute of Technology (Sweden); Ingemar Söderquist, Saab AB (Sweden); Fabiano Fruett, Univ. Estadual de Campinas (Brazil) [10168-130]

Evaluation of a new source localization method in a dispersive medium based on energy decay, Sa'ed Alajjouni, Virginia Polytechnic Institute and State Univ. (USA); Mico Woolard, virginia tech (USA); Pablo A. Tarazaga, Virginia Polytechnic Institute and State Univ. (USA) [10168-131]

Inversion-based imaging using lagrange polynomial parameterization and genetic algorithm optimization, Yew Li Hor, A*STAR Institute of High Performance Computing (Singapore) [10168-132]

Wireless sensing nodes for substructure and subsurface conditions monitoring, Xiaochao Tang, Widener University (USA); Zach Hill, Widener Univ. (USA) [10168-133]

The use of distributed optical fiber sensing technique for pavement subgrade performance monitoring, Wanqiu Liu, Dalian Univ. of Technology (China); Shujuan Wang, Jilin Provincial Transport Scientific Research Institute (China) [10168-134]

Optical-fiber point liquid-level sensor based on light scattering, Ying Gong, Junfeng Ge, Jun Shu, Bin Hua, Huazhong Univ. of Science and Technology (China) [10168-136]

Evaluation of trajectory shaping guidance law for the spacecraft, Zhongtao Cheng, Yongji Wang, Lei Liu, Huazhong Univ. of Science and Technology (China) [10168-137]

Disbond detection using guided wave Pzt excitation in honeycomb composite sandwich structure, Chandrakant Pol, Walchand College of Engineering Sangli (India) [10168-141]

CONFERENCE 10169

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

Damage identification in highway bridges using distribution factors, Michael V. Gangone, The Univ. of Texas at Tyler (USA) [10169-44]

Feasible of optical infrared thermography test for heat shrinkable tapes inspection used in oil and gas pipeline, Yue Yu, China Special Equipment Inspection and Research Institute (China) [10169-91]

The mathematical model that describes the periodic spouting of a geyser induced by boiling, Hiroyuki Kagami, Fujita Health Univ. (Japan) [10169-92]

An extended Preisach model for effects of magnetization history on magnetomechanical behavior of steel cables, Lin Liu, Chunyuan Li, Rui Li, Yongfu Li, Chongqing Univ. of Posts and Telecommunications (China) [10169-93]

Application of interface waves for near surface damage detection in hybrid structures, Mohammadreza Jahanbin, Villanova Univ. (USA) and The Boeing Co. (USA); Sridhar Santhanam, Villanova Univ. (USA); Richard H. Bossi, Mark Jahanbin, The Boeing Co. (USA) [10169-96]

Guided wave propagation and quantitative evaluation of seawater ingress in GFRP naval composites, Mohit Garg, Shruti Sharma, Sandeep K. Sharma, Rajeev Mehta, Thapar Univ. (India) [10169-97]

Research on multi-parameter monitoring of steel frame shaking-table test using smartphone, Ruicong Han, Dalian Univ. of Technology (China); Kenneth J. Loh, Univ. of California, San Diego (USA); Xuefeng Zhao, Yan Yu, Dalian Univ. of Technology (China) [10169-98]

Side-drilled hole detection of CFRP without pre-knowledge of anisotropic group velocity, Yongsheng Shao, Jing Lin, Liang Zeng, Xuwei Cao, Xi'an Jiaotong Univ. (China) [10169-99]

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 Monday 27 March.

Fault diagnosis of rotating machinery using wavelet-based feature extraction and support vector machine classifier, Han Tran, California Polytechnic State Univ., San Luis Obispo (USA) . . . [10169-100]

Detection of damage in advanced materials using laser Doppler vibrometry, Theodoti Kordatou, Ilias K. Tragazikis, Theodore E. Matikas, Univ. of Ioannina (Greece) . . . [10169-101]

The effect of erosion on the fatigue limit of advanced composite materials, Evangelos Z. Kordatos, Sheffield Hallam Univ. (United Kingdom); Dimitrios A. Exarchos, Theodore E. Matikas, Univ. of Ioannina (Greece) . . . [10169-102]

Variable thick plate focus scan imaging detection with a 2D array guided wave transducer, Shiyuan Zhou, Zhe Li, Chunguang Xu, Shaohan Wang, Xuan Wu, Beijing Institute of Technology (China) . . . [10169-103]

A close inspection and vibration sensing aerial robot for steel structures with an EPM-based landing device, Kazuya Takeuchi, Arata Masuda, Shunsuke Akahori, Yoshiyuki Higashi, Nanako Miura, Kyoto Institute of Technology (Japan) . . . [10169-104]

Nondestructive spectroscopic characterization of building materials, Aschalew Kassu, Carlton W. Farley III, Jonathan Mills, Lauren Walker, Rachel Sanders, Anup Sharma, Alabama A&M Univ. (USA) . . . [10169-105]

Structural model updating of small damages using response surface method, Linren Zhou, Huang Song, Bo Wu, South China Univ. of Technology (China) . . . [10169-106]

On impedance measurement of reinforced concrete on the surface for estimate of corroded rebar, Akira Sasamoto, Jun Yu, Yoshihisa Harada, National Institute of Advanced Industrial Science and Technology (Japan); Masahiro Iwata, Kazuhiro Noguchi, EMIC (Japan) . . . [10169-107]

Phase sensitive thermography for quality assessment of giant magnetostrictive composite materials, Peng Yang, Rani F. Elhajjar, Chiu-Tai Law, Univ. of Wisconsin-Milwaukee (USA) . . . [10169-108]

Monitoring applied stress and creep effects in concrete using ultrasonic full-waveform comparison techniques, Ali Hafiz, Thomas Schumacher, Portland State Univ. (USA) . . . [10169-109]

Performance evaluation of guidance and control system on hypersonic vehicle, Megnan Li, Yongji Wang, Lei Liu, Huazhong Univ. of Science and Technology (China) . . . [10169-110]

CONFERENCE 10170

Health Monitoring of Structural and Biological Systems XI

Fatigue crack monitoring of aerospace structure based on binary tree support vector machines, Shenbo Lu, Zhou Li, Nanjing Univ. of Aeronautics and Astronautics (China) . . . [10170-110]

Non-destructive monitoring of a prestressed bridge with data-driven methods, Maria Pina Limongelli, Mattia Tirone, Politecnico di Milano (Italy); Cecilia Surace, Politecnico di Torino (Italy) . . . [10170-111]

Concrete surface strain develop progress monitoring of nuclear power plant containment vessel during the containment test using fiber optic sensors, Kaixing Liao, Suzhou Nuclear Power Research Institute, China General Nuclear Power Corp. (China); Jinke Li, Dalian Univ. of Technology (China); Xianglong Kong, Suzhou Nuclear Power Research Institute, China General Nuclear Power Corp. (China); Changsen Sun, Xuefeng Zhao, Dalian Univ. of Technology (China) . . . [10170-112]

In-situ control of topological dynamics in one-dimensional dimer systems, Aman R. Thakkar, Rajesh Chaunsali, Jinkyu Yang, Univ. of Washington (USA) [10170-113]

Sound transmission loss of metamaterial thin plates with periodic subwavelength arrays of piezoelectric patches shunted with amplifier-resonator feedback circuits, Xiaodong Zhang, Gang Wang, Hunan Univ. (China) . . . [10170-114]

A novel nonlinear damage resonance intermodulation effect for structural health monitoring, Francesco Ciampa, Michele Meo, Univ. of Bath (United Kingdom); Gennaro Scarselli, Univ. del Salento (Italy) . . . [10170-115]

Numerical simulation on the temperature behavior of the main cable for suspension bridge, Linren Zhou, Lan Chen, Zhiguang Huang, Chunfang Liang, South China Univ. of Technology (China) . . . [10170-116]

Damage estimation of sewer pipe using subtitles of CCTV inspection video, Ki-Tae Park, Byeong Cheol Kim, Tae Heon Kim, Dong Woo Seo, Korea Institute of Civil Engineering and Building Technology (Korea, Republic of) . . . [10170-117]

Structural health monitoring of fiber reinforced composites by means of CNTs, Flavia Libonati, Claudio Sbarufatti, Matteo Corbetta, Diego Scaccabarozzi, Simone Cinquemani, Politecnico di Milano (Italy); Alberto J. Suarez, Alejandro Urena, Univ. Rey Juan Carlos (Spain) . . . [10170-118]

A comparative study on book shelf steel structure based on frequency domain, time domain, and time-frequency plane modal analysis, Ardalan Sabamehr, Ashutosh Bagchi, Concordia Univ. (Canada) . . . [10170-119]

Integration of fiber Bragg grating optic sensors for strain detection in prosthesis composed of CFRP composite, Jason Harris, California State Univ., Long Beach (USA) . . . [10170-120]

Digitization of passive and active resonant shunting circuits and its application in smart piezoelectric metamaterial beams, Gang Wang, Xiaodong Zhang, Hunan Univ. (China) . . . [10170-121]

Performance assessment of engineering structures based on long-gauge FBG sensors: a review, Wan Hong, Nanjing Tech Univ. (China); Shizhi Chen, Southeast Univ. (China) . . . [10170-122]

Modeling the strain monitoring data based on Copulas and its application in missing data recovery, Zhicheng Chen, Harbin Institute of Technology (China); Fujian Zhang, CCCC Highway Consultants Co., Ltd. (China); Hui Li, Yuequan Bao, Shunlong Li, Harbin Institute of Technology (China) . . . [10170-123]

Automated vehicle counting using image processing and machine learning, Sean Meany, Rosana E. Martinez-Castro, Edward Eskew, Shinae Jang, Univ. of Connecticut (USA) . . . [10170-124]

Using LabView for real-time simulation of monitoring and tracking process a plurality of biological objects, Aleksandr Nikolskyy, Vinnytsia National Technical Univ. (Ukraine); Vladimir G. Krasilenko, Vinnytsia Social Economy Institute (Ukraine); Yosyp Y. Bylinsky, Vinnytsia National Technical Univ. (Ukraine) . . . [10170-125]

Ultrasonic wave mixing for nonlinear ultrasonics in viscoelastic finite volume fluids, Andriejus Demcenko, Rab Wilson, Julien Reboud, Jonathan M. Cooper, Univ. of Glasgow (United Kingdom) . . . [10170-126]

Advances in acoustic source localization in an anisotropic plate without knowing its material properties, Won Hyun Park, College of Optical Sciences, The Univ. of Arizona (USA); Pawel Packo, AGH Univ. of Science and Technology (Poland); Tribikram Kundu, The Univ. of Arizona (USA) . . . [10170-127]

CONFERENCE 10171

Smart Materials and Nondestructive Evaluation for Energy Systems III

Nanocomposite functional paint sensor for infrared detecting and energy harvesting, Ashok K. Batra, Bir B. Bohara, Al-Muatasim Alomari, Chance M. Glenn Sr., Alabama A&M Univ. (USA); James Raymond Currie, NASA Marshall Space Flight Ctr. (USA) . . . [10171-9]

Building environment assessment and energy consumption estimation using smart phones, Xiangli Li, Li Zhang, Yingqi Jia, Zihan Wang, Xin Jin, Xuefeng Zhao, Dalian Univ. of Technology (China) . . . [10171-26]

Local elasticity mapping of aluminum matrix composites using scanning acoustic microscopy, Theodoti Kordatou, Ilias K. Tragazikis, Theodoros E. Matikas, Univ. of Ioannina (Greece) . . . [10171-27]

Cement-based materials with graphene nanophase, Panagiota Aikaterini T. Dalla, Ilias K. Tragazikis, Dimitrios A. Exarchos, Konstantinos G. Dassiou, Theodoros E. Matikas, Univ. of Ioannina (Greece) . . . [10171-28]

Energy harvesting from polyvinylidene fluoride (PVDF) modified by nanoparticles, Ping Zhao, Alec Kadlec, Shifa Wang, Emmanuel U. Enemuoh, Univ. of Minnesota, Duluth (USA) . . . [10171-29]

CONFERENCE 10172

A Tribute Conference Honoring Daniel Inman

A study on the accordion structure type thermoelectric power generation module using the metal direct bonding technology, Hiroshi Sato, So Baba, National Institute of Advanced Industrial Science and Technology (Japan); Tetsuro Yanaseko, Kogakuin Univ. (Japan); Hiroshi Asanuma, Chiba Univ. (Japan) . . . [10172-21]

Bimolecular material systems, Donald J. Leo, The Univ. of Georgia (USA) [10172-22]

CONFERENCE 10163

Electroactive Polymer Actuators and Devices (EAPAD) XIX

CONFERENCE 10164

Active and Passive Smart Structures and Integrated Systems XI

CONFERENCE 10165

Behavior and Mechanics of Multifunctional Materials and Composites XI

CONFERENCE 10167

Nano-, Bio-, Info-Tech Sensors and 3D Systems

Tuesday Plenary Session • 8:10 am to 10:00 am

8:10 to 8:30 am:

SPIE Best Student Paper Awards

EAP-in-Action Demonstration Award

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



Plenary Presentation: 8:30 to 9:15 am

NDE for the 21st century: industry 4.0 requires NDE 4.0 (Plenary), Norbert G. Meyendorf, Iowa State Univ. (USA). .[10171-500]



Plenary Presentation: 9:15 to 10:00 am

A smart structural dynamics strategy for testing tomorrow's structures (Plenary), David J. Ewins, Imperial College London (United Kingdom). [10172-500]

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

Sessions 6A and 6B run concurrently.

SESSION 6A

**LOCATION: SALON E
TUE 10:30 AM TO 12:10 PM**

EAP Actuators

Session Chairs: **Gabor M. Kovacs**, EMPA (Switzerland); **Christoph Keplinger**, Univ. of Colorado Boulder (USA)

10:30 am: **DEMES rotary joint: theories and applications**, Shu Wang, Zhaogang Hao, Mingyu Li, Bo Huang, Harbin Institute of Technology (China); Li Ning Sun, Soochow Univ. (China); Jianwen Zhao, Harbin Institute of Technology (China). . . . [10163-22]

10:50 am: **Dielectric elastomer actuator for the measurement of cell traction forces with sub-cellular resolution**, Samuel Rosset, Alexandre Poulin, Ecole Polytechnique Fédérale de Lausanne (Switzerland); Alicia Zollinger, Michael Smith, Boston Univ. (USA); Herbert R. Shea, Ecole Polytechnique Fédérale de Lausanne (Switzerland) [10163-23]

SESSION 6B

**LOCATION: SALON D
TUE 10:30 AM TO 12:10 PM**

EAP Based on Dielectric Elastomers I

Session Chairs: **Richard J. Spontak**, North Carolina State Univ. (USA); **Barbar J. Akle**, Lebanese American Univ. (Lebanon)

10:30 am: **Chemically pre-strained dielectric elastomer finite element analysis**, Brittany A. Newell, Gary W. Krutz, Purdue Univ. (USA). [10163-27]

10:50 am: **Thermodynamics and instability of dielectric elastomer**, Liwu Liu, Yanju Liu, Jinsong Leng, Harbin Institute of Technology (China). . . . [10163-28]

SESSION 7

**LOCATION: SALON G + H
TUE 10:30 AM TO 12:10 PM**

Passive and Active Vibration Isolation Systems II: Metamaterials

Session Chairs: **Alper Erturk**, Georgia Institute of Technology (USA); **Longqiu Li**, Harbin Institute of Technology (China)

10:30 am: **Longitudinal metastructure bar with an active vibration absorber**, Katherine Reichl, Daniel J. Inman, Univ. of Michigan (USA). [10164-34]

10:50 am: **Piezoelectric metamaterials with synthetic impedance shunts**, Christopher Sugino, Georgia Institute of Technology (USA); Stephen M. Leadenham, Lawrence Livermore National Lab. (USA); Massimo Ruzzene, Alper Erturk, Georgia Institute of Technology (USA). [10164-35]

11:10 am: **Tunable acoustic metamaterial based on PZT**, Xiaohui Zhu, Jing Qiao, Guangyu Zhang, Qiang Zhou, Yingdan Wu, Longqiu Li, Harbin Institute of Technology (China) [10164-36]

SESSION 7

**LOCATION: SALON I
TUE 10:30 AM TO 11:50 AM**

Self Healing and 3D Printing

Session Chair: **Marcelo Dapino**, The Ohio State Univ. (USA)

10:30 am: **Rheological properties of eutectic gallium-indium alloy liquid metal as a smart self-healing material**, Carleen Bowers, Jennifer Lalli, Richard O. Claus, NanoSonic, Inc. (USA) [10165-35]

10:50 am: **NDE of smart rheologically recoverable self-healing and radiation shielding materials**, Jennifer Lalli, NanoSonic, Inc. (USA); Gerard Valle, NASA Johnson Space Ctr. (USA); Carleen Bowers, Vince Baranaukas, Keith Hill, Richard O. Claus, NanoSonic, Inc. (USA); Thomas Borak, Colorado State Univ. (USA) [10165-36]

11:10 am: **3D printed thermoplastic polyurethane with isotropic material properties**, Cameron J. Hohimer, Josef F. Christ, Nahal Aliheidari, Changki Mo, Amir Ameli, Washington State Univ. Tri-Cities (USA). [10165-37]

SESSION 11

**LOCATION: SALON A
TUE 10:30 AM TO 11:10 AM**

Nanosensors and Systems III

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

10:30 am: **Micro-nano sensors, systems, and devices for precision medicine (Keynote Presentation)**, Ajit Khosla, Yamagata Univ. (Japan). [10167-39]

CONFERENCE 10168

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

CONFERENCE 10169

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

CONFERENCE 10170

Health Monitoring of Structural and Biological Systems XI

CONFERENCE 10171

Smart Materials and Nondestructive Evaluation for Energy Systems III

Tuesday Plenary Session • 8:10 am to 10:00 am

8:10 to 8:30 am:

SPIE Best Student Paper Awards

EAP-in-Action Demonstration Award

Bioinspiration, Biomimetics, and Bioreplication

Best Student Paper Award: In Memory of H. Don Wolpert



Plenary Presentation: 8:30 to 9:15 am

NDE for the 21st century: industry 4.0 requires NDE 4.0 (Plenary), Norbert G. Meyendorf, Iowa State Univ. (USA). [10171-500]



Plenary Presentation: 9:15 to 10:00 am

A smart structural dynamics strategy for testing tomorrow's structures (Plenary), David J. Ewins, Imperial College London (United Kingdom). [10172-500]

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

Sessions 7A and 7B run concurrently.

SESSION 7A

**LOCATION: COLUMBIA
TUE 10:30 AM TO 12:10 PM**

Structural Health Monitoring for Structural and Geotechnical Systems

Session Chairs: **Chin-Hsiung Loh**, National Taiwan Univ. (Taiwan); **David Mascareñas**, Los Alamos National Lab. (USA)

10:30 am: **A probabilistic model for visual inspection of concrete shear walls**, Arvin Ebrahimkhanlou, Salvatore Salamone, The Univ. of Texas at Austin (USA) . . [10168-31]

10:50 am: **Performance assessment of geotechnical stabilization elements using distributed fiber optic sensing**, Christoph Monsberger, Helmut Woschitz, Werner Lienhart, Technische Univ. Graz (Austria); Václav Račanský, Martin Hayden, Keller Grundbau GmbH (Austria)[10168-32]

SESSION 7B

**LOCATION: SALON F
TUE 10:30 AM TO 12:10 PM**

Multifunctional Materials for Structural Health Monitoring

Session Chairs: **Simon Laflamme**, Iowa State Univ. College of Engineering (USA); **Maurizio Porfiri**, NYU Tandon School of Engineering (USA)

10:30 am: **Damage detection and localization algorithm using a dense sensor network of thin film sensors**, Austin R. J. Downey, Iowa State Univ. College of Engineering (USA); Filippo Ubertini, Univ. degli Studi di Perugia (Italy); Simon Laflamme, Iowa State Univ. College of Engineering (USA) [10168-36]

10:50 am: **Metamaterial based passive wireless temperature sensor**, Yirong Lin, Hasanul Karim, Luis Chavez, Norman Love, The Univ. of Texas at El Paso (USA) [10168-37]

SESSION 9

**LOCATION: EUGENE
TUE 10:30 AM TO 12:10 PM**

Civil Infrastructures NDE/SHM I

Session Chairs: **Genda Chen**, Missouri Univ. of Science and Technology (USA); **Yu-Min Su**, National Kaohsiung Univ. of Applied Sciences (Taiwan)

10:30 am: **Cable fracture detection with acoustic emission**, Hongya Qu, Tiantian Li, Genda Chen, Missouri Univ. of Science and Technology (USA) [10169-35]

10:50 am: **Finite element model updating of multi-span steel-arch-steel-girder bridges based on ambient vibrations**, Tsung-Chin Hou, Wei-Tuan Gao, Chia-Sheng Chang, Guan-Rong Chu, National Cheng Kung Univ. (Taiwan); Yu-Min Su, National Kaohsiung Univ. of Applied Sciences (Taiwan). [10169-36]

SESSION 7

**LOCATION: SALON B + C
TUE 10:30 AM TO 12:30 PM**

Real-time Sensing and Testing at Extreme Environments

Session Chairs: **Tadeusz Uhl**, AGH Univ. of Science and Technology (Poland); **Andrei N. Zagrai**, New Mexico Institute of Mining and Technology (USA)

10:30 am: **Development and testing of a multi-transducers system for the measurement of the height of condensed water in steam pipes with steady-state and turbulence flow conditions**, Shyh-Shiuh Lih, Hyeong Jae Lee, Yoseph Bar-Cohen, Mircea Badescu, William Cervantes, Jet Propulsion Lab. (USA) [10170-35]

10:50 am: **NIR intensity sensor for water pressure monitoring**, Wei-Chih Wang, Univ. of Washington (USA) and National Tsing Hua Univ. (Taiwan) [10170-36]

SESSION 4

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

NDE of Energy Components and Systems

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

10:30 am: **Condition monitoring of rotor blades and foundations of wind turbines**, Bernd Frankenstein, Fraunhofer IKTS-MD (Germany); Norbert G. Meyendorf, Iowa State Univ. (USA); Bianca Weihnacht, Tobias Gaul, Lars Schubert, Eberhard Schulze, Fraunhofer IKTS-MD (Germany) [10171-32]

CONFERENCE 10163

Sessions 6A and 6B run concurrently.

**SESSION 6A
CONTINUED**

11:10 am: **Dielectric elastomer actuator with variable bending stiffness property based on interlaminar electrostatic chucking**, Hiroya Imamura, Univ. of Washington (USA) and Nabtesco Corp. (Japan); Kevin Kadooka, Minoru Taya, Univ. of Washington (USA) [10163-24]

11:30 am: **Snap actuation of dielectric elastomer and hydrogel in soft smart structure and robot**, Tiefeng Li, Xiangping Chen, Mingqi Zhang, Banguan Liu, Zhejiang Univ. (China) . . [10163-25]

11:50 am: **High speed torsional actuators**, Seyed Mohammad Mirvakili, Massachusetts Institute of Technology (USA); John D. W. Madden, The Univ. of British Columbia (Canada); Ian W. Hunter, Massachusetts Institute of Technology (USA) [10163-26]

Lunch Break
Tue 12:10 pm to 1:40 pm

**SESSION 6B
CONTINUED**

11:10 am: **Inherently pre-strained and self-healing elastomers: new generation of freestanding electroactuators**, Mohammad Vatankhah-Varnosfaderani, Sergei S. Sheyko, The Univ. of North Carolina at Chapel Hill (USA); Krzysztof Matyjaszewski, Carnegie Mellon Univ. (USA); William F. M. Daniel Jr., Qiaoxi Li, Benjamin J. Morgan, The Univ. of North Carolina at Chapel Hill (USA); Richard J. Spontak, North Carolina State Univ. (USA) [10163-29]

11:30 am: **Super stretchable soft actuator by using twisted and coiled polyurethane fiber**, Kyeong Ho Cho, Min Geun Song, Yeong Eun Kim, Sang Yul Yang, Hosang Jung, Jae-Do Nam, Hyouk Ryeol Choi, Sungkyunkwan Univ. (Korea, Republic of) [10163-30]

11:50 am: **Development of a fatigue testing setup for dielectric elastomer membrane actuators**, Marc Hill, ZeMA GmbH (Germany); Gianluca Rizzello, Stefan S. Seelecke, Univ. des Saarlandes (Germany) [10163-31]

Lunch Break
Tue 12:10 pm to 2:00 pm

CONFERENCE 10164

**SESSION 7
CONTINUED**

11:30 am: **A metastable modular structural system for adaptive nonreciprocal wave propagation**, Zhen Wu, Kon-Well Wang, Univ. of Michigan (USA) [10164-37]

11:50 am: **Toward structurally integrated locally resonant metamaterials for vibration attenuation**, Jascha Schmied, ETH Zürich (Switzerland); Christopher Sugino, Georgia Institute of Technology (USA); Andrea Bergamini, EMPA (Switzerland); Paolo Ermanni, ETH Zürich (Switzerland); Massimo Ruzzene, Alper Erturk, Georgia Institute of Technology (USA) [10164-38]

Lunch Break Tue 12:10 pm to 1:40 pm

CONFERENCE 10165

**SESSION 7
CONTINUED**

11:30 am: **The impact of nozzle and bed temperatures on the fracture resistance of FDM printed materials**, Nahal Aliheidari, Washington State Univ. Tri-Cities (USA); Rajasekhar Tripuraneni, New Jersey Institute of Technology (USA); Cameron J. Hohimer, Josef F. Christ, Amir Ameli, Washington State Univ. Tri-Cities (USA); Siva Nadimpalli, New Jersey Institute of Technology (USA) . . . [10165-38]

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

CONFERENCE 10167

SESSION 12

**LOCATION: SALON A
TUE 11:10 AM TO 12:10 PM**

3D Printing and Applications II

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

11:10 am: **Review 3D printing technologies for micro-nano systems**, Ajit Khosla, Yamagata Univ. (Japan) [10167-40]

11:30 am: **Liquid-in-gel 3D printed droplet-based materials**, Elio Challita, Joseph S. Najem, Eric C. Freeman, Donald J. Leo, The Univ. of Georgia (USA) [10167-41]

11:50 am: **Inkjet-printed micro air flow sensor**, Wei-Chih Wang, Univ. of Washington (USA) and National Tsing Hua Univ. (Taiwan); Benjamin Estroff, Univ. of Washington (USA); Yu-Hsin Chiang, National Tsing Hua Univ. (Taiwan) [10167-42]

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

CONFERENCE 10168

Sessions 7A and 7B run concurrently.

**SESSION 7A
CONTINUED**

11:10 am: **Response reduction methods for base isolated buildings with collision to retaining walls**, Akiko Kishida, Yuki Yamashita, Nao Nishimura, Yoichi Mukai, Hideo Fujitani, Kenzo Taga, Kobe Univ. (Japan). [10168-33]

11:30 am: **Damage detection of structures by wavelet analysis: application to seismic response of RC/ Steel frames**, Wen Hsueh, Chin-Hsiung Loh, National Taiwan Univ. (Taiwan). [10168-34]

11:50 am: **Scaled model experiments for automated sinkhole detection using ground penetrating radar**, Yun-Kyu An, Man Sung Kang, Dong Jun Lee, Sejong Univ. (Korea, Republic of). [10168-35]

Lunch Break Tue 12:10 pm to 1:40 pm

**SESSION 7B
CONTINUED**

11:10 am: **Experimental study on damage detection in a wind turbine blade using a thin film sensor array**, Austin R. J. Downey, Iowa State Univ. College of Engineering (USA); Simon Laflamme, Iowa State Univ. of Science and Technology (USA); Filippo Ubertini, Univ. degli Studi di Perugia (Italy); Partha Sarkar, Iowa State Univ. of Science and Technology (USA). [10168-38]

11:30 am: **Simultaneous sensing of fluid velocity and temperature using particle tracers embedding nitrobenzofurazan functionalized thermosensitive hydrogels**, Filippo Cellini, NYU Tandon School of Engineering (USA); Sean D. Peterson, Univ. of Waterloo (Canada); Maurizio Porfiri, NYU Tandon School of Engineering (USA). [10168-39]

11:50 am: **Dynamic piezoresistive response of hybrid nanocomposites**, Audrey Gbaguidi, Sirish Namilae, Daewon Kim, Embry-Riddle Aeronautical Univ. (USA). [10168-40]

Lunch Break Tue 12:10 pm to 1:40 pm

CONFERENCE 10169

**SESSION 9
CONTINUED**

11:10 am: **Development of linear shear piezoelectric phased array for structural health monitoring**, Wentao Wang, Hui Zhang, Jerome P. Lynch, Carlos E. S. Cesnik, Univ. of Michigan (USA); Hui Li, Harbin Institute of Technology (China). [10169-37]

11:30 am: **Development of an integrated lifetime assessment model for bridge condition evaluation**, Yun Bai, Saeed K. Babanajad, David Masceri, Hooman Parvardeh, Rutgers, The State Univ. of New Jersey (USA); Robert Zobel, Federal Highway Administration Turner Fairbank Highway Research Ctr. (USA); Franklin Moon, Ali Maher, Rutgers, The State Univ. of New Jersey (USA). [10169-38]

11:50 am: **An innovative approach in deterioration modelling of bridge using AASHTO element-level condition rating**, Saeed K. Babanajad, Yun Bai, Jiayi Luo, David Masceri, Hooman Parvardeh, Rutgers, The State Univ. of New Jersey (USA); Robert Zobel, Federal Highway Administration Turner Fairbank Highway Research Ctr. (USA); Franklin Moon, Ali Maher, Rutgers, The State Univ. of New Jersey (USA). [10169-39]

Lunch Break Tue 12:10 pm to 1:40 pm

CONFERENCE 10170

**SESSION 7
CONTINUED**

11:10 am: **Diffuse field reconstruction for near surface imaging**, Anthony J. Croxford, Jack Potter, Univ. of Bristol (United Kingdom) [10170-37]

11:30 am: **Development of BS-PT based high temperature ultrasonic transducer**, Prathamesh Bilgunde, Leonard J. Bond, Ctr. for Nondestructive Evaluation, Iowa State Univ. of Science and Technology (USA). [10170-38]

11:50 am: **Adaptation of electromechanical impedance SHM for space-based platforms**, David C. Hunter, Andrei N. Zagrai, New Mexico Institute of Mining and Technology (USA); Seth S. Kessler, Metis Design Corp. (USA). [10170-39]

12:10 pm: **Adaptive on-line signal denoising using stochastic resonance for acoustic emission-based structural health monitoring**, Jinki Kim, Univ. of Michigan (USA); Ryan L. Harne, The Ohio State Univ. (USA); Kon-Well Wang, Univ. of Michigan (USA). [10170-17]

Lunch Break Tue 12:30 pm to 1:40 pm

CONFERENCE 10171

**SESSION 4
CONTINUED**

11:10 am: **Time-frequency analysis of guided ultrasonic waves used for assessing integrity of rock bolts**, Tadeusz Stepinski, AGH Univ. of Science and Technology (Poland). [10171-17]

11:30 am: **Effective source location of damages in cylindrical high pressure composite vessels through advanced zonal location method**, Dong-Jin Yoon, Byeong-Hee Han, Choon-Su Park, Il-Bum Kwon, Korea Research Institute of Standards and Science (Korea, Republic of) [10171-18]

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

CONFERENCE 10163

Sessions 7A and 7B run concurrently.

SESSION 7A

LOCATION: SALON E
TUE 1:40 PM TO 3:00 PM

3D Printing as a Fabrication Method

Session Chairs: **William S. Oates**, Florida State Univ. (USA); **Hyeong Jae Lee**, Jet Propulsion Lab. (USA)

1:40 pm: **Permanent magnets as biasing mechanism for improving the performance of circular dielectric elastomer out-of-plane actuators**, Philipp Loew, Gianluca Rizzello, Stefan S. Seelecke, Univ. des Saarlandes (Germany) [10163-97]

2:00 pm: **3D printing PLA and silicone elastomer structures with sugar solution support material**, Armita Hamidi, Shrenik Jain, Yonas Tadesse, The Univ. of Texas at Dallas (USA) [10163-33]

2:20 pm: **Ras Labs-CASIS-ISS NL experiment for synthetic muscle returned to Earth: resistance to ionizing radiation**, Lenore Rasmussen, Leila N. Albers, Simone Rodriguez, 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); Leon Moy, Patrick Mark, Daniel Prillaman, Robert Nordarse, Michael J. Menegus, U.S. Army Armament Research, Development and Engineering Ctr. (USA); Jo Ann Ratto, Christopher Thellen, Danielle Froio, U.S. Army Natick Research, Development and Engineering Ctr. (USA); Cosme Furlong, Payam Razavi, Worcester Polytechnic Institute (USA); Logan Valenza, Florida Institute of Technology (USA); Catherine Poirier, Trinity College (Ireland); Charles Sinkler, Worcester Polytechnic Institute (USA); Dylan Corl, Raritan Valley Community College (USA); Surbhi Hablani, Skidmore College (USA); Tyler Fuerst, Sergio Gallucci, Whitney Blocher, Clarkson Univ. (USA); Stephanie Liffland, The Univ. of North Carolina at Chapel Hill (USA) . . [10163-118]

2:40 pm: **Drop-on-demand printing of dielectric elastomer actuator electrodes**, Samuel Schlatter, Samuel Rosset, Herbert R. Shea, Ecole Polytechnique Fédérale de Lausanne (Switzerland) [10163-35]

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

SESSION 7B

LOCATION: SALON D
TUE 1:40 PM TO 3:00 PM

Ionic EAP Materials

Session Chairs: **Iain A. Anderson**, The Univ. of Auckland (New Zealand); **Samuel Rosset**, Ecole Polytechnique Fédérale de Lausanne (Switzerland)

1:40 pm: **Design of high-frequency ultrathin trilayer conducting polymer micro-actuators**, Saeedeh Ebrahimi Takaloo, The Univ. of British Columbia (Canada); Katlin Rohtlaid, Univ. de Cergy-Pontoise (France); Ngoc Tan Nguyen, Univ. de Valenciennes et du Hainaut-Cambrésis (France); Cédric Plesse, Frédéric Vidal, Univ. de Cergy-Pontoise (France); Eric Cattan, Univ. de Valenciennes et du Hainaut-Cambrésis (France); John D. W. Madden, The Univ. of British Columbia (Canada) [10163-36]

2:00 pm: **Temperature and humidity dependence of ionic electroactive polymer actuators**, Sunjai Nakshatharan Shanmugam, Andres Punning, Alvo Aabloo, Univ. of Tartu (Estonia) [10163-102]

2:20 pm: **Property modification of nafion via polymer blending with polyimide**, Taeseon Hwang, Jungsoo Nam, Dong-Chan Lee, Kwang Jin Kim, Univ. of Nevada, Las Vegas (USA) [10163-38]

2:40 pm: **The highly stable air-operating IPMC actuator with consecutive and controlled channels generated by copper foam**, Qingsong He, Zhigang Liu, Min Yu, Zhenhong Dai, Institute of Bio-inspired Structure and Surface Engineering (China) [10163-39]

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

CONFERENCE 10164

SESSION 8

LOCATION: SALON G + H
TUE 1:40 PM TO 3:00 PM

Biologically Inspired Systems

Session Chairs: **Kon-Well Wang**, Univ. of Michigan (USA); **Shad Roundy**, The Univ. of Utah (USA)

1:40 pm: **An earthworm-like robot using origami structures**, Hongbin Fang, Yetong Zhang, Kon-Well Wang, Univ. of Michigan (USA) [10164-39]

2:00 pm: **Multistability inspired by the oblique, pennate architectures of skeletal muscle**, Narayanan Kidambi, Univ. of Michigan (USA); Ryan L. Harne, The Ohio State Univ. (USA); Kon-Well Wang, Univ. of Michigan (USA) . [10164-40]

2:20 pm: **A micromachined ultrasonic power receiver for biomedical implants**, Hamid Basaeri, Shad Roundy, The Univ. of Utah (USA) [10164-41]

2:40 pm: **Smart composites based on controllably grafted graphene oxide particles and elastomeric matrix with tunable sensing capability**, Miroslav Mrlik, Josef Osicka, Tomas Bata Univ. of Zlin (Czech Republic); Marketa Ilcikova, Polymer Institute SAS (Slovakia); Vladimir Pavlinek, Tomas Bata Univ. of Zlin (Czech Republic); Jaroslav Mosnáček, Polymer Institute SAS (Slovakia) [10164-42]

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

CONFERENCE 10165

SESSION 8

LOCATION: SALON I
TUE 1:20 PM TO 3:00 PM

Photoresponsive Materials

Session Chair: **Ralph C. Smith**, North Carolina State Univ. (USA)

1:20 pm: **On the electric and magnetic alignment of magnetoactive barium hexaferrite-PDMS composites**, Md Abdulla Al Masud, Corey Breznak, Paris von Lockette, Zoubeida Ounaies, Pennsylvania State Univ. (USA) [10165-39]

1:40 pm: **Magnetoelastic shockwave response: experimental and numerical analysis**, John P. Domann, Univ. of California, Los Angeles (USA); Ryan Crum, Lawrence Livermore National Lab. (USA); Vijay Gupta, Greg P. Carman, Univ. of California, Los Angeles (USA) . . [10165-40]

2:00 pm: **Rate dependence and shape memory effects in azobenzene polymers**, William S. Oates, Sadiyah S. Chowdhury, Matthew Worden, Dennice Roberts, Florida State Univ. (USA) [10165-41]

2:20 pm: **Programmable bending of liquid crystal polymer strips by light and heat**, Yongzhong Huo, Yang Zhang, Yiwei Xu, Fudan Univ. (China) [10165-42]

2:40 pm: **Multiferroic control of exchange bias: creation of small magnetic motors**, John P. Domann, Greg P. Carman, University of California, Los Angeles (USA) [10165-43]

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

CONFERENCE 10167

SESSION 13

LOCATION: SALON A
TUE 1:30 PM TO 2:10 PM

Nanosensors and Systems IV

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

1:30 pm: **Military efforts in nanosensors, 3D printing, and imaging detection**, Eugene Edwards, Janice C. Booth, J. Keith Roberts, Christina L. Brantley, Sihon H. Crutcher, U.S. Army Research, Development and Engineering Command (USA); Michael S. Kranz, EngeniusMicro, LLC (USA); Mohamed Seif, Paul B. Ruffin, Alabama A&M Univ. (USA) [10167-44]

1:50 pm: **Magnetic nanotubes for drug delivery**, Mouli Ramasamy, Vijay Varadan, The Pennsylvania State University (USA) [10167-45]

SESSION 14

LOCATION: SALON A
TUE 2:10 PM TO 6:10 PM

3D Printing and Applications III

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

2:10 pm: **Energy storage crystalline gel materials for 3D printing application**, Yuchen Mao, Yamagata Univ. (Japan) and Donghua Univ. (China); Takuya Miyazaki, Jin Gong, Yamagata Univ. (Japan); Meifang Zhu, Donghua Univ. (China) . . . [10167-30]

2:30 pm: **Simulation of 3D food printing extrusion and deposition**, Masato Makino, Yamagata Univ. (Japan); Daisuke Fukuzawa, SIMLON Co., Ltd. (Japan); Takahiro Murashima, Tohoku Univ. (Japan); Hidemitsu Furukawa, Yamagata Univ. (Japan) [10167-46]

2:50 pm: **Development of gel dosimeter with 3D printer**, Kazuyuki Sakai, Yamagata Univ. (Japan) [10167-47]

3:10 pm: **Direct G-code manipulation for 3D material weaving**, Soko Koda, Hiroya Tanaka, Keio Univ. (Japan) [10167-48]

Coffee Break. Tue 3:30 pm to 3:50 pm

CONFERENCE 10168

Sessions 8A and 8B run concurrently.

SESSION 8A

LOCATION: COLUMBIA
TUE 1:40 TO 3:00 PM
Sensing Human Occupants in Buildings

Session Chairs: **Hae Young Noh**, Carnegie Mellon Univ. (USA); **Fuh-Gwo Yuan**, North Carolina State Univ. (USA)

1:40 pm: **Design and development of a prototype platform for gait analysis**, Tess E. Diffenbaugh, Matthew A. Marti, Jakin Jagani, Victoria Garcia, Grady Iliff, Americo G. Woolard, Austin Phoenix, Pablo A. Tarazaga, Virginia Polytechnic Institute and State Univ. (USA); Dustin Bales, V. V. N. Sriram Malladi, GAITE LLC (USA) [10168-41]
 2:00 pm: **Characterizing footstep-induced structural vibration using K-SVD for sparse representation**, Jonathon Fagert, Mostafa Mirshekari, Hae Young Noh, Carnegie Mellon Univ. (USA) [10168-42]

2:20 pm: **Localization and tracking of footsteps via on-floor accelerometers**, Americo G. Woolard, V. V. N. Sriram Malladi, Pablo A. Tarazaga, Virginia Polytechnic Institute and State Univ. (USA) [10168-43]

2:40 pm: **Optimal design of a magnetorheological damper for smart prosthetic knees**, Fei Gao, Yannan Liu, Wei-Hsin Liao, The Chinese Univ. of Hong Kong (Hong Kong, China) [10168-44]

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

SESSION 8B

LOCATION: SALON F
TUE 1:40 PM TO 3:00 PM
Novel Sensing Technologies III

Session Chairs: **Daniele Zonta**, Univ. degli Studi di Trento (Italy); **Haiying Huang**, The Univ. of Texas at Arlington (USA)

1:40 pm: **Structural analysis and aeroservoelastic response simulation of smart fin operated by piezoelectric actuators**, Chul Woo Park, SangJoon Shin, YoungBin Bin, Seoul National Univ. (Korea, Republic of); YooJin Kang, LG Display (Korea, Republic of); Bum-Soo Yoon, Ji Won Park, Kwang Joon Yoon, Konkuk Univ. (Korea, Republic of); Hyun Young Choi, Agency for Defense Development (Korea, Republic of) [10168-45]

2:00 pm: **Determination of orthotropic mechanical properties of 3D printed parts for structural health monitoring**, Bastien Poissenot, Steven Anton, Austin Scheyer, Tennessee Technological Univ. (USA) [10168-46]

2:20 pm: **Finite difference analysis and experimental validation of 3D photonic crystals for structural health monitoring**, Valentina Piccolo, Univ. degli Studi di Trento (Italy) and Univ. of Pittsburgh (USA); Andrea Chiappini, Consiglio Nazionale Delle Ricerche (Italy); Alessandro Vaccari, Fondazione Bruno Kessler (Italy); Antonino Calà Lesina, Univ. of Ottawa (Canada); Maurizio Ferrari, CNR-Istituto di Fotonica e Nanotecnologie (Italy); Luca Deseri, Univ. degli Studi di Trento (Italy) and Brunel Univ. (United Kingdom) and Univ. of Pittsburgh (USA); Marcus Perry, Univ. of Strathclyde (United Kingdom); Daniele Zonta, Univ. degli Studi di Trento (Italy) and National Research Council (Italy) and Univ. of Strathclyde (United Kingdom) . . [10168-47]

2:40 pm: **Improved equivalent circuit modeling and simulation of magnetostrictive tuning fork gyro sensors**, Uwe Marschner, Eric Starke, TU Dresden (Germany); JinHyeong Yoo, U.S. Army Research Lab. (USA); Alison B. Flatau, Univ. of Maryland, College Park (USA) . . [10168-48]

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

CONFERENCE 10169

SESSION 10

LOCATION: EUGENE
TUE 1:40 PM TO 3:00 PM

Civil Infrastructures NDE/SHM II

Session Chairs: **Kenneth J. Loh**, Univ. of California, San Diego (USA); **Denvid Lau**, City Univ. of Hong Kong (Hong Kong, China)

1:40 pm: **Comparison of electrical impedance tomography inverse solver approaches for distributed strain sensing**, Yingjun Zhao, Johannes Kepler Univ. Linz (Austria); Sumit Gupta, Long Wang, Kenneth J. Loh, Univ. of California, San Diego (USA); Martin Schagerl, Johannes Kepler Univ. Linz (Austria) [10169-40]

2:00 pm: **The integration of periodic truss bridge design and impulse response method**, Onur Can, Didem Ozevin, Univ. of Illinois at Chicago (USA) [10169-41]

2:20 pm: **Damage localization and quantification of a pretensioned concrete beam using stochastic subspace identification**, Alessandro Cancelli, Laura Micheli, Simon Laflamme, Alice Alipour, Sri Sritharan, Iowa State Univ. of Science and Technology (USA); Filippo Ubertini, Univ. degli Studi di Perugia (Italy) [10169-42]

2:40 pm: **Nondestructive testing and monitoring of stiff large-scale structures by measuring 3D coordinates of cardinal points using electronic distance measurements in a trilateration architecture**, David H. Parker, Parker Intellectual Property Enterprises, LLC (USA) [10169-43]

Coffee Break
 Tue 3:00 pm to 3:40 pm

CONFERENCE 10170

Sessions 8A and 8B run concurrently.

SESSION 8A

LOCATION: SALON B + C
TUE 1:40 PM TO 3:00 PM

Metamaterial III

Session Chairs: **Fabio Semperlotti**, Purdue Univ. (USA); **Mostafa A. Nouh**, Univ. at Buffalo (USA)

1:40 pm: **A numerical and experimental study on the performance of acoustic black hole based metamaterials**, Hongfei Zhu, Univ. of Notre Dame (USA); Fabio Semperlotti, Purdue Univ. (USA) [10170-40]

2:00 pm: **A mechanical power dissipation model for axially loaded metamaterial bars**, Hasan Al Babaa, Mostafa A. Nouh, Univ. at Buffalo (USA) [10170-41]
 2:20 pm: **Mechanical metamaterials: recent advances and opportunities in structural health monitoring**, Eduard Karpov, Larry Danso, Univ. of Illinois at Chicago (USA) [10170-42]

2:40 pm: **Nonlinear dynamics of a lattice of bi-stable units with defects**, Myungwon Hwang, Andres F. Arrieta, Purdue Univ. (USA) [10170-43]

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

SESSION 8B

LOCATION: PEARL
TUE 1:40 PM TO 3:00 PM

Guided Waves I: Civil Infrastructures Monitoring

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

1:40 pm: **Ultrasonic damage imaging of structural components with bulk and guided waves using match coefficients**, Simone Sternini, Univ. of California, San Diego (USA); Antonino Quattrocchi, Roberto Montanini, Univ. degli Studi di Messina (Italy); Francesco Lanza di Scalea, Univ. of California, San Diego (USA) [10170-44]

2:00 pm: **Nondestructive assessment of waveguides using an integrated electromechanical impedance and ultrasonic waves approach**, Amir Nasrollahi, Zhaoyun Ma, Piervincenzo Rizzo, Univ. of Pittsburgh (USA) [10170-45]

2:20 pm: **Guided wave attenuation in composite materials**, Tomasz Wandowski, Pawel Kudela, Pawel H. Malinowski, Wieslaw M. Ostachowicz, The Szwalski Institute of Fluid-Flow Machinery (Poland) . . . [10170-46]

2:40 pm: **Guided waves based SHM systems: parameters selection for better identification and localization of damages in composites stiffened plates**, Ernesto Monaco, Natalino Daniele Boffa, Vittorio Memmolò, Leandro Maio, Fabrizio Ricci, Univ. degli Studi di Napoli Federico II (Italy) [10170-47]

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

CONFERENCE 10171

SESSION 5

LOCATION: PORTLAND
TUE 1:20 PM TO 4:30 PM

NDE and Monitoring of Energy Components and Systems

Session Chair: **Ali Abdul-Aziz**, Kent State Univ. (USA)

1:20 pm: **Analytical modeling and data acquisition software development for rotor dynamics testing in spin laboratory**, Ali Abdul-Aziz, Kent State Univ. (USA); Mark R. Woike, NASA Glenn Research Ctr. (USA); Daniel Arble, Univ. of Maryland, College Park (USA) [10171-19]

1:40 pm: **Wave path calculation of total focusing method for phased array imaging to evaluate weld zone of elbow pipes**, Choon-Su Park, SeungHyun Cho, Wonjae Choi, Korea Research Institute of Standards and Science (Korea, Republic of) [10171-20]

2:00 pm: **Non-invasive imaging tools for SMAs inspection**, Nicolas P. Avdelidis, Hai Zhang, Univ. Laval (Canada); Dimitrios A. Exarchos, Univ. of Ioannina (Greece); Clemente Ibarra-Castaneda, Xavier P. V. Maldague, Univ. Laval (Canada); Theodoros E. Matikas, Univ. of Ioannina (Greece) [10171-21]

2:20 pm: **Experimental investigation of wave dispersion in fresh and hardened concrete**, Sokratis N. Iliopoulos, Vrije Univ. Brussel (Belgium); Fabian Malm, Christian U. Grosse, Technische Univ. München (Germany); Dimitrios G. Aggelis, Vrije Univ. Brussel (Belgium) [10171-22]

2:40 pm: **Novel dynamic thermal characterization of multifunctional concretes with phase change materials**, Anna Laura Pisello, Claudia Fabiani, Antonella D'Alessandro, Filippo Ubertini, Univ. degli Studi di Perugia (Italy); Luisa Fernanda Cabeza, Univ. de Lleida (South Sudan); Franco Cotana, Univ. degli Studi di Perugia (Italy) [10171-23]

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

CONFERENCE 10163

Sessions 8A and 8B run concurrently.

SESSION 8A

LOCATION: SALON E
TUE 3:30 PM TO 6:10 PM

Analysis and Modeling EAP Actuators Performance

Session Chairs: **John D. W. Madden**, The Univ. of British Columbia (Canada); **Gih-Keong Lau**, Nanyang Technological Univ. (Singapore)

3:30 pm: **Rate dependent constitutive behavior of dielectric elastomers and applications in legged robotics** (*Invited Paper*), William S. Oates, Paul Miles, Wei Gao, Jonathan Clark, Somayeh Mashayekhi, Mohammad Y. Hussaini, Florida State Univ. (USA) [10163-40]

4:10 pm: **Numerical investigation of chemically stimulated composite hydrogel-layers**, Martin Sobczyk, Thomas Wallmersperger, TU Dresden (Germany) [10163-41]

4:30 pm: **Modeling and experimentally characterizing ionic buoyancy engines**, Barbar J. Akle, Jalal Nasser, Lebanese American Univ. (Lebanon) [10163-42]

4:50 pm: **Dynamic instability of dielectric elastomer actuators subjected to unequal biaxial prestress**, Atul Sharma, Dhanashri M. Joglekar, Manish M. Joglekar, Indian Institute of Technology Roorkee (India) [10163-43]

5:10 pm: **Numerical analysis of helical dielectric elastomer actuators**, Saurabh Nair, Daewon Kim, Embry-Riddle Aeronautical Univ. (USA) [10163-44]

5:30 pm: **Nonlinear vibration of dielectric elastomer incorporating strain stiffening**, Fangfang Wang, Tongqing Lu, T. J. Wang, Xi'an Jiaotong Univ. (China) [10163-45]

5:50 pm: **Analysing trade-offs in the frequency response of dielectric elastomer generators**, Plinio Rodrigues de Oliveira Zanini, Jonathan M. Rossiter, Martin Homer, Univ. of Bristol (United Kingdom) [10163-46]

SESSION 8B

LOCATION: SALON D
TUE 3:30 PM TO 6:10 PM

EAP Materials Fabrication Methods and Processes I

Session Chairs: **Qibing Pei**, Univ. of California, Los Angeles (USA); **Geoffrey M. Spinks**, Univ. of Wollongong (Australia)

3:30 pm: **Hybrid carbon nanotube yarn artificial muscles powered by moisture**, Shi Hyeong Kim, Tae Jin Mun, Seon Jeong Kim, Hanyang Univ. (Korea, Republic of) [10163-47]

3:50 pm: **Electrospraying and ultraviolet light curing of nanometer-thin polydimethylsiloxane membranes for low-voltage DEA**, Bekim Osmani, Tino Töpfer, Florian M. Weiss, Univ. Basel (Switzerland); Gabor M. Kovacs, EMPA (Switzerland); Bert Müller, Univ. Basel (Switzerland) [10163-48]

4:10 pm: **Leakage current and actuation efficiency of thermally evaporated low-voltage dielectric elastomer thin-film actuators**, Tino Töpfer, Bekim Osmani, Samuel Lörcher, Bert Müller, Univ. Basel (Switzerland) [10163-49]

4:30 pm: **Development of flexible electrodes from carbon nanotubes and polydimethylsiloxane**, Titus M. Mulembo, Takahiro Nitta, Nagai Gakuji, Hirohisa Tamagawa, Sasaki Minoru, Gifu Univ. (Japan) [10163-50]

4:50 pm: **Fabrication and characterizations of a micropump system utilizing ionic polymer-metal composite with inner petal-shaped architecture**, Yanjie Wang, Hohai Univ. (China); Jie Ru, Zicai Zhu, Xi'an Jiaotong Univ. (China); Denglin Zhu, Hohai Univ. (China); Xiaobing Liang, Henan Mechanical and Electrical Vocational College (China) [10163-51]

5:10 pm: **Optimization study for fabrication of micro-scale stacked dielectric elastomer actuators**, Mert Corbaci, Kathleen Lamkin-Kennard, Wayne W. Walter, Rochester Institute of Technology (USA) [10163-52]

5:30 pm: **Fabrication of ultra-thin IPMC actuator for flapping motion of butterfly**, Yanjie Wang, Hohai Univ. (China); Bin Luo, Zicai Zhu, Xi'an Jiaotong Univ. (China); Denglin Zhu, Hohai Univ. (China); Xiaobing Liang, Henan Mechanical and Electrical Vocational College (China) [10163-53]

5:50 pm: **Microfabricated PEDOT trilayer actuators: synthesis, characterization, and modeling**, Ngoc Tan Nguyen, Univ. de Valenciennes et du Hainaut-Cambrésis (France) and The Univ. of British Columbia (Canada); Cédric Plesse, Frédéric Vidal, Univ. de Cergy-Pontoise (France); Caroline Soyer, Sébastien Grondel, Univ. de Valenciennes et du Hainaut-Cambrésis (France); John D. W. Madden, The Univ. of British Columbia (Canada); Eric Cattan, Institut d'Electronique de Microélectronique et de Nanotechnologie (France) [10163-54]

CONFERENCE 10164

SESSION 9

LOCATION: SALON G + H
TUE 3:20 PM TO 6:20 PM

Energy Harvesting and Scavenging II: Broadband/Nonlinear

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

3:20 pm: **Nonlinear analysis of micro piezoelectric energy harvesters**, Yu Cheng Wang, S. A. Chen, Yi-Chung Shu, Sun Chiu Lin, Wen-Jong Wu, National Taiwan Univ. (Taiwan) [10164-43]

3:40 pm: **Maximizing direct current power delivery from bistable vibration energy harvesting beams subjected to realistic base excitations**, Quanqi Dai, Ryan L. Harne, The Ohio State Univ. (USA) [10164-44]

4:00 pm: **Broadband energy harvesting using phononic crystal with multiple defects**, Soo-Ho Jo, Yong Chang Shin, Heonjun Yoon, Byung D. Youn, Seoul National Univ. (Korea, Republic of); Miso Kim, Choon-Su Park, Wonjae Choi, Korea Research Institute of Standards and Science (Korea, Republic of) [10164-45]

4:20 pm: **Performance metric comparison study for non-magnetic bi-stable energy harvesters**, Andres F. Arrieta, Purdue University (USA); Janav P. Udani, Purdue Univ. (USA); Cailin Wrigley, The Univ. of Melbourne (Australia) [10164-46]

4:40 pm: **Enhanced vibration energy harvesting from oil drilling based on the principle of stochastic resonance**, Hongjip Kim, Virginia Polytechnic Institute and State Univ. (USA) [10164-47]

5:00 pm: **Performance evaluation of nonlinear energy harvesting with magnetically coupled dual beams**, Chunbo Lan, The Univ. of Auckland (New Zealand) and Northwestern Polytechnical Univ. (China); Lihua Tang, The Univ. of Auckland (New Zealand); Weiyang Qin, Northwestern Polytechnical Univ. (China) [10164-48]

5:20 pm: **Modeling of plucking piezoelectric energy harvesters with contact theory**, Xinlei Fu, Wei-Hsin Liao, The Chinese Univ. of Hong Kong (Hong Kong, China) [10164-49]

5:40 pm: **Experimental investigation of low aspect ratio, large amplitude, aeroelastic energy harvesting systems**, Benjamin Kirschmeier, Matthew Bryant, North Carolina State Univ. (USA) [10164-50]

6:00 pm: **Effective kinetic energy harvesting via structural instabilities**, Ashkan Haji Hosseini, Konstantin Turitsyn, Massachusetts Institute of Technology (USA) [10164-51]

CONFERENCE 10165

SESSION 9

LOCATION: SALON I
TUE 3:30 PM TO 5:30 PM

Shape Memory Materials II

Session Chair: **Hyeong Jae Lee**, Jet Propulsion Lab. (USA)

3:30 pm: **Magnetic domains evolution in NiMnGa samples loaded magento-mechanically**, Constantin Ciocanel, Heidi Feigenbaum, Northern Arizona Univ. (USA) [10165-44]

3:50 pm: **Triple-shape memory effect of styrene-based polymer**, Jinsong Leng, Wenbing Li, Yanju Liu, Harbin Institute of Technology (China) [10165-45]

4:10 pm: **Programmable shape memory polycaprolactone foams and their composite actuated by microwave**, Fenghua Zhang, Yanju Liu, Jinsong Leng, Harbin Institute of Technology (China) [10165-46]

4:30 pm: **The research of vacuum thermal cycling resistant transparent shape memory polyimide and its application in space flexible electronics**, Hui Gao, Longnan Huang, Xin Lan, Liwu Liu, Yanju Liu, Jinsong Leng, Harbin Institute of Technology (China) [10165-47]

4:50 pm: **Investigations on the thermo-mechanical behaviour of the CuAlNi/polyimide shape memory alloy bimorph in temperature sensing of a transformer oil**, Akash K., Palani A. Iyamparimal, Chandan K., Parikshit G., Narayane Dhiraj, Reena Disawal, Bhupesh K. Lad, Vipul Singh, Indian Institute of Technology Indore (India) [10165-48]

5:10 pm: **Computational simulations of contractile dielectric elastomer composites**, Yali Li, Nakhiah C. Goulbourne, Univ. of Michigan (USA) [10165-58]

Conference End.

CONFERENCE 10167

SESSION 14 CONTINUED

3:50 pm: **The flexibility controlling study for 3D printed splint**, Jianyou Li, Hiroya Tanaka, Keio Univ. (Japan) [10167-49]

4:10 pm: **The generative system of combinable natural structure**, Yinghsiu Huang, National Kaohsiung Normal Univ. (Taiwan); Hiroya Tanaka, Keio Univ. (Japan) [10167-50]

4:30 pm: **4D printing of active shape-changing structures with shape memory polymers**, Hongqiu Wei, Qiwei Zhang, Yongtao Yao, Liwu Liu, Yanju Liu, Jinsong Leng, Harbin Institute of Technology (China) [10167-51]

4:50 pm: **SAW based micro- and acousto- fluidics in biomedicine**, Mouli Ramasamy, The Pennsylvania State University (USA); Prashanth Kumar, Pennsylvania State Univ. (USA); Vijay Varadan, The Pennsylvania State University (USA) [10167-52]

5:10 pm: **Design of the mechanical properties of the gel by the 3D gel printer "SWIM-ER"**, Azusa Saito, Takafumi Ota, Taishi Tase, Kyuichiro Takamatsu, Masaru Kawakami, Hidemitsu Furukawa, Yamagata Univ. (Japan) [10167-53]

5:30 pm: **Synthesis of crystalline gels on a light-induced polymerization 3D printer**, Jin Gong, Yuchen Mao, Takuya Miyazaki, Yamagata Univ. (Japan); Meifang Zhu, Donghua Univ. (China) [10167-54]

5:50 pm: **Direct-writing of copper-based micropatterns on polymer substrates using femtosecond laser reduction of copper (II) oxide nanoparticles**, Mizue Mizoshiri, Yasuaki Ito, Junpei Sakurai, Seiichi Hata, Nagoya Univ. (Japan) [10167-55]

CONFERENCE 10168

Sessions 9A and 9B run concurrently.

SESSION 9A

LOCATION: COLUMBIA
TUE 3:30 PM TO 6:10 PM

Novel Sensing Technologies II

Session Chairs: **Kenneth J. Loh**, Univ. of California, San Diego (USA); **Rosalind M. Wynne**, Villanova Univ. (USA)

3:30 pm: **Measurements of multicore microstructured optical fibers heated up to 50 degrees Celsius**, Rosalind M. Wynne, Villanova Univ. (USA) [10168-49]

3:50 pm: **MFL based cable damage detection and quantitative analysis**, Jooyoung Park, Ju-Won Kim, Junkyeong Kim, Seunghye Park, Sungkyunkwan Univ. (Korea, Republic of) [10168-50]

4:10 pm: **External loading pattern recognition of self-sensing carbon nanotube (CNT) concrete: data mining approach**, Shervin Khazaeli, Concordia Univ. (Canada) [10168-51]

4:30 pm: **A novel spectral profile multiplexed FBG sensor network with application to the quasi-static and low velocity test of a Mylar sheet**, Guodong Guo, Drew A. Hackney, Mark Pankow, Kara J. Peters, North Carolina State Univ. (USA) [10168-52]

4:50 pm: **Subsurface structural sensing using non-contact tomography and embedded nanocomposites**, Kenneth J. Loh, Univ. of California, San Diego (USA) [10168-53]

5:10 pm: **Fiber gratings strain sensor systems for composites and adhesive joints**, Ingrid Scheel, Eric Udd, Columbia Gorge Research LLC (USA) . . . [10168-54]

5:30 pm: **Feasibility of magnetic fiber-optic based corrosion sensor**, Safieh Almahmoud, Oleg Shirayev, Nader Vahdati, Paul Rostron, The Petroleum Institute (United Arab Emirates) . [10168-55]

5:50 pm: **Optical sensing of metal tiny particles using ceria nanoparticles via fluorescence quenching technique**, Nader Shehata, Effat Samir, Soha Gaballah, Mohamed Rizk, Bassem Mokhtar, Mohamed Azab, Alexandria Univ. (Egypt) [10168-56]

SESSION 9B

LOCATION: SALON F
TUE 3:30 PM TO 6:10 PM

Fiber Optic Sensors for Structural Health Monitoring

Session Chairs: **Genda Chen**, Missouri Univ. of Science and Technology (USA); **Haiying Huang**, The Univ. of Texas at Arlington (USA)

3:30 pm: **Distributed fiber optic temperature sensors and data-enhanced modeling of steel beams in fire**, Yi Bao, Genda Chen, Missouri Univ. of Science and Technology (USA) [10168-57]

3:50 pm: **Shape sensing of inflatable aerospace structures with fiber optic curvature rosettes**, Justin M. Bond, Dryver R. Huston, The Univ. of Vermont (USA) [10168-58]

4:10 pm: **Test of FBG sensors for monitoring high pressure pipes**, Antonio Paolozzi, Sapienza Univ. di Roma (Italy); Claudio Paris, Museo Storico della Fisica e Ctr. Studi e Ricerche "Enrico Fermi" (Italy) and Sapienza Univ. di Roma (Italy); Cristian Vendittozzi, Univ. de Brasilia (Brazil); Marialuisa Mongelli, ENEA (Italy); Hiroshi Asanuma, Chiba Univ. (Japan) [10168-59]

4:30 pm: **Corrosion detection for steel with soft coating using in-line fiber Bragg grating sensor**, Fodan Deng, Ying Huang, Fardad Azarmi, North Dakota State Univ.(USA) . . . [10168-60]

4:50 pm: **Distributed fiber optic strain sensing to detect artificial pitting corrosion in stirrups**, Jiachen Zhang, Neil A. Hoult, Queen's Univ. (Canada); Vinutha Kancharla, National Institute of Technology (India) [10168-61]

5:10 pm: **A buoyancy-based fiber Bragg grating tilt sensor**, Muneesh Maheshwari, Yaowen Yang, Nanyang Technological Univ. (Singapore) [10168-62]

5:30 pm: **Embedded fiber Bragg grating sensor for the simultaneous measurement of strain and temperature**, Abhay K. Singh, Haiying Huang, The Univ. of Texas at Arlington (USA); Yupeng Zhu, Ming Han, Univ. of Nebraska-Lincoln (USA) . . . [10168-63]

5:50 pm: **Effect of gauge length on embedded fiber Bragg grating sensor response in woven fiber composites**, Claire E. Davis, Andrew Phillips, Patrick Norman, Nik Rajic, Defence Science and Technology Group (Australia) [10168-64]

CONFERENCE 10169

SESSION 11

LOCATION: EUGENE
TUE 3:40 PM TO 6:20 PM

Civil Infrastructures NDE/SHM III

Session Chairs: **Dwight A. Clayton**, Oak Ridge National Lab. (USA); **Zhili Feng**, Oak Ridge National Lab. (USA)

3:40 pm: **Study on temperature and damage sensing capability of Portland cement through the thermoelectric measurements**, Tsung-Chin Hou, Ko-Hung Tai, National Cheng Kung Univ. (Taiwan); Yu-Min Su, National Kaohsiung Univ. of Applied Sciences (Taiwan) [10169-94]

4:00 pm: **A pre-posterior analysis framework for quantifying the value of seismic monitoring of infrastructure**, Piotr Omenzetter, Univ. of Aberdeen (United Kingdom); Maria Pina Limongelli, Politecnico di Milano (Italy); Ufuk Yazgan, Istanbul Technical Univ. (Turkey) [10169-46]

4:20 pm: **Experimental damage localization in a full-scale 7 storey benchmark building under seismic excitation**, Maria Pina Limongelli, Politecnico di Milano (Italy); Chiara Iacovino, Rocco Ditommaso, Felice C. Ponzio, degli Studi della Basilicata (Italy) [10169-47]

4:40 pm: **Highly nonlinear solitary waves to estimate the modulus of concrete with different water-to-cement ratios**, Amir Nasrollahi, Wen Deng, Piervincenzo Rizzo, Univ. of Pittsburgh (USA) [10169-48]

5:00 pm: **Accuracy analysis of point cloud modeling for evaluating concrete specimens**, Nicolas D'Amico, Tzu-Yang Yu, Univ. of Massachusetts Lowell (USA) [10169-49]

5:20 pm: **Quantitative reference-free dynamic distributed sensing of damage**, Saeed K. Babanajad, Rutgers, The State Univ. of New Jersey (USA); Farhad Ansari, Univ. of Illinois at Chicago (USA) [10169-50]

5:40 pm: **Condition assessment of corroded steel rebar in free space using synthetic aperture radar images**, Christopher Ingemi, Jones Owusu Twumasi, Swinderjit Singh Litt, Tzu-Yang Yu, Univ. of Massachusetts Lowell (USA) [10169-51]

6:00 pm: **Continuous and embedded solutions for SHM of concrete structures using changing electrical potential in self-sensing cement-based composites**, Austin R. J. Downey, Iowa State Univ. of Science and Technology (USA); Enrique Garcia-Macias, Univ. de Sevilla (Spain); Antonella Dalessandro, Univ. degli Studi di Perugia (Italy); Rafael Castro-Triguero, Univ. de Córdoba (Spain); Filippo Ubertini, Univ. degli Studi di Perugia (Italy); Simon Laflamme, Iowa State Univ. of Science and Technology (USA) [10169-52]

CONFERENCE 10170

Sessions 9A and 9B run concurrently.

SESSION 9A

LOCATION: SALON B + C
TUE 3:30 PM TO 6:10 PM

Metamaterial IV

Session Chairs: **Mostafa A. Nouh**, Univ. at Buffalo (USA); **Fabio Semperlotti**, Purdue Univ. (USA)

3:30 pm: **An analytical model for band gap behavior in lumped elastic metamaterials**, Hasan Al Babaa, Mostafa A. Nouh, Tarunraj Singh, Univ. at Buffalo (USA) [10170-48]

3:50 pm: **Wave localization in beams due to band inversion**, Raj Kumar Pal, Georgia Institute of Technology (USA); Jianfei Yin, National Univ. of Defense Technology (China); Massimo Ruzzene, Georgia Institute of Technology (USA) [10170-49]

4:10 pm: **Nonlinear wave dynamics of hollow ellipsoidal cylinder lattice**, Hyunryung Kim, Francesca C. Green, Univ. of Washington (USA); Eunho Kim, Chonbuk National Univ. (Korea, Republic of); Jinkyu Yang, Univ. of Washington (USA) [10170-50]

4:30 pm: **Acoustic vortex beam generation using a compact metamaterial aperture**, Charles Rohde, U.S. Naval Research Lab. (USA); Christina Naify, Jet Propulsion Lab. (USA); Theodore P. Martin, Michael Nicholas, Matthew D. Guild, Gregory J. Orris, U.S. Naval Research Lab. (USA) [10170-51]

4:50 pm: **Analyzing the frequency band gap in functionally graded materials with harmonically varying material properties**, Mohammad Hossein Ansari, M. Amin Karami, Univ. at Buffalo (USA) [10170-52]

5:10 pm: **Scattering of longitudinal acoustic phonons in thin silicon membranes**, Dhruv Gelda, Sanjiv Sinha, Univ. of Illinois at Urbana-Champaign (USA) [10170-53]

5:30 pm: **Smart Kirigami open honeycombs in shape changing actuation and dynamics**, Robin M. Neville, Fabrizio Scarpa, Univ. of Bristol (United Kingdom); Jinsong Leng, Harbin Institute of Technology (China) [10170-54]

5:50 pm: **Gradient-index based smart metamaterial for elastic wave focusing**, Kaijun Yi, LTDS, ECL (France); Manuel Collet, CNRS (France) [10170-55]

SESSION 9B

LOCATION: PEARL
TUE 3:30 PM TO 6:10 PM

Guided Waves II: Measurement, Damage Detection, and Scattering

Session Chairs: **Srinivasan Gopalakrishnan**, Indian Institute of Science (India); **Michael Todd**, Univ. of California, San Diego (USA)

3:30 pm: **Directionality of A0 lamb wave mode scattering at defects**, Paul Fromme, Univ. College London (United Kingdom) [10170-56]

3:50 pm: **Guided waves scattering by a geometrical or damage feature: application to fatigue crack and machined notch**, Nicolas Quaegebeur, Nidhal Bouslama, Maxime Bilodeau, Patrice Masson, Ahmed Maslouhi, Philippe Micheau, Univ. de Sherbrooke (Canada) [10170-57]

4:10 pm: **Beamforming of Lamb waves using 2D array based on Fermat spiral**, Lukasz Ambroziński, Tadeusz Stepinski, AGH Univ. of Science and Technology (Poland) . [10170-58]

4:30 pm: **Lamb wave interaction at debondings due to impact damage in complex stiffened CFRP structures**, Benjamin Eckstein, Airbus Group Innovations (Germany); Maria Moix Bonet, Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany); Martin Bach, Nicolas Dobmann, Airbus Group Innovations (Germany) [10170-59]

4:50 pm: **Damage feature extraction from Lamb wave signals of a door surround structure**, Maria Moix Bonet, Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany); Benjamin Eckstein, Martin Bach, Airbus Group Innovations (Germany); Peter Wierach, Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany) [10170-60]

5:10 pm: **Laser Doppler vibrometry and PZT sensing for the study of guided waves in a stepped aluminum plate**, Leandro Maio, Fabrizio Ricci, Vittorio Memmolo, Natalino Daniele Boffa, Ernesto Monaco, Univ. degli Studi di Napoli Federico II (Italy); Ajit K. Mal, Christoph Schaal, Univ. of California, Los Angeles (USA) [10170-61]

5:30 pm: **Developing a passive-active optical array for structural health monitoring of plate like structures**, Xiaoyi Sun, Lingyu Yu, Univ. of South Carolina (USA) [10170-62]

5:50 pm: **Local numerical modelling of ultrasonic guided waves in linear and nonlinear media**, Piotr Kijanka, Rafal Radecki, Tadeusz Uhl, Wiesław J. Staszewski, AGH Univ. of Science and Technology (Poland); Michael J. Leamy, Georgia Institute of Technology (USA); Pawel Packo, AGH Univ. of Science and Technology (Poland) [10170-63]

CONF. 10171

3:30 pm: **Crash response of a new 3D open cell structure for sandwich cores**, Luca Boccardo, Univ. degli Studi di Napoli Federico II (Italy); Fulvio Pinto, Univ. of Bath (United Kingdom); Antonio Langella, Univ. degli Studi di Napoli Federico II (Italy); Michele Meo, Univ. of Bath (United Kingdom) [10171-24]

3:50 pm: **Detection and characterization of exercise induced muscle damage via thermography and image processing**, Nicolas P. Avdelidis, Univ. Laval (Canada); Vassilios Kappatos, Univ. of Southern Denmark (Denmark); George Georgoulas, Luleå Univ. of Technology (Sweden); Petros Karvelis, Technological Educational Institute of Epirus (Greece); Chara K. Deli, Univ. of Thessaly (Greece); Panagiotis Theodorakeas, Maria Kouli, National Technical Univ. of Athens (Greece); Athanasios Z. Jamurtas, Univ. of Thessaly (Greece) [10171-25]

4:10 pm: **Briquetting and carbonization of biomass products for the sustainable productions of activated carbons**, Nasrin B. Khorasgani, Bahareh Karimibavani, Mohammed Alamir, Amy P. McClain, Ramazan Asmatulu, Wichita State Univ. (USA) . . . [10171-31]

Conference End.

CONFERENCE 10163

Electroactive Polymer Actuators and Devices (EAPAD) XIX

Sessions 9A and 9B run concurrently.

SESSION 9A

**LOCATION: SALON E
WED 8:00 AM TO 10:00 AM**

Applications of EAP Actuators to Robotic Mechanisms I

Session Chairs: **Lenore Rasmussen**, Ras Labs., LLC (USA); **Jonathan M. Rossiter**, Univ. of Bristol (United Kingdom)

8:00 am: **Reliable, robust, electrically powered soft actuators that self-heal from mechanical and electrical damage** (*Invited Paper*), Christoph Keplinger, Univ. of Colorado Boulder (USA) [10163-55]

8:40 am: **Entirely soft dielectric elastomer robots**, E.-F. Markus Henke, Auckland Bioengineering Institute, The Univ. of Auckland (New Zealand) and Institut für Festkörperelektronik, TU Dresden (Germany); Katherine E. Wilson, Iain A. Anderson, Auckland Bioengineering Institute, The Univ. of Auckland (New Zealand) [10163-56]

SESSION 9B

**LOCATION: SALON D
WED 8:00 AM TO 10:00 AM**

Applications of EAP Actuators to Various Mechanisms II

Session Chairs: **Bert Müller**, Univ. Basel (Switzerland); **Gih-Keong Lau**, Nanyang Technological Univ. (Singapore)

8:00 am: **Artificial muscles for electrical energy harvesting** (*Invited Paper*), Seon Jeong Kim, Shi Hyeong Kim, Hanyang Univ. (Korea, Republic of); Ray H. Baughman, The Univ. of Texas at Dallas (USA) [10163-60]

8:40 am: **Adaptive gripper using multi-segmented dielectric elastomer with electroadhesion**, Jang Ho Park, Siara Hunt, Athul Radhakrishnan, Daewon Kim, Embry-Riddle Aeronautical Univ. (USA) [10163-61]

CONFERENCE 10164

Active and Passive Smart Structures and Integrated Systems XI

Sessions 10A and 10B run concurrently.

SESSION 10A

**LOCATION: SALON G + H
WED 8:00 AM TO 10:00 AM**

Energy Harvesting and Scavenging III: Applications

Session Chairs: **Wei-Hsin Liao**, The Chinese Univ. of Hong Kong (Hong Kong, China); **Yonas Tadesse**, The Univ. of Texas at Dallas (USA)

8:00 am: **Evaluation of human-scale motion energy harvesting for wearable electronics**, Bharat Kathpalia, Ilan Stern, David Tan, Alper Erturk, Georgia Institute of Technology (USA) [10164-52]

8:20 am: **Energy harvesting from mouse click of robot finger using piezoelectrics**, Youngsu Cha, Jin Hong, Jaemin Lee, Jung-Min Park, Keehoon Kim, Korea Institute of Science and Technology (Korea, Republic of) [10164-53]

8:40 am: **Design and test of a power-generated magnetorheological damper**, Xian-Xu Bai, Qi Zou, Li-Jun Qian, Hefei Univ. of Technology (China) [10164-54]

SESSION 10B

**LOCATION: SALON I
WED 8:40 AM TO 10:00 AM**

Magneto Rheological Systems I: Haptics

Session Chairs: **Seung-Bok Choi**, Inha Univ. (Korea, Republic of); **Nguyen Quoc Hung**, Industrial Univ. of Hochiminh City (Viet Nam)

8:40 am: **Development of haptic system for surgical robot**, Han-Gyeol Gang, Jiong Min Park, Kumoh National Institute of Technology (Korea, Republic of); Seung-Bok Choi, Inha Univ. (Korea, Republic of); Jung Woo Sohn, Kumoh National Institute of Technology (Korea, Republic of) [10164-58]

CONF. 10167

Nano-, Bio-, Info-Tech Sensors and 3D Systems

**SESSION 15
STARTS AT 9:10 AM**

See page 56.

CONFERENCE 10168

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

Sessions 10A and

SESSION 10A

**LOCATION: COLUMBIA
WED 8:00 AM TO 10:00 AM**

Monitoring Strategies for Bridges

Session Chairs: **Ying Huang**, North Dakota State Univ. (USA); **Jennifer A. Rice**, Univ. of Florida (USA)

8:00 am: **The Federal Highway Administration (FHWA) Long-Term Bridge Performance (LTBP) program products: from field SHM and NDT/NDE testing to well-established data driven deterioration models**, Hooman Parvardeh, Saeed Babanajad, Yun Bai, Rutgers, The State Univ. of New Jersey (USA); Robert Zobel, Federal Highway Administration Turner Fairbank Highway Research Ctr. (USA); David Masceri, Franklin Moon, Ali Maher, Rutgers, The State Univ. of New Jersey (USA) [10168-65]

8:20 am: **Utilization of wireless structural health monitoring systems as decision making tools for a risk assessment of a network of railroad bridges**, Katherine Flanigan, Rui Hou, Nephi R. Johnson, Jerome P. Lynch, Univ. of Michigan (USA); Mohammed M. Ettouney, Mohammed Ettouney LLC (USA); Sharada Alampalli, Prospect Solutions, LLC (USA); Andrew Zimmerman, Civionics, Inc. (USA) [10168-66]

8:40 am: **In-pavement fiber Bragg grating sensors for high-speed weigh-in-motion measurements**, Mu'ath Al-Tarawneh, Ying Huang, North Dakota State Univ. (USA) [10168-67]

CONFERENCE 10169

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

Sessions 12A, 12B and 12C run concurrently.

SESSION 12A

**LOCATION: EUGENE
WED 8:00 AM TO 11:50 AM**

**Ultrasonic/
Acoustic Emission
Technologies I**

Session Chairs: **Xiaoning Jiang**, North Carolina State Univ. (USA); **Didem Ozevin**, Univ. of Illinois at Chicago (USA)

8:00 am: **High temperature transducer using aluminum nitride single crystal for laser ultrasound detection**, Taeyang Kim, Jinwook Kim, Xiaoning Jiang, North Carolina State Univ. (USA) [10169-53]

8:20 am: **3D printed metamaterial design to focus wave energy in thin plates**, Minoo Kabor, Margaret Allen, Didem Ozevin, Univ. of Illinois at Chicago (USA) [10169-54]

8:40 am: **Development of a nonlinear ultrasonic NDE technique for detection of kissing bonds in composites**, Jonathan Alston, Advanced Composites Ctr. for Innovation and Science, Univ. of Bristol (United Kingdom); Anthony J. Croxford, Univ. of Bristol (United Kingdom) [10169-55]

SESSION 12B

**LOCATION: PORTLAND
WED 8:20 AM TO 10:20 AM**

**Modeling and
Simulation**

Session Chairs: **Piotr Omenzetter**, Univ. of Aberdeen (United Kingdom); **Oliver J. Myers**, Clemson Univ. (USA)

8:20 am: **Reliably detectable flaw size for NDE methods that use calibration**, Ajay M. Koshti, NASA Johnson Space Ctr. (USA) [10169-63]

8:40 am: **Foundation stiffness in the linear modeling of wind turbines**, Chih-Hung Chiang, Chaoyang Univ. of Technology (Taiwan); Chih-Peng Yu, National Chung Hsing Univ. (Taiwan); Yen-Hao Chen, Jiunnren Lai, Chaoyang Univ. of Technology (Taiwan) [10169-64]

9:00 am: **Research on public participant urban infrastructure safety protection system using smartphone**, Xuefeng Zhao, Niannian Wang, Dalian Univ. of Technology (China); Jinping Ou, Dalian Univ. of Technology (China) and Harbin Institute of Technology (China); Yan Yu, Mingchu Li, Dalian Univ. of Technology (China) [10169-65]

CONFERENCE 10170

Health Monitoring of Structural and Biological Systems XI

Sessions 10A and 10B run concurrently.

SESSION 10A

**LOCATION: SALON B + C
WED 8:00 AM TO 10:00 AM**

**Nonlinear
Techniques**

Session Chairs: **Wieslaw Jerzy Staszewski**, AGH Univ. of Science and Technology (Poland); **Zhongqing Su**, The Hong Kong Polytechnic Univ. (Hong Kong, China)

8:00 am: **Nonlinear ultrasonic assessment of fracture properties of asphalt mixtures**, Megan E. McGovern, Univ. of Illinois at Urbana-Champaign (USA); Behzad Behnia, Western New England Univ. (USA); William G. Buttler, Univ. of Missouri-Columbia (USA); Henrique L. Reis, Univ. of Illinois at Urbana-Champaign (USA) [10170-64]

8:20 am: **Early stage damages quantification in composites using nonlinear modulation technique**, Subir Patra, Sourav Banerjee, University of South Carolina (USA) [10170-65]

8:40 am: **A three-dimensional analytical model for interpreting contact acoustic nonlinearity generated by a breathing crack in plate**, Zhongqing Su, Kai Wang, The Hong Kong Polytechnic Univ. (Hong Kong, China) [10170-66]

SESSION 10B

**LOCATION: PEARL
WED 8:00 AM TO 10:00 AM**

**Modeling for
Metamaterial and
Guided Waves**

Session Chairs: **Wieslaw M. Ostachowicz**, The Szwalski Institute of Fluid-Flow Machinery (Poland); **Lingyu Yu**, Univ. of South Carolina (USA)

8:00 am: **Spectral element method implementation on GPU for Lamb wave simulation**, Pawel Kudela, Tomasz Wandowski, Maciej Radzienski, The Szwalski Institute of Fluid-Flow Machinery (Poland); Wieslaw M. Ostachowicz, The Szwalski Institute of Fluid-Flow Machinery (Poland) and Warsaw Univ. of Technology (Poland) [10170-70]

8:20 am: **On the assumption of transverse isotropy of a honeycomb sandwich panel for NDT applications**, Christoph Schaal, California State Univ., Northridge (USA) and Univ. of California, Los Angeles (USA); Steffen Tai, Ajit K. Mal, Univ. of California, Los Angeles (USA) [10170-71]

8:40 am: **Nonlinear dispersion effects in elastic plates: numerical modelling and validation**, Pawel Packo, Piotr Kijanka, Rafal Radecki, AGH Univ. of Science and Technology (Poland); Michael J. Leamy, Georgia Institute of Technology (USA); Tadeusz Uhl, Wieslaw J. Staszewski, AGH Univ. of Science and Technology (Poland) [10170-72]

CONF. 10172

A Tribute Conference Honoring Daniel Inman

**SESSION 1
STARTS AT 9:00 AM**

See page 57.

10B run concurrently.

SESSION 10B

**LOCATION: SALON F
WED 8:20 AM TO 10:00 AM**

**Energy Saving and
Harvesting Methods
for Sensors**

Session Chairs: **David Mascareñas**, Los Alamos National Lab. (USA); **Kenneth A. Cunefare**, Georgia Institute of Technology (USA)

8:20 am: **Effectiveness of compressed sensing and transmission in wireless sensor networks for structural health monitoring**, Takahiro Fujiwara, Haruki Uchiito, Tomoya Tokairin, Hiroyuki Kawai, Hakodate National College of Technology (Japan) [10168-100]

8:40 am: **Compact piezoelectric resonance mass balance for sample verification and mass quantification**, Stewart Sherrit, Hyeong Jae Lee, Gene B. Merewether, Christopher R. Yahnker, Jet Propulsion Lab. (USA) [10168-71]

CONFERENCE 10163

SESSION 9A AND 9B CONTINUED

Sessions 9A and 9B run concurrently.

9:00 am: **Fluid electrodes for submersible robotics based on dielectric elastomer actuators**, Caleb Christianson, Nathaniel Goldberg, Shengqiang Cai, Michael T. Tolley, Univ. of California, San Diego (USA) [10163-57]

9:20 am: **Actuating materials and fabrication strategies for soft robotics and wearable robotics**, Geoffrey M. Spinks, Univ. of Wollongong (Australia) . [10163-58]

9:40 am: **A soft flying robot driven by a dielectric elastomer actuator**, Yingxi Wang, National Univ. of Singapore (Singapore); Hui Zhang, Southeast Univ. (China); Hareesh Godaba, Boo Cheong Khoo, Jian Zhu, National Univ. of Singapore (Singapore) . [10163-59]

Coffee Break
Wed 10:00 am to 10:30 am

9:00 am: **Impedance control for electromechanical transducers based on dielectric elastomers**, Thorben Hoffstadt, Jürgen Maas, Ostwestfalen-Lippe Univ. of Applied Sciences (Germany) [10163-62]

9:20 am: **Design and motion control of bioinspired humanoid robot head: from servo motors toward artificial muscles**, Yara Almubarak, Mohsen Jafarzadeh, Yonas Tadesse, The Univ. of Texas at Dallas (USA) [10163-63]

9:40 am: **Integration of flexible high-voltage thin-film transistors to drive a matrix of dielectric elastomer actuators**, Alexis Murette, Samuel Rosset, Danick Briand, Herbert R. Shea, Ecole Polytechnique Fédérale de Lausanne (Switzerland) [10163-64]

Coffee Break
Wed 10:00 am to 10:30 am

CONFERENCE 10164

SESSION 10A AND 10B CONTINUED

Sessions 10A and 10B run concurrently.

9:00 am: **Optimization of voltage output of energy harvesters with continuous mechanical rotation extracted from human motion**, Evan Rashid, Armita Hamidi, Yonas Tadesse, The Univ. of Texas at Dallas (USA) [10164-55]

9:20 am: **Topology synthesis of planar ground structures for energy harvesting applications**, Francesco Danzi, Politecnico di Torino (Italy); James M. Gibert, Purdue Univ. (USA); Enrico Cestino, Giacomo Frulla, Politecnico di Torino (Italy) [10164-56]

9:40 am: **3D-printed lens for structure-borne wave focusing and energy harvesting**, Serife Tol, F. Levent Degertekin, Alper Erturk, Georgia Institute of Technology (USA) [10164-57]

Coffee Break
Wed 10:00 am to 10:30 am

9:00 am: **Design and simulation of a new bidirectional actuator for haptic systems featuring MR fluid**, Nguyen Quoc Hung, Vietnamese-German Univ. (Viet Nam); Diep Bao Tri, Ngoc Diep Nguyen, Ho Chi Minh Univ. of Industry (Viet Nam); Seung-Bok Choi, Inha Univ. (Korea, Republic of) [10164-59]

9:20 am: **Design and evaluation of a 2D haptic joystick featuring bidirectional magnetorheological actuator**, Quoc Hung Nguyen, Vietnamese-German Univ. (Viet Nam); Bao Tri Diep, Ngoc Diep Nguyen, Dai Hiep Le, Industrial Univ. of Hochiminh City (Viet Nam) [10164-60]

9:40 am: **Design and control of a 7-DOF slave robot integrated with a magneto-rheological haptic master**, Yong-Hoon Hwang, Seung-Bok Choi, Inha Univ. (Korea, Republic of) [10164-61]

Coffee Break
Wed 10:00 am to 10:30 am

CONFERENCE 10167

SESSION 15

**LOCATION:
SALON A
WED 9:10 AM TO 10:10 AM**

Graphene Nanostructure

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

9:10 am: **Photo-electronic current transport in back-gated graphene transistor**, Ashok Srivastava, Xinlu Chen, K. M. Mohsin, Louisiana State Univ. (USA) [10167-56]

9:30 am: **Graphene field effect transistor for generating on-chip thermoelectric power**, Yaser M. Banadaki, Southern Univ. and A&M College (USA); Hsuan-Chao Hou, Safura Sharifi, Louisiana State Univ. (USA) [10167-57]

9:50 am: **Phononic dispersion of graphene using atomistic-continuum model and spectrally formulated finite element method**, Sushovan Mukherjee, Srinivasan Gopalakrishnan, Indian Institute of Science (India) [10167-58]

Coffee Break
Wed 10:10 am to 10:40 am

CONFERENCE 10168

SESSION 10A AND 10B

Sessions 10A and 10B

9:00 am: **Investigating extreme event loading on coastal bridges using wireless sensor technology**, Douglas A. Gelineau, Jennifer A. Rice, Justin R. Davis, Univ. of Florida (USA) . . [10168-68]

9:20 am: **Smart photonic coating for civil engineering field: for a future inspection technology on concrete bridge**, Hiroshi Fudouzi, Koichi Tsuchiya, Shin-ichi Todoroki, National Institute for Materials Science (Japan); Tsuyoshi Hyakutake, Hiroyuki Nitta, Itaru Nishizaki, Public Works Research Institute (Japan); Yoshikazu Tanaka, Hiroshima Univ. (Japan); Takao Ohya, SHO-BOND Corp. (Japan) [10168-69]

9:40 am: **Simultaneous identification method of damage and vehicle parameters on bridges utilizing long-gauge strain influence line under moving vehicle loads**, Shizhi Chen, Gang Wu, Southeast Univ. (China); Bitao Wu, East China Jiaotong Univ. (China) . . [10168-70]

Coffee Break
Wed 10:00 am to 10:30 am

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CONFERENCE 10169

SESSION 12A AND 12B CONTINUED

Sessions 12A, 12B and 12C run concurrently.

9:00 am: **Energy harvesting from acoustic fields for self-powered sensors in pumped fluid systems**, Kenneth A. Cunefare, Ellen A. Skow, Alper Erturk, Georgia Institute of Technology (USA)[10168-72]

9:20 am: **Elastically suspended backpack energy harvester with nonlinear design to enhance efficiency and comfortability**, Mingyi Liu, Wei Che Tai, Lei Zuo, Virginia Polytechnic Institute and State Univ. (USA)[10168-73]

9:40 am: **The effects of damage accumulation in optimizing a piezoelectric energy harvester configuration**, Eric J. Kjolsing, ANATECH Corp. (USA); Michael Todd, Univ. of California, San Diego (USA)[10168-74]

Coffee Break
Wed 10:00 am to 10:30 am

9:00 am: **Tree root detection from ground surface vibration measurements**, Michal K. Kalkowski, Jennifer M. Muggleton, Emiliano Rustighi, Univ. of Southampton (United Kingdom) [10169-56]

9:20 am: **Prognostics of railway prestressed concrete sleeper damage using acoustic emission technology**, Sakdirat Kaewunruen, Mayorkinos Papaefias, The Univ. of Birmingham (United Kingdom); Ange-Therese Akono, Univ. of Illinois at Urbana-Champaign (USA)[10169-57]

9:40 am: **Ultrasonic waves in biaxially stressed multi-layered and 1D phononic structures**, Andriejus Demcenko, Univ. of Glasgow (United Kingdom); Arno W. F. Volker, TNO (Netherlands); Jonathan M. Cooper, Univ. of Glasgow (United Kingdom)[10169-58]

Coffee Break
Wed 10:00 am to 10:30 am

9:20 am: **Optimizing probability of detection point estimate demonstration**, Ajay M. Koshti, NASA Johnson Space Ctr. (USA) [10169-66]

9:40 am: **Crack detection flaw size parameter modeling for x-rays at grazing angle to crack faces**, Ajay M. Koshti, NASA Johnson Space Ctr. (USA) [10169-67]

10:00 am: **Smart structures: modeling, analysis, and control with different strategies**, Nader Ghareeb, Mohamed Gaith, Sayed Mohamad Soleimani, Australian College of Kuwait (Kuwait) [10169-69]

Coffee Break
Wed 10:20 am to 10:50 am

CONFERENCE 10170

SESSION 10A AND 10B CONTINUED

Sessions 10A and 10B run concurrently.

9:00 am: **Fatigue crack detection by nonlinear spectral correlation with a wideband input**, Peipei Liu, Hoon Sohn, KAIST (Korea, Republic of) [10170-67]

9:20 am: **Numerical investigation of nonlinear interactions between multimodal guided waves and delamination in composite structures**, Yanfeng Shen, Shanghai Jiao Tong Univ. (China) [10170-68]

9:40 am: **Analysis of debonding in single lap joints based on employment of ultrasounds**, Francesco Nicassio, Gennaro Scarselli, Univ. del Salento (Italy) [10170-69]

Coffee Break
Wed 10:00 am to 10:30 am

9:00 am: **Coupled electromechanical modeling of piezoelectric transducers for collimated beam generation**, Vamshi K. Chillara, Cristian Pantea, Dipen N. Sinha, Los Alamos National Lab. (USA) [10170-73]

9:20 am: **Tunability of phononic crystal through mechanical buckling and contact**, Ronghao Bao, Weiqiu Chen, Zhejiang Univ. (China) [10170-74]

9:40 am: **Wave propagation in periodic dielectric elastomer beam under finite deformation**, Weiqiu Chen, Zhejiang Univ. (China) [10170-75]

Coffee Break
Wed 10:00 am to 10:30 am

CONFERENCE 10172

SESSION 1

**LOCATION: MT HOOD
WED 9:00 AM TO 10:10 AM**

The Role of Humor in Academics

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

9:00 am: **Some recently obtained results in classical vibration and acoustics: coexistence of traveling and standing waves in a one-dimensional non-dispersive continuum** (*Invited Paper*), Larry A. Bergman, Univ. of Illinois at Urbana-Champaign (USA) [10172-1]

9:30 am: **Fractional order absolute vibration suppression (AVS) controllers**, Yoram Halevi, Technion-Israel Institute of Technology (Israel) [10172-2]

9:50 am: **Multifunctional smart composites with integrated carbon nanotube yarn and sheet**, Devika Chauhan, Guangfeng Hou, Vianessa Ng, Sumeet Chaudhary, Michael Paine, Nicholas Lalley, Massoud Rabiee, Marc M. Cahay, Vesselin N. Shanov, David B. Mast, Univ. of Cincinnati (USA); David S. Lashmore, The Univ. of New Hampshire (USA); Yijun Liu, Univ. of Cincinnati (USA); Sergey Yarmolenko, Svitlana Fialkova, North Carolina A&T State Univ. (USA); Zhangzhang Yin, Mark J. Schulz, Univ. of Cincinnati (USA) [10172-3]

Coffee Break
Wed 10:10 am to 10:40 am

CONFERENCE 10163

Sessions 10A and 10B run concurrently.

SESSION 10A

LOCATION: SALON E
WED 10:30 AM TO 11:50 AM

Applications of EAP Actuators to Various Mechanisms III

Session Chairs: **Holger Böse**, Fraunhofer-Institut für Siliciumforschung ISC (Germany); **E.-F. Markus Henke**, The Univ. of Auckland (New Zealand)

10:30 am: **Energy analysis of a DEAP-based cylindrical actuator coupled with a radial negative stiffness spring**, Jonathan Chavanne, Yoan Civet, Yves Perriard, Ecole Polytechnique Fédérale de Lausanne (Switzerland) [10163-65]

10:50 am: **Development of a soft untethered robot using artificial muscle actuators**, Jiawei Cao, Lei Qin, Heow Pueh Lee, Jian Zhu, National Univ. of Singapore (Singapore) [10163-66]

11:10 am: **Electrically tunable window based on unfolding of wrinkled ZnO/Ag thin film**, Milan Shrestha, Rosmin E. Mohan, Anansa S. Ahmed, Anand K. Asundi, Gih-Keong Lau, Nanyang Technological Univ. (Singapore) [10163-67]

11:30 am: **Dielectric elastomer grippers using tensioned arch flexures**, Kim-Rui Heng, Anansa S. Ahmed, Gih-Keong Lau, Nanyang Technological Univ. (Singapore) [10163-68]

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

SESSION 10B

LOCATION: SALON D
WED 10:30 AM TO 11:50 AM

Applications of EAP Actuators to Various Mechanisms IV

Session Chairs: **Liwu Liu**, Harbin Institute of Technology (China); **Jian Zhu**, National Univ. of Singapore (Singapore)

10:30 am: **From elastomeric flight muscles to tunable window** (*Invited Paper*), Gih-Keong Lau, Yao-Wei Chin, Kim-Rui Heng, Anansa S. Ahmed, Milan Shrestha, Nanyang Technological Univ. (Singapore) [10163-69]

11:10 am: **Hydrogels for engineering: normalization of swelling due to arbitrary stimulus**, Adrian Ehrenhofer, Thomas Wallmersperger, TU Dresden (Germany) [10163-71]

11:30 am: **Exploring dielectric elastomers as actuators for hand tremor suppression**, Christopher R. Kelley, Jeffrey L. Kauffman, Univ. of Central Florida (USA) . [10163-70]

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

CONFERENCE 10164

Sessions 11A and 11B run concurrently.

SESSION 11A

LOCATION: SALON G + H
WED 10:30 AM TO 12:10 PM

Energy Harvesting and Scavenging IV: General

Session Chair: **Byeng D. Youn**, Seoul National Univ. (Korea, Republic of)

10:30 am: **Metamaterial-based energy harvester design: prevention of wave cancellation**, Yong Chang Shin, Soo-Ho Jo, Heonjun Yoon, Byeng D. Youn, Seoul National Univ. (Korea, Republic of); Miso Kim, Choon-Su Park, Wonjae Choi, Korea Research Institute of Standards and Science (Korea, Republic of) [10164-62]

10:50 am: **Adaptive piezoelectric metamaterial for wave attenuation and energy harvesting**, Jiawen Xu, Shilong Li, Jiong Tang, Univ. of Connecticut (USA) [10164-63]

11:10 am: **Experimental demonstration of metamaterial-based elastic energy focusing and harvesting**, Miso Kim, Choon-Su Park, Wonjae Choi, Korea Research Institute of Standards and Science (Korea, Republic of); Yong Chang Shin, Soo-Ho Jo, Heonjun Yoon, Byeng D. Youn, Seoul National Univ. (Korea, Republic of) [10164-64]

11:30 am: **Wind energy harvesting with Halbach array**, Kevin Wang, Ya S. Wang, Stony Brook Univ. (USA) [10164-65]

11:50 am: **Luneburg lens for omnidirectional structure-borne wave focusing and energy harvesting**, Serife Tol, F. Levent Degertekin, Alper Erturk, Georgia Institute of Technology (USA) [10164-66]

Lunch Break Wed 12:10 to 1:20 pm

SESSION 11B

LOCATION: SALON I
WED 10:30 AM TO 12:10 PM

Passive and Active Vibration Isolation Systems III: Piezoelectric

Session Chairs: **Jiong Tang**, Univ. of Connecticut (USA); **Jeffrey L. Kauffman**, Univ. of Central Florida (USA)

10:30 am: **A continuous switching model for piezoelectric state switching methods**, Garrett K. Lopp, Jeffrey L. Kauffman, Univ. of Central Florida (USA) . . [10164-68]

10:50 am: **Metamaterial-inspired piezoelectric system with dual functionalities: energy harvesting and vibration suppression**, Guobiao Hu, Lihua Tang, Raj Das, The Univ. of Auckland (New Zealand) [10164-67]

11:10 am: **Automobile brake squeal noise suppression by piezoelectric-based dither control**, Jaehan Park, Jeongha Song, Gyuhae Park, Chonnam National Univ. (Korea, Republic of); Taeho Jung, Jeongkyu Kim, Hyundai Motor Co. (Korea, Republic of) [10164-69]

11:30 am: **Multi-objective optimization of piezoelectric circuitry network for mode delocalization and vibration suppression of bladed disk**, Jiong Tang, David Yoo, Univ. of Connecticut (USA) [10164-70]

11:50 am: **Enhanced synchronized switch damping control to cancel out the beating phenomenon**, Gabriele Cazzulani, Marco Costantini, Francesco Braghin, Politecnico di Milano (Italy) [10164-71]

Lunch Break Wed 12:10 to 1:40 pm

CONFERENCE 10167

SESSION 16

LOCATION: SALON A
WED 10:40 AM TO 12:20 PM

Fabrication and Characterization of Nanosensors and Structures II

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

10:40 am: **Mechanical property characterization of cellulose nanofiber by atomic force microscopy**, Lindong Zhai, Jeong-Woong Kim, Sangho Song, Jaehwan Kim, Inha Univ. (Korea, Republic of) [10167-59]

11:00 am: **Elastic wave propagation in in-homogenous peridynamic bar**, Venkata Mutnuri, Srinivasan Gopalakrishnan, Indian Institute of Science (India) [10167-60]

11:20 am: **Band structure computation of polygonal solid-solid phononic crystal with features using frequency domain spectral superelement method**, Sushovan Mukherjee, Srinivasan Gopalakrishnan, Indian Institute of Science (India) [10167-61]

11:40 am: **A numerical model for the prediction of the electrical conductivity of nanofilled polymeric matrices**, Monica Ciminello, Antonio Concilio, Salvatore Ameduri, Ctr. Italiano Ricerche Aerospaziali (Italy) [10167-62]

12:00 pm: **Nanomechanics of carbon nanotubes**, Mouli Ramasamy, Vijay Varadan, The Pennsylvania State University (USA) [10167-63]

Conference End.

CONFERENCE 10168

Sessions 11A and

SESSION 11A

LOCATION: COLUMBIA
WED 10:30 AM TO 12:10 PM

Ultrasonic Methods

Session Chairs: **Jerome P. Lynch**, Univ. of Michigan (USA); **Steven Anton**, Tennessee Technological Univ. (USA)

10:30 am: **Impedance-based structural health monitoring of additive manufactured structures with embedded piezoelectric wafer**, Austin Scheyer, Steven Anton, Tennessee Technological Univ. (USA) [10168-75]

10:50 am: **Damage imaging of an isotropic plate using matching pursuit algorithm**, Ho-Wuk Kim, Fuh-Gwo Yuan, North Carolina State Univ. (USA) [10168-76]

11:10 am: **Ultrasonic array investigation of titanium rod integrated in bone**, Jerome P. Lynch, Wentao Wang, Univ of Michigan (USA) [10168-77]

11:30 am: **Sensor network performance and reliability evaluation algorithms**, Durai Arun, CSIR-National Aerospace Labs. (India) and Visvesvaraya Technological Univ. (India); Sathyanarayana C. N., Raja S., Parthasarathi Naidu V., CSIR-National Aerospace Labs. (India) [10168-78]

11:50 am: **Optical air-coupled NDT system with ultra-broad frequency bandwidth**, Balthasar Fischer, Wolfgang Rohringer, Thomas Heine, XARION Laser Acoustics GmbH (Austria) [10168-138]

Lunch Break Wed 12:10 to 1:20 pm

CONFERENCE 10169

Sessions 12A, and 12C run concurrently.

SESSION 11B

**LOCATION: SALON F
WED 10:30 AM TO 12:10 PM**

Control of Large-scale Structures

Session Chairs: **Hiroshi Asanuma**, Chiba Univ. (Japan); **Sung Han Sim**, Ulsan National Institute of Science and Technology (Korea, Republic of)

10:30 am: **Development of smart wave mitigation structure using array of poles**, Hiroshi Asanuma, Chiba Univ. (Japan). . . . [10168-79]

10:50 am: **Adaptive vibration control of structures under earthquakes**, Jiann-Shiun Lew, Tennessee State Univ. (USA); Chin-Hsiung Loh, National Taiwan Univ. (Taiwan); Jer-Nan Juang, National Cheng-Kung University (Taiwan). . . . [10168-80]

11:10 am: **A new self-powered electromagnetic damper for structural vibration control**, Maziar Jamshidi, Hong Kong Univ. of Science and Technology (Hong Kong, China) and Sharif Univ. of Technology (Iran, Islamic Republic of); Chih Chen Chang, Hong Kong Univ. of Science and Technology (Hong Kong, China) . . . [10168-81]

11:30 am: **Integrated cable vibration control system using wireless sensors**, Seunghoo Jeong, Sung Han Sim, Ulsan National Institute of Science and Technology (Korea, Republic of); Soo Jin Cho, The Univ. of Seoul (Korea, Republic of) . . . [10168-82]

11:50 am: **Characteristics of spaceborne cooler vibration isolator using a pseudoelastic shape memory alloy**, Seong-Cheol Kwon, Su-Eun Jang, Hyun-Ung Oh, Chosun Univ. (Korea, Republic of). . . . [10168-83]

Lunch Break Wed 12:10 to 1:40 pm

SESSION 12A CONTINUED

10:30 am: **Finite element simulation of ultrasonic waves in corroded reinforced concrete for early-stage corrosion detection**, Qixiang Tang, Tzu-Yang Yu, Univ. of Massachusetts Lowell (USA). . . . [10169-59]

10:50 am: **Development of an ultrasonic nondestructive inspection method for impact damage detection in composite aircraft structures**, Margherita Capriotti, Hyung Kim, Francesco Lanza di Scalea, Hyonny Kim, Univ. of California, San Diego (USA). . . . [10169-60]

11:10 am: **Nondestructive evaluation of defects in carbon fiber reinforced polymer (CFRP) composites**, Andrew C. Y. Ngo, Henry K. H. Goh, Karen K. Lin, Institute of Materials Research and Engineering (IMRE) (Singapore) . . . [10169-61]

11:30 am: **Nondestructive evaluation of pipes with dent using ultrasonic guided waves**, Prabhakaran Manogharan, Satheesh Jeyaraman, Sivaramanivas Ramaswamy, General Electric Co. (India). . . . [10169-62]

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

SESSION 12C

**LOCATION: PORTLAND
WED 10:50 AM TO 12:10 PM**

Piezoelectric Sensing Technologies

Session Chairs: **Lingyu Yu**, Univ. of South Carolina (USA); **Yu-Min Su**, National Kaohsiung Univ. of Applied Sciences (Taiwan)

10:50 am: **Excitation and reception of non-dispersive guided waves using face-shear d24 mode piezoelectric transducers**, Hongchen Miao, Peking Univ. (China) . . . [10169-70]

11:10 am: **Laser-based piezoelectric structural health monitoring system for remote l-beam crack detection**, Chen Zhang, Haifeng Zhang, Univ. of North Texas (USA) . . . [10169-71]

11:30 am: **Sensing capabilities of piezoelectric wafer active sensors in extreme nuclear environment**, Mohammad Faisal Haider, Bin Lin, Lingyu Yu, Victor Giurgiutiu, Univ. of South Carolina (USA) . . . [10169-72]

11:50 am: **Damage size and depth estimation using laser scanning and wavenumber based signal processing**, DuHwan Kim, Jun Young Jeon, Chonnam National Univ. (Korea, Republic of); Eric B. Flynn, Los Alamos National Lab. (USA); Gyuhae Park, Chonnam National Univ. (Korea, Republic of) . . . [10169-73]

Lunch Break Wed 12:10 to 1:40 pm

CONFERENCE 10170

Sessions 11A and 11B run concurrently.

SESSION 11A

**LOCATION: SALON B + C
WED 10:30 AM TO 11:50 AM**

Acoustic Emission

Session Chairs: **Victor Giurgiutiu**, Univ. of South Carolina (USA); **Sridhar Krishnaswamy**, Northwestern Univ. (USA)

10:30 am: **Reflective SOA-based fiber Bragg grating ultrasonic sensing system with two wave mixing interferometric demodulation**, Heming Wei, Sridhar Krishnaswamy, Northwestern Univ. (USA)[10170-76]

10:50 am: **Continuum development of acoustic emission source modelling of cracks**, Roshan Joseph, Md. Yeasin Bhuiyan, Victor Giurgiutiu, Univ. of South Carolina (USA) . . . [10170-77]

11:10 am: **Probabilistic location estimation of acoustic emission sources in isotropic plates with one sensor**, Arvin Ebrahimkhanlou, Salvatore Salamone, The Univ. of Texas at Austin (USA) . . [10170-78]

11:30 am: **Physics of materials based understanding of acoustic emission waveforms from fatigue cracks**, Md. Yeasin Bhuiyan, Jingjing Bao, Banibrata Poddar, Victor Giurgiutiu, Univ. of South Carolina (USA) . . . [10170-79]

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

SESSION 11B

**LOCATION: PEARL
WED 10:30 AM TO 11:50 AM**

Guided Waves III: Advanced Material Monitoring

Session Chairs: **Hoon Sohn**, KAIST (Korea, Republic of); **Niranjan Desai**, Purdue Univ. Northwest (USA)

10:30 am: **High frequency guided wave propagation in monocrystalline silicon wafers**, Marco Pizzolato, Bernard Masserey, Jean-Luc Robyr, Haute Ecole Spécialisée de Suisse Occidentale (Switzerland); Paul Fromme, Univ. College London (United Kingdom). . . . [10170-80]

10:50 am: **Studying the effects of delamination on wave propagation behavior in integrated circuit packages and defect detection using guided waves**, Javadi Ikram, Rajesh Kumar Neerukatti, Intel Corp. (USA); Aditi Chattopadhyay, Arizona State Univ. (USA) . . . [10170-81]

11:10 am: **Combined vibration- and guided wave-based approach for composite panels health assessment**, Maciej Radzienski, Pawel Kudela, The Szwalski Institute of Fluid-Flow Machinery (Poland); Maosen Cao, Hohai Univ. (China); Wieslaw M. Ostachowicz, The Szwalski Institute of Fluid-Flow Machinery (Poland) and Warsaw Univ. of Technology (Poland) . . [10170-82]

11:30 am: **Numerical modeling of the load effect on PZT-induced guided wave for load compensation of damage detection**, Hu Sun, Yishou Wang, Xinlin Qing, Xiamen Univ. (China). . . . [10170-83]

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

CONFERENCE 10172

SESSION 2

**LOCATION: MT HOOD
WED 10:40 AM TO 12:00 PM**

How to Climb the Academic Career Ladder: Three Universities

Session Chair: **Ya S. Wang**, Stony Brook Univ. (USA)

10:40 am: **Electromechanical impedance-based fault detection in a rotating machine by using an operating condition compensation approach**, Karina M. Tsuruta, Diogo S. Rabelo, Aldemir Ap Cavalini Jr., Roberto M. Finzi, Valder Steffen Jr., Univ. Federal de Uberlândia (Brazil) . . . [10172-4]

11:00 am: **Feedback control design based on spectral element method**, Sanderson M. Conceição, Douglas D. Bueno, Vicente Lopes Jr., Univ. Estadual Paulista "Júlio de Mesquita Filho" (Brazil) . . . [10172-5]

11:20 am: **Design and experimental verification of a semi-active pitch link for helicopter vibration attenuation**, Marcel A. Clementino, Carlos De Marqui Jr., Univ. de São Paulo (Brazil) . . . [10172-6]

11:40 am: **Impedance-based structural health monitoring**, Gyuhae Park, Chonnam National Univ. (Korea, Republic of); Daniel J. Inman Sr., Univ. of Michigan (USA) . . . [10172-7]

Lunch Break Wed 12:00 to 1:10 pm

CONFERENCE 10163

Sessions 11A and 11B run concurrently.

SESSION 11A

**LOCATION: SALON E
WED 1:20 PM TO 3:00 PM**

Use of EAP in the Form of Fibers and Textile

Session Chairs: **Tiefeng Li**, Zhejiang Univ. (China); **Richard J. Spontak**, North Carolina State Univ. (USA)

1:20 pm: **Bottlebrush elastomers: a promising molecular engineering route to tunable, prestrain-free dielectric elastomers** (*Invited Paper*), Mohammad Vatanikhah-Varnosfaderani, William F. M. Daniel Jr., Alexandr P. Zhushma, Qiaoxi Li, Benjamin J. Morgan, The Univ. of North Carolina at Chapel Hill (USA); Krzysztof Matyjaszewski, Carnegie Mellon Univ. (USA); Daniel P. Armstrong, North Carolina State Univ. (USA); Andrey V. Dobrynin, The Univ. of Akron (USA); Sergei S. Sheyko, The Univ. of North Carolina at Chapel Hill (USA); Richard J. Spontak, North Carolina State Univ. (USA) [10163-72]

1:40 pm: **Deformation behavior of carbon-fiber reinforced shape-memory-polymer composites used for deployable structures**, Xin Lan, Liwu Liu, Fengfeng Li, Chengtong Pan, Yanju Liu, Jinsong Leng, Harbin Institute of Technology (China) [10163-73]

2:00 pm: **A novel sheet actuator using plasticized PVC gel and flexible electrodes**, Yi Li, Minoru Hashimoto, Shinshu Univ. (Japan) [10163-74]

2:20 pm: **Film stretching influence on lifetime of DEAP system**, Alessandro Iannarelli, Mohamad G. Niasar, Technische Univ. Delft (Netherlands) [10163-75]

2:40 pm: **Development of novel textile and yarn actuators using plasticized PVC gel**, Ayumi Furuse, Minoru Hashimoto, Shinshu Univ. (Japan) [10163-76]

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

SESSION 11B

**LOCATION: SALON D
WED 1:20 PM TO 3:00 PM**

EAP Based on Dielectric Elastomers II

Session Chairs: **Rocco Vertechy**, Univ. degli Studi di Bologna (Italy); **Kam K. Leang**, The Univ. of Utah (USA)

1:20 pm: **Electrical breakdown phenomena of dielectric elastomers** (*Invited Paper*), Ramona Mateiu, Liyun Yu, Anne L. Skov, Technical Univ. of Denmark (Denmark) [10163-77]

2:00 pm: **Viscoelastic performance of dielectric elastomer subject to different voltage stimulation**, Junjie Sheng, China Academy of Engineering Physics (China); Bo Li, Hualing Chen, Xi'an Jiaotong Univ. (China); Lei Liu, Xi'an Jiaotong Univ. (China); Yuqing Zhang, China Academy of Engineering Physics (China) [10163-78]

2:20 pm: **Continuous vibration analysis of dielectric elastomer membranes**, Sophie Nalbach, ZeMa GmbH (Germany); Gianluca Rizzello, Stefan S. Seelecke, Univ. des Saarlandes (Germany) [10163-79]

2:40 pm: **Breakdown detection system for dielectric elastomer actuators**, Michele Ghilardi, James J. C. Busfield, Queen Mary, Univ. of London (United Kingdom) and Materials Research Institute, Queen Mary, Univ. of London (United Kingdom); Federico Carpi, Univ. degli Studi di Firenze (Italy) [10163-80]

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

CONFERENCE 10164

Sessions 12A and 12B run concurrently.

SESSION 12A

**LOCATION: SALON G + H
WED 1:20 PM TO 3:00 PM**

Passive and Active Vibration Isolation Systems IV

Session Chairs: **Faramarz Gordaninejad**, Univ. of Nevada, Reno (USA); **Daewon Kim**, Embry-Riddle Aeronautical Univ. (USA)

1:20 pm: **MR fluid filled spring for vibration control**, Stanislaw Sikulski, Daewon Kim, Embry-Riddle Aeronautical Univ. (USA) [10164-72]

1:40 pm: **The role of vibration absorbers in chiral lattice metastructures**, Brittany C. Essink, Daniel J. Inman, Univ. of Michigan (USA) [10164-73]

2:00 pm: **Measured performance of a semi-active tuned mass damper with acceleration feedback**, Marcin Maslanka, AGH Univ. of Science and Technology (Poland) [10164-74]

2:20 pm: **A fail-safe liquid spring-controllable magnetorheological damper system for three-dimensional earthquake isolation system**, Sevki Cesmecci, Faramarz Gordaninejad, Keri Ryan, Walaa Eltahawy, Univ. of Nevada, Reno (USA) [10164-75]

2:40 pm: **An adaptive magnetorheological elastomer bridge bearing**, Siddaiah Yarra, Majid Behrooz, David Mar, Nathan Pinuelas, Blake Muzinich, Gokhan Pekcan, Ahmad M. Itani, Nelson G. Publicover, Faramarz Gordaninejad, Univ. of Nevada, Reno (USA) [10164-76]

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

SESSION 12B

**LOCATION: SALON I
WED 1:40 PM TO 3:00 PM**

Modeling, Optimization, Signal Processing, Control, and Design of Integrated Systems I

Session Chair: **Suyi Li**, Clemson Univ. (USA)

1:40 pm: **Bistability and variable stiffness of cellular solids designed based on origami patterns**, Sattam Sengupta, Suyi Li, Clemson Univ. (USA) [10164-77]

2:00 pm: **Optimization design of an adaptive CFRC reflector for high order wave-front error control**, Lan Lan, Houfei Fang, Ke Wu, Shui-Dong Jiang, Yang Zhou, Shanghai YS Information Technology Co., Ltd. (China) [10164-78]

2:20 pm: **Design of a 3D printed lightweight orthotic device based on TCP muscle: iGrab hand orthosis**, Lokesh Kumar Saharan, Monica Jung de Andrade, The Univ. of Texas at Dallas (USA); Tiffany Jefferson, Lynntech (USA); Ray H. Baughman, Yonas Tadesse, The Univ. of Texas at Dallas (USA) [10164-79]

2:40 pm: **Active control of tail fin for power regulation on a wind turbine of low power**, Lenin Molina-Muñoz, Univ. del Istmo (Mexico); Josué Enriquez-Zárate, RTO Energy (Mexico); Orlando Lastres-Danguillecourt, Univ. de Ciencias y Artes de Chiapas (Mexico); R. Dorrego-Portela, Univ. del Istmo (Mexico) [10164-80]

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

CONFERENCE 10168

Sessions 12A and 12B run concurrently.

SESSION 12A

**LOCATION: COLUMBIA
WED 1:20 PM TO 3:00 PM**

Health Assessment of Metallic Structures

Session Chairs: **R. Andrew Swartz**, Michigan Technological Univ. (USA); **Salvatore Salamone**, The Univ. of Texas at Austin (USA)

1:20 pm: **Operational modal analysis of a steel-frame, low-rise building with L-shaped construction**, Rodrigo Sarlo, Pablo A. Tarazaga, Mary E. Kasarda, Virginia Polytechnic Institute and State Univ. (USA) [10168-84]

1:40 pm: **Sparse reconstruction localization of multiple acoustic emissions in large diameter pipelines**, Brennan Dubuc, Arvin Ebrahimkhanlou, Salvatore Salamone, The Univ. of Texas at Austin (USA) [10168-85]

2:00 pm: **Application of cross-correlation of scattered wave-field in stiffened aluminum panel**, YuSheng Chang, National Institute of Aerospace (USA) and North Carolina State Univ. (USA) [10168-86]

2:20 pm: **Detection and assessment of surface cracking in steel pipes based on vibration data using a multi-class support vector machine-recursive feature elimination**, Samir Mustapha, American Univ. of Beirut (Lebanon); Ali Braytee, Univ. of Technology, Sydney (Australia); Lin Ye, The Univ. of Sydney (Australia) [10168-87]

2:40 pm: **Detection and assessment of flaws in friction stir welded metallic plates**, Mohammad Ali Fakhri, Samir Mustapha, Jaafar Tarraf, American Univ. of Beirut (Lebanon); Georges Ayoub, Univ. of Michigan-Dearborn (USA); Ramsey Hamade, American Univ. of Beirut (Lebanon) [10168-88]

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

SESSION 12B

**LOCATION: SALON F
WED 1:40 PM TO 4:50 PM**

Novel Sensing Technologies IV

Session Chairs: **Seunghee Park**, Sungkyunkwan Univ. (Korea, Republic of); **Chih Chen Chang**, Hong Kong Univ. of Science and Technology (Hong Kong, China)

1:40 pm: **Sensing and modeling of urban pollution and exposure**, Masoud Ghandehari, New York Univ. (USA) [10168-89]

2:00 pm: **Structural health monitoring using a hybrid network of self-powered accelerometer and strain sensors**, Amir H. Alavi, Hassene Hasni, Pengcheng Jiao, Nizar Lajnef, Michigan State Univ. (USA) [10168-90]

2:20 pm: **Simulation and experimental study on tensile force measurement of PS tendons using an embedded EM sensor**, Byoungjoon Yu, Jinkyong Kim, Seunghee Park, Sungkyunkwan Univ. (Korea, Republic of) [10168-91]

2:40 pm: **Tunable mechanical monolithic sensors for real-time broadband distributed monitoring of large civil and industrial infrastructures**, Fabrizio Barone, Gerardo Giordano, Univ. degli Studi di Salerno (Italy) [10168-92]

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

CONFERENCE 10169

Sessions 13A and 13B run concurrently.

SESSION 13A

**LOCATION: EUGENE
WED 1:20 PM TO 3:00 PM**

**Ultrasonic/
Acoustic Emission
Technologies II**

Session Chairs: **Didem Ozevin**, Univ. of Illinois at Chicago (USA); **Xiaoning Jiang**, North Carolina State Univ. (USA)

1:20 pm: **The evaluation of ordinary Portland cement concrete subject to elevated temperatures in conjunction with acoustic emission and splitting tensile test**, Yu-Min Su, National Kaohsiung Univ. of Applied Sciences (Taiwan); Tsung-Chin Hou, National Cheng Kung Univ. (Taiwan); Ping-Ni Hou, Guan-Ying Chen, National Kaohsiung Univ. of Applied Sciences (Taiwan). [10169-74]

1:40 pm: **Ultrasonic velocity testing of steel pipeline welded joints**, Hector G. Carreon, Univ. Michoacana de San Nicolás de Hidalgo (Mexico). [10169-75]

2:00 pm: **Pressure-tension test for assessing fatigue in concrete**, Sayed Mohamad Soleimani, Australian College of Kuwait (Kuwait); Andrew J. Boyd, Andrew Komar, McGill Univ. (Canada) [10169-76]

2:20 pm: **2D numerical model for analysis of possible second-order interactions of ultrasonic waves with a presence of fluid and solid interface**, Andriėjus Demcenko, Univ. of Glasgow (United Kingdom); Michael Mazilu, Univ. of St. Andrews (United Kingdom); Rab Wilson, Jonathan M. Cooper, Univ. of Glasgow (United Kingdom). [10169-77]

2:40 pm: **Electrical resonance eddy current sensor for submillimeter defect detection**, Yew Li Hor, A*STAR Institute of High Performance Computing (Singapore) [10169-78]

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

SESSION 13B

**LOCATION: PORTLAND
WED 1:40 PM TO 3:00 PM**

**Other Sensing
Technologies**

Session Chairs: **Yu-Min Su**, National Kaohsiung Univ. of Applied Sciences (Taiwan); **Lingyu Yu**, Univ. of South Carolina (USA)

1:40 pm: **Measurement of mechanical properties of metallic glass at elevated temperature using sonic resonance method**, Suresh Kaluvan, Haifeng Zhang, Sanghita Mridha, Sundeeep Mukherjee, Univ. of North Texas (USA) . . . [10169-79]

2:00 pm: **The effect of prestresses on guided wave propagation in plates**, Kranthi P. Peddetti, Villanova Univ. (USA) and FLSmidth & Co. A/S (Denmark); Sridhar Santhanam, Villanova Univ. (USA). [10169-80]

2:20 pm: **Embedded FBG sensor configuration for space environment hazard exposure monitoring of CFRP composites**, Yurim Park, Hyunseok Kwon, Pratik Shrestha, Chun-Gon Kim, KAIST (Korea, Republic of) . . . [10169-81]

2:40 pm: **Approximating the coefficient of thermal expansion of concrete using time periods of uniform thermal gradient**, Jack Reilly, Hiba Abdel-Jaber, Princeton Univ. (USA); Matthew Yarnold, Tennessee Technological Univ. (USA); Branko Glisic, Princeton Univ. (USA) [10169-82]

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

CONFERENCE 10170

Sessions 12A and 12B run concurrently.

SESSION 12A

**LOCATION: SALON B + C
WED 1:40 PM TO 3:00 PM**

**Civil Infrastructure
I: Measurement
Optimization and
Application**

Session Chairs: **Henrique L. Reis**, Univ. of Illinois at Urbana-Champaign (USA); **Ajay M. Koshti**, NASA Johnson Space Ctr. (USA)

1:40 pm: **Using prospect theory to develop a decision support system for a bridge under continuous monitoring**, Denise Bolognani, Princeton Univ. (USA); Claudia Squazzardo, Carlo Cappello, Univ. degli Studi di Trento (Italy); Branko Glisic, Princeton Univ. (USA); Daniele Zonta, Univ. of Strathclyde (United Kingdom). [10170-84]

2:00 pm: **A multi-objective evolutionary optimization approach to identifying structural damage under uncertainty**, Pei Cao, David Yoo, Jiong Tang, Univ. of Connecticut (USA). [10170-85]

2:20 pm: **Monitoring strength development in cementitious material using embedded piezo-transducers**, Arun Narayanan, Amarteja Kocherla, Kolluru V. L. Subramaniam, Indian Institute of Technology Hyderabad (India). [10170-87]

2:40 pm: **Mapping and modeling of urban thermal radiation**, Masoud Ghandehari, New York Univ. (USA) [10170-88]

Coffee Break. Wed 3:00 to 3:20 pm

SESSION 12B

**LOCATION: PEARL
WED 1:20 PM TO 3:00 PM**

**Optical and
Thermal
Techniques for
Civil Infrastructure
Monitoring**

Session Chairs: **Christopher Niezrecki**, Univ. of Massachusetts Lowell (USA); **Zhu Mao**, Univ. of Massachusetts Lowell (USA)

1:20 pm: **Application of the normalized curvature ratio to an in-service structure**, Kaitlyn S. Kliever, Branko Glisic, Princeton Univ. (USA) [10170-89]

1:40 pm: **Effect of out-of-plane specimen movement on the accuracy of the smallest specimen strain measurable using the digital image correlation technique**, Joel R. Poling, Niranjana Desai, Purdue Univ. Northwest (USA) . [10170-90]

2:00 pm: **Uncertainty quantification of phase-based motion estimation on noisy sequence of images**, Aral Sarrafi, Zhu Mao, Univ. of Massachusetts Lowell (USA) [10170-91]

2:20 pm: **Comparison of optimal sensor placement techniques for damage detection on a highway bridge**, Edward Eskew, Shinae Jang, Univ. of Connecticut (USA). [10170-92]

2:40 pm: **Study on evaluation of corrosion condition of reinforcing bar embedded concrete using infrared thermal imaging camera**, Watanabe Ruiko, Hosei Univ. (Japan). . . . [10170-93]

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

CONFERENCE 10172

SESSION 3

**LOCATION: MT HOOD
WED 1:10 PM TO 2:50 PM**

**How Many Books is
Too Many?**

Session Chair: **Steven Anton**, Tennessee Technological Univ. (USA)

1:10 pm: **Dynamics of smart structures: from energy harvesting to metamaterials**, Alper Erturk, Georgia Institute of Technology (USA). [10172-8]

1:30 pm: **Integrated fiber optic structural health sensors for inflatable space habitats**, Osgar John Ohanian III, Naman Garg, Matt Castellucci, Luna Innovations Inc. (USA) [10172-9]

1:50 pm: **Piezoelectric energy harvesters for powering leadless pacemakers**, Mohammad Hossein Ansari, M. Amin Karami, Univ. at Buffalo (USA) [10172-10]

2:10 pm: **Optical properties of NKN nanowire synthesized by controlled pulsed laser deposition**, Mariya Boryszenko, Ya S. Wang, Stony Brook Univ. (USA); Wenrui Zhang, Mingzhao Liu, Brookhaven National Lab. (USA). [10172-11]

2:30 pm: **Recent developments on SMA actuators: understanding failure and fatigue**, Robert W. Wheeler III, Francis Phillips, Dimitris Lagoudas, Texas A&M Univ (USA). [10172-12]

Coffee Break. Wed 2:50 to 3:20 pm

CONFERENCE 10163

Sessions 12A and 12B run concurrently.

SESSION 12A

**LOCATION: SALON E
WED 3:30 PM TO 5:50 PM**

Applications of EAP Actuators to Various Mechanisms V

Session Chairs: **Jinsong Leng**, Harbin Institute of Technology (China); **Seyed Mohammad Mirvakili**, Massachusetts Institute of Technology (USA)

3:30 pm: **New approach to improve the energy density of hybrid electrodielectric elastomer generators**, Clara Lagomarsini, Univ. Grenoble Alpes (France); Claire Jean-Mistral, Institut National des Sciences Appliquées de Lyon (France); Stéphane Monfray, STMicroelectronics (France); Alain Sylvestre, G2Elab (France) [10163-81]

3:50 pm: **A dielectric elastomer-based tactile display for multiple fingertip interaction with virtual soft bodies**, Hugh Boys, Gabriele Frediani, Stefan Poslad, James Busfield, Queen Mary, Univ. of London (United Kingdom); Federico Carpi, Univ. degli Studi di Firenze (Italy)[10163-82]

4:10 pm: **Use of a thermoplastic elastomer gel with shape memory behavior as a bimorphic dielectric elastomer**, Daniel P. Armstrong, Richard J. Spontak, North Carolina State Univ. (USA) [10163-83]

4:30 pm: **Experimental test of a dynamically tuned wave energy converter based on inflatable dielectric elastomer generators**, Marco Fontana, Scuola Superiore Sant'Anna (Italy); Rocco Vertechy, Univ. degli Studi di Bologna (Italy)[10163-84]

4:50 pm: **Surface texture change on-demand and microfluidic devices based on thickness mode actuation of dielectric elastomer actuators (DEAs)**, Ankit Ankit, Chien A. Nguyen, Nripan Mathews, Nanyang Technological Univ. (Singapore) [10163-85]

5:10 pm: **Rubbery computing**, Katherine E. Wilson, E.-F. Markus Henke, Iain A. Anderson, The Univ. of Auckland (New Zealand) [10163-86]

5:30 pm: **Interactive haptic display based on soft actuator and soft sensor**, Hoa Phung, Hyouk Ryeol Choi, Phi Tien Hoang, Canh Toan Nguyen, Hosang Jung, Tien Dat Nguyen, Hyo Seung Han, Hyunyoung Shin, Sang Yul Yang, Sungkyunkwan Univ. (Korea, Republic of) [10163-87]

SESSION 12B

**LOCATION: SALON D
WED 3:30 PM TO 5:50 PM**

EAP Materials Fabrication Methods and Processes II

Session Chairs: **Jonathan M. Rossiter**, Univ. of Bristol (United Kingdom); **Seon Jeong Kim**, Hanyang Univ. (Korea, Republic of)

3:30 pm: **Stackable configurations of artificial muscle modules that is continuously-tunable by voltage (Invited Paper)**, Adrian Koh, Vy Khanh Vo Tran, Anup Teejo Mathew, National Univ. of Singapore (Singapore) [10163-88]

4:10 pm: **Micro-fabrication of a noval linear actuator**, Shui-Dong Jiang, Fang Hou-Fei, Shanghai YS Information Technology Co., Ltd. (China) [10163-89]

4:30 pm: **Effect of electrical terminals made of copper to the ionic electroactive polymer actuators**, Sunjai Nakshatharan Shanmugam, Urmas Johanson, Andres Punning, Alvo Aabloo, Univ. of Tartu (Estonia) [10163-90]

4:50 pm: **Fabrication of multilayered conductive polymer structures via selective visible light photopolymerization**, Andrew T. Cullen, Aaron D. Price, Western Univ. (Canada) . [10163-91]

5:10 pm: **Design and fabrication of conductive polyaniline transducers via computer controlled direct ink writing**, Frederick B. Holness, Aaron D. Price, Western Univ. (Canada) [10163-92]

5:30 pm: **Adhesion enhancement methods for a roll-to-sheet fabrication process of DE stack-transducers and their influences on the electric properties**, Helge Bochmann, Ostwestfalen-Lippe Univ. of Applied Sciences (Germany) [10163-93]

Conference End.

CONFERENCE 10164

Sessions 13A and 13B run concurrently.

SESSION 13A

**LOCATION: SALON G + H
WED 3:30 PM TO 5:50 PM**

Magneto Rheological Systems II

Session Chairs: **Ramin Sedaghati**, Concordia Univ. (Canada); **Christian Hegger**, Ostwestfalen-Lippe Univ. of Applied Sciences (Germany)

3:30 pm: **Geometry optimization of permanent magnet magnetorheological damper constrained in a specific volume**, Tae-Hoon Lee, Seung-Bok Choi, Inha Univ. (Korea, Republic of)[10164-81]

3:50 pm: **Weight and space saving design of energy-efficient MRF-based clutches for hybrid powertrains**, Christian Hegger, Jürgen Maas, Ostwestfalen-Lippe Univ. of Applied Sciences (Germany) [10164-82]

4:10 pm: **Optimal design and experimental analysis of a magnetorheological valve system for the vehicle lifter used in maintenance**, Sang-Un Shin, Tae-Hoon Lee, Seung-Bok Choi, Inha Univ. (Korea, Republic of) [10164-83]

4:30 pm: **Array type of MR sponge tactile sensor for medical applications**, Seung-Woo Cha, Seung-Bok Choi, Inha Univ. (Korea, Republic of) [10164-84]

4:50 pm: **Design of a 7-DOF haptic master using a magneto-rheological devices for robot surgery**, Seok-Rae Kang, Seung-Bok Choi, Inha Univ. (Korea, Republic of) [10164-85]

5:10 pm: **Sound transmission analysis of partially treated MR fluid based sandwich panels using finite element method**, Masoud Hemmatian, Ramin Sedaghati, Concordia Univ. (Canada)[10164-86]

5:30 pm: **Design and evaluation of a shear-mode MR damper for suspension system of front-loaded washing machines**, Quoc Hung Nguyen, Vietnamese-German Univ. (Viet Nam); Quoc Duy Bui, Long Vuong Hoang, Industrial Univ. of Hochiminh City (Viet Nam); Dai Hiep Le, Vietnamese-German Univ. (Viet Nam) [10164-87]

SESSION 13B

**LOCATION: SALON I
WED 3:30 PM TO 4:30 PM**

Modeling, Optimization, Signal Processing, Control, and Design of Integrated Systems II

Session Chairs: **Suyi Li**, Clemson Univ. (USA); **Alice Alipour**, Iowa State Univ. of Science and Technology (USA)

3:30 pm: **Ultrasound acoustic energy transfer for cavitation bubble manipulation: nonlinear hydroelastic model**, Marjan Bakhtiari Nejad, Ehsan Esmaili, Ahmed Elnahas, Sunghwan Jung, Shima Shahab, Virginia Polytechnic Institute and State Univ. (USA) [10164-88]

3:50 pm: **Probabilistic performance-based design for high performance control systems**, Liang Cao, Laura Micheli, Alessandro Cancelli, Simon Laflamme, Alice Alipour, Iowa State Univ. of Science and Technology (USA)[10164-89]

4:10 pm: **Vibration control using a variable coil-based friction damper**, Mohsen Amjadian, Anil Kumar Agrawal, The City College of New York (USA) [10164-90]

Conference End.

CONFERENCE 10168

Sessions 12B, 12C and 13 run concurrently.

SESSION 13

**LOCATION: COLUMBIA
WED 3:30 PM TO 5:30 PM**

System Identification and Damage Detection Methods

Session Chairs: **Fabio Semperlotti**, Purdue Univ. (USA); **Chin-Hsiung Loh**, National Taiwan Univ. (Taiwan)

3:30 pm: **Stochastic subspace system identification using multivariate time-frequency distributions**, Chia-Ming Chang, National Taiwan Univ. (Taiwan); Shieh-Kung Huang, National Ctr. for Research on Earthquake Engineering (Taiwan) [10168-97]

3:50 pm: **Structural damage detection using high dimension data reduction and visualization techniques**, Jia-Hua Lin, Hsueh Wen, Chin-Hsiung Loh, National Taiwan Univ. (Taiwan)[10168-98]

4:10 pm: **Vibration analysis of lumped parameter systems via fractional order models**, John Hollkamp, Fabio Semperlotti, Purdue Univ. (USA); Mihir Sen, Univ. of Notre Dame (USA) [10168-99]

4:30 pm: **A distributed cloud-based cyberinfrastructure framework for integrated bridge monitoring**, Seongwoon Jeong, Stanford Univ. (USA); Rui Hou, Jerome P. Lynch, Univ. of Michigan (USA); Hoon Sohn, KAIST (Korea, Republic of); Kincho H. Law, Stanford Univ. (USA) [10168-139]

4:50 pm: **A new correlation-based damage identification method using experimental modal information**, Khac Duy Nguyen, Tommy H. T. Chan, David P. Thambiratnam, Theanh Nguyen, Queensland Univ. of Technology (Australia) [10168-101]

5:10 pm: **Wavelet-based adaptive meshing for electrical impedance tomography**, Fabio Semperlotti, Purdue Univ. (USA) and Univ. of Notre Dame (USA); Jie Yang, Univ. of Notre Dame (USA) [10168-102]

Conference End.

CONFERENCE 10169

SESSION 14

**LOCATION: EUGENE
WED 3:30 PM TO 4:50 PM**

Vision-based NDE/SHM

Session Chairs: **Xiaoyu R. Zheng**, Virginia Polytechnic Institute and State Univ. (USA); **Fuh-Gwo Yuan**, North Carolina State Univ. (USA)

3:30 pm: **Vision-based damage identification of impact damage in a composite sandwich structure**, Huan-Yu Chang, Fuh-Gwo Yuan, National Institute of Aerospace (USA) [10169-83]

3:50 pm: **A feasibility study of damage detection in beams using high-speed camera**, Chao Wan, Fuh-Gwo Yuan, North Carolina State Univ. (USA) [10169-84]

4:10 pm: **A novel optical investigation technique for railroad track inspection and assessment**, Alessandro Sabato, Christopher H. Beale, Christopher Niezrecki, Univ. of Massachusetts Lowell (USA) [10169-85]

4:30 pm: **Defect visualization in CFRP-bonded concrete by using high speed camera and motion magnification technique**, Qiwen Qiu, Denvid Lau, City Univ. of Hong Kong (Hong Kong, China) [10169-86]

SESSION 15

**LOCATION: EUGENE
WED 4:50 PM TO 6:10 PM**

NDE/SHM for Wind Turbines, Tunnels, and Buildings Applications

Session Chairs: **Xiaoyu R. Zheng**, Virginia Polytechnic Institute and State Univ. (USA); **Fuh-Gwo Yuan**, North Carolina State Univ. (USA)

4:50 pm: **Damage severity assessment of wind turbine blades through fuzzy finite element model updating**, Heather Turnbull, Piotr Omenzetter, Univ. of Aberdeen (United Kingdom) [10169-87]

5:10 pm: **Investigation of the stochastic subspace identification method for on-line wind turbine tower monitoring**, Kaoshan Dai, Ying Wang, Jianze Wang, Tongji Univ. (China); Zhenhua Huang, Univ. of North Texas (USA); Xiaosong Ren, Tongji Univ. (China) [10169-88]

5:30 pm: **Motion-blur-compensated structural health monitoring system for tunnels at a speed of 100 km/h**, Tomohiko Hayakawa, Masatoshi Ishikawa, The Univ. of Tokyo (Japan) [10169-89]

5:50 pm: **Hyperspectral imaging of building emissions**, Masoud Ghandehari, New York Univ. (USA) [10169-90]

Conference End.

CONFERENCE 10170

Sessions 13A and 13B run concurrently.

SESSION 13A

**LOCATION: SALON B + C
WED 3:20 PM TO 6:00 PM**

Civil Infrastructure II: Materials and Structures

Session Chairs: **Paul Fromme**, Univ. College London (United Kingdom); **Henrique L. Reis**, Univ. of Illinois at Urbana-Champaign (USA)

3:20 pm: **Quantitative evaluation of rejuvenators to restore embrittlement temperatures in oxidized asphalt mixtures using acoustic emission source location technique**, Zhe Sun, Univ. of Illinois at Urbana-Champaign (USA); Behzad Behnia, Western New England Univ. (USA); William G. Buttlar, Univ. of Missouri-Columbia (USA); Henrique L. Reis, Univ. of Illinois at Urbana-Champaign (USA) [10170-94]

3:40 pm: **Monitoring of prestress losses using long-gauge fiber optic sensors**, Hiba Abdel-Jaber, Branko Glisic, Princeton Univ. (USA) [10170-95]

4:00 pm: **System identification of timber masonry walls using shaking table test**, Timir Baran Roy, Concordia Univ. (Canada); Luis Guerreiro, Univ. de Lisboa (Portugal); Ashutosh Bagchi, Concordia Univ. (Canada) [10170-96]

4:20 pm: **Abnormal behavior detection algorithm of infra-structure using unfamiliarity index**, Byeong Cheol Kim, Ki-Tae Park, Tae Heon Kim, Dong Woo Seo, Korea Institute of Civil Engineering and Building Technology (Korea, Republic of) [10170-98]

4:40 pm: **Monitoring the residual strains of concrete which exposure to freeze-thaw tests**, Haifeng Lv, Dalian Univ. of Technology (China); Kaixing Liao, Xianglong Kong, Suzhou Nuclear Power Research Institute, China General Nuclear Power Corp. (China); Xuefeng Zhao, Dalian Univ. of Technology (China) [10170-99]

5:00 pm: **Condition assessment of steel box girder: a strain-matching-based approach**, Shiyin Wei, Harbin Institute of Technology (China); Fujian Zhang, CCC Highways Consultants Co., Ltd. (China); Shunlong Li, Hui Li, Harbin Institute of Technology (China) [10170-100]

5:20 pm: **Development of a real-time bridge structural monitoring and warning system: a case study in Thailand**, Ittipong Khemapech, Watsawee Sansrimahachai, Manachai Toachoodee, Univ. of the Thai Chamber of Commerce (Thailand) [10170-101]

5:40 pm: **Experimental validation of a structural damage detection method based on Marginal Hilbert Spectrum**, Timir Baran Roy, Concordia Univ. (Canada); Srishti Banerji, Michigan State Univ. (USA); Ashutosh Bagchi, Concordia Univ. (Canada) [10170-102]

SESSION 13B

**LOCATION: PEARL
WED 3:30 PM TO 5:30 PM**

Emerging and Futuristic Techniques and Issues

Session Chairs: **Wieslaw M. Ostachowicz**, The Szwedalski Institute of Fluid-Flow Machinery (Poland); **Anthony J. Croxford**, Univ. of Bristol (United Kingdom)

3:30 pm: **Moisture contamination detection in adhesive layer using embedded fibre Bragg grating sensors**, Magdalena M. Mieloszyk, The Szwedalski Institute of Fluid-Flow Machinery (Poland); Rohan N. Soman, The Szwedalski Institute of Fluid-Flow Machinery (Poland); Veronica Bonilla Mora, Gdansk Univ. of Technology (Poland); Wieslaw M. Ostachowicz, The Szwedalski Institute of Fluid-Flow Machinery (Poland) and Warsaw Univ. of Technology (Poland) [10170-103]

3:50 pm: **BIM-based structural performance assessment of individual modules for SHM sensors placement in modular building projects**, Mojtaba Valinejadshoubi, Ashutosh Bagchi, Osama Mosehli, Concordia Univ. (Canada) [10170-104]

4:10 pm: **Temperature dependence of electro-mechanical impedance based bond-line integrity monitoring**, Prathamesh Bilgunde, Ctr. for Nondestructive Evaluation, Iowa State Univ. of Science and Technology (USA) [10170-105]

4:30 pm: **Load identification sensor based on distributed fiber optic technology**, Monica Ciminello, Antonio Concilio, Salvatore Ameduri, Ctr. Italiano Ricerche Aerospaziali (Italy); Giuseppe Sala, Paolo Bettini, Silvia Nicoli, Politecnico di Milano (Italy) [10170-106]

4:50 pm: **Elastic band structure engineering of anti-chiral lattices for acoustic metamaterial applications**, Theodore P. Martin, Kristin M. Charipar, Matthew D. Guild, Alberto Piqué, Gregory J. Orris, U.S. Naval Research Lab. (USA) [10170-107]

5:10 pm: **Localization of a breathing crack in stepped beams using nonlinear frequency mixing**, Dhanashri M. Joglekar, Manish M. Joglekar, Indian Institute of Technology Roorkee (India) [10170-109]

Conference End.

CONFERENCE 10172

SESSION 4

**LOCATION: MT HOOD
WED 3:20 PM TO 4:40 PM**

The Art of Retaining Old Friends

Session Chair: **Henry A. Sodano**, Univ. of Michigan (USA)

3:20 pm: **Gust prediction via artificial hair sensor array and neural network**, Kaman S. Thapa Magar, Univ. of Dayton Research Institute (USA); Alexander M. Pankonien, Gregory W. Reich, Air Force Research Lab. (USA) [10172-13]

3:40 pm: **A new piezo-actuated compliant mechanism with self-tuned flexure arm**, Mingxiang Ling, Junyi Cao, Xi'an Jiaotong Univ. (China) [10172-14]

4:00 pm: **Research and development of energy harvesting from vibrations and human motions**, Wei-Hsin Liao, The Chinese Univ. of Hong Kong (Hong Kong, China) [10172-15]

4:20 pm: **Analytical and finite element performance evaluation of embedded piezoelectric sensors in polyethylene**, Mohsen Safaei, Steven R. Anton, Tennessee Technological Univ. (USA) [10172-16]

SESSION 5

**LOCATION: MT HOOD
WED 4:40 PM TO 6:00 PM**

Knowing When to Retire

Session Chair: **Pablo A. Tarazaga**, Virginia Polytechnic Institute and State Univ. (USA)

4:40 pm: **On the distributed observer/controller strategy for disturbance rejection**, Cassio T. Faria, ZhongZhe Dong, Xueji Zhang, Siemens Industry Software (Belgium) [10172-17]

5:00 pm: **Simultaneous passive broadband vibration suppression and energy harvesting with metastructures**, Jared D. Hobeck, Daniel J. Inman Sr., Univ. of Michigan (USA) [10172-18]

5:20 pm: **Piezoelectric interfaces enabled energy harvesting and tailored damping in fiber composites**, Mohammad H. Malakooti, Univ. of Michigan (USA); Brendan A. Patterson, Christopher C. Bowland, Hyun-Sik Hwang, Univ. of Florida (USA); Henry A. Sodano, Univ. of Michigan (USA) [10172-19]

5:40 pm: **Two score years less five of an Anglo-American Special Relationship in Structural Dynamics (AASRSD)**, David J. Ewins, Imperial College London (United Kingdom) [10172-20]

Conference End.

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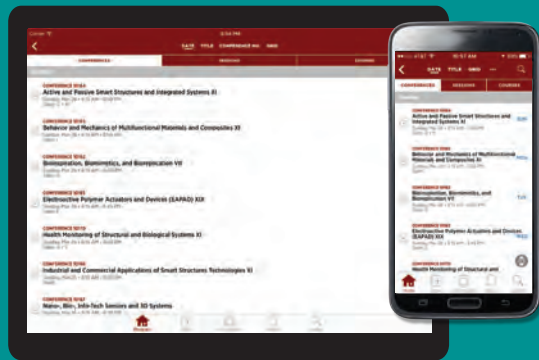


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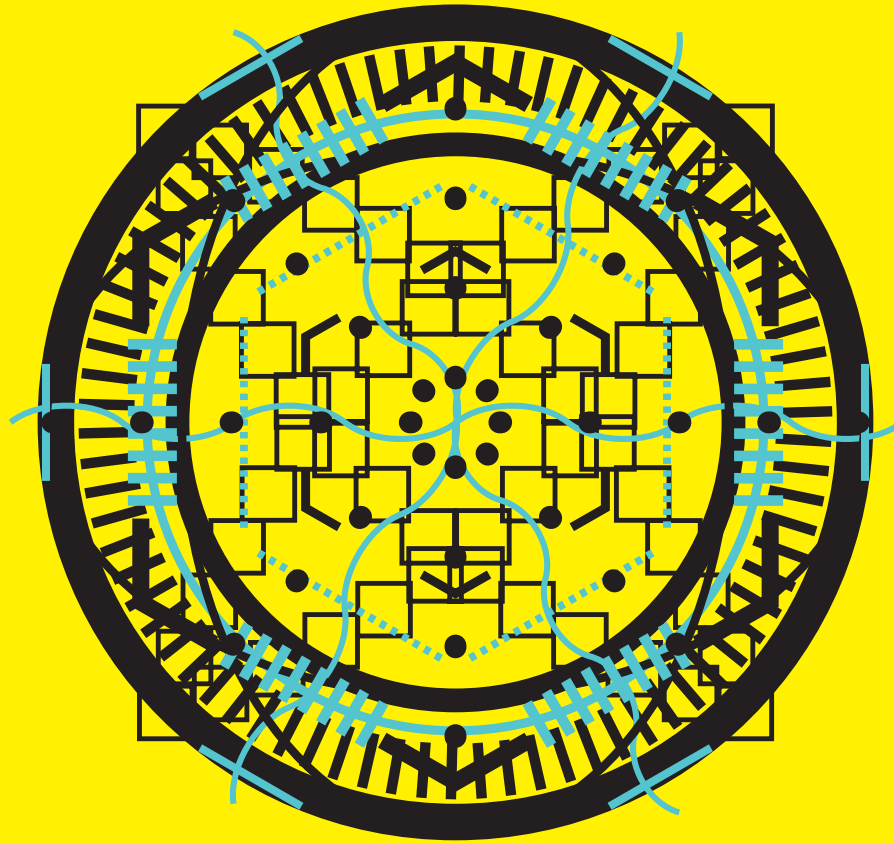
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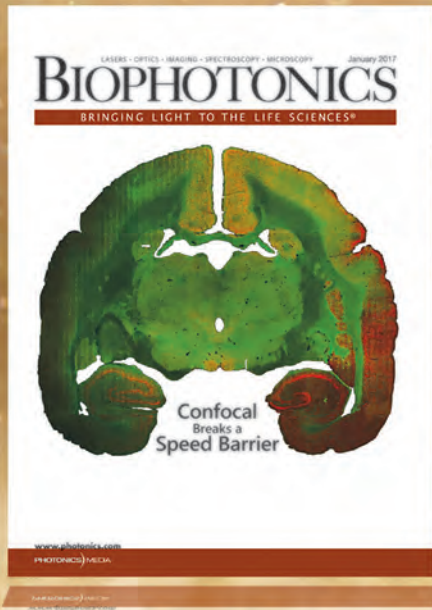


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