SPIE. SMART STRUCTURES + NONDESTRUCTIVE EVALUATION

TECHNICAL PROGRAM

Smart Structures + Nondestructive Evaluation 2018

TECHNICAL PROGRAM

Your complete guide to conferences and special events

Conferences and Course
4–8 March 2018

Embassy Suites by Hilton Denver
Denver, Colorado, USA

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SPIE. SMART STRUCTURES+ NONDESTRUCTIVE EVALUATION

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ADVANCING LIGHT.

SMART STRUCTURES + NONDESTRUCTIVE EVALUATION 2018

Technologies for structural health monitoring, advanced materials, and engineered biorobotics.

4–8 March 2018
Embassy Suites by Hilton Denver
Denver, Colorado, USA

Welcome to Denver

CUTTING-EDGE RESEARCH

WORLD-CLASS SPEAKERS

TRAINING AND EDUCATION

FOCUSED TECHNICAL TOPICS

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MODERN SOLUTIONS TO A RANGE OF GLOBAL CHALLENGES

SPIE Smart Structures + Nondestructive Evaluation is the largest international meeting on smart materials, sensor networks, nondestructive evaluation 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)

SPIE. SMART STRUCTURES+ NONDESTRUCTIVE EVALUATION

YOUR CONFERENCE REGISTRATION INCLUDES:

- Conference sessions, plenaries, panels, technical events, and poster sessions
- Welcome Reception
- Coffee breaks
- A choice of Proceedings

SPIE is the international society for optics and photonics, an educational not-for-profit organization founded in 1955 to advance light-based science, engineering, and technology. The Society serves nearly 264,000 constituents from 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 2017.

For more information, visit www.SPIE.org.

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The leading event for advanced materials and structural health monitoring

Plenary Presentations
pages 8–9

See these world-class speakers discussing the latest directions and most promising breakthroughs.

Special Events
page 10-11

Join your peers and colleagues at these special events including the Welcome Reception, Best Student Paper contest, and more.

Award Announcements
page 11, 13

Don't miss any of the award announcements and presentations at 2018 Smart Structures + Nondestructive Evaluation.

SPIE. SMART STRUCTURES+ NONDESTRUCTIVE EVALUATION

Hear the latest research from 800 technical presentations in 10 parallel conferences, 20 live demonstrations of EAP-in-Action, as well as Best Student Paper Competition, Poster Session, and EAP Course.

800 ATTENDEES

10 CONFERENCES

800 PAPERS

1 COURSE

SPIE. SMART STRUCTURES+ NONDESTRUCTIVE EVALUATION

4–8 March 2018
Embassy Suites by Hilton Denver, Denver, Colorado (USA)

Conferences: Hear the latest advancements in sensing and measurement science with advanced materials, diagnostics, and smart systems.

EAP-in-Action Demonstrations

page 14–17

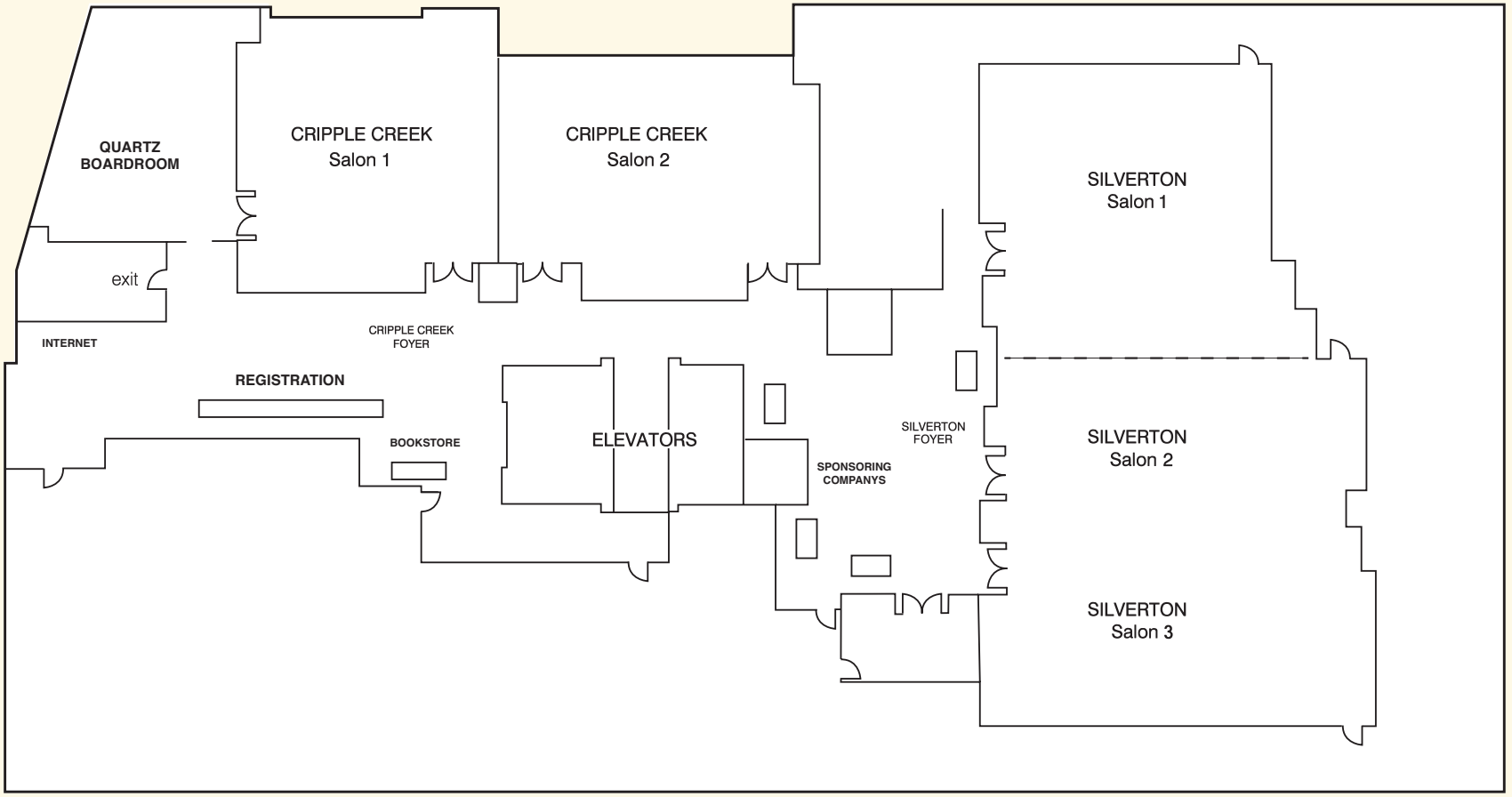
This Session highlights some of the latest capabilities and applications of Electroactive Polymers (EAP) materials where the attendees are shown demonstrations of these materials in action.

3D Printing Demonstration Session

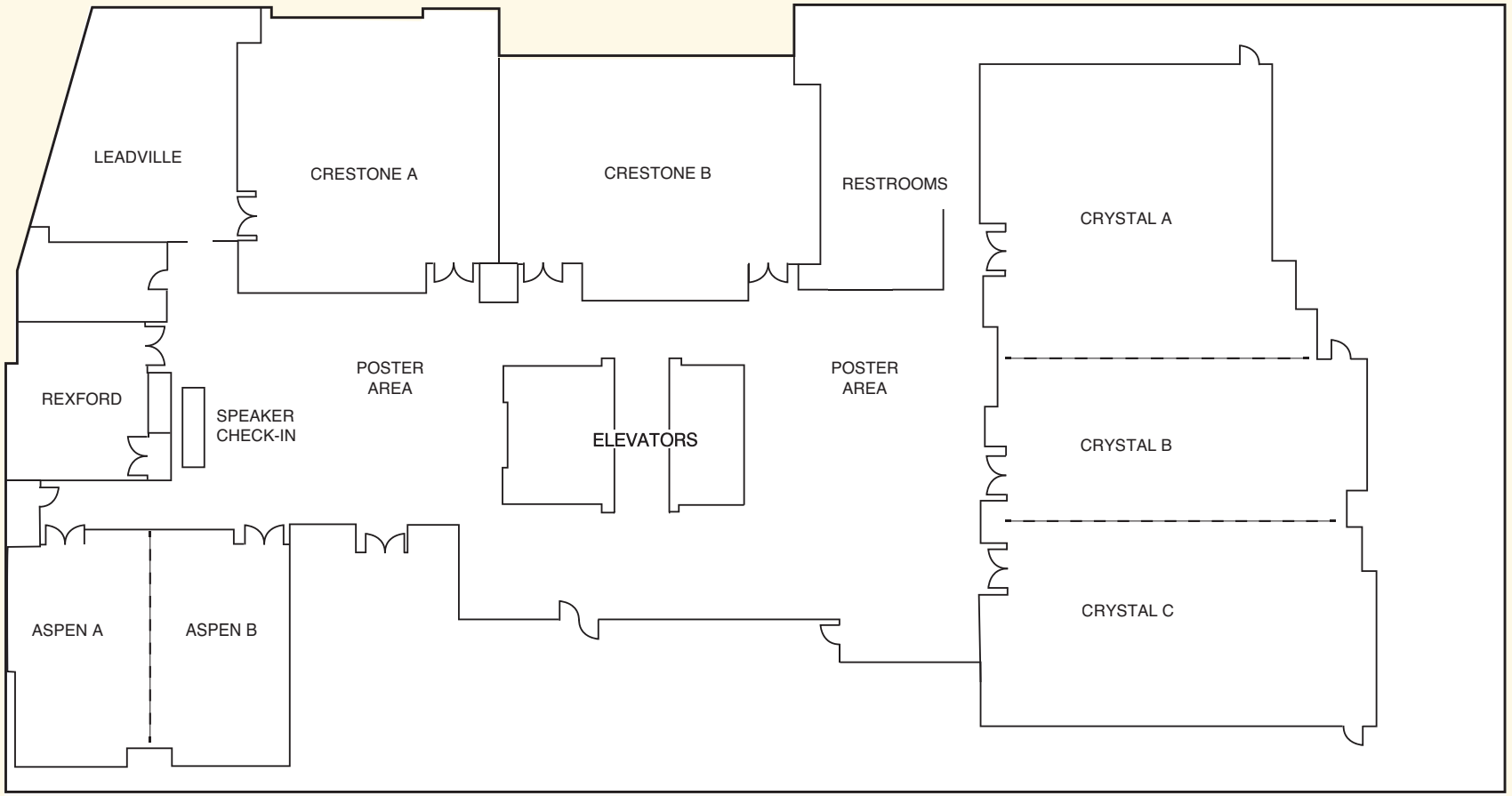
page 18–19

This demonstration session will cover new 3D printing technologies such as focusing on soft robotics, molecular models, and food. Each demonstration will include a brief oral talk describing the technology.

FLOOR PLAN
EMBASSY SUITES, 2ND FLOOR



FLOOR PLAN
EMBASSY SUITES, 3RD FLOOR



Welcome

The Organizing Committee of SPIE's 25th Annual International Symposium on Smart Structures and Material Systems + Nondestructive Evaluation 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 ten parallel conferences, SS/NDE brings together emerging technologies and advanced research in instrumentation, sensing, and measurement science with advanced materials, diagnostics, and smart systems. Engineers and researchers from government, military, academia and the commercial sector will discuss the current status and future directions of smart structures and materials, NDE, and health monitoring. Case studies, emerging research agendas, and innovative new technologies will be presented.

The Symposium covers all aspects of the evolving fields of materials, enabling technologies, sensor/actuator design, and applications of these technologies to cover the whole spectrum of life in the 21st century, including commercial, medical, aerospace, and military fields. It also includes several conferences on NDE and structural health monitoring, safety, security, characterization of materials, detection of materials defects and degradation, evaluation of the state of damage enabling reliable component failure prediction, application of micro- and nanomaterial systems, energy systems and infrastructure. New conference topics related to the Internet of Things, Industry 4.0, and use of data in product design, fabrication, maintenance, and system management will also be explored for the first time.

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

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The Univ. of Arizona (USA)

Gregory W. Reich
Air Force Research Lab. (USA)

2018 SYMPOSIUM CO-CHAIRS:

Zoubeida Ounaies
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Hoon Sohn
KAIST (Korea, Republic of)

SPIE. SMART STRUCTURES+ NONDESTRUCTIVE EVALUATION

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SPIE. SPIE is the international society for optics and photonics, an educational not-for-profit organization founded in 1955 to advance light-based science, engineering, and technology. The Society serves nearly 264,000 constituents from 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 2017.

SPECIAL EVENTS

MONDAY

2018 NDE Lifetime Achievement Award and **2018 SSM Lifetime Achievement Award,** 8:20 to 8:30 am, p. 11

Plenary Presentation: **Nonlinear Ultrasonic Methods for Nondestructive Damage Assessment in Structural Materials** (Qu), 8:30 to 9:15 am, p. 8

Plenary Presentation: **Sensitivity Analysis and Uncertainty Quantification for Smart Materials and Adaptive Structures** (Smith), 9:15 to 10:00 am, p. 8

EAPAD Keynote Presentation: Origami-Inspired Engineering: From Minimally Invasive Surgery to Exoplanet Exploration (Trease), 10:30 to 11:10 am, p. 10

20th Annual EAP-in-Action Session and Demonstrations, 4:30 to 5:45 pm, p. 14-17

All-Symposium Welcome Reception, 6:00 to 7:30 pm, p. 10

TUESDAY

SPIE Fellow Awards, 8:15 to 8:30 am, p. 13

Plenary Presentation: **Multifunctional Vascularized Polymers and Composites** (Sottos), 8:30 to 9:15 am, p. 8

Plenary Presentation: **Current and Future Needs and Research for Composite Materials NDE** (Cramer), 9:15 to 10:00 am, p. 9

Tutorial: **Applications of Uncertainty Analysis in Smart Materials and Adaptive Structures** (Smith, Oates), 10:30 am to 3:00 pm, p. 10

Lunch with the Experts - A Student Networking Event, 12:30 to 1:30 pm, p. 11

SPIE Best Student Paper Session, 1:30 to 5:00 pm, p. 11

Poster Session, 6:00 to 7:30 pm, p. 11

WEDNESDAY

SPIE Best Student Paper Awards, Bioinspiration, Biomimetics, and Bioreplication Best Student Paper Award: In Memory of H. Don Wolpert, and **EAP-In-Action Demonstration Awards,** 8:15 to 8:30 am, p. 11

Plenary Presentation: **Origami-Inspired Systems: Opportunities for Smart Material and Structure Impact** (Howell), 8:30 to 9:15 am, p. 9

Plenary Presentation: **The Measure of a Person's Life** (Varadan), 9:15 to 10:00 am, p. 9

Poster Session, 6:00 to 7:30 pm, p. 11

3D Printing Demonstration Session, 4:00 pm to 6:00 pm, p. 18-19

CONFERENCES

10593 **Bioinspiration, Biomimetics, and Bioreplication VIII** (Lakhtakia/Martín-Palma/Knez), p. 28–54

10594 **Electroactive Polymer Actuators and Devices (EAPAD) XX** (Bar-Cohen/Anderson), p. 28–64

10595 **Active and Passive Smart Structures and Integrated Systems XII** (Erturk/Han), p. 28–64

10596 **Behavior and Mechanics of Multifunctional Materials and Composites XII** (Naguib/Goulbourne), p. 28–60

10597 **Nano-, Bio-, Info-Tech Sensors and 3D Systems** (Varadan/Khosla/Furukawa/Kim/Song/Choi/Roh), p. 28–53

10598 **Sensors and Smart Structures Technologies for Civil, Mechanical, and Aerospace Systems** (Sohn/Lynch/Wang), p. 29–65

10599 **Nondestructive Characterization and Monitoring of Advanced Materials, Aerospace, Civil Infrastructure, and Transportation XII** (Shull/Gyekenyesi/Yu/Wu), p. 29–63

10600 **Health Monitoring of Structural and Biological Systems XII** (Kundu/Fromme), p. 29–63

10601 **Smart Materials and Nondestructive Evaluation for Energy Systems IV** (Matikas/Peters/Meyendorf/Niezrecki), p. 29–37

10602 ***(NEW!)*** **Smart Structures and NDE for Industry 4.0** (Meyendorf/Clingman), p. 29–43

COURSE

SC634 **Electroactive Polymer Actuators, Sensors, and Devices,** 1:30 pm to 5:30 pm, p. 20

PLENARY SESSIONS

MONDAY 5 MARCH 2018

Location: Silverton, Salon 2

8:20 to 8:30 am:

2018 SSM Lifetime Achievement Award Presentation presented to **Wei-Hsin Liao,** The Chinese Univ. of Hong Kong (Hong Kong, China)

2018 NDE Lifetime Achievement Award Presentation presented to **Michael J. S. Lowe,** Imperial College London (United Kingdom)

8:30 to 9:15 am:

NONLINEAR ULTRASONIC METHODS FOR NONDESTRUCTIVE DAMAGE ASSESSMENT IN STRUCTURAL MATERIALS

Jianmin Qu

Tufts Univ. (USA)

Abstract: In this talk, I will first introduce recent models that relate the measured nonlinear ultrasonic signals to pertinent microstructural parameters that characterize the state of damage in structural materials. This will be followed by discussions of several ultrasonic measurement techniques including the generation of second harmonic and nonlinear wave mixing. The talk will conclude with several case studies involving fatigue damage in high-strength superalloys, radiation damage in stainless steels, plastic deformation in aluminum alloys, ASR-induced damage in concrete, etc. These studies clearly demonstrated that nonlinear ultrasonic measurements provide quantitative inputs to determine the material state and measure damage in structural materials.

Biography: **Jianmin Qu** is Karol Family Professor in the Department of Mechanical Engineering at Tufts University. He has authored/co-authored two books, 12 book chapters and over 200 referred journal papers in the general area of theoretical and applied mechanics.

9:15 to 10:00am:

SENSITIVITY ANALYSIS AND UNCERTAINTY QUANTIFICATION FOR SMART MATERIALS AND ADAPTIVE STRUCTURES

Ralph C. Smith

North Carolina State Univ. (USA)

Abstract: This presentation will focus on concepts pertaining to sensitivity analysis (SA) and uncertainty quantification (UQ) for smart materials and adaptive structures. Pertinent issues are first illustrated in the context of applications utilizing piezoelectric and shape memory alloy actuators, finite-deformation viscoelastic models, x-ray crystallography, and quantum-informed continuum models. This will demonstrate that the basic UQ goal is to ascertain uncertainties inherent to parameters, initial and boundary conditions, experimental data, and models themselves to make predictions with improved and quantified accuracy. The use of data, to improve the predictive accuracy of models, is central to uncertainty quantification so it is natural to next provide an overview of how Bayesian techniques can be used to construct distributions for model inputs. The discussion will subsequently focus on computational techniques to propagate these distributions through complex models to construct prediction intervals for statistical quantities of interest such as expected stresses in viscoelastic materials, displacements in macro-fiber composites, and strains in SMA tendons. The use of sensitivity analysis to isolate critical model inputs and reduce model complexity is synergistic with uncertainty quantification and will be discussed next. The presentation will conclude with discussion detailing how uncertainty quantification can be used to improve robust control designs for smart material systems.

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 boards of the Journal of Intelligent Material Systems and Structures and the SIAM/ASA Journal on Uncertainty Quantification. Smith was Chair of the 2003 and 2004 SPIE Smart Structures/NDE Conference on Modeling, Signal Processing, and Control and served as Technical and General Chair of the 2014 and 2015 SMASIS conferences. He is the recipient of the 2017 SPIE Smart Structures and Materials Lifetime Achievement Award and the 2016 ASME Adaptive Structures and Material Systems Prize.

TUESDAY 6 MARCH 2018

Location: Silverton, Salon 2

8:30 to 9:15 am:

MULTIFUNCTIONAL VASCULARIZED POLYMERS AND COMPOSITES

Nancy R. Sottos

Beckman Institute for Advanced Science and Technology (USA)

Abstract: Integration of microvascular networks in synthetic materials provides an effective vehicle for the distribution and replenishment of active fluids throughout the material, enabling of a plurality of biologically inspired functions such as self-healing, regeneration, EM reconfiguration, and self-cooling. Several approaches exist for fabricating complex microvascular networks in structural polymers and composites including soft lithography, laser micromachining, electrostatic discharge, and fugitive inks. In recent work, we have developed a library of sacrificial materials, which can be formed into a range of sacrificial templates including: spheres, fibers, sheets, and 3D printed structures. The templates are embedded in polymers and composites and removed using a thermal treatment process, vaporization of sacrificial components (VaSC), leaving behind an inverse replica. This lecture describes the progression of microvascular materials from relatively primitive networks to fully three-dimensional bio-inspired vasculature integrated in multifunctional fiber reinforced composites.

Biography: **Nancy Sottos** is the Donald B. Willet Professor of Engineering in the Department of Materials Science and Engineering and the Beckman Institute at the University of Illinois Urbana-Champaign. Sottos started her career at Illinois in 1991 after earning a Ph.D. from the University of Delaware. Her research interests include self-healing polymers and advanced composites, mechanochemically active polymers, tailored interfaces and novel materials for energy storage.

9:15 to 10:00 am:

CURRENT AND FUTURE NEEDS AND RESEARCH FOR COMPOSITE MATERIALS NDE

K. Elliott Cramer

NASA Langley Research Ctr. (USA)

Abstract: The use of composite materials continues to increase in the aerospace community due to the potential benefits of reduced weight, increased strength, and manufacturability. The ability to characterize damage in carbon fiber reinforced polymer composite components is required to enable damage progression models capable of yielding accurate remaining life predictions. As these composite structures become larger and more complex, nondestructive evaluation (NDE) techniques capable of quantifying and fully characterizing the material state are needed. This paper will present an overview of current NDE research activities for quantitative characterization of aerospace composites as well as a discussion of future directions in NDE research.

Biography: **Mr. Elliott Cramer** is the Head of the Nondestructive Evaluation Sciences Branch in the Research Directorate at NASA Langley Research Center. Prior to his management position, he was a senior researcher with 28 years of experience in both experimental NDE technique development and computational modeling of energy propagation in materials. Mr. Cramer is also the recipient of numerous NASA awards, he holds 12 U.S. Patents and has authored more than 80 technical publications.

WEDNESDAY 7 MARCH 2018

Location: Silverton, Salon 2

8:15 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 9:15am:

ORIGAMI-INSPIRED SYSTEMS: OPPORTUNITIES FOR SMART MATERIAL AND STRUCTURE IMPACT

Larry L. Howell

Brigham Young Univ. (USA)

Abstract: For centuries origami artists have invested immeasurable effort developing origami models under extreme self-imposed constraints (e.g. only paper, no cutting or gluing, one regular-shaped sheet). The accessible and formable medium of paper has enabled swift prototyping of vast numbers of possible designs. This has resulted in stunning origami structures and mechanisms that were created in a simple medium and using a single fabrication process (folding). The origami artists' methods and perspectives have created systems that have not previously been conceived using traditional engineering methods. Using origami-inspired methods, it may be possible to design origami-like systems, but using different materials and processes to meet emerging product requirements. This presentation will highlight research in origami-based engineering at Brigham Young University, will discuss a diverse set of applications, including emerging areas where smart materials and structures can be used to create new systems with unprecedented performance.

Biography: **Larry L. Howell** is an Associate Dean and Professor at Brigham Young University. He received his PhD from Purdue University, was a consultant for Engineering Methods, and an engineer on the prototype of the F-22 Raptor. He is the co-editor of the *Handbook of Compliant Mechanisms* and the author of *Compliant Mechanisms.*

9:15 to 10:00 am:

THE MEASURE OF A PERSON'S LIFE

Vasundara V. Varadan

Univ. of Arkansas (USA)

Abstract: As one approaches age 70, "what is the measure of one's life?" is a question worth considering. For example, is one's life measured by the pinnacle of one's career, the number of publications and awards, memberships in prestigious professional societies, the amount of research funding received, or one's accumulated wealth? In the final analysis, it is none of the above. That is, as many come to realize, what really matters in one's life is the direct and positive impact we have had on the lives of other people and our service to society. In this talk I will share my thoughts on such matters as I reflect on the impact of my own life on the lives of others. As I address my career path from academia to starting a company, I will reflect on the mentoring opportunities in which I have been privileged to participate. In particular, I will discuss my interest in promoting women in science and engineering, and the many efforts to which I contributed and spearheaded at universities and within professional societies such as SPIE.

Biography: **Dr. Vasundara V. Varadan** is a Distinguished Professor Emeritus in the department of Electrical Engineering at the University of Arkansas, where she also directed the Microwave and Optics Laboratory for Imaging and Characterization (MOLIC). Prior to joining the University of Arkansas, she spent 22 years at the Pennsylvania State University where she was Distinguished Professor and Co-Director of the Research Center for the Engineering of Electronic & Acoustic Materials. During 2002-2004, she served as the Division Director of Electrical & Communications Systems at the National Science Foundation. She received her B.Sc. and M.Sc. in Physics from the University of Kerala (India) before going on to earn an M.S. and Ph.D. in Physics from the University of Illinois - Chicago. Her areas of teaching and research interest are RF metamaterial design, LTCC fabrication and characterization, optical metamaterial design and fabrication, light trapping in thin film and nanowire solar cells, microwave measurement systems, and MW dielectroscopy for imaging and NDE applications. Dr. Varadan retired in Spring 2013 after an extremely successful career of teaching, research, and mentoring students. She is currently CEO and founder of Microwave Measurement Systems LLC. She has published over 285 journal papers and is Fellow of the Acoustical Society of America, SPIE, IOP, and Senior Member of IEEE. Throughout her career, Dr. Varadan has been interested in promoting women in science and technology – most notably, she earned an award for her NSF-funded MsWiz (89-91), and she was a US Delegate in the US-China Joint Workshop on Women in Science and Technology at the United Nations Women's Conference in Beijing in 1995.

SPECIAL AND TECHNICAL EVENTS

EAPAD Keynote Presentation

Monday 5 March 2018 · 10:30 AM - 11:10 AM
Location: Silverton, Salon 2

ORIGAMI-INSPIRED ENGINEERING: FROM MINIMALLY INVASIVE SURGERY TO EXOPLANET EXPLORATION

Brian Trease, The Univ. of Toledo (USA)

Abstract: The engineering world has exploded with recent interest in the craft of origami. This traditional art form most often associated with Japan has become fertile ground for inspiration of devices with applications ranging from medicine to aerospace. What is it about origami that makes it attractive, and why is the origami revolution occurring now? This talk will present an overview of the prominent figures and applications that are currently driving innovation in the field. Engineers and artists alike have come together to develop new techniques that take the practice from paper curiosities to practical engineered devices and systems. Foldable tools are now entering the human body during minimally invasive surgery, and foldable optical structures are being designed for the next generation of space-based telescopes. Mathematicians, material scientists, roboticists, architects, and mechanical designers are all investigating classical origami patterns and inventing new ones, benefiting from the insights and craftsmanship of partnering artist. The resulting software tools are accessible by engineers, tinkerers, and artists alike, some of who then leverage laminated manufacturing techniques to fabricate fully operational systems with embedded electrical components and smart material actuation. While engineering is often influenced by external disciplines, such as biology or aesthetics, the melding of engineering and origami has been uniquely synergistic. The interaction of scientists and artists has mutually benefited both sides: beyond the novel advancements in engineering, the artists themselves are taking back the numerical tools and material innovations, using them to produce revolutionary pieces of balanced complexity and elegance.

Biography: After graduating from the University of Michigan, **Dr. Brian Trease** spent eight years working at NASA JPL in Pasadena, CA. His specialties include mechanism design, optimization, flexible systems, and deployable structures. At NASA, Dr. Trease was a research technologist in compliant mechanisms, printable spacecraft, rover mobility, and solar sail development. His current research interests at the University of Toledo include origami-inspired design, biomimicry, swarm robotics, and autonomous robotics for environmental remediation.

All-Symposium Welcome Reception

Monday 5 March 2018 · 6:00 PM - 7:30 PM
Location: 4th Floor, Atrium

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

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

Tuesday 6 March 2018 · 10:30 AM - 3:00 PM
Location: Quartz Boardroom

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.

Lunch with the Experts - A Student Networking Event

Tuesday 6 March 2018 · 12:30 PM - 1:30 PM
Location: 4th Floor, Atrium Alcove

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.

Sponsored by

SPIE Best Student Paper Session

Tuesday 6 March 2018 · 1:30 PM - 5:00 PM
Location: Quartz Boardroom

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

Tuesday Poster Session

Tuesday 6 March 2018 · 6:00 PM - 7:30 PM
Location: 3rd Floor, Crestone and Crystal Foyer

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

Additional Poster Viewing:

Tuesday 6 March 2018 · 10:00 AM – 4:00 PM

Wednesday Poster Session

Wednesday 7 March 2018 · 6:00 PM - 7:30 PM
Location: 3rd Floor, Crestone and Crystal Foyer

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

Additional Poster Viewing:

Wednesday 7 March 2018 · 10:00 AM – 4:00 PM

Monday 5 March 2018 · 8:20 AM – 8:30 AM
Location: Silverton, Salon 2

2018 NDE Lifetime Achievement Award

presented to

Michael J. S. Lowe, Imperial College London (United Kingdom)

Biography: **Michael J. S. Lowe** holds a BSc degree in Civil Engineering and MSc and PhD degrees in Mechanical Engineering. He worked in engineering consultancy from 1979 to 1989, specialising in the application and development of numerical methods for the solution of problems in solid mechanics. His principal clients were in the nuclear power and offshore oil industries. He joined Imperial College London in 1989, where he is now Professor of Mechanical Engineering. His research is in the use of ultrasound for Non Destructive Evaluation (NDE), with specialist interests in guided waves, scattering from defects, interactions with features and material structure, and numerical modelling. He has published over 280 indexed papers in these topics. He was elected Fellow of the Royal Academy of Engineering in 2014 for his research contributions to NDE. He is a founder director of Guided Ultrasonics Ltd, a spin-out company set up to transfer guided wave techonology to industrial use.

2018 SSM Lifetime Achievement Award

presented to

Wei-Hsin Liao, The Chinese Univ. of Hong Kong (Hong Kong, China)

Biography: **Wei-Hsin Liao** received his Ph.D. from The Pennsylvania State University. Since 1997, Dr. Liao has been with The Chinese University of Hong Kong, where he is Professor and Associate Dean of Engineering. His research has led to publications of over 200 papers in international journals and conference proceedings, 16 granted patents. He was the Conference Chair for the Active and Passive Smart Structures and Integrated Systems, SPIE Smart Structures/NDE in 2014 and 2015. He is a recipient of the ASME Best Paper Awards in Structures (2008), Mechanics and Material Systems (2017). Dr. Liao is a Fellow of ASME and IOP.

Wednesday, 7 March 2018 · 8:15 AM – 8:30 AM
Location: Silverton, Salon 2

SPIE Best Student Paper Awards

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 VIII conference chairs will choose the Best Student Paper Award from their conference. This award is sponsored by the Optical Society of Southern California. A cash prize will be given to the first, second, and third place winners.

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 19 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 2018 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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COURTESY OF SPIE.

Tuesday 6 March · 8:15 AM – 8:30 AM
Location: Silverton, Salon 2

2018 SPIE Fellow Recognition presented to

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

Biography: **Prof. Norbert Meyendorf** is Professor of Aerospace and Engineering at Iowa State University of Science & Technology. He was Director of the Fraunhofer IKTS Branch in Berlin from 20014 – 2015. From 2004 till 2013 he was Branch Director of the Dresden Branch of the Fraunhofer Institute for Nondestructive Testing (IZFP-D), Germany, that is now the Branch for Material Diagnostics (IKTS-MD) of the world's largest ceramic Institute, the Fraunhofer Institute for Ceramic Technologies and Systems IKTS. Norbert Meyendorf is Graduate Faculty in the Graduate Chemical and Materials Engineering Program at the University of Dayton/USA since 2000 and Professor for Micro- and Nanotesting at the University of Dresden/Germany since 2006. Norbert Meyendorf was Head of the Barkhausen Award Comitee of the Materials Research Network Dresden MFD e. V.

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

Biography: **Prof. Kara Peters** is a Program Director of Mechanics of Materials and Structures and Design of Engineering Material Systems, as well as Professor of Mechanical and Aerospace Engineering at North Carolina State University. Dr. Peters' long-term goal is to contribute to the advancement of nondestructive evaluation and structural health monitoring techniques for composite aerospace structures. The advancements tend to increase safety and improve performance of structural systems. Dr. Peters is interested in structural health monitoring, optical fiber sensors, and composite materials. Currently, she is designing and integrating optical sensors into composites (woven, laminates, sandwich structures, and joints) and is studying self-healing composite sandwich structures.

Hoon Sohn, KAIST (Korea, Republic of)

Biography: **Prof. Sohn Hoon** is a Professor in the Department of Civil and Environmental Engineering at KAIST (Korea Advanced Institute of Science and Technology). Prof. Hoon has developed core source technologies in the field of structural safety diagnosis and nondestructive inspection, and contributed to the enhancement of the safety of social infrastructures and the relief of public anxiety about facility safety. Other research interests include structural dynamics, system identification, smart materials & structures, modal analysis & vibration testing, active sensing, signal processing, data interrogation, probabilistic & statistical analysis, and statistical pattern recognition. Structural Health Monitoring (SHM) is an integrated process of data acquisition, signal processing and statistical inference used to track and assure the safety and performance of a structure.

Steve E. Watkins, Missouri Univ. of Science and Technology (USA)

Biography: **Prof. Steve E. Watkins** is a Professor of Electrical and Computer Engineering and Associate Chair of Electrical Engineering Undergraduate Studies at the Missouri University of Science and Technology. He was the Faculty-Member-in-Residence for the 2005 Washington Internships for Students of Engineering (WISE) Program, was an IEEE-USA 2004 Congressional Fellow, was a visiting physicist for the U.S.A.F. Phillips Laboratory at the Kirtland Air Force Base, and was a visiting scholar for Nippon Telegraph and Telephone in Tokyo, Japan. Dr. Watkins is a member of IEEE (senior member), ASEE, and SPIE (fellow and senior member). At Missouri S&T, he is advisor to the Eta Kappa Nu Chapter and the IEEE AESS Student Chapter (which competed and placed second in the 2008 Outback Challenge Competition).

Huikai Xie, Univ. of Florida (USA)

Biography: **Prof. Huikai Xie** received his B.S., M.S. and Ph.D. degrees in electrical and computer engineering from Beijing Institute of Technology, Tufts University and Carnegie Mellon University, respectively. He joined the University of Florida in 2002. He also worked at Tsinghua University (1992-1996), Bosch Corp. (2001,2002) and US Air Force Research Lab as a summer faculty fellow (2007,2008,2009). His research interests include MEMS/NEMS, integrated sensors, microactuators, integrated power passives, CNT-CMOS integration, optical MEMS, LiDAR, micro-spectrometers, optical bioimaging, and endomicroscopy. He has published over 280 technical papers, and holds more than 30 US patents. He is a fellow of IEEE and SPIE. He is an associate editor of IEEE Sensors Letters and Micromachines.

20TH ANNUAL EAP-IN-ACTION SESSION AND DEMONSTRATIONS

Part of conference 10594 on EAPAD.

Monday 5 March · 4:30 PM – 5:45 PM
Location: Silverton, Salon 2

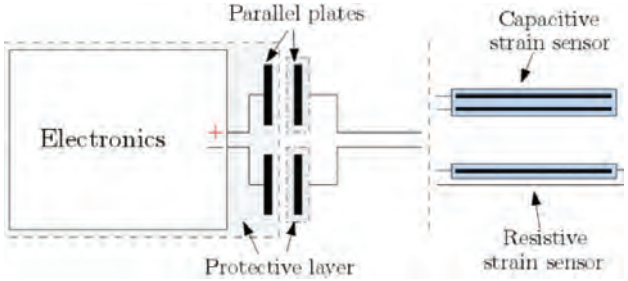
Session Chair:
Yoseph Bar-Cohen
Jet Propulsion Lab. (USA)

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

TENTATIVE EAP DEMONSTRATIONS

Capacitive coupling as an underwater signal transmission interface

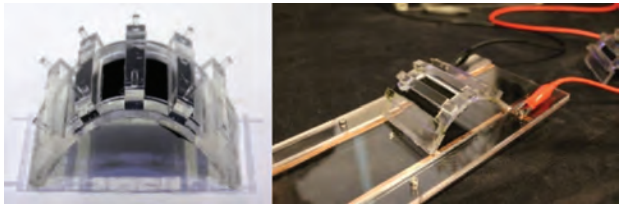
Christopher R. Walker, Samuel Rosset, and **Iain Anderson,** The Univ. of Auckland (New Zealand)



Capacitive coupling will be showcased as a signal transmission method to interface a capacitive strain sensor with electronics underwater. This signal transmission interface has the potential to simplify strain sensor integration into underwater wearables. The demonstration technology could be useful in diver health monitoring, human-interaction, and performance sport coaching applications.

Autonomous soft robots without electronics

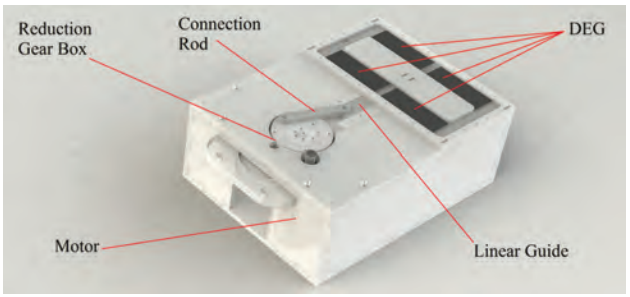
E.-F. Markus Henke, Katherine E. Wilson, and Iain A. Anderson, Biomimetics Lab., The Univ. of Auckland (New Zealand)



Multifunctional dielectric elastomers possess outstanding characteristics for future developments in soft robotics. Large actuation combined with piezoresistive switches enables new fast dielectric elastomer logic elements that can directly drive soft robotic structures. Combining soft DE electronics with silicone skeletons enables the design of entirely soft, autonomous robots. This demo will present the design of soft skeletons (see example below), able to undergo large actuations and simultaneously maintaining necessary pre-strains in DE membranes; the integration of multifunctional DE electronics for autonomous signal generation using integrated DE oscillators; and a design that uses DE electronics, soft skeletons and electro static adhesion for locomotion.

An integrated self-priming circuit with electret charge source

Patrin K. Illenberger, Katherine E. Wilson, Udaya K. Madawala and Iain A. Anderson, Biomimetics Lab., Univ. of Auckland (New Zealand)



The Dielectric elastomer generator (DEG) is well suited for harvesting energy from natural motion sources. A DEG requires a source of initial high voltage priming charge to generate energy. In small DEG, a high voltage charge source is expensive and impractical to implement. To overcome this obstacle a Self Priming Circuit (SPC) was developed that uses low voltage and boosts this voltage. In this demo we present an Integrated SPC with an electret charge source that can rapidly boost charge to a high voltage without the need for external initial priming charge. A mechanical setup for evaluating the SPC can be seen in the provided figure.

Single channel high voltage power supply with integrated touch screen

Samuel Rosset, Biomimetics Lab, The Univ. of Auckland (New Zealand) and Ecole Polytechnique Fédérale de Lausanne (Switzerland); Patrin Illenberger, Biomimetics Lab, The Univ. of Auckland (New Zealand); Samuel Schlatter Herbert Shea, Ecole Polytechnique Fédérale de Lausanne (Switzerland); Iain Anderson, Biomimetics Lab, The Univ. of Auckland (New Zealand)

A completely independent high-voltage power supply will be demonstrated to drive dielectric elastomer actuators. It can generate a user-programmable voltage between 0 V and 5 kV, either continuously or as a square signal between 1 mHz and 1 kHz. It integrates a large 7'' LCD touch screen and a user-friendly graphic user interface. Its integrated battery makes it possible to use the power supply.

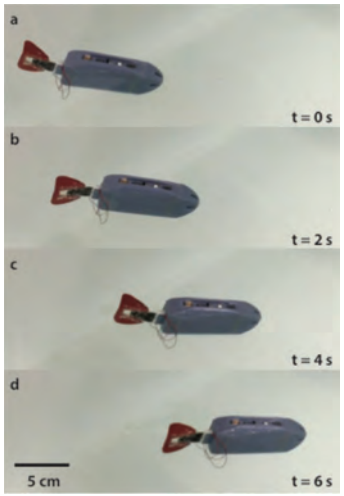
The latest offerings in wearable electroactive polymer technology from StretchSense Ltd.

Eric Ambos, Iain Anderson, StretchSense Ltd. (New Zealand)

This will include a glove that transmits via Bluetooth to phone or computer hand kinematic data from embedded stretch sensors with on-board inertial measurement. Uses include gaming, virtual reality and good old fashioned air guitar (or violin). The new application software can depict a live 3D rendering of your hand.

An untethered swimming robot powered by dielectric elastomer actuators

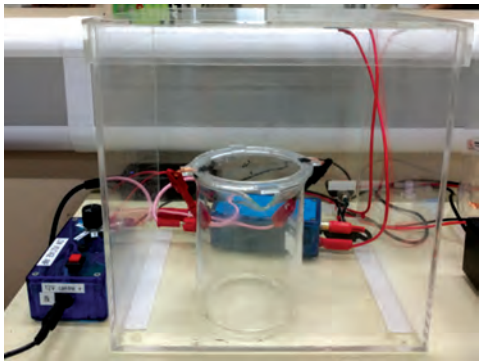
Mihai Duduta, Florian C. Berlinger, Hudson Gloria, Radhika Nagpal, Robert J. Wood, and David R. Clarke, Harvard Univ. (USA)



DEAs are rarely used in untethered robots because their force output is too small to enable locomotion via crawling or swimming. A multilayer assembly technique was developed to fabricate stronger bimorph actuators capable of outputting 20 mN of thrust when flapping in water at 1-8 Hz. A 10 cm long robot encapsulating the high voltage power supply that swims at 0.2 body lengths / second will be demonstrated.

Towards electroactive gel artificial muscle structures

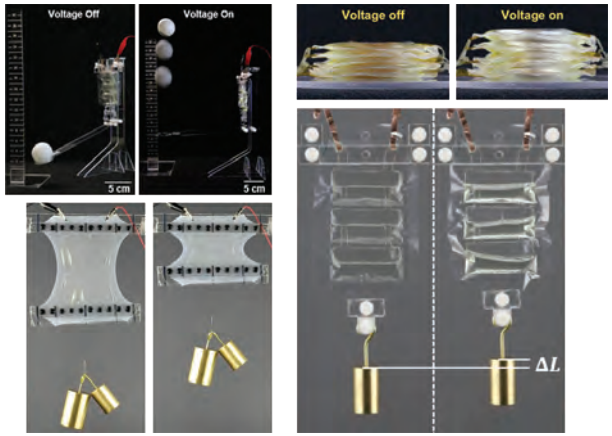
Majid Taghavi, Tim Helps, Univ. of Bristol (United Kingdom)



Electroactive gel actuators show great promise as artificial muscles because of their high strain and low elastic modulus but were not yet demonstrated performance characteristics necessary for ubiquity. In this demo newly developed electroactive gel actuators will be demonstrated with performance, achieved by optimization of not just material but also structural design of constituent components.

HASEL: Hydraulically amplified self-healing electrostatic actuators with muscle-like performance

Eric Acome, Shane K. Mitchell, Timothy G. Morrissey, Nicholas Kellaris, Vidyacharan Gopaluni Venkata, Madison B. Emmett, Claire Benjamin, Madeline King, Garrett Smith, Miles Radakovitz, Christoph Keplinger, Univ. of Colorado (USA)

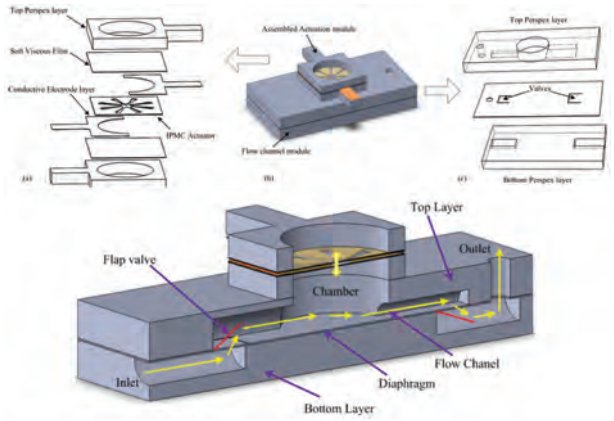


Soft electrostatic actuators that provide muscle-like performance will be demonstrated. These electrically controlled devices are based on a new class of soft actuators, termed hydraulically amplified self-healing electrostatic (HASEL) actuators, which recover from electrical failure while also combining the benefits of pneumatic and dielectric elastomer actuators. Key attributes are presented such as the ability to deliver large actuation force, achieve large actuation strain, output high power, and self-sense deformation for controlled actuation.

EAP-in-Action Demonstrations continues next 2 pages.

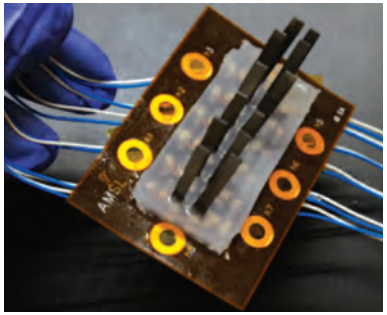
Fabrication and characterizations of a full-plastic micropump with petal-shaped ionic polymer-metal composite actuators

Yanjie Wang, Jie Ru, Zicai Zhu, Deling Zhu, and Xiaobing Liang, Xi'an Jiaotong Univ. (China)



As a critical research area, micropump has extensively emerged for many electronics and biological applications, especially for drug delivery. The actuating diaphragm, a key component of micropump, plays an important role in pumping-system. IPMC is a promising material candidate for micropump actuating diaphragm since it can be operated with low input voltages and can produce a large stroke by appropriate structural design. In this demo, we will present a petal-IPMC diaphragm obtained by mechanical cutting into micropump.

Multiple mode ionic polymer-metal composite array for the use in travelling wave actuators and sensing

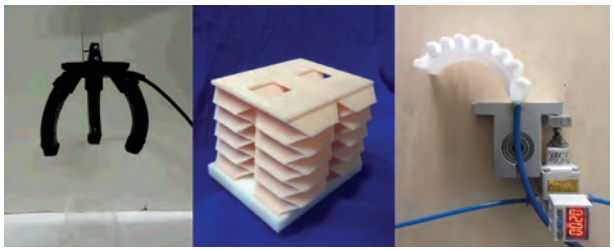


Sarah Trabia, Robert Hunt, Taeseon Hwang, Qi Shen, Zachary Frank, Justin Neubauer, Zakai Olsen, Tyler Stalbaum, Blake Naccarato, Kwang Kim, Active Materials and Smart Living Lab., Univ. of Nevada Las Vegas (USA)

In nature, there are teams of actuator-like limbs that move together, such as cilia. By producing a travelling wave effect, they can transport items, generate flow, and act as sensors. It would be ideal for researchers to be able to reproduce something similar to create more biomimetic systems. Presented is an Ionic Polymer-Metal Composite (IPMC) array that has the ability to work as a team of actuators moving in a travelling wave or a team of sensors, being able to give a reading of the flow across the surface of the array. In this demo an IPMC array that works as an actuator and sensor will be presented.

Applications of smart polymers and their structures

Liwu Liu, Xiongfei Lv, Qinghua Guan, Jinrong Li, Yanju Liu and Jinsong Leng, Harbin Institute of Technology (China)



This demonstration will show smart polymers and their structures in action taking advantages of their being light weight, fast response, and large deformation. The demonstration will include the applications of EAP, shape memory polymer (SMP) and other smart structures. Specifically, a smart gripper, based on EAP and SMP materials, will be presented. Different soft actuators with various structures could achieve bend, elongation, contraction and other types of movements.

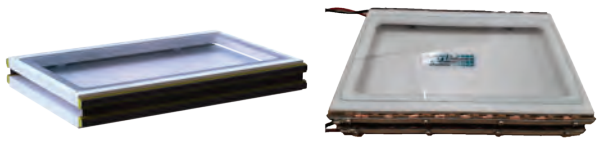
Synthetic Muscle™: Shape-morphing EAP based materials and actuators

Lenore Rasmussen, Simone Rodriguez, and Matthew Bowers, Ras Labs, Inc. (USA)

Ras Labs Synthetic Muscle™ is a class of electroactive polymer (EAP) based materials and actuators that contract, and with reversed electric input polarity, expand. Several actuators and sensors will be presented including a thick shape-morphing EAP pad that controllably contract or expand and is being used to prototype self-adjusting extremely comfortable prosthetic socket liners and other void-filling continual-fit applications, such as ear buds.

Haptic feedback demonstrators based on strip dielectric elastomer actuators

Philipp Loew, and Daniel Bruch, Univ. des Saarlandes, Lehrstuhl für Intelligente Materialsysteme, Intelligent Material Systems Lab (Germany)



CAD design final prototype

In times where touchscreens become more and more present in our daily lives, a haptic feedback based on the image you are receiving from the screen is helpful to operate a touch device without looking at it. The haptic feedback demonstrator, which is based on strip dielectric elastomer actuators is, is designed to perform this task, especially simulating buttons and rough surfaces.

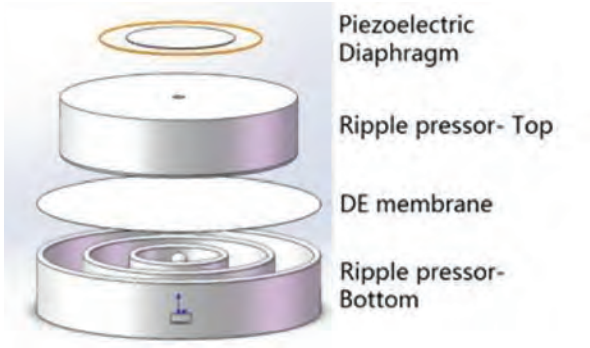
Loudspeaker based on cone shaped out-of-plane dielectric elastomer actuators

Philipp Loew, and Daniel Bruch, Univ. des Saarlandes, Lehrstuhl für Intelligente Materialsysteme, Intelligent Material Systems Lab (Germany)

Due to their advantages, such as lightweight, energy efficiency, low cost, compactness and freedom in design, dielectric elastomers are suited to substitute commercial loudspeakers. The presented demonstrator supplies the overall driving motion by an out-of-plane biased cone shaped dielectric elastomer actuator. In contrast to conventional loudspeakers, sound is generated by the active membrane surface.

Dielectric elastomer energy harvester autonomously primed by piezo- and tribo-electricity

Koh Soo Jin Adrian, Liu Chong, Ahmed Haroun, Anup Teejo Mathew, National Univ. of Singapore (Singapore)



A Dielectric Elastomer (DE) Energy Harvester that is autonomously-primed with a piezo- and a tribo-electric source will be demonstrated. The similar nature of piezo- and tribo-electric primers with DE allows a DEG to operate autonomously without the need of an external source of electricity. We present an assembly of a piezo-DEG and tribo-DEG energy harvester. The piezo- and tribo- sources will provide a voltage prime of about 100 V. The DE film then takes over the electrical charges from the piezo- and tribo- source, and amplifies the voltage.

High-frequency actuation of CuAlNi shape memory alloy thin film composites

Ashish K. Shukla, Akash K., Mani Prabu, Jayachandran S., Deepesh Meena, Sachin Bhirodkar, Anbarasu Manivannan, Palani I.A., Indian Institute of Technology (India)

Cu-Al-Ni Shape Memory Alloy/Polyimide composite films were developed by thermal evaporation exhibited two-way displacement without post processing and training. Developed sheets are actuated using joule heating at different frequencies and the displacement was measured using Laser displacement sensor. Wings made of these actuators will be demonstrated using voltages in square waveform with control over pulse width and amplitude.

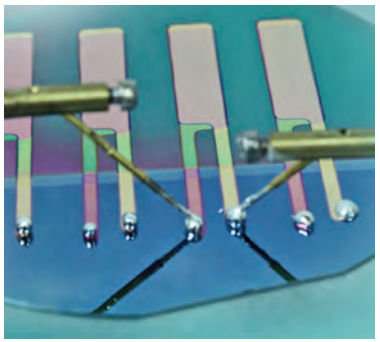
Hybrid piezoelectric shunt dampers for space rack vibration control: modeling and optimization

Bo Yan, Ke Wang, Zhihong Qiao, Chuanyu Wu, Zhejiang Science and Technology Univ. (China)

In this demo, piezoelectric transducers with some hybrid shunt damping circuit will be demonstrated to reduce vibrations. An electrical absorber was designed and optimized with the modal damping method to suppress the one mode vibration.

Enhancing the capabilities of artificial muscle implants using low-voltage dielectric elastomer sensors

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



The reduction of elastomer film thickness to a few hundred nanometers allows dielectric elastomer transducers (DET) to operate with only a few volts. DET nanostructures based on polydimethylsiloxane films are reliably fabricated by molecular beam deposition and in situ ultraviolet radiation curing. As capacitive sensors, these nanometer-thin DETs exhibit outstanding sensitivity of 4 kPa-1 for pressures between 0.01 and 10 kPa, which corresponds to loads between 0.01 and 10 g/mm. This resolution qualifies for resolving pressure changes at urethra. The team envisions this sensor for reliable force feedback integrated into an artificial muscle implant to treat urinary incontinence. Photo: Nanometer-thin dielectric elastomer layers (green) are fabricated by molecular beam deposition on a 2-inch Si-wafer (blue). The embedding Au-electrodes (goldish) are contacted via liquid metal drops.

3D PRINTING DEMONSTRATION SESSION

Wednesday 7 March · 4:00 PM – 6:00 PM · Part of conference 10597 on Nano-, Bio-, and Info-Tech Sensors and 3D Systems.

Location: Silverton, Salon 2

Session Chairs:

Ajit Khosla,
Yamagata Univ. (Japan)

Hidemitsu Furukawa,
Yamagata Univ. (Japan)

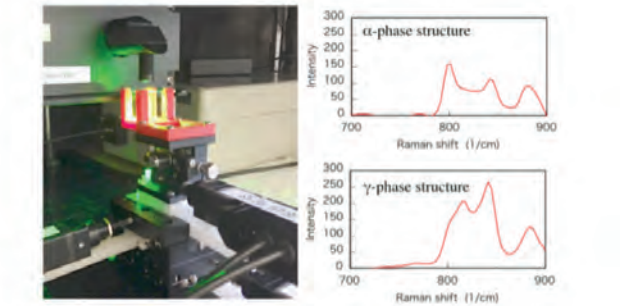
This demonstration session will cover new 3D printing technologies such as focusing on soft robotics, molecular models, and food. Each demonstration will include a brief oral talk describing the technology. All registered attendees are welcome.

TENTATIVE DEMONSTRATIONS

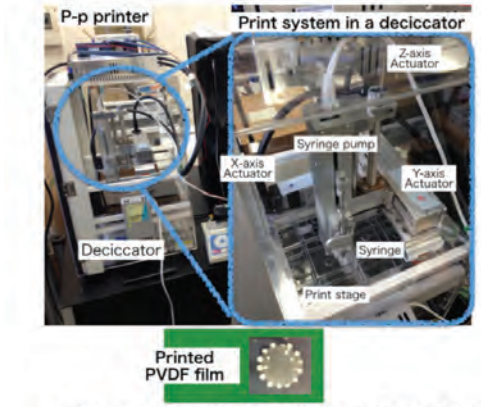
Smart Material for printing: Piezo-electric polymer film

Noriyasu Yamada, Atsuki Shiratori, Go Murasawa, Yamagata Univ. (Japan)

Poly(vinylidene fluoride) (PVDF) has four crystalline structures (α, β, γ and δ phase structures) in solid state. Only α-phase structure shows no crystal dipole, but this phase structure is converted easily into other phase structures according to some schemes. Generally, PVDF is given uniaxial stretch and polarization processes in order to convert into β-phase or γ-phase structure before sensor and actuator film use. However, we recently found a novel method in which PVDF film structure became β-phase or γ-phase without mechanical deformation processes. Furthermore, this technique enables us to apply printing technology, and realize the creation of free-form 3D sensor and actuators. Authors have constructed PVDF film fabrication techniques. As a result, PVDF crystalline structure was changeable using the techniques. In addition, a novel PVDF printer, which can draw free-form 2D PVDF film, has been developed on the basis of PVDF film fabrication results. We would present our PVDF film fabrication techniques and P-p printer in the demo session.



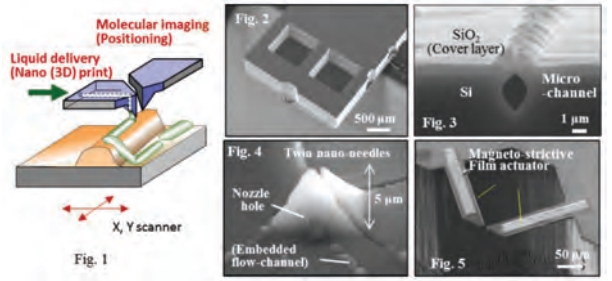
In-house Measurement system based on Raman spectroscopy and measurement results of present printed PVDF films (PVDF molecular structure is changeable using our method)



In-house piezo-electric polymer print system (P-p printer: Free form PVDF film can be fabricat

Fabrication of a 3D nano printing device

Jinseo Hong, Yusuke Masuda, Takashi Mineta, Yamagata Univ. (Japan)



We have developed a fabrication process of a 3D nano-printing device based on atomic force microscopic (AFM) probe technologies. The proposed device consists of twin silicon needle/cantilever probes. One is for high resolution imaging of a substrate surface for positioning, and the other is for liquid delivering to the substrate surface at an aimed position (Fig. 1). Figure 2 shows the fabricated prototype. The delivering cantilever has an embedded micro-fluidic channel (Fig. 3) and a silicon nano-needle with an outlet nozzle hole (Fig. 4). A liquid reagent is flown from reservoirs on a silicon base chip to a substrate surface through a micro-channel and an outlet nozzle. We have developed the fabrication process of narrow-gapped twin silicon AFM needle tips with liquid delivering function by using silicon narrow-trench etching, trench protection with refilling SiO2 film, and silicon crystalline anisotropic etching. Narrow-gapped twin triangular-pyramidal silicon tips, with a nozzle-hole (~ϕ1μm), can be formed at each end of the cantilevers through the self-align etching technique. The embedded micro-channel, connected to the nozzle hole, is formed by the similar trench etching, side-wall protection with SiO2 thin film, anisotropic plasma etching at the trench bottom for the channel expansion, and SiO2 film growth for sealing (Fig. 3). We have also proposed silicon dual cantilever stacked with FePd magneto-strictive thin film actuator for cantilever switching. The twin cantilevers were located orthogonally to each other. When external magnetic flux is applied along the cantilever, the magneto-strictive film deflects away from a substrate surface. After the release, the other non-deflected cantilever can be used for imaging or delivering operation. In our future work, we are going to characterize the liquid delivery property in detail and demonstrate the nano-printing method.

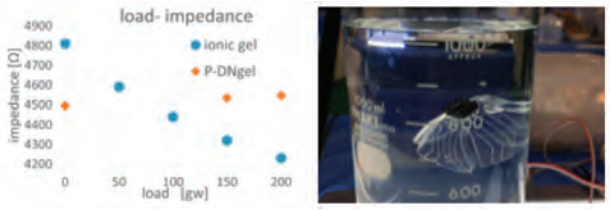
3D printing of foods

Mai Kodama, Ryo Ishigaki, Samiul Basher, Hiroyuki Sasaki, Azusa Saito, Masato Makino, Ajit Khosla, Masaru Kawakami, Hidemitsu Furukawa, Yamagata Univ. (Japan)

In recent years, various types of 3D printers have been developed along with the trend of manufacturing with 3D printers. 3D printers are mainly used to make "things" by using synthetic resin as materials, but recently 3D food printers that make "food" such as pizza and chocolate which were developed and became a hot topic. However, these 3D printers are adapted to only one material, which is difficult to shape in various food materials. Therefore, we developed a multi-material 3D food printer "FP-2400" that can be applied to other food materials. Many 3D food printers are syringe pump based, but FP-2400 is screw based. This is a very new type of 3D food printer. By adopting the screw type, it became easy to control the material, as well as possible to use several kinds of materials. So far, we have succeeded in shaping rice flour gel (Fig. 1), bean paste (Fig. 2), cookie (Fig. 3) etc. as food printing materials. It is possible to print with other food gel type materials, as long as we print like this. The bean paste (Fig. 2) is a traditional Japanese sweet, and sometimes many customers likes to take printed food at the exhibition (Fig. 4). Eating 3D-shaped foods was sometimes fun, and it is getting popularity. In the future, we aim to be able to design not only shape but also will think about nutrition, taste and texture with 3D food printer. We believe that this technology can be applied to nursing care and hospital foods that require special attention and we can prepare meals tailored as their needs. In this demo session we will show the shaping by the bean paste.

3D printing for gel robotics

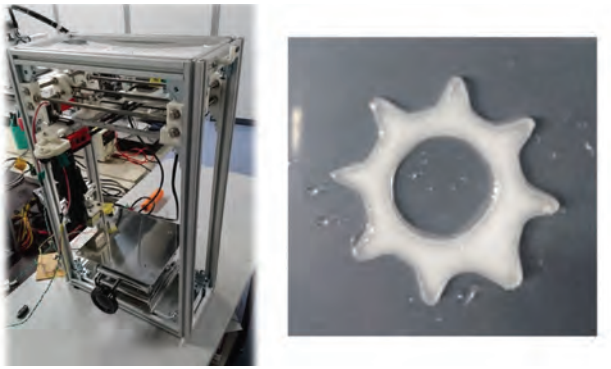
Kazunari Yoshida, Yuki Takishima, Yuuta Hara, Masaru Kawakami, and Hidemitsu Furukawa, Yamagata Univ. (Japan)



It is very beneficial to utilize the 3D-printing technique for robotics. Since the 3D printing technique of hydrogel materials has been developed [1], application of gel materials to robotics become easier. Soft materials, such as polymer hydrogels, are required for developing the domestic robots, hence 3D-printed gel objects will play important roles in such fields. We are developing the gel pressure sensor utilizing ionic liquid [2]. In the case of application of alternating electric fields, impedance is decreased with increase in the pressure to ionic gel which is including the ionic liquid. Fig 1 shows the impedance as a function of applied normal load (control: particle double network gel). We combine this technique and 3D printing technique, and then, apply to soft robots and novel prosthetic arm. Furthermore, we are developing the jelly-fish-like soft robot utilizing the transparent shape memory gel (T-SMG) and shrinkable wires (Fig. 2). Such robot oscillatory move like jelly fish, and this movement is induced with silent. In addition, that will have a low environmental burden. We also combine this technique and 3D printing technique, and apply to underwater exploration gel robots.

RepRap SWIM-ER: low-cost open-source 3D gel printer

Azusa Saito, Kei Sato, Samiul Basher, Masaru Kawakami, Hidemitsu Furukawa, Yamagata Univ. (Japan)



Gels, soft and wet materials, have unique properties such as transparency, biocompatibility, and low friction. In recent years, high strength gel has been developed. Various studies take advantage of these characteristics has proceeded, we research to use high strength gel. High-strength gels are expected to be put to practical use in various situations. For example, gel organ models and gel artificial blood vessels are required at a medical site. Also in the field of robotics, soft materials are drawing attention. To put a high-strength gel into practical use, it is necessary to free-form a gel using a 3D gel printer. We developed a 3D gel Printer "SWIM-ER", has enabled modeling of complex shapes of the gel. However, this is expensive. Therefore not all of the gel researchers and the companies have such a device. "RepRap" is the abbreviation for "Replicating rapidly prototyper", the open source 3D printer. Most of the RepRap parts are made of a resin, and the 3D digital data of the parts and its firmware are posted on the internet. Therefore, we can easily create another 3D printer by building the parts with a 3D printer and programing the firmware on an inexpensive electronic substrate like the "Arduino". In this research, we aimed to develop a low-cost 3D gel printer which can be used by anyone using RepRap.

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SC634

Course Level: Introductory · CEU: 0.4

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Sunday 4 March 2018 · 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.

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

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

Geoffrey M. Spinks, Univ. of Wollongong (Australia), 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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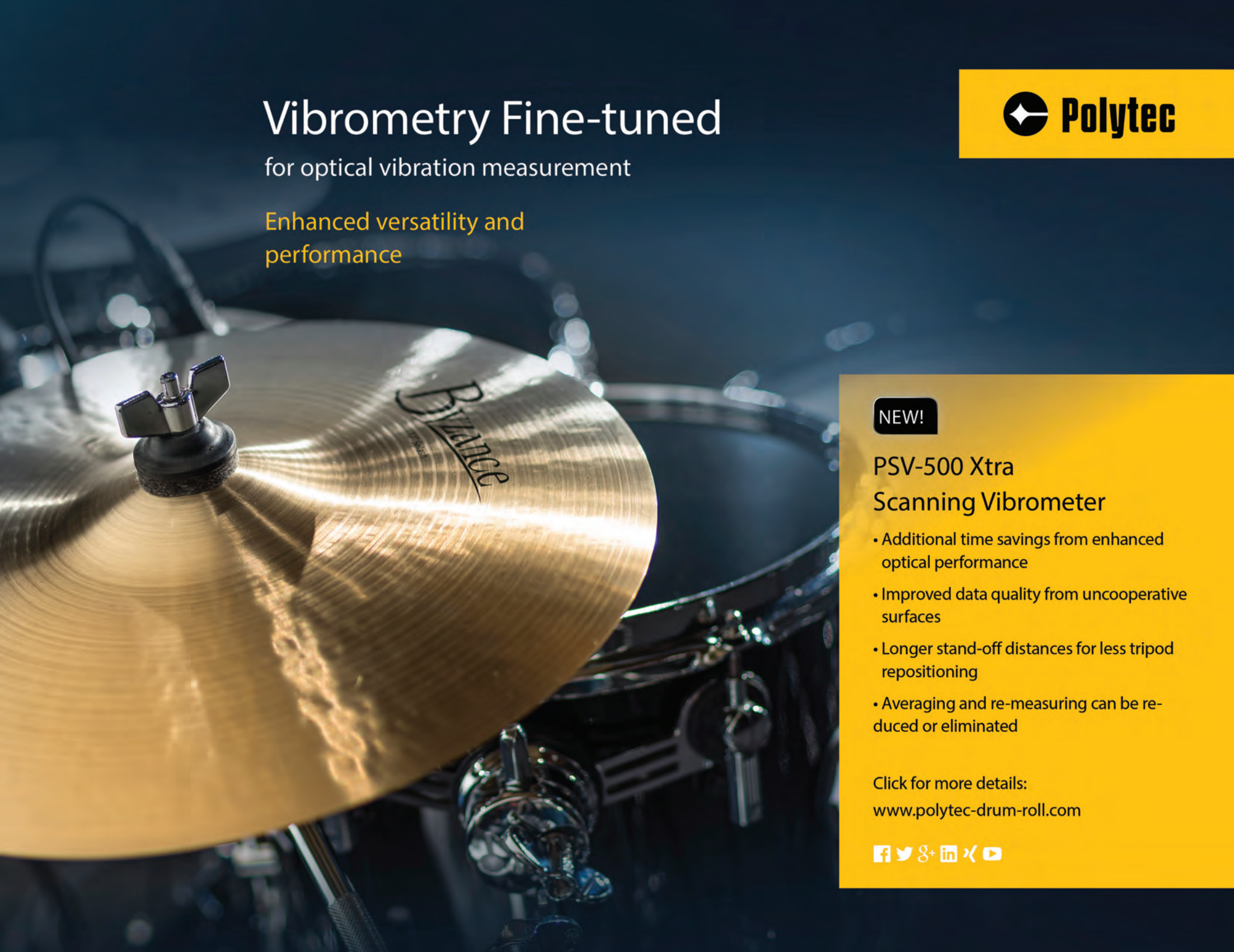

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Monday 5 March . . . . . 7:00 am to 5:00 pm
Tuesday 6 March . . . . . 7:30 am to 4:00 pm
Wednesday 7 March . . . . . 7:45 am to 4:00 pm
Thursday 8 March . . . . . 7:45 am to 4:00 pm

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Includes admission to all conference sessions, plenaries, panels, and poster sessions, Welcome Reception, coffee breaks, and a choice of online proceedings, or online collection.

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Monday through Thursday . . . . 7:30 am to 5:00 pm

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Poster Setup Instructions

3rd Floor Crestone and Crystal Foyer

Tuesday 6 March and Wednesday 7 March

Poster presenters may set up between 10:00 am and 4:00 pm on Tuesday 6 March for the Tuesday Poster Session or Wednesday, 7 March for the Wednesday Poster Session. Presenters who have not set up by 4:00pm will be considered a "no show" and their manuscript will not be published. Presenters must remove their posters by 7:30pm that same night. Posters not removed will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the poster sessions.

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2nd Floor Foyer

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www.denver.org/restaurants/denver-dining

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CONFERENCE SESSION SCHEDULE

	CONFERENCE 10593 Bioinspiration, Biomimetics, and Bioreplication VIII	CONFERENCE 10594 Electroactive Polymer Actuators and Devices (EAPAD) XX	CONFERENCE 10595 Active and Passive Smart Structures and Integrated Systems XII	CONFERENCE 10596 Behavior and Mechanics of Multifunctional Materials and Composites XII	CONFERENCE 10597 Nano-, Bio-, Info-Tech Sensors and 3D Systems
Monday 5 March	Session 1 Mon 10:30 am to 11:30 am Inaugural Session *(Lakhtakia)* Session 2 Mon 11:30 am to 12:30 pm Flight I *(Liu)*	Session 1 Mon 10:30 am to 11:50 am EAP as Emerging Actuators *(Bar-Cohen, Anderson)*	Session 1 Mon 10:30 am to 11:50 am Energy Harvesting I: Nonlinear *(Han, Harne)*	Session 1 Mon 10:30 am to 11:30 am Auxetic and Metamaterials *(Naguib)*	Session 1 Mon 10:30 am to 11:10 am Wearable and Implantable Technology and Healthcare I *(Varadan)* Session 2 Mon 11:10 am to 12:30 pm Wearable and Implantable Technology and Healthcare II *(Varadan)*
	Session 3 Mon 1:45 pm to 3:05 pm Material Structures I *(Knez)* Session 4 Mon 3:35 pm to 4:55 pm Bio-Optics *(Saito)*	Session 2 Mon 1:20 pm to 3:00 pm Field-Activatable EAP I *(Madden, Rossiter)* 4:30 pm to 5:45 pm EAP-in Action Demonstration Session *(Bar-Cohen)*	Session 2 Mon 1:20 pm to 3:00 pm Passive and Active Vibration Isolation/ Attenuation I *(Erturk, Kauffman)* Session 3 Mon 3:20 pm to 5:40 pm Energy Harvesting II: Piezoelectric *(Zuo, Anto)*	Session 2 Mon 1:20 pm to 3:00 pm Shape Memory Materials I *(Goulbourne, Beck)* Session 3 Mon 3:30 pm to 6:00 pm Additive Manufacturing I *(Wereley)*	Session 3 Mon 1:30 pm to 2:10 pm Additive Manufacturing and 3D Printing *(Song)* Session 4 Mon 2:10 pm to 3:10 pm 3D Printing and Applications I *(Khosla)* Session 5 Mon 3:40 pm to 4:20 pm Nanosensors and Systems I *(Varadan)* Session 6 Mon 4:20 pm to 6:00 pm Fabrication and Characterization of Nanosensors and Structures I *(Zhai)*
Tuesday 6 March	Session 5 Tue 10:30 am to 11:30 am Energy *(Fiumara)* Session 6 Tue 11:30 am to 12:30 pm Robotics *(Lenau)*	Session 3 Tue 10:30 am to 12:10 pm Advances in EAP Materials *(Kim, deBotton)*	Session 4 Tue 10:30 am to 12:10 pm Morphing and Deployable Structures *(Arrieta, Huxdorf)*	Session 4 Tue 10:30 am to 12:20 pm Origami Materials *(Ounaies, von Lockette)*	Session 7 Tue 10:30 am to 11:10 am Keynote Session I *(Varadan)* Session 8 Tue 11:10 am to 12:50 pm 3D Printing and Applications II *(Yahagi)*
	Session 7 Tue 2:00 pm to 3:20 pm Adhesion *(Walther)* Session 8 Tue 3:50 pm to 5:30 pm Particulate Matter *(Martín-Palma)*	Session 4 Tue 1:40 pm to 3:00 pm IMPC *(Baughman, Spinks)* Session 5 Tue 3:30 pm to 5:50 pm Modeling EAP Materials *(Taya, Keplinger)*	Session 5 Tue 1:40 pm to 3:00 pm Fluid-Structure Interaction *(Schwesinger, Erturk)* Session 6 Tue 3:30 pm to 5:50 pm Bistable Structures and Energy Harvesters *(Liao, Tang)*	Session 5 Tue 1:50 pm to 3:10 pm Dielectrics and Piezolectrics *(Sundaresan, Ameli)* Session 6 Tue 3:40 pm to 6:00 pm Additive Manufacturing II *(Dapino, Yang)*	Session 9 Tue 1:50 pm to 2:30 pm Keynote Session II *(Varadan)* Session 10 Tue 2:30 pm to 3:30 pm Nanosensors and Systems II *(Song)* Session 11 Tue 4:00 pm to 6:00 pm Nanosensors and Systems III *(Varadan)*

CONFERENCE 10598 Sensors and Smart Structures Technologies for Civil, Mechanical, and Aerospace Systems		CONFERENCE 10599 Nondestructive Characterization and Monitoring of Advanced Materials, Aerospace, Civil Infrastructure, and Transportation XII	CONFERENCE 10600 Health Monitoring of Structural and Biological Systems XII	CONFERENCE 10601 Smart Materials and Nondestructive Evaluation for Energy Systems IV	CONFERENCE 10602 Smart Structures and NDE for Industry 4.0
Session 1 Mon 10:30 am to 11:50 am UAV for Structural Inspection *(Jung, Natkins)*		Session 1 Mon 10:30 am to 12:10 pm SHM/NDE of Civil Structures/ Infrastructure I *(Yu, Chen)*	Session 1 Mon 10:30 am to 11:50 am Distributed Sensors for SHM *(Kundu, Fromme)*	Session 1 Mon 10:30 am to 12:00 pm Development and Application of Smart Materials for Energy Systems *(Abdul-Aziz)*	Session 1 Mon 10:30 am to 11:30 am Smart Structures and NDE for Industry 4.0: Introduction *(Meyendorf, Pal)* Session 2 Mon 11:30 am to 12:10 pm Smart Structures and NDE for Industry 4.0 *(Meyendorf, Pal)*
Session 2 Mon 1:00 pm to 3:00 pm Advanced Composite Technologies *(Ryu, Loh)* Session 3 Mon 3:20 pm to 6:00 pm Health Assessment of Composite Structures *(Ostachowicz, Tallman)*		Session 2 Mon 1:30 pm to 3:10 pm SHM/NDE of Civil Structures/ Infrastructure II *(Su, Lau)* Session 3 Mon 3:40 pm to 6:00 pm SHM/NDE of Civil Structures/ Infrastructure III *(Loh, Ezell)*	Session 2 Mon 1:20 pm to 3:00 pm Nonlinear Ultrasonic Techniques *(Staszewski, Qing)* Session 3 Mon 3:20 pm to 6:00 pm Guided Wave for SHM/NDE *(Ricci, Shen)*	Session 2 Mon 1:00 pm to 3:20 pm Characterization of Materials and NDE/ SHM of Energy *(Exarchos)* Session 3 Mon 3:50 to 5:30 pm Techniques and Materials for Energy Harvesting: Wind Energy Systems *(Avdelidis)*	Session 3 Mon 1:20 pm to 2:00 pm Keynote Session *(Omenzetter)* Session 4 Mon 2:00 pm to 3:00 pm Acquisition and Analysis of Large Amount of Data (Big Data) *(Omenzetter)* Session 5 Mon 3:30 pm to 4:10 pm New Applications for Smart Structures and Materials for Industry 4.0 *(Gath)* Session 6 Mon 4:10 pm to 5:30 pm Smart Structures and Additive Manufacturing *(Meyendorf)*
Session 4A Tue 10:30 am to 12:10 pm Vision-Based Structural Health Monitoring I *(Jahanshahi, Torbol)*	Session 4B Tue 10:30 am to 12:10 pm Wireless Sensors and Applications I *(Jo, Li)*	Session 4 Tue 10:30 am to 12:10 pm Aerospace and Advanced Materials SHM/ NDE I *(Gyekenyesi, Yuan)*	Session 4 Tue 10:30 am to 12:30 pm Civil Infrastructure Monitoring I *(Niezrecki, Uhl)*		Session 7 Tue 10:30 am to 12:10 pm Real-Time Monitoring and Smart NDE *(Clingman)*
Session 5A Tue 1:40 pm to 3:00 pm Vision-Based Structural Health Monitoring II *(Cha, Li)* Session 6A Tue 3:30 pm to 5:50 pm Deep Learning for Structural Health Monitoring *(An, Cho)*	Session 5B Tue 1:40 pm to 3:00 pm Wireless Sensors and Applications II *(Wang, Huang)* Session 6B Tue 3:30 pm to 5:50 pm Novel Sensing Technologies I *(Li, Wang)*	Session 5 Tue 1:40 pm to 3:00 pm Aerospace and Advanced Materials SHM/ NDE II *(Yuan, Gyekenyesi)* Session 6 Tue 3:30 pm to 5:50 pm Aerospace and Advanced Materials SHM/ NDE III *(Ozevin, Bowland)*	Session 5 Tue 1:40 pm to 3:00 pm Advanced Modeling Techniques *(Banerjee, Koshti)* Session 6 Tue 3:20 pm to 6:00 pm Medical/Biomedical Applications *(Rizzo, Jiang)*		Session 8 Tue 1:40 pm to 3:00 pm Application of Smart Structures and Materials *(Clingman)*

CONFERENCE SESSION SCHEDULE

	CONFERENCE 10593 Bioinspiration, Biomimetics, and Bioreplication VIII	CONFERENCE 10594 Electroactive Polymer Actuators and Devices (EAPAD) XX		CONFERENCE 10595 Active and Passive Smart Structures and Integrated Systems XII		CONFERENCE 10596 Behavior and Mechanics of Multifunctional Materials and Composites XII	CONFERENCE 10597 Nano-, Bio-, Info-Tech Sensors and 3D Systems
Wednesday 7 March	Session 9 Wed 10:30 am to 11:40 am Flight II *(Chahl)*	Session 6 Wed 10:30 am to 12:10 pm Dielectric Elastomers *(Perline, Su)*		Session 7A Wed 10:30 am to 12:10 pm Bio-Inspired Structures and Systems *(Akle, Shahab)*	Session 7B Wed 10:30 am to 12:10 pm Metamaterials and Metastructures I *(Erturk, Tang)*	Session 7 Wed 10:30 am to 12:10 pm Shape Memory Materials II *(Hartl, Lagoudas)*	Session 12 Wed 10:30 am to 11:10 am Keynote Session III *(Choi)* Session 13 Wed 11:10 am to 12:30 pm Nanomaterials and Applications *(Varadan)*
	Session 10 Wed 1:10 pm to 3:20 pm Soft Matter *(Keplinger)* Session 11 Wed 3:50 pm to 4:50 pm Material Structures II *(Kim)* Session 12 Wed 4:50 pm to 5:50 pm Tutorial Lecture *(Lakhtakia)*	Session 7 Wed 1:40 pm to 3:00 pm Field-Activatable EAP II *(Pei, Kornbluh)* Session 8 Wed 3:30 pm to 5:50 pm Applications of Dielectric Elastomers *(Trease, Sottos)*		Session 8A Wed 1:40 to 3:00 pm Energy Harvesting III: Piezoelectric *(Karami, Youn)* Session 9A Wed 3:30 to 5:30 pm Magnetic and Magneto/Electrorheological Systems *(Sims, Kavlicoglu)*	Session 8B Wed 1:40 to 3:00 pm Acoustic/Fluid-Structure Interaction *(Shahab, Danesh-Yazdi)* Session 9B Wed 3:30 to 5:50 pm Piezoelectric Materials and Systems I *(Anton, Arrieta)*	Session 8 Wed 1:40 pm to 3:00 pm Nanocomposites Applications *(Sodano, Rizvi)* Session 9 Wed 3:30 pm to 6:00 pm Magnetostrictive Materials *(Lynch, Kim)*	Session 14 Wed 1:30 pm to 2:10 pm Wearable Medical Devices and 3D Printing I *(Varadan)* Session 15 Wed 2:10 pm to 2:35 pm Wearable Medical Devices and 3D Printing II *(Khosla, Furukawa)* Wed 4:00 pm to 6:00 pm Wearable Medical Devices and 3D Printing Demonstration Session *(Khosla, Furukawa)*
Thursday 8 March		Session 9A Thu 8:00 to 10:00 am EAP Fabrication Processes *(Bauer, Böse)* Session 10A Thu 10:30 to 11:50 am Applications of IPMC *(Zhu, Rasmussen)*	Session 9B Thu 8:00 to 10:00 am Applications of EAP I *(Henke, Wallmersperger)* Session 10B Thu 10:30 to 11:50 am Conducting Polymers *(Vertechy, Lan)*	Session 10A Thu 8:00 to 10:00 am Energy Harvesting IV: Design and Optimization *(Lee, Zuo)* Session 11A Thu 10:30 to 11:50 am Smart Sensing and Signal Processing for Diagnostics *(Kim, Barone)*	Session 10B Thu 8:00 to 10:00 am Passive and Active Vibration Isolation Attenuation II *(Han, Erturk)* Session 11B Thu 10:30 to 11:50 am Piezoelectric Materials and Systems II *(Ozer, Towfighian)*	Session 10 Thu 8:00 am to 10:00 am Mechanics of Multifunctional Materials *(Oates)* Session 11 Thu 10:30 am to 11:50 am Physically Responsive Materials *(Smith, Rizvi)*	
		Session 11A Thu 1:20 to 3:00 pm EAP Sensors *(Rosset, Liu)* Session 12A Thu 3:30 to 5:50 pm Applications of EAP III *(Koh, Christianson)*	Session 11B Thu 1:20 to 3:00 pm Applications of EAP II *(Shea, Fontana)* Session 12B Thu 3:30 to 5:50 pm Applications of EAP IV *(Anderson)*	Session 12A Thu 1:20 to 3:00 pm Shape Memory Materials and Systems *(Solomou, Hartl)* Session 13A Thu 3:30 to 5:50 pm Energy Harvesting V: General *(Towfighian, Wang)*	Session 12B Thu 1:20 to 3:00 pm Metamaterials and Metastructures II *(Tang, Karami)* Session 13B Thu 3:30 to 5:10 pm Magnetorheological Systems *(Maas, Kavlicoglu)*	Session 12 Thur 1:40 pm to 3:00 pm Multifuctional Materials and Applications *(Ameli, Cinquemani)*	

CONFERENCE 10598 Sensors and Smart Structures Technologies for Civil, Mechanical, and Aerospace Systems		CONFERENCE 10599 Nondestructive Characterization and Monitoring of Advanced Materials, Aerospace, Civil Infrastructure, and Transportation XII		CONFERENCE 10600 Health Monitoring of Structural and Biological Systems XII	
Session 7A Wed 10:30 am to 12:10 pm Novel Sensing Technologies II *(Glisic, Peters)*	Session 7B Wed 10:30 am to 12:10 pm Machine Learning for Structural Health Monitoring *(Cha, Ni)*	Session 7 Wed 10:30 am to 12:10 pm Vision-Based SHM/NDE *(Yu, Sabato)*		Session 7 Wed 10:30 am to 12:30 pm Elastic and Metamaterial I *(Huang, Yang)*	
Session 8A Wed 2:00 pm to 3:00 pm Modeling of Smart Materials and Sensor Performance *(Kim, Wang)* Session 9A Wed 3:20 pm to 6:00 pm Interrogation of Structures I *(Loh, Semperlotti)*	Session 8B Wed 1:40 pm to 3:00 pm Civil Infrastructure Monitoring I *(Laflamme, Lynch)* Session 9B Wed 3:20 pm to 6:00 pm Civil Infrastructure Monitoring II *(Li, Loh)*	Session 8 Wed 1:40 pm to 3:00 pm SHM/NDE Additive Manufacturing *(Zhang, Zheng)* Session 9 Wed 3:30 pm to 5:30 pm Radar SHM/NDE *(Xia, Wan)*		Session 8A Wed 1:40 pm to 3:00 pm Elastic and Metamaterial II *(Yang, Huang)* Session 9A Wed 3:20 pm to 6:00 pm Elastic and Metamaterial III *(Huang, Yang)*	Session 8B Wed 1:40 pm to 3:00 pm Modeling/Simulation and Experiment for Nonlinear/Linear Ultrasonic Techniques I *(Hafezi, Taskhiri)* Session 9B Wed 3:30 pm to 5:50 pm Composite Monitoring *(Ostachowicz, Krishnaswamy)*
Session 10A Thu 8:00 am to 10:20 am Fiber Optic Sensors for Structural Health Monitoring I *(Huang, Jenkins)* Session 11A Thu 10:50 am to 12:10 pm Sensor Development and Applications *(Yun)*	Session 10B Thu 8:00 am to 10:00 am Novel Sensing Technologies III *(Krishnaswamy, Huang)* Session 11B Thu 10:30 am to 12:30 pm New Technological Advances *(Liao)*	Session 10A Thu 8:00 to 10:00 am Guided Wave SHM/NDE *(Jiang, Shull)* Session 11 Thu 10:30 am to 11:50 am Industrial-Process Control NDE/NDT I *(Feng, Zuo)*	Session 10B Thu 8:00 am to 11:30 am SHM/NDE Sensor Modeling *(Omenzetter, Laflamme)*	Session 10A Thu 8:00 am to 10:00 am Elastic and Metamaterial IV *(Semperlotti, Nouh)* Session 11A Thu 10:30 am to 11:50 am Elastic and Metamaterial V *(Su, Zagrai)*	Session 10B Thu 8:00 am to 10:00 am Modeling/Simulation and Experiment for Nonlinear/Linear Ultrasonic Techniques II *(Jhang, Hafezi)* Session 11B Thu 10:30 am to 11:50 am Modeling/Simulation and Experiment for Nonlinear/Linear Ultrasonic Techniques III *(Hafezi, Taskhiri)*
Session 12A Thu 1:40 pm to 3:00 pm Integration of Smart Sensing Systems *(Kim, Huang)* Session 13A Thu 3:30 pm to 6:10 pm Fiber Optic Sensors for Structural Health Monitoring II *(Wang, Chen)*	Session 12B Thu 1:30 pm to 3:10 pm Interrogation of Structures II *(Hong, Liu)* Session 13B Thu 3:40 pm to 6:00 pm Internet of Things Sensor Network *(Huston, Laflamme)*	Session 12 Thu 1:20 pm to 2:20 pm Industrial/Process Control NDE/NDT II *(Feng, Zuo)*		Session 12A Thu 1:20 pm to 4:30 pm Civil Infrastructure Monitoring II *(Reis, Giurgiutiu)*	Session 12B Thu 1:20 pm to 5:30 pm Emerging and Futuristic Techniques *(Fromme, Mao)*

TECHNICAL CONFERENCES

CONFERENCE 10593

Monday–Wednesday
5–7 March 2018
Proceedings of
SPIE Vol. 10593

Bioinspiration, Biomimetics, and Bioreplication VIII

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

Conference Co-Chairs: **Raúl J. Martín-Palma,** Univ. Autónoma de Madrid (Spain); **Mato Knez,** CIC nanoGUNE Consolider (Spain)

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CONFERENCE 10594

Monday–Thursday
5–8 March 2018
Proceedings of SPIE Vol. 10594

Electroactive Polymer Actuators and Devices (EAPAD) XX

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

Conference Co-Chair: **Iain A. Anderson,** The Univ. of Auckland (New Zealand)

Program Committee: **Barbar J. Akle,** Lebanese American Univ. (Lebanon); **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); **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); **Jonathan M. Rossiter,** Univ. of Bristol (United Kingdom); **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 10595

Monday–Thursday
5–8 March 2018
Proceedings of SPIE Vol. 10595

Active and Passive Smart Structures and Integrated Systems XII

Conference Chair: **Alper Erturk,** Georgia Institute of Technology (USA)

Conference Co-Chair: **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 Gordaninejad,** Univ. of Nevada, Reno (USA); **Nakhiah C. Goulbourne,** Univ. of Michigan (USA); **Ryan 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); **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); **Gyuhae Park,** Chonnam National Univ. (Korea, Republic of); **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 10596

Monday–Thursday
5–8 March 2018
Proceedings of
SPIE Vol. 10596

Behavior and Mechanics of Multifunctional Materials and Composites XII

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

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

Program Committee: **Gregory P. Carman,** Univ. of California, Los Angeles (USA); **Constantin Ciocanel,** Northern Arizona Univ. (USA); **Marcelo J. Dapino,** The Ohio State Univ. (USA); **Darren J. Hartl,** Texas A&M Univ. (USA); **Daniel J. Inman,** Univ. of Michigan (USA); **Kwang Jin Kim,** Univ. of Nevada, Las Vegas (USA); **Dimitris C. Lagoudas,** Texas A&M Univ. (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); **William S. Oates,** Florida State Univ. (USA); **Zoubeida Ounaies,** The Pennsylvania State Univ. (USA); **Ralph C. Smith,** North Carolina State Univ. (USA); **Vishnu Baba Sundaresan,** The Ohio State Univ. (USA)

CONFERENCE 10597

Monday–Wednesday
5–7 March 2018
Proceedings of
SPIE Vol. 10597

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

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

Conference Co-Chairs: **Ajit Khosla,** Yamagata Univ. (Japan); **Hidemitsu Furukawa,** 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); **Mamoru Kawakami,** Yamagata Univ. (Japan); **Kimiya Komurasaki,** The Univ. of Tokyo (Japan); **Hideki Kyogoku,** Kindai Univ. (Japan); **Uhn Lee M.D.,** Gachon Univ. Gil Medical Ctr. (Korea, Republic of); **Go Murasawa,** Yamagata Univ. (Japan); **Hani E. Naguib,** Univ. of Toronto (Canada); **Ilkwon Oh,** KAIST (Korea, Republic of); **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)

CONFERENCE 10598

Monday–Thursday · 5–8 March 2018
Proceedings of SPIE Vol. 10598

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

Conference Chair: **Hoon Sohn,** KAIST (Korea, Republic of)

Conference Co-Chairs: **Jerome P. Lynch,** Univ. of Michigan (USA); **Kon-Well Wang,** Univ. of Michigan (USA)

Program Committee: **Hiroshi Asanuma,** Chiba Univ. (Japan); **Chih Chen Chang,** Hong Kong Univ. of Science and Technology (Hong Kong, China); **Genda Chen,** Missouri Univ. of Science and Technology (USA); **Alison B. Flatau,** Univ. of Maryland, College Park (USA); **Branko Glisic,** Princeton Univ. (USA); **Faramarz Gordaninejad,** Univ. of Nevada, Reno (USA); **Benjamin L. Grisso,** Naval Surface Warfare Ctr. Carderock Div. (USA); **Ryan L. Harne,** The Ohio State Univ. (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); **Mohammad Reza Jahanshahi,** Purdue Univ. (USA); **Gi-Woo Kim,** Inha Univ. (Korea, Republic of); **Jeong-Tae Kim,** Pukyong National Univ. (Korea, Republic of); **Masahiro Kurata,** Kyoto Univ. (Japan); **Simon Laflamme,** Iowa State Univ. (USA); **Hui Li,** Harbin Institute of Technology (China); **Jian Li,** The Univ. of Kansas (USA); **Suyi Li,** Clemson Univ. (USA); **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); **Theodore E. Matikas,** Univ. of Ioannina (Greece); **Norbert G. Meyendorf,** Iowa State Univ. of Science and Technology (USA); **Akira Mita,** Keio Univ. (Japan); **Yiqing Ni,** The Hong Kong Polytechnic Univ. (Hong Kong, China); **Hae Young Noh,** Carnegie Mellon Univ. (USA); **Irving J. Oppenheim,** Carnegie Mellon Univ. (USA); **Wieslaw M. Ostachowicz,** The Szewalski Institute of Fluid-Flow Machinery (Poland); **Kara J. Peters,** North Carolina State Univ. (USA); **Michael K. Philen,** Virginia Polytechnic Institute and State Univ. (USA); **Piervincenzo Rizzo,** Univ. of Pittsburgh (USA); **Massimo Ruzzene,** Georgia Institute of Technology (USA); **Donghyeon Ryu,** New Mexico Institute of Mining and Technology (USA); **Liming W. Salvino,** Office of Naval Research Global (USA); **Fabio Semperlotti,** Purdue Univ. (USA); **Wei Song,** The Univ. of Alabama (USA); **Wieslaw J. Staszewski,** AGH Univ. of Science and Technology (Poland); **R. Andrew Swartz,** Michigan Technological Univ. (USA); **Tyler N. Tallman,** Purdue Univ. (USA); **Marco Torbol,** Ulsan National Institute of Science and Technology (Korea, Republic of); **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,** Zhejiang Univ. (China); **Daniele Zonta,** Univ. degli Studi di Trento (Italy)

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CONFERENCE 10599

Monday–Thursday
5–8 March 2018
Proceedings of SPIE Vol. 10599

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

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

Conference Co-Chairs: **Andrew L. Gyekenyesi,** Ohio Aerospace Institute (USA); **Tzu-Yang Yu,** Univ. of Massachusetts Lowell (USA); **H. Felix Wu,** U.S. Dept. of Energy (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); **Denvid 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); **Oliver J. Myers,** Clemson Univ. (USA); **Piotr Omenzetter,** Univ. of Aberdeen (United Kingdom); **Didem Ozevin,** Univ. of Illinois at Chicago (USA); **Akira Sasamoto,** National Institute of Advanced Industrial Science and Technology (Japan); **Caesar Singh,** U.S. Dept. of Transportation (USA); **Yu-Min Su,** National Kaohsiung Univ. of Applied Sciences (Taiwan); **Yan Wan,** Univ. of 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 10600

Monday–Thursday
5–8 March 2018
Proceedings of SPIE
Vol. 10600

Health Monitoring of Structural and Biological Systems XII

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

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

Program Committee: **Sourav Banerjee,** Univ. of South Carolina (USA); **Yoseph Bar-Cohen,** Jet Propulsion Lab. (USA); **Fu-Kuo Chang,** Stanford Univ. (USA); **Anthony J. Croxford,** Univ. of Bristol (United Kingdom); **Victor Giurgiutiu,** Univ. of South Carolina (USA); **Srinivasan Gopalakrishnan,** Indian Institute of Science (India); **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); **Mostafa A. Nouh,** Univ. at Buffalo (USA); **Wieslaw M. Ostachowicz,** The Szewalski 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); **Fabio Semperlotti,** Purdue Univ. (USA); **Yanfeng Shen,** Shanghai Jiao Tong Univ. (China); **Hoon Sohn,** KAIST (Korea, Republic of); **Wieslaw J. Staszewski,** AGH Univ. of Science and Technology (Poland); **Tadeusz Stepinski,** 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)

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CONFERENCE 10601

Monday–Tuesday
5–6 March 2018
Proceedings of
SPIE Vol. 10601

Smart Materials and Nondestructive Evaluation for Energy Systems IV

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

Conference Co-Chairs: **Kara J. Peters,** North Carolina State Univ. (USA); **Norbert G. Meyendorf,** Iowa State Univ. of Science and Technology (USA); **Christopher Niezrecki,** Univ. of Massachusetts Lowell (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); **Dimitrios A. Exarchos,** Univ. of Ioannina (Greece); **Peter Heilmann,** arxes-tolina GmbH (Germany); **Manfred Johannes,** South African Institute for Non-Desctructive Testing (South Africa); **Vassilios Kappatos,** Univ. of Southern Denmark (Denmark); **Michael Kroening,** Pontifícia 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); **Stefano Sfarra,** Univ. degli Studi dell'Aquila (Italy); **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 10602

Monday–Tuesday
5–6 March 2018
Proceedings of
SPIE Vol. 10602

Smart Structures and NDE for Industry 4.0

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

Conference Co-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 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 Co. (USA); **Jayanth N. Kudva,** NextGen Aeronautics, Inc. (USA); **Amrita Kumar,** Acellent Technologies, Inc. (USA); **Jay Lee,** Univ. of Cincinnati (USA); **Jung-Ryul Lee,** KAIST (Korea, Republic of); **Donald J. Leo,** The Univ. of Georgia (USA); **Zheng Liu,** The Univ. of British Columbia Okanagan (Canada); **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,** Armstrong Flight Research Ctr. (USA); **Janet M. Sater,** Institute for Defense Analyses (USA); **Edward V. White,** The Boeing Co. (USA); **Christian Wunderlich,** Fraunhofer-IKTS CMD (Germany)

Monday Plenary Session · Location: Silverton Ballroom · Mon 8:20 am to 10:00 am

8:20 to 8:30 am:

2018 SSM Lifetime Achievement Award Presentation
presented to **Wei-Hsin Liao**, The Chinese Univ. of Hong Kong (Hong Kong, China)

2018 NDE Lifetime Achievement Award Presentation
presented to **Michael J. S. Lowe**, Imperial College London (United Kingdom)

8:30 to 9:15 am:
Plenary Presentation

Nonlinear ultrasonic methods for nondestructive damage assessment in structural materials
Jianmin Qu, Tufts Univ. (USA)

9:15 to 10:00 am:
Plenary Presentation

Sensitivity analysis and uncertainty quantification for smart materials and adaptive structures
Ralph C. Smith, North Carolina State Univ. (USA)

Coffee Break · 10:00 am to 10:30 am

CONFERENCE 10593
Bioinspiration, Biomimetics, and Bioreplication VIII

SESSION 1

LOCATION: CRIPPLE CREEK 1
MON 10:30 AM TO 11:30 AM

Inaugural Session

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

10:30 am: **Design paradigms for engineered biomimicry** *(Keynote Presentation)*, Torben A. Lenau, Technical Univ. of Denmark (Denmark) . . . . [10593-1]

CONFERENCE 10594
Electroactive Polymer Actuators and Devices (EAPAD) XX

SESSION 1

LOCATION: SILVERTON SALON 2
MON 10:30 AM TO 11:50 AM

EAP as Emerging Actuators

Session Chairs: **Yoseph Bar-Cohen,** Jet Propulsion Lab. (USA); **Iain A. Anderson,** The Univ. of Auckland (New Zealand)

10:30 am: **Origami-inspired engineering: from minimally invasive surgery to exoplanet exploration** *(Invited Paper)*, Brian Trease, The Univ. of Toledo (USA) . . . . . [10594-1]

CONFERENCE 10595
Active and Passive Smart Structures and Integrated Systems XII

SESSION 1

LOCATION: CRESTONE SALON A
MON 10:30 AM TO 11:50 AM

Energy Harvesting I: Nonlinear

Session Chairs: **Jae-Hung Han,** KAIST (Korea, Republic of); **Ryan L. Harne,** The Ohio State Univ. (USA)

10:30 am: **Efficiency and effectiveness of stabilization control of high-energy orbit for wideband piezoelectric vibration energy harvesting**, Norihiko Kitamura, Arata Masuda, Kyoto Institute of Technology (Japan). . . . . [10595-1]

10:50 am: **A one-dimensional finite element formulation for piezoelectric energy harvester including geometrical and material nonlinearities**, José Ramirez, Claudio Gatti, Sebastian Machado, Univ. Tecnológica Nacional (Argentina); Mariano Febbo, Univ. Nacional del Sur (Argentina) . . . . . .[10595-2]

CONFERENCE 10596
Behavior and Mechanics of Multifunctional Materials and Composites XII

SESSION 1

LOCATION: ASPEN A
MON 10:30 AM TO 11:30 AM

Auxetic and Metamaterials

Session Chair: **Hani E. Naguib,** Univ. of Toronto (Canada)

10:30 am: **Fractional viscoelasticity of soft elastomers and auxetic foams**, Eugenia Stanisauskis, The Ohio State Univ. (USA); Hannah Solheim, Univ. of Houston (USA); Paul Miles, North Carolina State Univ. (USA); Zhe Liu, Mohammed Y. Hussaini, Changchun Zeng, William S. Oates, Florida State Univ. (USA)[10596-1]

10:50 am: **Design of active unit cell for an underwater acoustic metamaterial carpet cloak**, Benjamin S. Beck, Amanda D. Hanford, Peter Kerrian, Aaron Stearns, Applied Research Lab. (USA) . . . . . .[10596-3]

CONFERENCE 10597
Nano-, Bio-, Info-Tech Sensors and 3D Systems

SESSION 1

LOCATION: CRYSTAL SALON B/C
MON 10:30 AM TO 11:10 AM

Wearable and Implantable Technology and Healthcare I

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

10:30 am: **Wireless wearable and implantable monitoring and therapeutic systems for monitoring cardiac and neurological disorders** *(Keynote Presentation)*, Vijay K. Varadan, The Pennsylvania State Univ. (USA) . . . . . [10597-1]

Monday Plenary Session · Location: Silverton Ballroom · Mon 8:20 am to 10:00 am

8:20 to 8:30 am:

2018 SSM Lifetime Achievement Award Presentation
presented to **Wei-Hsin Liao**, The Chinese Univ. of Hong Kong (Hong Kong, China)

2018 NDE Lifetime Achievement Award Presentation
presented to **Michael J. S. Lowe**, Imperial College London (United Kingdom)

8:30 to 9:15 am:
Plenary Presentation

Nonlinear ultrasonic methods for nondestructive damage assessment in structural materials
Jianmin Qu, Tufts Univ. (USA)

9:15 to 10:00 am:
Plenary Presentation

Sensitivity analysis and uncertainty quantification for smart materials and adaptive structures
Ralph C. Smith, North Carolina State Univ. (USA)

Coffee Break · 10:00 am to 10:30 am

CONFERENCE 10598
Sensors and Smart Structures Technologies for Civil, Mechanical, and Aerospace Systems

SESSION 1

LOCATION: CRESTONE SALON B
MON 10:30 AM TO 11:30 AM

UAV for Structural Inspection

Session Chairs: **Hyung-Jo Jung,** KAIST (Korea, Republic of); **Steve E. Watkins,** Missouri Univ. of Science and Technology (USA)

10:30 am: **Challenging issues and solutions of bridge inspection technology using unmanned aerial vehicles**, Hyung-Jo Jung, Jin-Hwan Lee, In-Ho Kim, KAIST (Korea, Republic of) . . . . . [10598-1]

10:50 am: **Deployment of mobile wireless sensor with built-in vision-based autonomous landing system using unmanned aerial vehicle**, Ali Abou-Elnour, Ajman Univ. of Science & Technology (United Arab Emirates) . . . . . [10598-3]

CONFERENCE 10599
Nondestructive Characterization and Monitoring of Advanced Materials, Aerospace, Civil Infrastructure, and Transportation XII

SESSION 1

LOCATION: CRYSTAL SALON A
MON 10:30 AM TO 12:10 PM

SHM/NDE of Civil Structures/ Infrastructure I

Session Chairs: **Tzu-Yang Yu,** Univ. of Massachusetts Lowell (USA); **Genda Chen,** Missouri Univ. of Science and Technology (USA)

10:30 am: **Distributed monitoring and assessment of damage in structural systems by optical fiber sensors** *(Invited Paper)*, Farhad Ansari, Yong Kong, Shi Yi, Elias A. Oskoui, Todd Taylor, Univ. of Illinois at Chicago (USA) . . . . . [10599-1]

CONFERENCE 10600
Health Monitoring of Structural and Biological Systems XII

SESSION 1

LOCATION: CRIPPLE CREEK 2
MON 10:30 AM TO 11:50 AM

Distributed Sensors for SHM

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

10:30 am: **Multi-rosettes sensing analyzes for an impact assessment in composite plate-like structure**, Katarzyna Majewska, Magdalena Mieloszyk, Wieslaw Ostachowicz, The Szewalski Institute of Fluid-Flow Machinery (Poland) . . [10600-1]

10:50 am: **High-frequency ultrasonic sensor arrays based on optical micro-ring resonators,** Heming Wei, Abhishek Amrithanath, Sridhar Krishnaswamy, Northwestern Univ. (USA). . . . . [10600-2]

CONFERENCE 10601
Smart Materials and Nondestructive Evaluation for Energy Systems IV

SESSION 1

LOCATION: ASPEN B
MON 10:30 AM TO 12:00 PM

Development and Application of Smart Materials for Energy Systems

Session Chair: **Ali Abdul-Aziz,** Kent State Univ. (USA)

10:30 am: **Optofluidic smart glass with wide angular performance** *(Keynote Presentation)*, Keith W. Goossen, Univ. of Delaware (USA); Dan Wolfe, ARCCA, Inc. (USA) . . . . . [10601-1]

11:00 am: **Passive vibration control of a plate via piezoelectric shunt damping with FEM and ECM**, Peyman Lahe, Koç Univ (Turkey); Amirreza Aghakhani, Ipek Basdogan, Koç Univ. (Turkey) . . . [10601-2]

CONFERENCE 10602
Smart Structures and NDE for Industry 4.0

SESSION 1

LOCATION: LEADVILLE
MON 10:30 AM TO 11:30 AM

Smart Structures and NDE for Industry 4.0: Introduction

Session Chairs: **Norbert G. Meyendorf,** Iowa State Univ. of Science and Technology (USA); **Saveri Pal,** Iowa State Univ. of Science and Technology (USA)

10:30 am: **Internet of things, 3D printing, and Industry 4.0: reasons for reinventing NDE** *(Keynote Presentation)*, Norbert G. Meyendorf, Iowa State Univ. of Science and Technology (Germany) . . . . . [10602-1]

11:00 am: **On the value of information for Industry 4.0**, Piotr Omenzetter, Univ. of Aberdeen (United Kingdom). . . . . [10602-2]

CONFERENCE 10593
Bioinspiration, Biomimetics, and Bioreplication VIII

SESSION 2

LOCATION: CRIPPLE CREEK 1
MON 11:30 AM TO 12:30 PM

Flight I

Session Chair: **Hao Liu,** Chiba Univ. (Japan)

11:30 am: **Bioinspired pitch control using a piezoelectric horizontal tail for UAVs**, Lawren L. Gamble, Daniel J. Inman, Univ. of Michigan (USA) . . . . . .[10593-2]

11:50 am: **Technological demonstration of an adaptive Aileron system**, Antonio Concilio, Gianluca Amendola Jr., Ignazio Dimino, Ctr. Italiano Ricerche Aerospaziali (Italy); Rosario Pecora, Francesco Amoroso, Univ. degli Studi di Napoli Federico II (Italy) . . . . . .[10593-3]

12:10 pm: **Optimization design process of a morphing winglet,** Antonio Concilio, Ctr. Italiano Ricerche Aerospaziali (Italy); Marco Lo Cascio, Alberto Milazzo, Univ. degli Studi di Palermo (Italy); Ignazio Dimino, Gianluca Amendola, Ctr. Italiano Ricerche Aerospaziali (Italy). . . . . .[10593-4]

Lunch Break . . . .Mon 12:30 pm to 1:45 pm

CONFERENCE 10594
Electroactive Polymer Actuators and Devices (EAPAD) XX

SESSION 1 CONTINUED

11:10 am: **25 years of conducting polymer actuators: history, mechanisms, applications, and prospects** *(Invited Paper)*, John D. W. Madden, The Univ. of British Columbia (Canada) . . . . . .[10594-2]

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

CONFERENCE 10595
Active and Passive Smart Structures and Integrated Systems XII

SESSION 1 CONTINUED

11:10 am: **Investigating a magnetically coupled vibration energy harvesting system under impulsive excitations**, Quanqi Dai, Ryan L. Harne, The Ohio State Univ. (USA) . . . . . .[10595-3]

11:30 am: **Interaction of nonlinear material and nonlinear non-ideal circuit dynamics in piezoelectric energy harvesting**, Stephen Leadenham, Alper Erturk, Georgia Institute of Technology (USA).[10595-4]

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

CONFERENCE 10596
Behavior and Mechanics of Multifunctional Materials and Composites XII

SESSION 1 CONTINUED

11:10 am: **Boundary modes in quasiperiodic elastic structures**, Matheus Inguaggiato Nora Rosa, UNICAMP (Brazil); Raj Kumar Pal, Georgia Institute of Technology (USA); José Roberto de França Arruda, Univ. Estadual de Campinas (Brazil); Massimo Ruzzene, Georgia Institute of Technology (USA) . . . . . .[10596-4]

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

CONFERENCE 10597
Nano-, Bio-, Info-Tech Sensors and 3D Systems

SESSION 2

LOCATION: CRYSTAL SALON B/C
MON 11:10 AM TO 12:30 PM

Wearable and Implantable Technology and Healthcare II

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

11:10 am: **New flexible RFID antennas using natural material**, Zaiki Awang, N. A. M. Affendi, N. M. Razali, Univ. Teknologi MARA (Malaysia) . . . . . .[10597-2]

11:30 am: **Biomechanical overload evaluation by means of wearable devices in industrial environment: a sEMG and inertial motion capture system based protocol**, Maria Grazia Lourdes Monaco, Univ. degli Studi della Campania Luigi Vanvitelli (Italy); Agnese Marchesi, Univ. degli Studi di Cassino e del Lazio Meridionale (Italy); Alessandro Greco, Univ. degli Studi della Campania Luigi Vanvitelli (Italy); Alessio Silvetti, INAIL (Italy); Francesco Caputo, Univ. degli Studi della Campania Luigi Vanvitelli (Italy); Francesco Draicchio, INAIL (Italy); Nadia Miraglia, Univ. degli Studi della Campania Luigi Vanvitelli (Italy) . . . . . .[10597-3]

11:50 am: **Wireless monitoring of driver's pulse rate and temperature using hand gloves approach**, Rohith R. Narala, Univ. of Arkansas (USA); Mouli Ramasamy, Vijay K. Varadan, The Pennsylvania State Univ. (USA) . . . . . .[10597-4]

12:10 pm: **Design of an accelerometer to maximize the performance of vector hydrophones**, Yongrae Roh, Seonghun Pyo, Seongmin Lee, Kyungpook National Univ. (Korea, Republic of). . . . . .[10597-5]

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

CONFERENCE 10598
Sensors and Smart Structures Technologies for Civil, Mechanical, and Aerospace Systems

SESSION 1 CONTINUED

11:10 am: **Autonomous UAV for structural inspection using deep learning and ultrasonic beacon**, Dongho Kang, Young-Jin Cha, Univ. of Manitoba (Canada) . . . . . [10598-4]

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

CONFERENCE 10599
Nondestructive Characterization and Monitoring of Advanced Materials, Aerospace, Civil Infrastructure, and Transportation XII

SESSION 1 CONTINUED

11:10 am: **Structural health monitoring and damage evaluation for steel confined reinforced concrete column using the acoustic emission technique,** Fangzhu Du, Dongsheng Li, Dalian Univ. of Technology (China) . . . . . [10599-2]

11:30 am: **Concrete delamination detection with adaptive wavelet transform,** Hongya Qu, Genda Chen, Missouri Univ. of Science and Technology (USA) . . . . . [10599-3]

11:50 am: **Detecting alkali-silica reaction in thick concrete structures using linear array ultrasound**, Dwight A. Clayton, N. Dianne Ezell, Hector J. Santos-Villalobos, Oak Ridge National Lab. (USA) . . [10599-4]

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

CONFERENCE 10600
Health Monitoring of Structural and Biological Systems XII

SESSION 1 CONTINUED

11:10 am: **Preliminary studies for the optimization of sensor placement for electro-mechanical impedance based damage detection**, Rohan N. Soman, Tomasz Wandowski, Pawel Malinowski, The Szewalski Institute of Fluid-Flow Machinery (Poland); Wieslaw Ostachowicz, The Szewalski Institute of Fluid-Flow Machinery (Poland) and Warsaw Univ. of Technology (Poland) . . . . . [10600-3]

11:30 am: **Quantitative monitoring of hole-edge damage growth using eddy current array sensor-based intelligent bolt**, Hu Sun, Jianbo Shao, Yishou Wang, Xinlin Qing, Xiamen Univ. (China) . [10600-4]

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

CONFERENCE 10601
Smart Materials and Nondestructive Evaluation for Energy Systems IV

SESSION 1 CONTINUED

11:20 am: **Efficient structural, material, and electronic configuration for piezoelectric wind energy harvesting**, Abhishek Agoramurthy, Saumav Kapoor, Hemant Goyal, Ayush Jain, Suresh Bhalla, Indian Institute of Technology Delhi (India) . . . . . [10601-3]

11:40 am: **High performance triboelectric nanogenerator using polyimide aerogel for energy harvesting and active sensing**, Hani E. Naguib, Zia Saadatania, Shahriar Ghaffari, Univ. of Toronto (Canada); Ebrahim Esmailzadeh, Univ. of Ontario Institute of Technology (Canada) . . . . . [10601-4]

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

CONFERENCE 10602
Smart Structures and NDE for Industry 4.0

SESSION 2

LOCATION: LEADVILLE
MON 11:30 AM TO 12:10 PM

Smart Structures and NDE for Industry 4.0

Session Chairs: **Norbert G. Meyendorf,** Iowa State Univ. of Science and Technology (USA); **Saveri Pal,** Iowa State Univ. of Science and Technology (USA)

11:30 am: **Application of the actor model to large scale NDE data analysis**, Chris Coughlin, Emphysic (USA) . . . . . [10602-3]

11:50 am: **A data driven approach for estimation of remaining useful life of laminated composite plates**, Hadi Fekrmandi, Yun Seok Gwon, South Dakota School of Mines and Technology (USA) . . . . . [10602-32]

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

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MONDAY 5 MARCH

CONFERENCE 10593

SESSION 3

LOCATION: CRIPPLE CREEK 1
MON 1:45 PM TO 3:05 PM

Material Structures I

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

1:45 pm: **Towards materials farming: biological fabrication of cellulose fibers with tailored properties** *(Invited Paper)*, Filipe Natalio, Weizmann Institute of Science (Israel) . . . . . [10593-5]

2:15 pm: **Biomimetics of and bio-inspiration from self-assembled biophotonic nanostructures** *(Invited Paper)*, Vinodkumar Saranathan, National Univ. of Singapore (Singapore) . .[10593-6]

2:45 pm: **Toward multicontrollable metasurfaces**, Akhlesh Lakhtakia, The Pennsylvania State Univ. (USA); Francesco Chiadini, Univ. degli Studi di Salerno (Italy) . . . . . [10593-7]

Coffee Break. . . . Mon 3:05 pm to 3:35 pm

CONFERENCE 10594

SESSION 2

LOCATION: SILVERTON SALON 2
MON 1:20 PM TO 3:00 PM

Field-Activatable EAP I

Session Chairs: **John D. W. Madden,** The Univ. of British Columbia (Canada); **Jonathan M. Rossiter,** Univ. of Bristol (United Kingdom)

1:20 pm: **Molecular machine: how ferroelectric polymers generate giant electrostriction** *(Invited Paper)*, Qiming M. Zhang, The Pennsylvania State Univ. (USA) . . . . . [10594-3]

2:00 pm: **Dielectric elastomers: past, present, and potential future** *(Invited Paper)*, Ron Pelrine, Roy D. Kornbluh, SRI International (USA); Qibing Pei, Univ. of California, Los Angeles (USA) . . .[10594-4]

2:40 pm: **Autonomous dielectric elastomer energy harvesters to harvest motion**, Adrian Koh, Chong Liu, Ahmed Haroun, Anup Teejo Mathew, National Univ. of Singapore (Singapore) . . . . . [10594-5]

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

CONFERENCE 10595

SESSION 2

LOCATION: CRESTONE SALON A
MON 1:20 PM TO 3:00 PM

Passive and Active Vibration Isolation/ Attenuation I

Session Chairs: **Alper Erturk,** Georgia Institute of Technology (USA); **Jeffrey L. Kauffman,** Univ. of Central Florida (USA)

1:20 pm: **Controllability of a magnetorheological energy absorber**, Xian-Xu Bai, Sheng Shen, Fei-Long Cai, Sen Yang, Hefei Univ. of Technology (China) . . . . . [10595-119]

1:40 pm: **Enhanced Synchronized Shunted Switch Architecture (SSSA) for active vibration control**, Massimo Viscardi, Maurizio Arena, Univ. degli Studi di Napoli Federico II (Italy); Pasquale Napolitano, VM ITALIA srl (Italy). .[10595-6]

2:00 pm: **Effects of a piezoelectric based nonlinear energy sink on the behavior of an electromechanically coupled beam**, Carlos De Marqui Jr., Tarcisio M. Silva, Univ. de São Paulo (Brazil); Alper Erturk, Georgia Institute of Technology (USA) . . . . . [10595-7]

2:20 pm: **A synthetic shunt for piezoelectric-based state switching**, Garrett K. Lopp, Jeffrey L. Kauffman, Univ. of Central Florida (USA) . . . . . [10595-8]

2:40 pm: **Performance evaluation of a semi-active cladding connection for multi-hazard mitigation**, Liang Cao, Yongqiang Gong, Laura Micheli, Simon Laflamme, Iowa State Univ. of Science and Technology (USA) . . . . . [10595-9]

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

CONFERENCE 10596

SESSION 2

LOCATION: ASPEN A
MON 1:20 PM TO 3:00 PM

Shape Memory Materials I

Session Chairs: **Nakhiah C. Goulbourne,** Univ. of Michigan (USA); **Benjamin S. Beck,** Applied Research Lab. (USA)

1:20 pm: **Damage evolution during actuation fatigue in shape memory alloys**, Francis Phillips, Texas A&M Univ. (USA); Robert W. Wheeler, Univ. of North Texas (USA); Dimitris C. Lagoudas, Texas A&M Univ. (USA) . . . . . [10596-5]

1:40 pm: **Shape memory alloy-actuated bistable composites for morphing structures**, Venkata Siva Chillara, Marcelo Dapino, The Ohio State Univ. (USA) . . . . . [10596-7]

2:00 pm: **Analytical model for a laminated shape memory alloy beam with piezoelectric layers**, Nguyen Viet, Khalifa Univ. of Science, Technology and Research (United Arab Emirates).[10596-9]

2:20 pm: **Novel photo- and mechano-responsive hydrogels for bioinspired photo-tracking and soft robotics**, Xiaoshi Qian, Univ. of California, Riverside (USA); Yusen Zhao, Yousif Alsaid, Univ. of California, Los Angeles (USA); Ximin He, University of California, Los Angeles (USA) . . . . . [10596-74]

2:40 pm: **3D microarchitected shape memory polymers**, Nakhiah C. Goulbourne, Yali Li, Univ of Michigan (USA) . . . . . [10596-76]

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

CONFERENCE 10597

SESSION 3

LOCATION: CRYSTAL SALON B/C
MON 1:30 PM TO 2:10 PM

Additive Manufacturing and 3D Printing

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

1:30 pm: **Additive manufacturing of metals as seen from within: in situ optical probes for defect mapping** *(Keynote Presentation)*, Manyalibo J. Matthews, Lawrence Livermore National Lab. (USA) . . . . . [10597-6]

SESSION 4

LOCATION: CRYSTAL SALON B/C
MON 2:10 PM TO 3:10 PM

3D Printing and Applications I

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

2:10 pm: **Temperature monitoring of molten pool of metal molded 3D printer using Seebeck effect**, Hiroshi Sato, Shingo Hiroshe, National Institute of Advanced Industrial Science and Technology (Japan). . . . . [10597-7]

2:30 pm: **3D printing at microscale by pyro-EHD effect,** Sara Coppola, Istituto di Scienze applicata e Sistemi Intelligenti (Italy); Giuseppe Nasti, Istituto per i Polimeri, Compositi e Biomateriali (Italy); Federico Olivieri, Veronica Vespini, Simonetta Grilli, Istituto di Scienze applicata e Sistemi Intelligenti (Italy); Pietro Russo, Istituto per i Polimeri, Compositi e Biomateriali (Italy); Pietro Ferraro, Istituto di Scienze applicata e Sistemi Intelligenti (Italy) . . . . . [10597-8]

2:50 pm: **3D printing of 'smart tongue' taste sensor device for soft drinks**, Vijay K. Varadan, The Pennsylvania State Univ. (USA) . . . . . [10597-9]

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

CONFERENCE 10598

SESSION 2

LOCATION: CRESTONE SALON B
MON 1:00 PM TO 3:00 PM

Advanced Composite Technologies

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

1:00 pm: **Predicting failure from conductivity changes in piezoresistive nanocomposites**, Hashim Hassan, Tyler N. Tallman, Purdue Univ. (USA) . . . .[10598-5]

1:20 pm: **Piezoelectric sensitivity of piezoceramic/polymer composite foams**, Gayaneh Petrossian, Cameron J. Hohimer, Amir Ameli, Washington State Univ. Tri-Cities (USA) . . . . . .[10598-6]

1:40 pm: **Self-powered sensing of high-rate tensile strain using multifunctional mechano-luminescence-optoelectronic composites**, Donghyeon Ryu, Elias Pulliam, New Mexico Institute of Mining and Technology (USA) . . . . . .[10598-7]

2:00 pm: **Spatial strain measurements using a strain-sensing grid patterned from nanocomposite films**, Peng Sun, Andrew Burton, Jerome P. Lynch, Univ. of Michigan (USA) . . . . . .[10598-8]

2:20 pm: **Numerical and experimental investigation of piezoresistive hybrid nanocomposites for strain sensing applications**, Muhammed Anees, Audrey Gbaguidi, Daewon Kim, Sirish Namilae, Embry-Riddle Aeronautical Univ. (USA) . . . . . .[10598-9]

2:40 pm: **Damage detection with ultrasonic guided wave under operational conditions**, Zahra Sharif Khodaei, Imperial College London (United Kingdom); Mohammad S. Salmanpour, Imperial College London (United Kingdom); M.H. Aliabadi, Imperial College London (United Kingdom) . . . . . .[10598-160]

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

CONFERENCE 10599

SESSION 2

LOCATION: CRYSTAL SALON A
MON 1:30 PM TO 3:10 PM

SHM/NDE of Civil Structures/ Infrastructure II

Session Chairs: **Yu-Min Su,** National Kaohsiung Univ. of Applied Sciences (Taiwan); **Denvid Lau,** City Univ. of Hong Kong (Hong Kong, China)

1:30 pm: **Neutral axis determination of full size concrete structures using coda wave measurements**, Hanwan Jiang, Univ. of Wisconsin-Platteville (USA); Hanyu Zhan, Ruinian Jiang, New Mexico State Univ. (USA) . . . . . .[10599-5]

1:50 pm: **Medium change based image estimation from application of inverse algorithms to coda wave measurements**, Hanyu Zhan, New Mexico State Univ. (USA); Hanwan Jiang, Univ. of Wisconsin-Platteville (USA); Ruinian Jiang, New Mexico State Univ. (USA). . .[10599-6]

2:10 pm: **Nondestructive evaluation of early age properties of concrete using a polymer based piezoelectric sensor**, Ehsan Ghafari, Ying Yuan, Na Lu, Purdue Univ. (USA) . . . . . .[10599-7]

2:30 pm: **Structural health monitoring for DOT using magnetic shape memory alloy cables in concrete**, Darren J. Hartl, Emery Sheahan, Allen Davis, Mirmilad Mirsayar, Texas A&M Univ. (USA) [10599-8]

2:50 pm: **Assessing the performance of electrical capacitance tomography for noncontact, subsurface, corrosion monitoring**, Sashank Shivakumar, Xi Qiu, Sumit Gupta, Kenneth J. Loh, Univ. of California, San Diego (USA) . . . .[10599-9]

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

CONFERENCE 10600

SESSION 2

LOCATION: CRIPPLE CREEK 2
MON 1:20 PM TO 3:00 PM

Nonlinear Ultrasonic Techniques

Session Chairs: **Wiesław J. Staszewski,** AGH Univ. of Science and Technology (Poland); **Xinlin Qing,** Xiamen Univ. (China)

1:20 pm: **Comparative study of classical and non-classical nonlinear elasticity in crack-wave local interaction models,** Wiesław J. Staszewski, Piotr Kijanka, Pawel Packo, Tadeusz Uhl, AGH Univ. of Science and Technology (Poland)[10600-5]

1:40 pm: **Damage characterization based on nonlinear guided wave simulation and chirplet matching pursuit algorithm**, Hui Zhang, Carlos E. S. Cesnik, Univ. of Michigan (USA) .[10600-6]

2:00 pm: **Nondestructive detection and assessment of high temperature hydrogen attack damage in carbon steels pressure vessels**, John F. Conway, Univ. of Illinois (USA); Megan E. McGovern, General Motors Research Lab. (USA); Dorian K. Balch, Sandia National Labs. (USA); Henrique L. Reis, Univ. of Illinois (USA) . . . . . .[10600-7]

2:20 pm: **Orientating and imaging fatigue cracks based on contact acoustic nonlinearity**, Zhongqing Su, Kai Wang, The Hong Kong Polytechnic Univ. (Hong Kong, China) . . . . . .[10600-8]

2:40 pm: **Nonlinear scattering features of guided waves from fatigue cracks,** Yanfeng Shen, Nipon Roy, Wu Xu, Shanghai Jiao Tong Univ. (China) [10600-9]

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

CONFERENCE 10601

SESSION 2

LOCATION: ASPEN B
MON 1:00 PM TO 3:20 PM

Characterization of Materials and NDE/SHM of Energy

Session Chair: **Dimitrios A. Exarchos,** Univ. of Ioannina (Greece)

1:00 pm: **Turbofan engine performance study under simulated failure and non-traditional flight conditions** *(Invited Paper)*, Ali Abdul-Aziz, Robert D. Bissler, David B. Stringer, Kent State Univ. (USA) . . . . . .[10601-5]

1:30 pm: **Analytical and experimental investigations of damage detection in marine risers**, Piotr Omenzetter, Univ. of Aberdeen (United Kingdom). . . . .[10601-6]

1:50 pm: **The synergy of ultrasonic experiments, numerical analyses of wave propagation, and scattering theories in cementitious materials**, Sokratis N. Iliopoulos, Lucas De Smet, Vrije Univ. Brussel (Belgium) . . . . . [10601-7]

2:10 pm: **Acoustic emission and active sensing capabilities on small- and full-scale nuclear dry cask storage structures**, Stephen Howden, Bin Lin, Lingyu Yu, Victor Giurgiutiu, Univ. of South Carolina (USA) . . . . . .[10601-8]

2:30 pm: **Pipeline thickness monitoring using a shear wave EMAT system under high lift-off condition,** Yang Zhao, Shandong Academy of Sciences (China); Xianbin Huang, SINOPEC Research Institute of Safety Engineering (China); Ju Yang, Nagoya Univ. (Japan); Jiangfeng Song, Shandong Academy of Sciences (China) . . . . . .[10601-9]

2:50 pm: **Nondestructive evaluation using eddy current pulsed thermographic imaging of basalt-carbon hybrid fiber-reinforced composite laminates subjected to low-velocity impact loadings** *(Invited Paper)*, Hai Zhang, Univ. Laval (Canada); Stefano Sfarra, Univ. degli Studi dell'Aquila (Italy); Ahmad Osman, Fraunhofer-Institut für Integrierte Schaltungen (IIS) (Germany) and Univ. of Applied Sciences (Germany); Fabrizio Sarasini, Sapienza Univ. di Roma (Italy); Bernd Valeske, Udo Netzelmann, Fraunhofer IZFP (Germany); Nicolas P. Avdelidis, National Technical Univ. of Athens (Greece); Clemente Ibarra-Castanedo, Xavier P. V. Maldague, Univ. Laval (Canada) . . . . . [10601-10]

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

CONFERENCE 10602

SESSION 3

LOCATION: LEADVILLE
MON 1:20 PM TO 2:00 PM

Keynote Session

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

1:20 pm: **Using smart materials to solve new challenges in the automotive industry** *(Keynote Presentation)*, Kerrie Gath, Clay Maranville, Janice Tardiff, Ford Motor Co. (USA) . . . . . .[10602-5]

SESSION 4

LOCATION: LEADVILLE
MON 2:00 PM TO 3:00 PM

Acquisition and Analysis of Large Amount of Data (Big Data)

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

2:00 pm: **Soil-pipe interaction modeling for pipe behavior prediction with super learning based methods**, Fang Shi, Zheng Liu, Eric Li, The Univ. of British Columbia Okanagan (Canada); Yafei Hu, City of Regina (Canada) . . . . . .[10602-6]

2:20 pm: **Research on masonry structures superficial damage identification and location for heritage buildings using deep learning method**, Xuefeng Zhao, Dalian Univ. of Technology (China); Qingan Zhao, Univ. of California, Berkeley (USA); Peng Zhao, The Palace Museum (China); Niannian Wang, Dalian Univ of Technology (China) . . . . .[10602-7]

2:40 pm: **Identification of ancient building components based on machine vision technology**, Zheng Zou, Niannian Wang, Dalian Univ. of Technology (China); Peng Zhao, The Palace Museum (China); Xuefeng Zhao, Dalian Univ. of Technology (China) . . . . . .[10602-8]

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

MONDAY 5 MARCH

CONFERENCE 10593

SESSION 4

LOCATION: CRIPPLE CREEK 1
MON 3:35 PM TO 5:15 PM

Bio-Optics

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

3:35 pm: **Investigating the origin of light emission from speleothems and biospeleothems**, Raúl J. Martín-Palma, Univ. Autónoma de Madrid (Spain); Humberto Cabrera, The Abdus Salam International Ctr. for Theoretical Physics (Italy); Charles Brewer-Carías, Sociedad Venezolana de Ciencias Naturales (Venezuela) . . . . . [10593-8]

3:55 pm: **Bioinspired invertebrate pest detection on standing crops**, Javaan S. Chahl, Huajian Liu, Univ. of South Australia (Australia) . . . . . [10593-9]

4:15 pm: **Duplication of large-area morpho-color material using flexible mold**, Akira Saito, Kosei Ishibashi, Midori Fukihara, Osaka Univ. (Japan) . . [10593-10]

4:35 pm: **A bioinspired broadband reflector in the VIS-NIR wavelength range**, Francesco Chiadini, Univ. degli Studi di Salerno (Italy); Vincenzo Fiumara, Univ. degli Studi della Basilicata (Italy); Antonio Scaglione, Univ. degli Studi di Salerno (Italy) . . . . . [10593-11]

4:55 pm: **Hydrogel thin film-based dynamic coloration for chemical sensing and camouflage**, Mo Sun, Meng Qin, Jiaqi Song, Univ. of California, Los Angeles (USA); Ruobing Bai, Harvard Univ. (USA); Yiqi Mo, Jerry H. Qi, Georgia Institute of Technology (USA); Zhigang Suo, Harvard Univ. (USA); Ximin He, Univ. of California, Los Angeles (USA) . .[10593-43]

CONFERENCE 10594

LOCATION: SILVERTON SALON 3
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 12–15.

CONFERENCE 10595

SESSION 3

LOCATION: CRESTONE SALON A
MON 3:20 PM TO 5:40 PM

Energy Harvesting II: Piezoelectric

Session Chairs: **Lei Zuo,** Virginia Polytechnic Institute and State Univ. (USA); **Steven R. Anton,** Tennessee Technological Univ. (USA)

3:20 pm: **Radially configured thermoacoustic piezoelectric energy harvesters,** Jesse Callanan, Mostafa A. Nouh, Univ. at Buffalo (USA) . . . [10595-10]

3:40 pm: **Electrically rectified piezoelectric energy harvester excited by rotary magnetic plucking**, Yi-Chung Shu, Y. P. Chang, W. C. Wang, National Taiwan Univ. (Taiwan) . . . . . [10595-11]

4:00 pm: **On the circuit solutions towards broadband and high-capability piezoelectric energy harvesting systems**, Junrui Liang, Bao Zhao, ShanghaiTech Univ. (China) . . . . [10595-13]

4:20 pm: **Energy harvesting from torsions of patterned piezoelectrics**, Youngsu Cha, Hangil You, Korea Institute of Science and Technology (Korea, Republic of). . . . . [10595-14]

4:40 pm: **Crystalline phase-transitioning acoustic pressure energy harvester**, Ellen Skow, Kenneth A. Cunefare, Georgia Institute of Technology (USA). . . [10595-15]

5:00 pm: **Battery-free electrical programmable initiation systems**, Carlos M. Pereira, U.S. Army Armament Research, Development and Engineering Ctr. (USA) . . . . . [10595-16]

5:20 pm: **Magnetic field enhanced piezoelectric stack energy harvesting system for low-frequency excitations**, Feng Qian, Shengxi Zhou, Lei Zuo, Virginia Polytechnic Institute and State Univ. (USA) . . . . . [10595-17]

CONFERENCE 10596

SESSION 3

LOCATION: ASPEN A
MON 3:30 PM TO 6:00 PM

Additive Manufacturing I

Session Chair: **Norman M. Wereley,** Univ. of Maryland, College Park (USA)

3:30 pm: **Ultrasonic additive manufacturing of smart structures** *(Invited Paper)*, Marcelo Dapino, The Ohio State Univ. (USA) . . . . . [10596-10]

4:00 pm: **Reprocessable thermosets for three-dimension printing**, Qi Ge, Biao Zhang, Martin Dunn, Singapore Univ. of Technology & Design (Singapore)[10596-11]

4:20 pm: **3D fabrication of transformable foam-like materials with high energy absorption and sensing capabilities using fused deposition processes**, Allen Sandwell, Katia Greco, Simon Park, Univ. of Calgary (Canada) . . . . . [10596-12]

4:40 pm: **Influence of SLM on compressive response of NiTi scaffolds**, Narges Shayesteh Moghaddam, The Univ. of Toledo (USA); Soheil Saedi, Univ. of Kentucky (USA); Amirhesam Amerinatanzi, Ahmadreza Jahadakbar, The Univ. of Toledo (USA); Ehsan Saghaian, Haluk Karaca, Univ. of Kentucky (USA); Mohammad Elahinia, The Univ. of Toledo (USA) . . . . . [10596-13]

5:00 pm: **Highly stretchable hydrogels for digital light processing based high resolution 3D printing**, Qi Ge, Shiya Li, Ahmad Serjouei, Biao Zhang, Singapore Univ. of Technology & Design (Singapore); Shlomo Magdassi, The Hebrew Univ. of Jerusalem (Israel) . . . . . [10596-14]

5:20 pm: **Electrical conductivity and piezoresistive response of 3D printed thermoplastic polyurethane/multiwalled carbon nanotube composites**, Cameron J. Hohimer, Gayaneh Petrossian, Amir Ameli, Changki Mo, Washington State Univ. Tri-Cities (USA); Petra Pötschke, Leibniz-Institut für Polymerforschung Dresden e.V. (Germany) . . . . . [10596-15]

5:40 pm: **Thermoelectric processing of multifunctional ionomer composites**, Vishnu Baba Sundaresan, The Ohio State Univ. (USA) . . . . . [10596-16]

CONFERENCE 10597

SESSION 5

LOCATION: CRYSTAL SALON B/C
MON 3:40 PM TO 4:20 PM

Nanosensors and Systems I

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

3:40 pm: **DNT detection using microspheres coated with NaYF4-Yb3+,Er3+-nanocrystals functionalized with PAA/PAH layers**, Abhishek Kottaram Amrithanath, Heming Wei, Sridhar Krishnaswamy, Northwestern Univ. (USA) . . . . . [10597-10]

4:00 pm: **Scale effect on dynamics of single wall carbon nanotube and double single wall carbon nanotube system using modified couple stress theory**, Swati Agrawal Jaiswal, V. K. Gupta, P. K. Kankar, PDPM Indian Institute of Information Technology, Design & Manufacturing Jabalpur (India) . . . . . [10597-11]

SESSION 6

LOCATION: CRYSTAL SALON B/C
MON 4:20 PM TO 6:00 PM

Fabrication and Characterization of Nano-sensors and Structures I

Session Chair: **Lindong Zhai,** INHA Univ. (Korea, Republic of)

4:20 pm: **Microwave characterization of graphene using an improved on-wafer calibration method**, Zaiki Awang, M. H. Kara, N. A. A. Rahim, Univ. Teknologi MARA (Malaysia) . . . . . [10597-12]

4:40 pm: **Electrospun unidirectional P(VDF-TrFE) pressure sensor for small strain sensing**, Zi-yi Zheng, Jun-Yi Ke, Yu-Hsiang Hsu, Chih-Kung Lee, National Taiwan Univ. (Taiwan) . . . . . [10597-13]

5:00 pm: **Fabrication and characteristics of cellulose nanofiber films,** Hyun-U Ko, Jung Woong Kim, Sunanda Roy, Jungho Park, Eun Sik Choi, Jaehwan Kim, INHA Univ. (Korea, Republic of) . . . . . [10597-14]

5:20 pm: **Fabrication and characterization of cellulose nanofiber/graphene oxide blended fibers,** Abdullahil Kafy, Hyun Chan Kim, Young-Min Yun, Tae June Kang, Jaehwan Kim, INHA Univ. (Korea, Republic of) . . . . . [10597-15]

5:40 pm: **Fabrication of piezoelectric and dielectric nanocomposites for sensor and energy storage application via fused deposition modeling**, Yirong Lin, Hoejin Kim, The Univ. of Texas at El Paso (USA); Jeffery Johnson, Univ. of California, Santa Barbara (USA) . . . . . [10597-16]

Univ. (USA)

CONFERENCE 10598

SESSION 3

LOCATION: CRESTONE SALON B
MON 3:20 PM TO 6:00 PM

Health Assessment of Composite Structures

Session Chairs: **Wieslaw M. Ostachowicz,** The Szewalski Institute of Fluid-Flow Machinery (Poland); **Tyler N. Tallman,** Purdue Univ. (USA)

3:20 pm: **Study of CFRP adhesive bonds influenced by manufacturing-related contaminations**, Pawel H. Malinowski, Wieslaw M. Ostachowicz, Tomasz Wandowski, The Szewalski Institute of Fluid-Flow Machinery (Poland); Angelos Christopoulos, Konstantinos Kitsianos, George Kanterakis, GMI Aero (France); Romain Ecault, Airbus S.A.S. (France); Rainer Stoessel, Airbus Group Innovations (Germany); Damien Segur, CEA Tech (France); Laurent Berthe, Maxime Sagnard, Ecole Nationale Supérieure d'Arts et Métiers (France); Fabienne Touchard, Institut PPRIME, CNRS (France) and ISAE-ENSMA (France); Michel Boustie, Institut PPRIME, CNRS (France); Welchy Leite Cavalcanti, Fraunhofer-Institut für Fertigungstechnik und Angewandte Materialforschung (Germany) . . . . . [10598-10]

3:40 pm: **Study of CFRP adhesive bonds influenced by factors encountered during aircraft operations**, Pawel H. Malinowski, Tomasz Wandowski, Wieslaw M. Ostachowicz, The Szewalski Institute of Fluid-Flow Machinery (Poland); Angelos Christopoulos, Ilias Koulalis, Konstantinos Kitsianos, George Kanterakis, GMI Aero (France); Romain Ecault, Airbus S.A.S. (France); Rainer Stoessel, Airbus Group Innovations (Germany); Damien Segur, CEA Tech (France); Laurent Berthe, Maxime Sagnard, Ecole Nationale Supérieure d'Arts et Métiers (France); Fabienne Touchard, Institut PPRIME, CNRS (France) and ISAE-ENSMA (France); Michel Boustie, Institut PPRIME, CNRS (France) and ISAE-ENSMA (France); Welchy Leite Cavalcanti, Fraunhofer-Institut für Fertigungstechnik und Angewandte Materialforschung (Germany) . . . . . [10598-11]

4:00 pm: **Damage severity assessment in composite structures using ultrasonic guided waves with chirp excitation,** Ifan Dafydd, Zahra Sharif Khodaei, M.H. Aliabadi, Imperial College London (United Kingdom) . . . . . [10598-12]

4:20 pm: **Poisson's ratio measurement of CFRP composites using embedded optical sensors of binary and multi-level logic processing for an optical encoder**, Amardeep Kaur, Sasi Jothibasu, Sudharshan Anandan, Steve E. Watkins, Jie Huang, K. Chandrashekhara, Missouri Univ. of Science and Technology (USA) . . . . . [10598-13]

4:40 pm: **Structural health monitoring of a composite F/A-18 wing section using a sparse piezoelectric transducer array,** Jacob R. McCullum, Byungseok Yoo, Darryll J. Pines, Norman M. Wereley, Univ. of Maryland, College Park (USA). . [10598-14]

5:00 pm: **Study of disbond effects in an Aramid honeycomb sandwich structure under variable ambient temperatures**, Shirsendu Sikdar, Pawel Kudela, The Szewalski Institute of Fluid-Flow Machinery (Poland); Wiesław M. Ostachowicz, The Szewalski Institute of Fluid-Flow Machinery (Poland) and Warsaw Univ. of Technology (Poland). . . . . [10598-15]

5:20 pm: **Detecting damage in composite structures using a planar array capacitive imaging technique,** Sumit Gupta, Kenneth J. Loh, Univ. of California, San Diego (USA) [10598-16]

5:40 pm: **Spatially continuous strain monitoring of carbon fiber composites using embedded distributed fiber optic sensors**, Sasi Jothibasu, Yang Du, Sudharshan Anandan, Gurjot Dhaliwal, K. Chandrashekhara, Amardeep Kaur, Jie Huang, Missouri Univ. of Science and Technology (USA) . . . . . [10598-17]

CONFERENCE 10599

SESSION 3

LOCATION: CRYSTAL SALON A
MON 3:40 PM TO 5:40 PM

SHM/NDE of Civil Structures/ Infrastructure III

Session Chairs: **Kenneth J. Loh,** Univ. of California, San Diego (USA); **N. Dianne Ezell,** Oak Ridge National Lab. (USA)

3:40 pm: **The preliminary evaluation of pavement temperature profile in conjunction with a real-time and multilayered temperature monitoring stations**, Yu-Min Su, Jui-An Wu, National Kaohsiung Univ. of Applied Sciences (Taiwan); Tsung-Chin Hou, National Cheng Kung Univ. (Taiwan); Ping-Ni Hou, National Kaohsiung Univ. of Applied Sciences (Taiwan); Ming-Gin Lee, Chaoyang Univ. of Technology (Taiwan) . . . . . [10599-10]

4:00 pm: **A wireless urban sensor network architecture for dense deployment in smart cities**, Katherine Flanigan, Jerome P. Lynch, Univ. of Michigan (USA) . . . . . [10599-11]

4:20 pm: **Piezoelectric micromachined acoustic emission sensors for early stage damage detection in structures**, Minoo Kabir, Hanie Kazari, Didem Ozevin, Univ. of Illinois at Chicago (USA) [10599-13]

4:40 pm: **A novel ball screw based electromagnetic energy harvester for railway track,** Yu Pan, Virginia Polytechnic Institute and State Univ. (USA); Teng Lin, Stony Brook Univ. (USA); Lei Zuo, Virginia Polytechnic Institute and State Univ. (USA) . . . . . [10599-14]

5:00 pm: **Combining the 3D model generated from point clouds and thermography to identify the defects presented on the facades of a building**, Yishuo Huang, Chih-Hung Chiang, Keng-Tsang Hsu, Chaoyang Univ. of Technology (Taiwan) . . . . . [10599-15]

5:20 pm: **An energy-harvesting power supply for underwater bridge scour monitoring sensors**, Yuli Wang, Yingjie Li, Huazhong Univ. of Science and Technology (China); Longzhuang He, Pourya Shamsi, Yahong R. Zheng, Missouri Univ. of Science and Technology (USA) . . . . . [10599-16]

CONFERENCE 10600

SESSION 3

LOCATION: CRIPPLE CREEK 2
MON 3:20 PM TO 6:00 PM

Guided Wave for SHM/NDE

Session Chairs: **Fabrizio Ricci,** Univ. degli Studi di Napoli Federico II (Italy); **Yanfeng Shen,** Shanghai Jiao Tong Univ. (China)

3:20 pm: **Active and passive health monitoring of a TN32 dry cask storage scaled down model**, Roshan Joseph, Stephen Howden, Bin Lin, Lingyu Yu, Victor Giurgiutiu, Univ. of South Carolina (USA) . . . . . [10600-10]

3:40 pm: **Composite structures defect imaging**, Paul Fromme, Univ. College London (United Kingdom) . . . . . [10600-11]

4:00 pm: **Hybrid guided waves based SHM system for composite structures delamination detection combining fiber Bragg gratings sensing and piezoelectric patches excitation**, Ernesto Monaco, Natalino Daniele Boffa, Univ. degli Studi di Napoli Federico II (Italy); Leandro Maio, Univ degli Studi di Napoli Federico II (Italy); Fabrizio Ricci, Univ. degli Studi di Napoli Federico II (Italy); Edgar Mendoza, Redondo Optics Inc. (USA) . . . . . [10600-12]

4:20 pm: **Reverse engineering stiffened plates using guided wave-based nondestructive testing methods,** Erin Hong, Christoph Schaal, California State Univ., Northridge (USA) . . . . . [10600-13]

4:40 pm: **Effects of transducers on guided wave based structural health monitoring**, Umar Amjad, The Univ. of Arizona (USA); Christopher Blase, Johann Wolfgang Goethe-Univ. Frankfurt am Main (Germany); Tribikram Kundu, Cac M. Dao, The Univ. of Arizona (USA); Jürgen Bereiter-Hahn, Johann Wolfgang Goethe-Univ. Frankfurt am Main (Germany) . . . . . [10600-14]

5:00 pm: **Silicon wafer defect detection using high frequency guided waves**, Michael Lauper, Haute Ecole Spécialisée de Suisse Occidentale (Switzerland); Paul Fromme, Univ. College London (United Kingdom); Jean-Luc Robyr, Bernard Masserey, Haute Ecole Spécialisée de Suisse Occidentale (Switzerland) . . . . . [10600-15]

5:20 pm: **Development of a de-icing system for aerodynamic surfaces based on ultrasonic waves**, Leandro Maio, Ernesto Monaco, Fabrizio Ricci, Natalino Daniele Boffa, Vittorio Memmolo, Univ. degli Studi di Napoli Federico II (Italy); Salvatore Ameduri, Antonio Concilio, Ctr. Italiano Ricerche Aerospaziali (Italy). . . . . [10600-16]

5:40 pm: **Comparative study of deterioration of composite due to moisture using strain, electro-mechanical impedence, and guided waves**, Rohan N. Soman, Pawel Malinowski, The Szewalski Institute of Fluid-Flow Machinery (Poland); Wieslaw Ostachowicz, The Szewalski Institute of Fluid-Flow Machinery (Poland) and Warsaw Univ. of Technology (Poland) . . . [10600-17]

CONF. 10601

SESSION 3

LOCATION: ASPEN B
MON 3:50 TO 5:30 PM

Techniques and Materials for Energy Harvesting: Wind Energy Systems

Session Chair: **Nicolas P. Avdelidis,** Univ. Laval (Canada)

3:50 pm: **Accordion type thermoelectric power generation device using the metal direct bonding technology**, Hiroshi Sato, National Institute of Advanced Industrial Science and Technology (Japan); Tetsuro Yanaseko, Kogakuin Univ. (Japan); Hiroshi Asanuma, Chiba Univ. (Japan). . . . . [10601-11]

4:10 pm: **Analysis of subharmonic motions for vibration energy harvesting using bistable oscillator**, Thomas Huguet, Institut National des Sciences Appliquées de Lyon (France); Adrien Badel, Univ. Savoie Mont Blanc (France); Olivier Lallart, Institut Camille Jordan (France); Mickaël Lallart, Institut National des Sciences Appliquées de Lyon (France) . . [10601-12]

4:30 pm: **Development of a piezoelectric energy harvesting floor**, Blake Stewart, Haifeng Zhang, Univ. of North Texas (USA) . . . . . [10601-13]

4:50 pm: **Flow induced piezoelectric energy harvester with automatic wind tracking mechanism**, Sarah Bundy, Haifeng Zhang, Suresh Kaluvan, Univ. of North Texas (USA)[10601-14]

5:10 pm: **Periodic wind disturbance rejection using robust individual control strategy**, Yuan Yuan, Xu Chen, Jiong Tang, Univ. of Connecticut (USA) . . . . . [10601-15]

Conference End.

CONFERENCE 10602

SESSION 5

LOCATION: LEADVILLE
MON 3:30 PM TO 4:10 PM

New Applications for Smart Structures and Materials for Industry 4.0

Session Chair: **Kerrie Gath,** Ford Motor Co. (USA)

3:30 pm: **2D and 3D PCD algorithms for deformation monitoring of reinforced concrete structural elements**, Tsung-Chin Hou, National Cheng Kung Univ. (Taiwan); Yu-Min Su, National Kaohsiung Univ. of Applied Sciences (Taiwan); Jen-Wei Liu, Tien-Yo Wu, Peng-Tu Wang, Cheng-Yan Wu, Yu-Wei Liu, Hsuan-Teh Hu, National Cheng Kung Univ. (Taiwan) . . . . . .[10602-9]

3:50 pm: **Bulk-wave ultrasonic propagation imagers**, Jung-Ryul Lee, Syed Haider Abbas, KAIST (Korea, Republic of) . [10602-11]

SESSION 6

LOCATION: LEADVILLE
MON 4:10 PM TO 5:30 PM

Smart Structures and Additive Manufacturing

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

4:10 pm: **Feasibility of developing an active soft catheter actuated by SMA wires**, Bardia Konh, Reza Ghorbani, Univ. of Hawai'i at Manoa (USA) . . . . . .[10602-12]

4:30 pm: **Precise shape-sensing method using micro pinhole for micro holes**, Tomohiko Hayakawa, Kenichi Murakami, Masatoshi Ishikawa, The Univ. of Tokyo (Japan). . . . . .[10602-13]

4:50 pm: **Development of a novel magneto-rheological brake with multiple pole rotor,** Quoc Hung Nguyen, Vietnamese-German Univ. (Viet Nam) . . . . . .[10602-14]

5:10 pm: **Application of entropy in crack identification at welding joint with a wireless smart coating sensor,** Xin Wang, Nan Wu, Univ. of Manitoba (Canada) . . . . . .[10602-15]

TUESDAY 6 MARCH

Tuesday Plenary Session · Location: Silverton Salon 2 · 8:15 am to 10:00 am

8:15 to 8:30 am:

SPIE Fellow Awards *presented to:*

- **Norbert G. Meyendorf,** Iowa State Univ. of Science and Technology (USA)
- **Kara J. Peters**, North Carolina State Univ. (USA)
- **Hoon Sohn**, KAIST (Korea, Republic of)
- **Steve E. Watkins**, Missouri Univ. of Science and Technology (USA)

8:30 to 9:15 am:
Plenary Presentation

Multifunctional vascularized polymers and composites

Nancy R. Sottos, Beckman Institute for Advanced Science and Technology (USA)

9:15 to 10:00 am:
Plenary Presentation

Current and future needs and research for composite materials NDE

K. Elliott Cramer, NASA Langley Research Ctr. (USA)

Coffee Break · 10:00 am to 10:30 am

CONFERENCE 10593
Bioinspiration, Biomimetics, and Bioreplication VIII

SESSION 5

LOCATION: CRIPPLE CREEK 1
TUE 10:30 AM TO 11:30 AM

Energy

Session Chair: **Vincenzo Fiumara,** Univ. degli Studi della Basilicata (Italy)

10:30 am: **Artificial photosynthesis as the basis for appliances ,** Carolyn M. Dry, Natural Process Design, Inc. (USA) . . . . . [10593-12]

10:50 am: **Bioinspired pseudo-ductile composite laminates with hierarchical energy absorption mechanism**, Francesco Rizzo, Fulvio Pinto, Michele Meo, Univ. of Bath (United Kingdom) . [10593-13]

11:10 am: **Investigation of leaf shape and edge design for faster evaporation in biomimetic heat dissipation systems**, Petra Gruber, Ariana I. K. S. Rupp, The Univ. of Akron (USA) . . . . . [10593-14]

CONFERENCE 10594
Electroactive Polymer Actuators and Devices (EAPAD) XX

SESSION 3

LOCATION: SILVERTON SALON 2
TUE 10:30 AM TO 12:10 PM

Advances in EAP Materials

Session Chairs: **Kwang Jin Kim,** Univ. of Nevada, Las Vegas (USA); **Gal deBotton,** Ben-Gurion Univ. of the Negev (Israel)

10:30 am: **Stronger, faster, and more powerful artificial muscle yarns and fibers** *(Invited Paper)*, Ray H. Baughman, The Univ. of Texas at Dallas (USA)[10594-6]

11:10 am: **Manufacturing polymer transducers: opportunities and challenges** *(Invited Paper)*, Gabor M. Kovacs, EMPA (Switzerland) . . . .[10594-7]

CONFERENCE 10595
Active and Passive Smart Structures and Integrated Systems XII

SESSION 4

LOCATION: CRESTONE SALON A
TUE 10:30 AM TO 12:10 PM

Morphing and Deployable Structures

Session Chairs: **Andres F. Arrieta,** Purdue Univ. (USA); **Oliver Huxdorf,** Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany)

10:30 am: **Conceptual design and dynamic analysis of bistable deployable structure**, Jong-Eun Suh, KAIST (Korea, Republic of); Suk-Yong Jeong, Agency for Defense Development (Korea, Republic of); Jae-Hung Han, KAIST (Korea, Republic of) . . . . . [10595-18]

10:50 am: **Control strategy of an electrically actuated morphing flap for the next generation green regional aircraft**, Maurizio Arena, Maria Chiara Noviello, Francesco Rea, Francesco Amoroso, Rosario Pecora, Univ. degli Studi di Napoli Federico II (Italy) . . . . . [10595-19]

11:10 am: **Aeroelastic stability analysis of a large civil aircraft equipped with morphing winglets and adaptive flap tabs**, Rosario Pecora, Francesco Amoroso, Maria Chiara Noviello, Univ. degli Studi di Napoli Federico II (Italy); Ignazio Dimino, Antonio Concilio, Ctr. Italiano Ricerche Aerospaziali (Italy). . . . . [10595-20]

CONFERENCE 10596
Behavior and Mechanics of Multifunctional Materials and Composites XII

SESSION 4

LOCATION: ASPEN A
TUE 10:30 AM TO 12:20 PM

Origami Materials

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

10:30 am: **Making faces: designing general shapes with thin nematic elastomer sheets** *(Invited Paper)*, Yu Xia, Hillel Aharoni, Xinyue Zhang, Randall D. Kamien, Shu Yang, Univ. of Pennsylvania (USA) . . . . . [10596-17]

11:00 am: **Modeling and optimization of self-folding origami structures undergoing large deformation**, Markus Geiss, Univ. of Colorado Boulder (USA) . . . . . [10596-18]

11:20 am: **Buckling behavior of origami unit cell facets under compressive loads**, Hani E. Naguib, Mohamed Ali Emhmed Kshad, Univ. of Toronto (Canada)[10596-19]

CONFERENCE 10597
Nano-, Bio-, Info-Tech Sensors and 3D Systems

SESSION 7

LOCATION: CRYSTAL SALON B/C
TUE 10:30 AM TO 11:10 AM

Keynote Session I

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

10:30 am: **Military comparison of 3D printed versus commercial components** *(Keynote Presentation)*, Eugene Edwards, Janice Booth, U.S. Army Research, Development and Engineering Command (USA); Michael Whitley, Michael Kranz, EngeniusMicro, LLC (USA); Mohamed Seif, Paul B. Ruffin, Alabama A&M Univ. (USA) . . . . . [10597-17]

Tuesday Plenary Session · Location: Silverton Salon 2 · 8:15 am to 10:00 am

8:15 to 8:30 am:

SPIE Fellow Awards *presented to:*

- **Norbert G. Meyendorf,** Iowa State Univ. of Science and Technology (USA)
- **Kara J. Peters**, North Carolina State Univ. (USA)
- **Hoon Sohn**, KAIST (Korea, Republic of)
- **Steve E. Watkins**, Missouri Univ. of Science and Technology (USA)

8:30 to 9:15 am:
Plenary Presentation

Multifunctional vascularized polymers and composites

Nancy R. Sottos, Beckman Institute for Advanced Science and Technology (USA)

9:15 to 10:00 am:
Plenary Presentation

Current and future needs and research for composite materials NDE

K. Elliott Cramer, NASA Langley Research Ctr. (USA)

Coffee Break · 10:00 am to 10:30 am

CONFERENCE 10598
Sensors and Smart Structures Technologies for Civil, Mechanical, and Aerospace Systems

Sessions 4A and 4B run concurrently.

SESSION 4A

LOCATION: CRESTONE SALON B
TUE 10:30 AM TO 12:10 PM

Vision-Based Structural Health Monitoring I

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

10:30 am: **Video-based crack detection using deep learning and naïve Bayes data fusion**, Fu-Chen Chen, Mohammad R. Jahanshahi, Purdue Univ. (USA) . . . . . [10598-18]

10:50 am: **Machine learning and digital image processing for non-contact modal parameters identification of structures,** Marco Torbol, Ulsan National Institute of Science and Technology (Korea, Republic of). . . . . [10598-19]

11:10 am: **Mapping and monitoring urban underground infrastructure with photogrammetric penetrating radar registration and augmented reality**, Dryver R. Huston, Robert Farrell, Dan Orfeo, Keith Thomas, Ming Qin, Mauricio Pereira, Tian Xia, The Univ. of Vermont (USA) . . . . . [10598-20]

SESSION 4B

LOCATION: ASPEN B
TUE 10:30 AM TO 12:10 PM

Wireless Sensors and Applications I

Session Chairs: **Hongki Jo,** The Univ. of Arizona (USA); **Jian Li,** The Univ. of Kansas (USA)

10:30 am: **Wireless fiber Bragg grating sensing system for civil, mechanical, and aerospace structures**, Muneesh Maheshwari, Yaowen Yang, Tanmay Chaturvedi, Nanyang Technological Univ. (Singapore) . . . . . [10598-22]

10:50 am: **Design and validation of a wireless distributed control experimental system on three-layer spring steel structure model**, Yan Yu, Changping Yang, Luyu Li, Dalian Univ. of Technology (China); Zhiqiang Liu, CCCC Highway Consultants Co., Ltd. (China) . . . . . [10598-23]

11:10 am: **Dense wireless capacitive sensor arrays for monitoring distortion-induced fatigue cracks in steel bridges**, Xiangxiong Kong, Jian Li, William Collins, Caroline R. Bennett, The Univ. of Kansas (USA); Hongki Jo, Jong-Hyun Jeong, The Univ. of Arizona (USA); Simon Laflamme, Iowa State Univ. of Science and Technology (USA) . . . . . [10598-24]

CONFERENCE 10599
Nondestructive Characterization and Monitoring of Advanced Materials, Aerospace, Civil Infrastructure, and Transportation XII

SESSION 4

LOCATION: CRYSTAL SALON A
TUE 10:30 AM TO 12:10 PM

Aerospace and Advanced Materials SHM/NDE I

Session Chairs: **Andrew L. Gyekenyesi,** Ohio Aerospace Institute (USA); **Fuh-Gwo Yuan,** North Carolina State Univ. (USA)

10:30 am: **The effect of nanoparticle enhanced sizing on the structural health monitoring sensitivity and mechanical properties of carbon fiber composites**, Christopher C. Bowland, Amit K. Naskar, Oak Ridge National Lab. (USA) . [10599-17]

10:50 am: **Carbon nanotube-embedded advanced aerospace composites for early-stage damage sensing,** Latha Nataraj, U.S. Army Research Lab. (USA) . . . . . [10599-18]

11:10 am: **Piezoresistive strain sensing of carbon nanotubes-based composite skin for aeronautical morphing structures**, Massimo Viscardi, Maurizio Arena, Univ. degli Studi di Napoli Federico II (Italy); Giuseppina Barra, Luigi Vertuccio, Liberata Guadagno, Univ. degli Studi di Salerno (Italy) . . . . . [10599-19]

CONFERENCE 10600
Health Monitoring of Structural and Biological Systems XII

SESSION 4

LOCATION: CRIPPLE CREEK 2
TUE 10:30 AM TO 12:30 PM

Civil Infrastructure Monitoring I

Session Chairs: **Christopher Niezrecki,** Univ. of Massachusetts Lowell (USA); **Tadeusz Uhl,** AGH Univ. of Science and Technology (Poland)

10:30 am: **High-speed non-contact ultrasound system for rail track integrity evaluation**, Francesco Lanza di Scalea, Xuan Zhu, Margherita Capriotti, Albert Liang, Univ. of California, San Diego (USA); Stefano Mariani, Imperial College London (United Kingdom); Simone Sternini, Univ. of California, San Diego (USA); Robert Wilson, Federal Railroad Administration (USA) . . . . . [10600-18]

10:50 am: **Bond graph based Bayesian network for fault detection of self-centering energy-dissipative bracing systems**, Daniela-Laura Manolache, Lucia Tirca, Concordia Univ. (Canada) [10600-19]

11:10 am: **Structural health monitoring and damage assessment during earthquake using smartphone**, Xuefeng Zhao, Ruicong Han, Dalian Univ. of Technology (China); Kenneth J. Loh, Univ. of California, San Diego (USA); Botao Xie, Dalian Univ. of Technology (China); Jinke Li, Dalian Univ. of Technology (China); Jinping Ou, Dalian Univ. of Technology (China) and Harbin Institute of Technology (China) . . . . . [10600-20]

CONFERENCE 10602
Smart Structures and NDE for Industry 4.0

SESSION 7

LOCATION: LEADVILLE
TUE 10:30 AM TO 12:10 PM

Real-Time Monitoring and Smart NDE

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

10:30 am: **Automated crack detection on pressed panel products using image processing**, Yeseul Kong, Hoyeon Moon, Hweekwon Jung, Gyuhae Park, Chonnam National Univ. (Korea, Republic of) . . . . . [10602-16]

10:50 am: **A comparative study of smart NDE techniques**, Saveri Pal, Norbert G. Meyendorf, Iowa State Univ. of Science and Technology (USA) . . . . . [10602-17]

11:10 am: **A new class of high-G and long-duration shock testing machines**, Jahangir S. Rastegar, Omnitek Partners, LLC (USA) . . . . . [10602-18]

TUESDAY 6 MARCH

CONFERENCE 10593

SESSION 6

LOCATION: CRIPPLE CREEK 1
TUE 11:30 AM TO 12:30 PM

Robotics

Session Chair: **Torben A. Lenau,** Technical Univ. of Denmark (Denmark)

11:30 am: **Interactive experiments in a robotics-based platform to simulate zebrafish response to a predator**, Roni Barak Ventura, Rana El Khoury, Gabrielle Cord-Cruz, Tommaso Ruberto, Maurizio Porfiri, NYU Tandon School of Engineering (USA) . . . . . [10593-15]

11:50 am: **Performance analysis of resilient bio-inspired structural systems**, Reena Patel, U.S. Army Engineer Research and Development Ctr. (USA); Carlos J. Colon Valez III, Univ. de Puerto Rico (USA); Guillermo A. Riveros, U.S. Army Engineer Research and Development Ctr. (USA); David S. Thompson, Mississippi State Univ. (USA); Edward J. Perkins, Jan J. Hoover, U.S. Army Engineer Research and Development Ctr. (USA); Felipe J. Acosta, Univ. de Puerto Rico (USA); John F. Peters, Mississippi State Univ. (USA). . . [10593-16]

12:10 pm: **Biomimetic soft robot using smart composite structure**, Sung-Hyuk Song, Korea Institute of Machinery & Materials (Korea, Republic of); Sung-Hoon Ahn, Seoul National Univ. (Korea, Republic of); Cheol Hoon Park, Young Su Son, Sunghwi Lee, Korea Institute of Machinery & Materials (Korea, Republic of) [10593-17]

Lunch Break . . . . Tue 12:30 pm to 2:00 pm

CONFERENCE 10594

SESSION 3 CONTINUED

11:50 am: **Twist-coil coupling for high stroke contractile artificial muscle fibers**, Geoffrey M. Spinks, Shazed M. Aziz, Univ. of Wollongong (Australia) . . . . . .[10594-8]

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

CONFERENCE 10595

SESSION 4 CONTINUED

11:30 am: **Feasibility studies for the installation of plasma synthetic jet actuators on the skin of a morphing wing flap,** Maurizio Arena, Matteo Chiatto, Francesco Amoroso, Rosario Pecora, Luigi de Luca, Univ. degli Studi di Napoli Federico II (Italy) . . . . . .[10595-21]

11:50 am: **Experimental investigations of a scaled shape-adaptive slat for wind energy rotor blades in preparation of wind tunnel measurements**, Oliver Huxdorf, Johannes Riemenschneider, Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany) . . . . .[10595-22]

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

CONFERENCE 10596

SESSION 4 CONTINUED

11:40 am: **A soft origami robot driven by electrostatic forces**, Jian Zhu, Jisen Li, National Univ. of Singapore (Singapore) . . . . . .[10596-20]

12:00 pm: **Optically and magnetically induced self-folding polymer composite prepared by electrospinning technique**, Kuei-Ren Chen, Wei-Hao Wang, Ta-I Yang, Chung Yuan Christian Univ. (Taiwan) . . . . . .[10596-21]

Lunch Break . . . . Tue 12:20 pm to 1:50 pm

CONFERENCE 10597

SESSION 8

LOCATION: CRYSTAL SALON B/C
TUE 11:10 AM TO 12:50 PM

3D Printing and Applications II

Session Chair: **Hikaru Yahagi,** Yamagata Univ. (Japan)

11:10 am: **Development of multi-material 3D printer**, Samiul Basher, Ajit Khosla, Hidemitsu Furukawa, Masaru Kawakami, Kumkum Ahmed, Azusa Saito, Hideaki Tamate, Yamagata Univ. (Japan) [10597-18]

11:30 am: **Development of double network gel ring and evaluation of friction properties**, Hikaru Yahagi, Yamagata Univ. (Japan); Masato Wada, National Institute of Technology, Tsuruoka College (Japan); Kazunari Yoshida, Ajit Khosla, Masaru Kawakami, Hidemitsu Furukawa, Yamagata Univ. (Japan). . . . . [10597-19]

11:50 am: **Development of high-strength gel dosimeter made by 3D gel printer**, Shota Inoue, Hidemitsu Furukawa, Ajit Khosla, Masaru Kawakami, Kazuyuki Sakai, Yamagata Univ. (Japan) . . . . . [10597-20]

12:10 pm: **Compression properties of 3D printed PLA infill specimens**, Balakrishnan Subeshan, Jeremy Marshall, Muhammad M. Rahman, Eylem Asmatulu, Wichita State Univ. (USA). . . . . [10597-21]

12:30 pm: **Fabrication of shape memory gels using 3D printer**, Md Nahin Islam Shiblee, Kumkum Ahmed, Azusa Saito, Hidemitsu Furukawa, Yamagata Univ. (Japan). . . . . [10597-22]

Lunch Break . . . . Tue 12:50 pm to 1:50 pm

CONFERENCE 10598

Sessions 4A and 4B run concurrently.

SESSION 4A CONTINUED

11:30 am: **Vision-based crack detection technique using cascade features**, Dharshan Lokekere Gopal, Rahmat Ali, Young-Jin Cha, Univ. of Manitoba (Canada) . . . . . [10598-21]

11:50 am: **Development of a flexible capacitive sensor for concrete structure health monitoring**, Yu Cheng, Hong Kong Univ. of Science and Technology (Hong Kong, China); Asad Hanif, Mirpur Univ. of Science and Technology (Pakistan); Zongjin Li, Univ. of Macau (Macao, China) . . . . . [10598-156]

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

SESSION 4B CONTINUED

11:30 am: **Multifunctional self-powered hydraulic system sensor node**, Maxwell F. Toothman, Ethian Ting, Ellen Skow, Kenneth A. Cunefare, Georgia Institute of Technology (USA) . . . . . [10598-25]

11:50 am: **Capacitance-based wireless strain sensor development**, Jong-Hyun Jeong, The Univ. of Arizona (USA); Jian Xu, Wuhan Univ. (China); Hongki Jo, The Univ. of Arizona (USA); Jian Li, Xiangxiong Kong, William Norfleet Collins, Caroline R. Bennett, The Univ. of Kansas (USA); Simon Laflamme, Iowa State Univ. of Science and Technology (USA) . . . . . [10598-26]

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

CONFERENCE 10599

SESSION 4 CONTINUED

11:30 am: **Damage detection in composites using nonlinear ultrasonically modulated thermography**, Dimitrios Dionysopoulos, Gian Piero Malfense Fierro, Michele Meo, Francesco Ciampa, Univ. of Bath (United Kingdom). . . . . [10599-20]

11:50 am: **Impact damage imaging in a curved composite aileron with instantaneous wavenumber via Riesz transform**, Huan-Yu Chang, Fuh-Gwo Yuan, National Institute of Aerospace (USA) . . . . . [10599-21]

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

CONFERENCE 10600

SESSION 4 CONTINUED

11:30 am: **Vibration analysis of a wind turbine blade cross-section via phase-based motion estimation and video magnification**, Aral Sarrafi, Peyman Poozesh, Christopher Niezrecki, Zhu Mao, Univ. of Massachusetts Lowell (USA) . . . . . [10600-21]

11:50 am: **The interaction of longitudinal guided waves with complex defect in pipeline**, Chen Qin, Yunfei Wang, Xiaojuan Wang, Xi'an Univ. of Technology (China) . . . . . [10600-22]

12:10 pm: **MRI myocardium T2* measurement by a new PCA-based object recognition algorithm**, Fabrizio Barone, Rocco Romano, Fausto Acernese, Gerardo Giordano, Univ. degli Studi di Salerno (Italy); Giovanni Babino, Azienda Ospedaliera Univ. San Giovanni di Dio e Ruggi D'Aragona (Italy). . . . . [10600-23]

Lunch Break . . . . Tue 12:30 pm to 1:40 pm

CONFERENCE 10602

SESSION 7 CONTINUED

11:30 am: **Development of magneto-rheological fluid (MRF) based clutch for output torque control of AC motors**, Quoc Hung Nguyen, Vietnamese-German Univ. (Viet Nam) . . . . . [10602-19]

11:50 am: **Comparison of guided and standing waves based full field laser scanning techniques for damage detection using wavenumber analysis,** Jun Young Jeon, Duhwan Kim, Gyuhae Park, Chonnam National Univ. (Korea, Republic of); To Kang, Soon Woo Han, Korea Atomic Energy Research Institute (Korea, Republic of) . . . . . [10602-20]

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

TUESDAY 6 MARCH

CONFERENCE 10593

SESSION 7

LOCATION: CRIPPLE CREEK 1
TUE 2:00 PM TO 3:20 PM

Adhesion

Session Chair: **Andreas Walther,** Univ. of Freiburg (Germany)

2:00 pm: **Visualization of dropwise condensation on a hydrophobic vertical plate with bioinspired surface treatment**, Blake Naccarato, Kwang Jin Kim, Univ. of Nevada, Las Vegas (USA) . . . . . [10593-18]

2:20 pm: **Observation of micro-topography of newt toe pads and investigating on wet adhesive properties of microstructured surface of PDMS**, Ling Gong, Univ. of Science and Technology of China (China) and Institute of Advanced Manufacturing Technology (China); Xiaojie Wang, Haiwu Yue, Xuan Wu, Institute of Advanced Manufacturing Technology (China) . . . . . [10593-19]

2:40 pm: **A wall-climbing robot using gecko-inspired dry adhesives and underactuated modular connecting mechanism**, Xuan Wu, Rongchuan Wang, Institute of Advanced Manufacturing Technology (China); Tao Mei, Shenzhen Smart Sec. & Surv. Robot Co. Ltd. (China); Xiaojie Wang, Institute of Advanced Manufacturing Technology (China) . . . . . [10593-20]

3:00 pm: **Making adhesive beads using natural processes**, Carolyn M. Dry, Natural Process Design, Inc. (USA) . . . . . [10593-22]

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

CONFERENCE 10594

SESSION 4

LOCATION: SILVERTON SALON 2
TUE 1:40 PM TO 3:00 PM

IMPC

Session Chairs: **Ray H. Baughman,** The Univ. of Texas at Dallas (USA); **Geoffrey M. Spinks,** Univ. of Wollongong (Australia)

1:40 pm: **Last twenty-five years of effort in developing fabrication-methods of IPMCs** *(Invited Paper)*, Kwang Jin Kim, Univ. of Nevada, Las Vegas (USA)[10594-9]

2:20 pm: **Moisture and electrical coupling stimulated ionic polymer actuator with superior deformation behavior**, Jie Ru, Zicai Zhu, Xi'an Jiaotong Univ. (China); Yanjie Wang, Hohai Univ. (China); Hualing Chen, Xi'an Jiaotong Univ. (China) . . . . . [10594-10]

2:40 pm: **An IPMC modeling approach for computational efficiency and rapid design development**, Zakai Olsen, Kwang Jin Kim, Univ. of Nevada, Las Vegas (USA) . . . . . [10594-11]

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

CONFERENCE 10595

SESSION 5

LOCATION: CRESTONE SALON A
TUE 1:40 PM TO 3:00 PM

Fluid-Structure Interaction

Session Chairs: **Norbert Schwesinger,** Technische Univ. München (Germany); **Alper Erturk,** Georgia Institute of Technology (USA)

1:40 pm: **Fluidic harvester under train of frozen boxcars (TFB) loading: a parametric study**, Amir Danesh-Yazdi, Penn State Behrend (USA); Oleg Goushcha, Manhattan College (USA); Niell Elvin, Yiannis Andreopoulos, The City College of New York (USA) . . . . . [10595-23]

2:00 pm: **Experimental proof of concept for piezoelectric flow harvesting for in-pipe metering systems**, Sherif Keddis, Rafik Mitry, Norbert Schwesinger, Technische Univ. München (Germany) . . . . . [10595-24]

2:20 pm: **Feasibility study of interacting side-by-side piezoelectric harvesters in low grid-generated turbulence**, Kevin Ferko, David M. Lachendro, Andrew W. Bradley, Amir Danesh-Yazdi, Penn State Behrend (USA) . . . . . [10595-25]

2:40 pm: **Coupling of nonlinear macro-fiber composite piezoelectric cantilever dynamics with hydrodynamic loads,** David Tan, Alper Erturk, Georgia Institute of Technology (USA) . . . . . [10595-26]

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

CONFERENCE 10596

SESSION 5

LOCATION: ASPEN A
TUE 1:50 PM TO 3:10 PM

Dielectrics and Piezoelectrics

Session Chairs: **Vishnu Baba Sundaresan,** The Ohio State Univ. (USA); **Amir Ameli,** Washington State Univ. Tri-Cities (USA)

1:50 pm: **Theoretical modeling of contractile dielectric elastomer composites**, Nakhiah C. Goulbourne, Univ. of Michigan (USA) . . . . . [10596-22]

2:10 pm: **A phenomenological model for coupled multi-axial piezoelectricity**, Yuchen Wei, Sergio Pellegrino, California Institute of Technology (USA) . . . [10596-23]

2:30 pm: **Uncertainty quantification for PZT bimorph actuators**, Nikolas Bravo, Ralph C. Smith, North Carolina State Univ. (USA); John Crews, Applied Research Associates, Inc. (USA) . . . . . [10596-24]

2:50 pm: **Active subspace uncertainty quantification for a polydomain ferroelectric phase-field model**, Lider S. Leon, Ralph C. Smith, North Carolina State Univ. (USA); William S. Oates, Florida State Univ. (USA); Paul Miles, North Carolina State Univ. (USA) . . . . . [10596-25]

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

CONFERENCE 10597

SESSION 9

LOCATION: CRYSTAL SALON B/C
TUE 1:50 PM TO 2:30 PM

Keynote Session II

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

1:50 pm: **Cellulose nanocrystal based transparent electroactive polyurethane for active lens application** *(Keynote Presentation)*, Hyun-U Ko, Hyun Chan Kim, Jung Woon Kim, Jiyun Lee, Jaehwan Kim, INHA Univ. (Korea, Republic of) . [10597-23]

SESSION 10

LOCATION: CRYSTAL SALON B/C
TUE 2:30 PM TO 3:30 PM

Nanosensors and Systems II

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

2:30 pm: **Properties of micro-nanofibrillated-chitin/Bamboo-cellulose nanofiber composite**, Le Van Hai, Lindong Zhai, Jung Woong Kim, Jungho Park, Jaehwan Kim, INHA Univ. (Korea, Republic of) . . . . . [10597-24]

2:50 pm: **Young's modulus measurement of cellulose nanofibers by atomic force microscopy**, Lindong Zhai, Hyun Chan Kim, Debora Kim, Ruth Mwongeli Muthoka, Jaehwan Kim, INHA Univ. (Korea, Republic of) . . . . . [10597-25]

3:10 pm: **Alignment of cellulose fibers by high-DC magnetic field**, Hyun Chan Kim, Lindong Zhai, Jinmo Kang, Sunanda Roy, Le Van Hai, Jaehwan Kim, INHA Univ. (Korea, Republic of) . . . . . [10597-26]

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

CONFERENCE 10598

Sessions 5A and 5B run concurrently.

SESSION 5A

LOCATION: CRESTONE SALON B
TUE 1:40 PM TO 3:00 PM

Vision-Based Structural Health Monitoring II

Session Chairs: **Young-Jin Cha,** Univ. of Manitoba (Canada); **Jian Li,** The Univ. of Kansas (USA)

1:40 pm: **Deep faster R-CNN based automated structural visual inspection for detecting multiple damage types**, Young-Jin Cha, Sadegh Mahmoudkhani, Univ. of Manitoba (Canada); Oral Büyüköztürk, Massachusetts Institute of Technology (USA) . . . . . [10598-27]

2:00 pm: **An image-based feature tracking approach for bolt loosening detection in steel connections**, Xiangxiong Kong, Jian Li, The Univ. of Kansas (USA) . . . . . [10598-28]

2:20 pm: **Automated fatigue crack identification through motion tracking in a video stream**, Xiangxiong Kong, Jian Li, The Univ. of Kansas (USA) . .[10598-29]

2:40 pm: **Automated volumetric damage detection and quantification using region-based convolution neural networks and an inexpensive depth camera**, Gustavo H. Beckman, Dimos Polyzois, Young-Jin Cha, Univ. of Manitoba (Canada) . . . . . [10598-30]

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

SESSION 5B

LOCATION: ASPEN B
TUE 1:40 PM TO 3:00 PM

Wireless Sensors and Applications II

Session Chairs: **Kon-Well Wang,** Univ. of Michigan (USA); **Haiying Huang,** The Univ. of Texas at Arlington (USA)

1:40 pm: **A methodology for structural health diagnosis and assessment using machine learning with noisy and incomplete data from self-powered wireless sensors,** Hadi Salehi, Saptarshi Das, Michigan State Univ. (USA); Shantanu Chakrabartty, Washington Univ. in St. Louis (USA); Subir Biswas, Rigoberto Burgueno, Michigan State Univ. (USA) . . . . [10598-31]

2:00 pm: **A low-cost wearable device for dynamic interrogation of antenna sensors**, Jun Yao, James Skilskyj, Haiying Huang, The Univ. of Texas at Arlington (USA) . . . . . [10598-32]

2:20 pm: **Demand-based wireless smart sensors for earthquake monitoring of civil infrastructure**, Yuguang Fu, Univ. of Illinois (USA); Li Zhu, Beijing Jiaotong Univ. (China); Billie F. Spencer Jr., Kirill A. Mechitov, Univ. of Illinois (USA) .[10598-33]

2:40 pm: **Piezoelectric charging and wireless communication**, Hyeong Jae Lee, Xiaoqi Bao, Shannon P. Jackson, Stewart Sherrit, Jet Propulsion Lab. (USA) . . . . . [10598-34]

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

CONFERENCE 10599

SESSION 5

LOCATION: CRYSTAL SALON A
TUE 1:40 PM TO 3:00 PM

Aerospace and Advanced Materials SHM/NDE II

Session Chairs: **Fuh-Gwo Yuan,** North Carolina State Univ. (USA); **Andrew L. Gyekenyesi,** Ohio Aerospace Institute (USA)

1:40 pm: **Nonlinear imaging (NIM) of barely visible impact damage (BVID) in composite panels using a semi and full air-coupled constructive nonlinear array (CNA) technique**, Gian Piero Malfense Fierro, Michele Meo, Univ. of Bath (United Kingdom) . . . . . [10599-22]

2:00 pm: **Novel SHM technologies for strain control of a composite main landing gear bay specimen,** Massimo Viscardi, Maurizio Arena, Pasquale Napolitano, Michele Guida, Natalino Daniele Boffa, Univ. degli Studi di Napoli Federico II (Italy); Monica Ciminello, Ctr. Italiano Ricerche Aerospaziali (Italy); Fabrizio Ricci, Univ. degli Studi di Napoli Federico II (Italy) . . . . . [10599-23]

2:20 pm: **3D strain sensor using tunable cellular composite with graphene-modified interfaces**, Yanxiao Li, Chuanrui Guo, Chenglin Wu, Missouri Univ. of Science and Technology (USA) . [10599-24]

2:40 pm: **Determination of depth and size of defects in carbon-fiber-reinforced plastic with different methods of pulse thermography**, Vitalij Popow, Benjamin Kelkel, Martin Gurka, Institut fuer Verbundwerkstoff (Germany) . . . . . [10599-25]

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

CONFERENCE 10600

SESSION 5

LOCATION: CRIPPLE CREEK 2
TUE 1:40 PM TO 3:00 PM

Advanced Modeling Techniques

Session Chairs: **Sourav Banerjee,** Univ. of South Carolina (USA); **Ajay M. Koshti,** NASA Johnson Space Ctr. (USA)

1:40 pm: **Predictive 1D and 2D guided-wave propagation in composite plates using the SAFE approach,** Hanfei Mei, Victor Giurgiutiu, Univ. of South Carolina (USA) . . . . . [10600-24]

2:00 pm: **Computational wave modeling of anisotropic plates with implementation of Symmetry Informed Sequential Mapping of Anisotropic Green's function (SISMAG)**, Sajan Shrestha, Sourav Banerjee, Univ. of South Carolina (USA) . . . . . [10600-25]

2:20 pm: **X-ray ray tracing simulation and flaw parameters for crack detection**, Ajay M. Koshti, NASA Johnson Space Ctr. (USA) . . . . . [10600-26]

2:40 pm: **Real-time tools and modeling for electro-mechanical impedance structural health monitoring**, Andrei N. Zagrai, Matthew A. Campisi, New Mexico Institute of Mining and Technology (USA) . . . . . [10600-27]

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

CONFERENCE 10602

SESSION 8

LOCATION: LEADVILLE
TUE 1:40 PM TO 3:00 PM

Application of Smart Structures and Materials

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

1:40 pm: **Tile-based vacuum jamming rigidization surface for inflatables**, Jonathan E. Luntz, Laura Giner Munoz, Diann E. Brei, Wonhee Kim, Univ. of Michigan (USA) . . . . . [10602-21]

2:00 pm: **Near DC force measurement using PVDF sensors**, Arun Kumar Ramanathan, Leon M. Headings, Marcelo J. Dapino, The Ohio State Univ. (USA) . . . . . [10602-22]

2:20 pm: **The output power and durability improvement with different beam shape of MEMS piezoelectric energy harvester**, Chao-Ting Chen, Yung Hsing Fu, Tang-Wei Hao, Shun-Chiu Lin, Wen-Jong Wu, National Taiwan Univ. (Taiwan). .[10602-23]

2:40 pm: **Piezoelectric-based self-powered electronic adjustable impulse switches**, Jahangir S. Rastegar, Philip Kwok, Omnitek Partners, LLC (USA) . . . . . [10602-24]

Conference End.

TUESDAY 6 MARCH

CONFERENCE 10593

SESSION 8

LOCATION: CRIPPLE CREEK 1
TUE 3:50 PM TO 5:30 PM

Particulate Matter

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

3:50 pm: **Biological and biomimetic radiative-cooling nanophotonic structures** *(Invited Paper)*, Nanfang Yu, Columbia Univ. (USA) . . . . . [10593-23]

4:20 pm: **Molecular engineering of self-assembled bioinspired nanocomposites** *(Invited Paper)*, Andreas Walther, Univ. of Freiburg (Germany) . . . . . [10593-24]

4:50 pm: **Enzyme mimetic bio-inorganic nanoparticles**, Mato Knez, CIC nanoGUNE (Spain) . . . . . [10593-25]

5:10 pm: **Encapsulated droplet-based materials with emergent functional properties**, Elio J. Challita, Donald J. Leo, Eric C. Freeman, The Univ. of Georgia (USA) . . . . . [10593-26]

CONFERENCE 10594

SESSION 5

LOCATION: SILVERTON SALON 2
TUE 3:30 PM TO 5:50 PM

Modeling EAP Materials

Session Chairs: **Minoru Taya,** Univ. of Washington (USA); **Christoph Keplinger,** Univ. of Colorado Boulder (USA)

3:30 pm: **The Peano-HASEL actuator: a versatile electrostatic actuator that linearly contracts on activation**, Nicholas Kellaris, Vidyacharan Gopaluni-Venkata, Garrett Smith, Shane K. Mitchell, Eric Acome, Christoph Keplinger, Univ. of Colorado Boulder (USA) . . . . . [10594-80]

3:50 pm: **Nonlinear electro-elastic modeling of thin dielectric elastomer plate actuators**, Elisabeth Staudigl, Michael Krommer, Yury Vetyukov, Technische Univ. Wien (Austria); Alexander Humer, Johannes Kepler Univ. Linz (Austria) . . . . . [10594-13]

4:10 pm: **Investigation of the thermal effects in dynamically driven dielectric elastomer actuators**, Mario Kleo, TU Dresden (Germany); Holger Mößinger, Florentine Förster-Zügel, Helmut F. Schlaak, Technische Univ. Darmstadt (Germany); Thomas Wallmersperger, TU Dresden (Germany) . . . . . [10594-14]

4:30 pm: **Fast model-based design of large stroke dielectric elastomer membrane actuators biased with pre-stressed buckled beams**, Daniel Bruch, Philipp Loew, Steffen Hau, Gianluca Rizzello, Stefan Seelecke, Univ. des Saarlandes (Germany) . . . . . [10594-15]

4:50 pm: **Instability and thermodynamics of dielectric elastomers**, Liwu Liu, Yanju Liu, Jinsong Leng, Harbin Institute of Technology (China) . . . . . [10594-16]

5:10 pm: **Modeling actuation of ionic polymer metal composites from the initial transient to back-relaxation**, Hesam Sharghi, Peng Zhang, Maurizio Porfiri, NYU Tandon School of Engineering (USA) . . . . . [10594-17]

5:30 pm: **Thermodynamically consistent electro-chemo-mechanical model for polymer membranes**, Marco Rossi, Thomas Wallmersperger, TU Dresden (Germany); Paola Nardinocchi, Sapienza Univ. di Roma (Italy) . . . . . [10594-18]

CONFERENCE 10595

SESSION 6

LOCATION: CRESTONE SALON A
TUE 3:30 PM TO 5:50 PM

Bistable Structures and Energy Harvesters

Session Chairs: **Wei-Hsin Liao,** The Chinese Univ. of Hong Kong (Hong Kong, China); **Lihua Tang,** The Univ. of Auckland (New Zealand)

3:30 pm: **Triggering high-energy orbit oscillation of bistable energy harvesters using electrical coupling**, Jiahua Wang, Wei-Hsin Liao, The Chinese Univ. of Hong Kong (Hong Kong, China) . . . . . [10595-27]

3:50 pm: **Synchronized switch technique based on dynamical state of bi-stable energy harvesters**, Lorenzo Alari, Janav P. Udani, Andres F. Arrieta, Purdue Univ. (USA); Francesco Braghin, Politecnico di Milano (Italy) . . . . . [10595-28]

4:10 pm: **Stochastic resonance energy harvesting for self-powered smart tires**, Hongjip Kim, Lei Zuo, Virginia Polytechnic Institute and State Univ. (USA). . [10595-29]

4:30 pm: **Buckled bistable beam actuation with twisted strings**, Reynolds Addo-Akoto, Jong-Eun Suh, Jongwan Lee, Jong-Seob Han, Jae-Hung Han, KAIST (Korea, Republic of) . . . . . [10595-30]

4:50 pm: **Dynamics of a bistable coupled dual-beam energy harvester and its experimental validation**, Chunbo Lan, Lihua Tang, Guobiao Hu, The Univ. of Auckland (New Zealand); Weiyang Qin, Northwestern Polytechnical Univ. (China) . . . . . [10595-31]

5:10 pm: **Exploiting nonlinearity bi-stable lattices for energy harvesting**, Myungwon Hwang, Andres F. Arrieta, Purdue Univ. (USA) . . . . . [10595-32]

5:30 pm: **A tunable nonlinear vibration energy harvester based on a magnetically sprung oscillator using ring magnets**, Arata Masuda, Yusuke Miyata, Sou Ushiki, Shingo Kato, Yuichi Nagahata, Kyoto Institute of Technology (Japan) . . . . . [10595-33]

CONFERENCE 10596

SESSION 6

LOCATION: ASPEN A
TUE 3:40 PM TO 6:00 PM

Additive Manufacturing II

Session Chairs: **Marcelo J. Dapino,** The Ohio State Univ. (USA); **Shu Yang,** Univ. of Pennsylvania (USA)

3:40 pm: **Solvent sensitivity of smart 3D-printed nanocomposite liquid sensor**, Nahal Aliheidari, Amir Ameli, Washington State Univ. Tri-Cities (USA); Petra Potschke, Leibniz-Institut für Polymerforschung Dresden e.V. (Germany) . . . . . [10596-26]

4:00 pm: **Selective laser melting of Ni-rich NiTi: selection of process parameters and the superelastic response**, Narges Shayesteh Moghaddam, The Univ. of Toledo (USA); Soheil Saedi, Univ. of Kentucky (USA); Amirhesam Amerinatanzi, The Univ. of Toledo (USA); Ehsan Saghaian, Univ. of Kentucky (USA); Ahmadreza Jahadakbar, The Univ. of Toledo (USA); Haluk Karaca, Univ. of Kentucky (USA); Mohammad Elahinia, The Univ. of Toledo (USA) . . . . . [10596-27]

4:20 pm: **Ultrasonic alignment of microparticles in nozzle-like geometries,** Molly A. Whittaker, Erin R. Dauson, Jaime A. Parra-Raad, Robert A. Heard, Irving J. Oppenheim, Carnegie Mellon Univ. (USA) . . . . . [10596-28]

4:40 pm: **Soft embedded micropillar arrays for actuation and sensing**, Alexandra Damley-Strnad, Nakhiah C. Goulbourne, Univ. of Michigan (USA) . . . . . [10596-29]

5:00 pm: **Electromechanical modeling of a 3D printed nanocomposite**, Alireza Nafari, Henry A. Sodano, Univ. of Michigan (USA) . . . . . [10596-30]

5:20 pm: **Mechanical evaluation of the SLM fabricated, stiffness-matched, mandibular bone fixation plates**, Ahmadreza Jahadakbar, Narges Shayesteh Moghaddam, Amirhesam Amerinatanzi, The Univ. of Toledo (USA); David Dean, The Ohio State Univ. (USA); Mohammad Elahinia, The Univ. of Toledo (USA) . . . . . [10596-31]

5:40 pm: **Development of non-wetting microfluidic channels for application in reconfigurable antennas**, Anthony Griffin, Univ. of Illinois (USA); Hong Pan, Gregory Huff, Texas A&M Univ. (USA); Nancy Sottos, Scott White, Univ. of Illinois (USA) . . . . . [10596-32]

CONFERENCE 10597

SESSION 11

LOCATION: CRYSTAL SALON B/C
TUE 4:00 PM TO 6:00 PM

Nanosensors and Systems III

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

4:00 pm: **Wireless detection of ammonia using SAW resonator**, Lokesh Rana, Reema Gupta, Monika Tomar, Vinay Gupta, Univ. of Delhi (India) . . . . . [10597-27]

4:20 pm: **Smart microsensors, MEMS, and their applications**, Se Chang Oh, Mouli Ramasamy, Vijay K. Varadan, The Pennsylvania State Univ. (USA) . [10597-28]

4:40 pm: **Realization of a microfluidic surface plasmon resonance biosensor for detection of meningitidis DNA,** Gurpreet Kaur, Monika Tomar, Vinay Gupta, Univ. of Delhi (India) . . . . . [10597-29]

5:00 pm: **Ionic liquid in 3D printing**, Kumkum Ahmed, Yamagata Univ. (Japan); Naofumi Naga, Shibaura Institute of Technology (Japan); Masaru Kawakami, Hidemitsu Furukawa, Yamagata Univ. (Japan) . . . . . [10597-30]

5:20 pm: **Fabrication of Love wave acoustic biosensor for detection of meningitidis DNA**, Lokesh Rana, Reema Gupta, Monika Tomar, Vinay Gupta, Univ. of Delhi (India) . . . . . [10597-31]

5:40 pm: **Integrated coplanar Pd-SnO2 hetrostructures based CNG/PNG sensor for wireless detection,** Avneet Singh, Univ. of Delhi (India); Anjali Sharma, Atma Ram Sanatan Dharma College (India); Monika Tomar, Vinay Gupta, Univ. of Delhi (India) . . . . . [10597-32]

CONFERENCE 10598

Sessions 6A and 6B run concurrently.

SESSION 6A

LOCATION: CRESTONE SALON B
TUE 3:30 PM TO 5:50 PM

Deep Learning for Structural Health Monitoring

Session Chairs: **Yun-Kyu An,** Sejong Univ. (Korea, Republic of); **Soojin Cho,** Ulsan National Institute of Science and Technology (Korea, Republic of)

3:30 pm: **The classification, detection, and quantification of crack damage on structures based on deep-learning using unmanned aerial vehicle**, Jin-Hwan Lee, Hyung-Jo Jung, In-Ho Kim, KAIST (Korea, Republic of). . . . . .[10598-35]

3:50 pm: **Deep learning-based concrete crack detection using hybrid images**, Yun-Kyu An, Keun-Young Jang, Sejong Univ. (Korea, Republic of); Byunghyun Kim, Soojin Cho, The Univ. of Seoul (Korea, Republic of). . . . . .[10598-36]

4:10 pm: **Deep learning-based rapid inspection of concrete structures**, Soojin Cho, Byunghyun Kim, Yein Lee, The Univ. of Seoul (Korea, Republic of) . . .[10598-37]

4:30 pm: **Data-driven structural diagnosis and conditional assessment: from shallow to deep learning**, Hong Pan, Jinggangshan Univ. (China); Zhibin Lin, North Dakota State Univ. (USA); Guoqing Gui, Jinggangshan Univ. (China); Changhui Yan, North Dakota State Univ. (USA). . . . . .[10598-38]

4:50 pm: **Variational autoencoder (VAE) for production quality inspection in manufacturing**, Seungtae Park, Hojin Lee, Bumsoo Park, Haedong Jeong, Seungchul Lee, Ulsan National Institute of Science and Technology (Korea, Republic of) [10598-39]

5:10 pm: **Deep convolutional neural networks for corrosion detection on metallic surfaces**, Deegan Atha, Mohammad R. Jahanshahi, Purdue Univ. (USA). . . . . .[10598-40]

5:30 pm: **Deep convolutional neural networks for crack detection**, Mohsen Maniat, Charles V. Camp, The Univ. of Memphis (USA). . . . . [10598-41]

SESSION 6B

LOCATION: ASPEN B
TUE 3:30 PM TO 5:50 PM

Novel Sensing Technologies I

Session Chairs: **Hui Li,** Harbin Institute of Technology (China); **Ming L. Wang,** Northeastern Univ. (USA)

3:30 pm: **MEMS infrared (IR) sensor based on piezoelectric bending resonators**, Xiaoqi Bao, Stewart Sherrit, Mina Rais-Zadeh, Clifford Frez, Jet Propulsion Lab. (USA) . . . . . .[10598-42]

3:50 pm: **Comparison of CO2 gas sensing between Langasite resonator and QCM**, Chen Zhang, Haifeng Zhang, Univ. of North Texas (USA). . . . .[10598-43]

4:10 pm: **Sensor-enabled geogrids with the geometrical characteristics of graphene nanoplatelets**, Mortaza Saeidi-Javash, The Univ. of Oklahoma (USA); Pouyan Karimi, Univ. of Illinois (USA); Kianoosh Hatami, The Univ. of Oklahoma (USA). . . . . .[10598-44]

4:30 pm: **Monolithic linear and angular sensors for real-time low-frequency structural distributed monitoring**, Fabrizio Barone, Gerardo Giordano, Univ. degli Studi di Salerno (Italy) . . . .[10598-45]

4:50 pm: **Thick-film resistors on glass ceramic substrates as smart aggregates for SHM**, Xinchun Guan, Ming Wen, Hui Li, Jinping Ou, Harbin Institute of Technology (China). . . . . .[10598-46]

5:10 pm: **A rotational actuator based on the piezoelectric bimorph**, Shui-Dong Jiang, Houfei Fang, Lei Liu III, Shanghai YS Information Technology Co., Ltd. (China). . . . . .[10598-47]

5:30 pm: **Saliva biomarker detection using an Aptamer-based nanosensor**, Wenjun Zhang, Sheyda Nazarian, Ming L. Wang, Northeastern Univ. (USA)[10598-48]

CONFERENCE 10599

SESSION 6

LOCATION: CRYSTAL SALON A
TUE 3:30 PM TO 5:30 PM

Aerospace and Advanced Materials SHM/NDE III

Session Chairs: **Didem Ozevin,** Univ. of Illinois at Chicago (USA); **Christopher C. Bowland,** Oak Ridge National Lab. (USA)

3:30 pm: **Impact detection method for composite winglets based on neural network implementation**, Massimo Viscardi, Maurizio Arena, Pasquale Napolitano, Natalino Daniele Boffa, Ernesto Monaco, Univ. degli Studi di Napoli Federico II (Italy). . . . . .[10599-26]

3:50 pm: **Characterizing the adhesion behavior of impact ice**, Andrew L. Gyekenyesi, Andrew H. Work, Ohio Aerospace Institute (USA); Richard E. Kreeger, NASA Glenn Research Ctr. (USA). . . . . .[10599-27]

4:10 pm: **Evaluation of linear and nonlinear features of electro-mechanical impedance measurements for detection and quantification of sub-surface cracks**, Christoph Kralovec, Thomas Erlinger, Sandra Gschossmann, Martin Schagerl, Johannes Kepler Univ. Linz (Austria). . . . . .[10599-28]

4:30 pm: **Application of optical interferometric techniques for non-destructive evaluation of novel "green" composite materials**, Vito Pagliarulo, Istituto di Scienze applicata e Sistemi Intelligenti (Italy); Pietro Russo, Vittorio Bianco, Istituto per i Polimeri, Compositi e Biomateriali (Italy); Pietro Ferraro, Istituto di Scienze applicata e Sistemi Intelligenti (Italy) . . . . . .[10599-29]

4:50 pm: **Characterization and optimization of spiral eddy current coils for in-situ crack detection,** Catalin Mandache, National Research Council Canada (Canada) . . . . . .[10599-30]

5:10 pm: **The pilot study of piezoelectric properties in asphalt-based PZT composites,** Yu-Min Su, Jia-Lin Chen, National Kaohsiung Univ. of Applied Sciences (Taiwan); Tsung-Chin Hou, National Cheng Kung Univ. (Taiwan); Huang-Hsin Pan, National Kaohsiung Univ. of Applied Sciences (Taiwan) . . . .[10599-32]

CONFERENCE 10600

SESSION 6

LOCATION: CRIPPLE CREEK 2
TUE 3:20 PM TO 6:00 PM

Medical/Biomedical Applications

Session Chairs: **Piervincenzo Rizzo,** Univ. of Pittsburgh (USA); **Xiaoning Jiang,** North Carolina State Univ. (USA)

3:20 pm: **Quantitative observation of bone healing in osseointegrated prostheses**, Wentao Wang, Jerome P. Lynch, Univ. of Michigan (USA). . . . . .[10600-28]

3:40 pm: **Imaging platforms for registering and analyzing the skin microrelief structure**, Ina Kundu, Xian Du, Brian Anthony, Massachusetts Institute of Technology (USA). . . . . .[10600-29]

4:00 pm: **Visualization of the scattering of focused ultrasonic waves at solid-fluid interfaces**, Matthew Brown, Christoph Schaal, Vibhav Durgesh, California State Univ., Northridge (USA) . . . . . .[10600-30]

4:20 pm: **Characterization of dental tissue by reflection and transmission ultrasound microscopy**, Christopher Blase, Johann Wolfgang Goethe-Univ. Frankfurt am Main (Germany); Umar Amjad, Tribikram Kundu, The Univ. of Arizona (USA); Maximilian Blume, Universitätsklinikum Frankfurt am Main (Germany); Jürgen Bereiter-Hahn, Johann Wolfgang Goethe-Univ. Frankfurt am Main (Germany); Robert Sader, Universitätsklinikum Frankfurt am Main (Germany) . . . . . .[10600-31]

4:40 pm: **Imaging the superficial vascular structure for mapping and identification,** Ina Kundu, Brian Anthony, Massachusetts Institute of Technology (USA). . .[10600-32]

5:00 pm: **Flexible piezo-composite ultrasound transducers for biomedical applications**, Taeyang Kim, Zheng Cui, Yong Zhu, Xiaoning Jiang, North Carolina State Univ. (USA) . . . . . .[10600-33]

5:20 pm: **Numerical and experimental investigation of the scattering of focused ultrasonic waves at solid-fluid interfaces**, Mehran Safisamghabadi, Christoph Schaal, Artavazd Babayan, Oscar Huinac, California State Univ., Northridge (USA) . .[10600-34]

5:40 pm: **Ultrasonic spectral analysis and augmented visualization for medical imaging**, Jianguo Ma, Beihang Univ. (China); Boya Chen, Min Wei, Yulin Li, Jie Du, Beijing Anzhen Hospital, Capital Medical Univ. (China); Lijun Xu, Beihang Univ. (China). . . . . .[10600-35]

TUESDAY POSTER SESSION

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

Conference attendees are invited to attend the poster session to network, enjoy light refreshments, and view the poster papers. Attendees are required to wear their conference registration badge. Authors of poster papers will be present to answer questions concerning their papers. Poster authors must set up their poster between 10 am and 4 pm on Tuesday 6 March.

CONFERENCE 10594

Electroactive Polymer Actuators and Devices (EAPAD) XX

Dynamic characteristics of out-of-plane vibration of dielectric elastomer resonator, Chao Tang, Changsheng Bian, Zhuoyuan Li, Bo Li, Hualing Chen, Xi'an Jiaotong Univ. (China). . . . . [10594-76]

Electro-mechanical coupling and instabilities in microstructured dielectric elastomers, Stephan Rudykh, Artemii Goshkoderia, Pavel Galich, Technion-Israel Institute of Technology (Israel) . . . . . [10594-77]

Charging efficiency of a passively switched flyback converter for dielectric elastomer generator, Toru Ikegame, Kentaro Takagi, Nagoya Univ. (Japan). . . . . [10594-78]

Grey-box modeling and control of torsional fishing-line artificial muscle actuator, Chihaya Oiwa, Nagoya Univ. (Japan); Ken Masuya, Kenji Tahara, Kyushu Univ. (Japan); Toshihira Irisawa, Nagoya Univ. (Japan); Kinji Asaka, National Institute of Advanced Industrial Science and Technology (Japan); Kentaro Takagi, Nagoya Univ. (Japan) . . . . . [10594-79]

An integrated self priming circuit with electret charge source, Patrin K. Illenberger, Katherine E. Wilson, Udaya K. Madawala, The Univ. of Auckland (New Zealand); Iain A. Anderson, The Univ. of Auckland (New Zealand) and Stretch Sense Ltd (New Zealand). . . . . [10594-81]

Thermal responsive multi-transfoming artificial muscles, Junggi Choi, Seon Jeong Kim, Hanyang Univ. (Korea, Republic of) . . . . . [10594-82]

Stacked HASEL actuators as artificial muscles in next-generation soft robotic devices, Shane K. Mitchell, Trent Martin, Eric Acome, Timothy G. Morrissey, Nicholas Kellaris, Vidyacharan Gopaluni-Venkata, Ethan Harrington, Christoph Keplinger, Univ. of Colorado Boulder (USA)[10594-83]

Synthetic Muscle electroactive polymer (EAP) based actuation and sensing for prosthetic and robotic applications, Lenore Rasmussen, Ras Labs., LLC (USA) and Worcester Polytechnic Institute (USA); Simone Rodriguez, Ras Labs., LLC (USA); Matthew Bowers, Ras Labs., LLC (USA) and Worcester Polytechnic Institute (USA); Gabrielle Franzini, Ras Labs., LLC (USA); Charles Gentile, Princeton Plasma Physics Lab. (USA); Cosme Furlong, Payam Razavi, Worcester Polytechnic Institute (USA) . . . . . [10594-84]

A dynamic physics-based model for step-response of IPMC actuators, Tyler Stalbaum, Qi Shen, Zakai Olsen, Kwang Jin Kim, Univ. of Nevada, Las Vegas (USA) . . . . . [10594-85]

On the multiple shape memory effect and the reversibility of multiple-shape-memory ionic polymer-metal composite actuator, Qi Shen, Sarah Trabia, Tyler Stalbaum, Kwang Jin Kim, Univ. of Nevada, Las Vegas (USA) . . . . . [10594-86]

An improved ionic polymer-metal composite catheter for use in endovascular procedures, Zachary Frank, Kwang Jin Kim, Univ. of Nevada, Las Vegas (USA) . . . . . [10594-87]

Fabrication of variously shaped poly vinyl chloride gel actuator with 3D printed outer case, Taeseon Hwang, Robert Hunt, Sarah Trabia, Zakai Olsen, Zachary Frank, Kwang Jin Kim, Univ. of Nevada, Las Vegas (USA). . . . . [10594-88]

Solvent change in polymerization influence linear actuation of polypyrrole carbide-derived carbon films, Rudolf Kiefer, Ton Duc Thang Univ. (Viet Nam); Zane Zondaka, Alvo Aabloo, Tarmo Tamm, Univ. of Tartu (Estonia) . . . . . [10594-89]

Hydrogel based braided artificial muscles, Bidita Binte Salahuddin, Holly Warren, Geoffrey M. Spinks, Univ. of Wollongong (Australia) . . . . . [10594-90]

Multi-touch capacitive sensor with new sensor arrangement , Yuting Zhu, Iain A. Anderson, The Univ. of Auckland (New Zealand) and StretchSense (New Zealand) . . . . . [10594-91]

HASEL: Hydraulically amplified self-healing electrostatic actuators with muscle-like performance, Eric Acome, Shane K. Mitchell, Timothy G. Morrissey, Nicholas Kellaris, Vidyacharan Gopaluni-Venkata, Madison B. Emmett, Claire Benjamin, Madeline King, Garrett Smith, Miles Radakovitz, Christoph Keplinger, Univ. of Colorado Boulder (USA)[10594-92]

Poly-3,4-ethylenedixoythiophene on carbide-derived carbon trilayer: combined linear actuation characterization, Rudolf Kiefer, Alo Kivilo, Zane Zondaka, Sunjai Nakshatharan, Kadi-Anne Küppar, Tarmo Tamm, Univ. of Tartu (Estonia). . . . . [10594-93]

Soft and adhesive metal electrode interfaces, Bekim Osmani, Tino Töpper, Bert Müller, Univ. Basel (Switzerland) . . . . . [10594-94]

CONFERENCE 10597

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

Stealth coating is not antidote against of microwave radiometer, Alexander G. Denisov, Jinghui Qiu, Harbin Institute of Technology (China) . . . . . [10597-40]

Yeast concentration analysis using the smartphone based microscopy with fiber-optic taper coupled to the camera module, Weiming Wang, Yan Yu, Hui Huang, Jinping Ou, Dalian Univ. of Technology (China) . . . . . [10597-41]

Hand gesture recognition using DBN-HMM method based on the fusion of electromyography and inertial measurements, Yucheng Wang, Institute of Advanced Manufacturing Technology (China); Zhonghui Wang, Nanjing Forestry Univ. (China); Xiaojie Wang, Institute of Advanced Manufacturing Technology (China) . . . . . [10597-42]

Soft capacitive sensors for measurement of both positive and negative pressures, Hongyang Shi, Thassyo Pinto, Yiheng Zhang, Chuan Wang, Xiaobo Tan, Michigan State Univ. (USA) . . . . . [10597-43]

MD simulation of cellulose nanofibers for its mechanical and thermal properties, Md Imrul Reza Shishir, Ruth Mwongeli Muthoka, Hyun Chan Kim, Jung Woong Kim, Jaehwan Kim, INHA Univ. (Korea, Republic of). . . . . [10597-44]

CONFERENCE 10599

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

The effect of erosion on the fatigue limit of metallic materials for aerospace applications, Evangelos Z. Kordatos, Sheffield Hallam Univ. (United Kingdom); Dimitrios A. Exarchos, Theodore E. Matikas, Univ. of Ioannina (Greece). . . . . [10599-69]

Evaluation of thermoplastic composites under cyclic and quasi-static bending tests, Simone Boccardi, Giovanni Maria Carlomagno, Carosena Meola, Univ. degli Studi di Napoli Federico II (Italy); Pietro Russo, Istituto per i Polimeri, Compositi e Biomateriali (Italy); Giorgio Simeoli, Consiglio Nazionale delle Ricerche (Italy) . . . . . [10599-70]

The impact of measurement uncertainty from experimental load distribution factors on bridge load rating, Michael V. Gangone, The Univ. of Texas at Tyler (USA) . . . . . [10599-71]

Study of aluminum content in a welding metal by thermoelectric measurements, Hector G. Carreon, Carlos Coronado, Sergio Ramirez, Univ. Michoacana de San Nicolás de Hidalgo (Mexico); Melchor Salazar, Instituto Mexicano del Petróleo (Mexico). . . . . [10599-72]

Destructive and nondestructive evaluation on mechanical damage of concrete cylinders due to acid attack, Kasey Mearls, Tzuyang Yu, Univ. of Massachusetts Lowell (USA) . . . [10599-73]

Characterization of technical surfaces by structure function analysis, Michael K. Kalms, Thomas Kreis, Ralf B. Bergmann, Bremer Institut für angewandte Strahltechnik GmbH (Germany) . [10599-74]

Towards the miniaturization of monolithic folded pendulums: a new approach to the implementation of small ad light sensors for ground, space, and marine applications, Fabrizio Barone, Gerardo Giordano, Univ. degli Studi di Salerno (Italy) . . . . . [10599-75]

Completely automated modal analysis procedure based on the combination of different OMA methods, Francesco Ripamonti, Alberto Bussini, Politecnico di Milano (Italy) . . . . . [10599-76]

Application of displacement monitoring method based on linear CCD sensor in medium-small span bridges, Lixiao Zhang, Peng Liu, Shulin Xie, Xuefeng Zhao, Dalian Univ. of Technology (China) . . . . . [10599-77]

Application of laser projection sensing technique to horizontal displacement monitoring of foundation pit, Peng Liu, Lixiao Zhang, Xuefeng Zhao, Dalian Univ. of Technology (China) . . . . . [10599-78]

Audio-based bolt-loosening detection technique of bolt joint, Yang Zhang, Xuefeng Zhao, Dalian Univ. of Technology (China); Wensheng Su, Zhigang Xue, Jiangsu Province Special Equipment Safety Supervision Inspection Institute Branch of Wuxi (China) . . . . . [10599-79]

A preliminary study of using smart phone to measure and access construction workers' near-miss fall events based on ANN, Mingyuan Zhang, Tianzhuo Cao, Xuefeng Zhao, Dalian Univ. of Technology (China) . . . . . [10599-80]

Construction of workers' activeness database based on smart phone sensor, Zhen Yang, Mingyuan Zhang, Xuefeng Zhao, Dalian Univ. of Technology (China) . . . . . [10599-81]

Surface behavior evaluation of cement paste in different simulate conditions of service, Dianela Gonzalez, Anabela Guilarducci, Nestor Ulibarrie, Carlos Freyre, Fabio Vincitorio, Univ. Tecnológica Nacional (Argentina) . . . . . [10599-82]

Methodologies for calibration testing of non-destructive monitoring techniques, Peter Bajorski, Rochester Institute of Technology (USA) . . . . . [10599-83]

Time-varying force identification for short cable by acceleration monitoring, Fujian Zhang, CCCC Highway Consultants Co., Ltd. (China) . . . . . [10599-84]

Structural health monitoring of dry cask storage canisters using piezoelectric wafer active sensors under gamma radiation exposure, Mohammad Faisal Haider, Bin Lin, Lingyu Yu, Victor Giurgiutiu, Univ. of South Carolina (USA) . [10599-85]

Evaluation method for corrosion level of rebar in RC with electrical impedance measurement, Akira Sasamoto, National Institute of Advanced Industrial Science and Technology (Japan) . . . . . [10599-86]

Digital based neutron imaging using an accelerator driven neutron generator, Michael Taylor, Evan Sengbusch, Phoenix Nuclear Labs. (USA) . . . . . [10599-87]

Real-time flutter boundary prediction based on time series models, Wenjing Gu, Li Zhou, Nanjing Univ. of Aeronautics and Astronautics (China) . . . . . [10599-88]

Real-time flutter boundary prediction using peak-hold method, Yingwen Ma, Li Zhou, Nanjing Univ. of Aeronautics and Astronautics (China) . . . . . [10599-89]

The effect of reinforcing bars to flaw detection in RC structure using surface wave group velocity profile generated by surface waves, Chia-Chi Cheng, Chaoyang Univ. of Technology (Taiwan) . . . . . [10599-90]

Mechanoluminescence based sensor system for structural health monitoring, Yang He, Harbin Institute of Technology (China) . . . . . [10599-92]

CONFERENCE 10601
Smart Materials and Nondestructive Evaluation for Energy Systems IV

Fiber bio-supercapacitor, Hyeon Jun Sim, Dong Yeop Lee, Seon Jeong Kim, Hanyang Univ. (Korea, Republic of) . . . . . [10601-16]

High performance yarn biofuel cell using carbon nanotube implanted in mouse, Dong Yeop Lee, Seon Jeong Kim, Hanyang Univ. (Korea, Republic of) . . . . . [10601-17]

Asymmetric yarn supercapacitor, Jongwoo Park, Seon Jeong Kim, Ctr. for Self-Powered Actuation, Hanyang Univ. (Korea, Republic of) . . . . . [10601-18]

Energy harvesting and storing system, Tae Jin Mun, Seon Jeong Kim, Hanyang Univ. (Korea, Republic of). . . . . [10601-19]

Embedded structured silver-zinc yarn battery, Jae Myeong Lee, Hanyang Univ. (Korea, Republic of); Changsoon Choi, Seon Jeong Kim, Ctr. for Self-Powered Actuation, Hanyang Univ. (Korea, Republic of) . . . . . [10601-20]

Hybrid MnO2/Ag sheath fiber supercapacitors, Jihwan Kim, Hanyang Univ. (Korea, Republic of); Changsoon Choi, Seon Jeong Kim, Ctr. for Self-Powered Actuation, Hanyang Univ. (Korea, Republic of). . . . . [10601-21]

Detection of damage in advanced materials using laser Doppler vibrometry, Theodoti Z. Kordatou, Ilias K. Tragazikis, Theodore E. Matikas, Univ. of Ioannina (Greece) . . . . . [10601-22]

Vibration monitoring of wind-turbine blades through optical fiber sensors, Gabriele Cazzulani, Simone Cinquemani, Stefano Marabelli, Ilmas Bayati, Politecnico di Milano (Italy) . . . . . [10601-23]

Novel infrared thermography approach for rapid assessment of damage in aerospace structures, Dimitrios A. Exarchos, Konstantinos G. Dassios, Theodore E. Matikas, Univ. of Ioannina (Greece). . . . . [10601-24]

Development of a nondestructive methodology based on near infrared imaging for the characterization of damage in transparent and semi-transparent aircraft components, Dimitrios A. Exarchos, Konstantinos G. Dassios, Theodore E. Matikas, Univ. of Ioannina (Greece) . . . . . [10601-25]

Fatigue behavior of aluminum structures subjected to corrosion, Panagiota Aikaterini T. Dalla, Ilias K. Tragazikis, Dimitrios A. Exarchos, Theodore E. Matikas, Univ. of Ioannina (Greece). . . . . [10601-26]

Stress monitoring of lithiuim ion cells during cycling to correlate with the electrochemical processes, Gao Liu, Lawrence Berkeley National Lab. (USA); Shuo Zhou, Lawrence Berkeley National Lab. (USA) and Sichuan Univ. (China); Guixin Wang, Sichuan Univ. (China) . . . . . [10601-27]

Task allocation algorithm for agricultural remote sensing using a group of UAVs, Nicolas P. Avdelidis, Min-Guk Seo, Hyo-Sang Shin, Antonios Tsourdos, Cranfield Univ. (United Kingdom). . . . . [10601-28]

CONFERENCE 10602
Smart Structures and NDE for Industry 4.0

Optimized stiffness distribution in high-rise structures, Reza Mokarramaydenlou, London Business and Engineering School (Iran, Islamic Republic of). . . . . [10602-25]

Metrological assurance and traceability for Industry 4.0 and additive manufacturing in Ukraine, Volodymyr V. Skliarov, Pavel Neyezhmakov, Alexander Prokopov, National Scientific Ctr. "Institute of Metrology" (Ukraine) . . . . . [10602-26]

Conductive ink print on PA66 gear for manufacturing condition monitoring sensors, Shintaro Futagawa, Daisuke Iba, Takahiro Kamimoto, Nanako Miura, Morimasa Nakamura, Takashi Iizuka, Arata Masuda, Akira Sone, Ichiro Moriwaki, Kyoto Institute of Technology (Japan) . [10602-27]

Computational modeling of colorimetric primary transducer for metrological assurance in additive manufacturing, Volodymyr V. Skliarov, National Scientific Ctr. "Institute of Metrology" (Ukraine) . . . . . [10602-28]

Structure-related object classification and detection based on convolutional neural network, Hongguo Su, Mingyuan Zhang, Dalian Univ. of Technology (China); Guangyi Zhou, Dalian Branch China Construction Engineering Division Corp. Ltd. (China); Xuefeng Zhao, Dalian Univ. of Technology (China) . . . . . [10602-29]

Image-based corrosion recognition for ship steel structures, Yang Yang, Shengyuan Li, Xuefeng Zhao, Dalian Univ. of Technology (China). . . . . [10602-30]

A new apporch to improve the performance of elastic metamaterials, Sheng Sang, Univ. of Arkansas at Little Rock (USA); Ziping Wang, Jiangsu Univ. (China); Eric Sandgren, Univ. of Arkansas at Little Rock (USA) . . . . . [10602-31]

WEDNESDAY 7 MARCH

Wednesday Plenary Session · Location: Silverton Salon 2 · 8:15 am to 10:00 am

8:15 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:
Plenary Presentation

Origami-inspired systems: opportunities for smart material and structure impact

Larry L. Howell, Brigham Young Univ. (USA)

9:15 to 10:00 am:
Plenary Presentation

The measure of a person's life

Vasundara V. Varadan, Univ. of Arkansas (USA)

Coffee Break · 10:00 am to 10:30 am

CONFERENCE 10593
Bioinspiration, Biomimetics, and Bioreplication VIII

SESSION 9

LOCATION: CRIPPLE CREEK 1
WED 10:30 AM TO 11:40 AM

Flight II

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

10:30 am: **Robustness strategies in bio-inspired flight systems: morphology, dynamics, and flight control** *(Invited Paper)*, Hao Liu, Toshiyuki Nakata, Ryusuke Noda, Chiba Univ. (Japan) . . . . .[10593-27]

11:00 am: **Transition flight control simulations of bioinspired FWMAV with extended unsteady vortex-lattice method**, Jong-Wan Lee, KAIST (Korea, Republic of); Anh Tuan Nguyen, Le Quy Don Technical Univ. (Viet Nam); Jae-Hung Han, KAIST (Korea, Republic of) [10593-28]

11:20 am: **Comparison of bio-inspired flapping foil propulsion systems with rotary propulsion**, Srikanth Dharwada, Aman Agarwal, Prabhu Rajagopal, Indian Institute of Technology Madras (India). . . . . .[10593-29]

Lunch Break . . . . Wed 11:40 am to 1:10 pm

CONFERENCE 10594
Electroactive Polymer Actuators and Devices (EAPAD) XX

SESSION 6

LOCATION: SILVERTON SALON 2
WED 10:30 AM TO 12:10 PM

Dielectric Elastomers

Session Chairs: **Richard Perline,** NuTech Solutions, Inc. (USA); **Ji Su,** NASA Langley Research Ctr. (USA)

10:30 am: **Review on viscoelastic behavior of dielectric polymers and their actuatorsiew talk on viscoelastic behavior of dielectric elastomer actuators** *(Invited Paper)*, Minoru Taya, Univ. of Washington (USA); Kevin Kadooka, Pacific Northwest National Laboratory (USA) . . . . . .[10594-19]

11:10 am: **The NERD setup: assessing the life time of electrodes for dielectric elastomer transducers**, Samuel Rosset, Christine de Saint-Aubin, Alexandre Poulin, Herbert Shea, Ecole Polytechnique Fédérale de Lausanne (Switzerland) . . . . . .[10594-20]

11:30 am: **Elastomeric diaphragm pump driven by fluid electrode dielectric elastomer actuators (FEDEAs)**, Caleb Christianson, Univ. of California, San Diego (USA); Nathaniel N. Goldberg, Univ. of California, Berkeley (USA); Michael T. Tolley, Univ. of California, San Diego (USA) .[10594-21]

11:50 am: **Dielectric elastomer minimum energy structures with high holding force**, Samuel Rosset, David McCoul, Nadine Besse, Herbert Shea, Ecole Polytechnique Fédérale de Lausanne (Switzerland) . . . .[10594-22]

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

CONFERENCE 10595
Active and Passive Smart Structures and Integrated Systems XII

Sessions 7A and 7B run concurrently.

SESSION 7A

LOCATION: CRESTONE SALON A
WED 10:30 AM TO 12:10 PM

Bio-Inspired Structures and Systems

Session Chairs: **Barbar J. Akle,** Lebanese American Univ. (Lebanon); **Shima Shahab,** Virginia Polytechnic Institute and State Univ. (USA)

10:30 am: **Fabrication and actuation performance of the plant-inspired fluidic origami cellular structure**, Hrishikesh Sane, Priyank Bhovad, Suyi Li, Clemson Univ. (USA) . . . . . .[10595-34]

10:50 am: **Energy release for the actuation and deployment of muscle-inspired asymmetrically multistable chains**, Narayanan Kidambi, Univ. of Michigan (USA); Yisheng Zheng, Univ. of Michigan (USA) and Xi'an Jiaotong Univ. (China); Kon-Well Wang, Univ. of Michigan (USA) . . . . . [10595-35]

11:10 am: **Bio-inspired hybrid vibration control methodology for intelligent isolated bridge structures**, Mariantonieta Gutierrez Soto, Univ. of Kentucky (USA) . . . . . [10595-36]

11:30 am: **Energy transfer between multiple vibrating flaps through flow interactions in an otherwise quiescent fluid domain**, Omidreza Sadeghi, Mark Stremler, Shima Shahab, Virginia Polytechnic Institute and State Univ. (USA) . . . . . [10595-37]

11:50 am: **Design and testing of a magnetic field resistant spider-like robot propelled by IPMC and MFC actuators**, Barbar J. Akle, Tony Al Najjar, Ibrahim Ibrahim, Lebanese American Univ. (Lebanon); Martin Gastal, Frank Glege, CERN (Switzerland) [10595-38]

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

SESSION 7B

LOCATION: COLORADO RECEPTION AREA
WED 10:30 AM TO 12:10 PM

Metamaterials and Metastructures I

Session Chairs: **Alper Erturk,** Georgia Institute of Technology (USA); **Lihua Tang,** The Univ. of Auckland (New Zealand)

10:30 am: **Supratransmission in a metastable modular metastructure for nonreciprocal wave transmission,** Zhen Wu, Kon-Well Wang, Univ. of Michigan (USA) . . . . . [10595-39]

10:50 am: **Dispersion tailoring in varying-inductance piezoelectric metamaterials and metastructures**, Christopher Sugino, Massimo Ruzzene, Alper Erturk, Georgia Institute of Technology (USA). . . .[10595-136]

11:10 am: **Internally coupled metamaterial beam for simultaneous vibration suppression and energy harvesting**, Guobiao Hu, Lihua Tang, The Univ. of Auckland (New Zealand); Raj Das, RMIT Univ. (Australia); Kean C. Aw, The Univ. of Auckland (New Zealand). . . . . .[10595-41]

11:30 am: **Locally resonant metamaterials with shape-memory alloy springs**, Vagner Sousa, Univ. de São Paulo (Brazil); Christopher Sugino, Georgia Institute of Technology (USA); Carlos De Marqui Jr., Univ. de São Paulo (Brazil); Alper Erturk, Georgia Institute of Technology (USA) . . . . . [10595-42]

11:50 am: **Passive metamaterial-based acoustic holograms in ultrasound energy transfer systems**, Ahmed Elnahhas, Marjan Bakhtiari Nejad, Muhammad R. Hajj, Shima Shahab, Virginia Polytechnic Institute and State Univ. (USA) . . . . . [10595-43]

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

CONFERENCE 10596
Behavior and Mechanics of Multifunctional Materials and Composites XII

SESSION 7

LOCATION: ASPEN A
WED 10:30 AM TO 12:10 PM

Shape Memory Materials II

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

10:30 am: **Experimental and numerical investigation of the stable crack growth regime during fracture in shape memory alloys**, Behrouz Haghgouyan, Sameer Jape, Ceylan Hayrettin, Texas A&M Univ. (USA); Theocharis Baxevanis, Univ. of Houston (USA); Ibrahim Karaman, Dimitris C. Lagoudas, Texas A&M Univ. (USA) . . . . . .[10596-33]

10:50 am: **Modeling of NiTiHf using finite difference method**, Nazanin Farjam, Reza Mehrabi, Mohammad Elahinia, The Univ. of Toledo (USA); Haluk Karaca, Univ. of Kentucky (USA); Reza Mirzaeifar, Virginia Polytechnic Institute and State Univ. (USA) . . . . . .[10596-34]

11:10 am: **Multifunctional polymers: shape memory composite nanofibers**, Fenghua Zhang, Harbin Institute of Technology (China). . . . . .[10596-35]

11:30 am: **An experimental study to investigate the buckling behavior of superelastic shape memory alloy bars**, Amedebrhan Asfaw, Osman E. Ozbulut, Univ. of Virginia (USA). . . . . .[10596-36]

11:50 am: **Corrosion monitoring of NiTi alloy with small-amplitude potential intermodulation technique**, Mahdi Mohajeri, Homero Castaneda, Dimitris C. Lagoudas, Texas A&M Univ. (USA) . . . . . .[10596-37]

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

Wednesday Plenary Session · Location: Silverton Salon 2 · 8:15 am to 10:00 am

8:15 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:
Plenary Presentation

Origami-inspired systems: opportunities for smart material and structure impact

Larry L. Howell, Brigham Young Univ. (USA)

9:15 to 10:00 am:
Plenary Presentation

The measure of a person's life

Vasundara V. Varadan, Univ. of Arkansas (USA)

Coffee Break · 10:00 am to 10:30 am

CONFERENCE 10597
Nano-, Bio-, Info-Tech Sensors and 3D Systems

SESSION 12

LOCATION: CRYSTAL SALON B/C
WED 10:30 AM TO 11:10 AM

Keynote Session III

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

10:30 am: **Overview of smart optics and its future** *(Keynote Presentation)*, Kyo D. Song, Norfolk State Univ. (USA); Sang H. Choi, NASA Langley Research Ctr. (USA) . . . . . [10597-33]

SESSION 13

LOCATION: CRYSTAL SALON B/C
WED 11:10 AM TO 12:30 PM

Nanomaterials and Applications

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

11:10 am: **Eigenwave guided band-structure optimization of functionally graded cellular structures**, Sushovan Mukherjee, S. Gopalakrishnan, Indian Institute of Science (India) . . . . . [10597-34]

11:30 am: **Phononic band structure in periodic cellular honeycombs with distributed internal viscous damping**, Sushovan Mukherjee, Indian Institute of Science (India) . . . . . [10597-35]

11:50 am: **Micro-power consumption combustion initiation devices and systems**, Carlos M. Pereira, U.S. Army Armament Research, Development and Engineering Ctr. (USA) . . . . . [10597-36]

12:10 pm: **3D helical nanomaterial structures and systems**, Vijay K. Varadan, The Pennsylvania State Univ. (USA) . . . . . [10597-37]

Lunch Break . . . Wed 12:30 pm to 1:30 pm

CONFERENCE 10598
Sensors and Smart Structures Technologies for Civil, Mechanical, and Aerospace Systems

Sessions 7A and 7B run concurrently.

SESSION 7A

LOCATION: CRESTONE SALON B
WED 10:30 AM TO 11:50 AM

Novel Sensing Technologies II

Session Chairs: **Branko Glisic,** Princeton Univ. (USA); **Kara J. Peters,** The National Science Foundation (USA)

10:30 am: **Piezoelectric torsional actuation in d36 shear-mode PMN-PT single crystals**, Pelin Berik, Middle East Technical Univ. (Cyprus); Xiaoning Jiang, Wei-Yi Chang, North Carolina State Univ. (USA) . . . . . [10598-50]

10:50 am: **Sensor optimization using an evolutionary strategy for structural health monitoring in high temperature environments**, Ying Huang, Simone Ludwig, North Dakota State Univ. (USA) . . . . . [10598-51]

11:10 am: **Response of long-gauge strain sensors in proximity of force application point**, Branko Glisic, Princeton Univ. (USA) . . . . . [10598-52]

11:30 am: **An approach to manipulate frequency selectivity in Basilar metamembrane based broadband frequency sensors**, Riaz Ahmed, Sourav Banerjee, Univ. of South Carolina (USA) . . . . . [10598-53]

Lunch Break . . . .Wed 11:50 am to 2:00 pm

SESSION 7B

LOCATION: ASPEN B
WED 10:30 AM TO 11:50 AM

Machine Learning for Structural Health Monitoring

Session Chairs: **Young-Jin Cha,** Univ. of Manitoba (Canada); **Yiqing Ni,** The Hong Kong Polytechnic Univ. (Hong Kong, China)

10:30 am: **Automated damage-sensitive feature extraction using unsupervised convolutional neural networks,** Zilong Wang, Young-Jin Cha, Univ. of Manitoba (Canada) . . . . . [10598-54]

10:50 am: **Crack identification inside on-site steel box girder based on fusion convolutional neural network**, Yang Xu, Hui Li, Jiahui Chen, Harbin Institute of Technology (China) . . . . . [10598-55]

11:10 am: **Online fatigue crack quantification and prognosis using nonlinear ultrasonic modulation and artificial neural network**, Hyung Jin Lim, Hoon Sohn, KAIST (Korea, Republic of) . . . . . [10598-56]

11:30 am: **Automated air-coupled impact echo based nondestructive testing using machine learning**, Tyler Epp, Dagmar Svecova, Young-Jin Cha, Univ. of Manitoba (Canada) . . . . . [10598-57]

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

CONFERENCE 10599
Nondestructive Characterization and Monitoring of Advanced Materials, Aerospace, Civil Infrastructure, and Transportation XII

SESSION 7

LOCATION: CRYSTAL SALON A
WED 10:30 AM TO 12:10 PM

Vision-Based SHM/NDE

Session Chairs: **Lingyu Yu,** Univ. of South Carolina (USA); **Alessandro Sabato,** Univ. of Massachusetts Lowell (USA)

10:30 am: **In situ imaging of advanced laser processes with inline coherent imaging**, Jordan A. Kanko, Laser Depth Dynamics Inc. (Canada); Stephen G. L. Nestor, Queen's Univ. (Canada); Christopher M. Galbraith, Paul J. L. Webster, Laser Depth Dynamics Inc. (Canada); James M. Fraser, Queen's Univ. (Canada) . . . . . [10599-33]

10:50 am: **Online welding process monitoring using multi-optical sensing techniques**, Jian Chen, Oak Ridge National Lab. (USA); Zongyao Chen, The Univ. of Tennessee (USA); Zhili Feng, Oak Ridge National Lab. (USA) . . . . . [10599-34]

11:10 am: **A novel camera localization system for extending three-dimensional digital image correlation**, Alessandro Sabato, Christopher Niezrecki, Univ. of Massachusetts Lowell (USA) . . . [10599-35]

11:30 am: **Experimental multiphysical characterization of an SMA driven, camber morphing owl wing section**, Hannah R. Stroud, Pedro Leal, Darren J. Hartl, Texas A&M Univ. (USA) . . [10599-36]

11:50 am: **Reframing measurement for structural health monitoring: a full-field strategy for structural identification**, Devin Harris, Mehrdad S. Dizaji, Osman E. Ozbulut, Mohamad Alipour, Univ. of Virginia (USA) . . . . . [10599-37]

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

CONFERENCE 10600
Health Monitoring of Structural and Biological Systems XII

SESSION 7

LOCATION: CRIPPLE CREEK 2
WED 10:30 AM TO 12:30 PM

Elastic and Metamaterial I

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

10:30 am: **A new membrane-type metamaterial for multiple peaks absorption at low frequencies**, Fabrizio Bucciarelli, Onorio Iervolino, Michele Meo, Univ. of Bath (United Kingdom) .[10600-36]

10:50 am: **Robust band tilting in dynamic materials**, Hussein Nassar, Hui Chen, Guoliang Huang, Univ. of Missouri (USA) . . . . . [10600-37]

11:10 am: **Subwavelength and directional topological waveguides in thin plates,** Chun-Wei Chen, Rajesh Chaunsali, Jinkyu Yang, Univ. of Washington (USA)[10600-38]

11:30 am: **Dispersion behavior of a hybrid phononic resonator**, David Depauw, Hasan Al Ba'ba'a, Mostafa A. Nouh, Univ. at Buffalo (USA) . . . . . [10600-39]

11:50 am: **Far-field superresolution imaging using shaped acoustic vortices**, Matthew Guild, Jeffrey Rogers, Charles Rohde, Theodore P. Martin, Gregory J. Orris, U.S. Naval Research Lab. (USA) [10600-40]

12:10 pm: **One-dimensional linear bi-directional acoustic diodes: design principle and optimization**, Weiqiu Chen, Yang Huang, Yingjie Chen, Zhejiang Univ. (China) . . . . . [10600-41]

Lunch Break . . . .Wed 12:30 pm to 1:40 pm

WEDNESDAY 7 MARCH

CONFERENCE 10593

SESSION 10

LOCATION: CRIPPLE CREEK 1
WED 1:10 PM TO 3:20 PM

Soft Matter

Session Chair: **Tobias Keplinger,** ETH Zürich (Switzerland)

1:10 pm: **From digital imaging to scalable active-composites for soft robots: a perspective** *(Invited Paper)*, Kwang Jin Kim, Robert Hunt, Zakai Olsen, Tyler Stalbaum, Univ. of Nevada, Las Vegas (USA) . . . . . [10593-30]

1:40 pm: **Passive variable recruitment of fluidic artificial muscles: application and analysis**, Edward Chapman, Matthew Bryant, North Carolina State Univ. (USA) . . . . . [10593-31]

2:00 pm: **Actuation of soft materials through ultrasonic atomization,** Han-Joo Lee, Morgan Funderburk, Kenneth J. Loh, Univ. of California, San Diego (USA) . . . . . [10593-32]

2:20 pm: **Facial prosthesis utilizing shape memory alloy as artificial muscle**, Anthony Santamaria, Moochul Shin, Paul Mazza, Western New England Univ. (USA) . . . . . [10593-33]

2:40 pm: **Experimental testing of silver coated coiled nylon artificail muscle and its application into a bio-inspired whale fin**, Robert Hunt, Qi Shen, Kwang Jin Kim, Univ. of Nevada, Las Vegas (USA) . . . . . [10593-34]

3:00 pm: **Biomimetic polyimide-supported cuprous oxide as photocatalytic film with tunable hydrophobicity and enhanced thermal stability**, I-Hsiang Tseng, Li-Huan Kang, Feng Chia Univ. (Taiwan) . . . . . [10593-35]

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

CONFERENCE 10594

SESSION 7

LOCATION: SILVERTON SALON 2
WED 1:40 PM TO 3:00 PM

Field-Activatable EAP II

Session Chairs: **Qibing Pei,** Univ. of California, Los Angeles (USA); **Ron Pelrine,** SRI International (USA)

1:40 pm: **A review of electrostrictive graft elastomers: structures, properties, and applications** *(Invited Paper)*, Ji Su, NASA Langley Research Ctr. (USA) . . . [10594-23]

2:20 pm: **Synthesis, characterization, and property investigation of polyvinylidene fluoride (PVDF)-graphene nanocomposites for energy harvesting application**, Chandan Kumar, Anupama Gaur, Pralay Maiti, Sanjay K. Rai, Indian Institute of Technology, Banaras Hindu Univ. (India) . . . . . [10594-24]

2:40 pm: **Fabrication and optimization of PVDF sensors using AM technology**, Ningyi Zhang, North Carolina State Univ. (USA); Yuan Zhu, Caifeng Chen, Feixiang Cai, Jiangsu Univ. (China); Fuh-Gwo Yuan, North Carolina State Univ. (USA)[10594-25]

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

CONFERENCE 10595

Sessions 8A and 8B run concurrently.

SESSION 8A

LOCATION: CRESTONE SALON A
WED 1:40 PM TO 3:00 PM

Energy Harvesting III: Piezoelectric

Session Chairs: **M. Amin Karami,** Univ. at Buffalo (USA); **Byeng Dong Youn,** Seoul National Univ. (Korea, Republic of)

1:40 pm: **Stochastic dynamics of piezoelectric energy harvesting under random vibration**, Heonjun Yoon, Seoul National Univ. (Korea, Republic of); Miso Kim, Choon-Su Park, Korea Research Institute of Standards and Science (Korea, Republic of); Byeng Dong Youn, Seoul National Univ. (Korea, Republic of) . . . . . [10595-44]

2:00 pm: **Experimental study on nonlinear thermally buckled piezoelectric energy harvesters for leadless pacemakers**, Mh Ansari, M. Amin Karami, Univ. at Buffalo (USA) . . . . . [10595-45]

2:20 pm: **Multiple piezo-patch energy harvesters on a thin plate with respective AC-DC conversion**, Amirreza Aghakhani, Ipek Basdogan, Koç Univ. (Turkey) . . . . . [10595-46]

2:40 pm: **Thickness-mode nanoscale flexoelectric energy harvesting: modeling and analysis**, Adriane G. Moura, Alper Erturk, Georgia Institute of Technology (USA) . . . . . [10595-47]

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

SESSION 8B

LOCATION: LEADVILLE
WED 1:40 PM TO 3:00 PM

Acoustic/Fluid-Structure Interaction

Session Chairs: **Shima Shahab,** Virginia Polytechnic Institute and State Univ. (USA); **Amir Danesh-Yazdi,** Penn State Behrend (USA)

1:40 pm: **Investigation of bubble dynamics in nonlinear acoustic field**, Marjan Bakhtiari Nejad, Shima Shahab, Virginia Polytechnic Institute and State Univ. (USA) . . . . . [10595-48]

2:00 pm: **Interaction of side-by-side piezoelectric harvesters in fractal grid-generated turbulence**, Kevin Ferko, David M. Lachendro, Andrew W. Bradley, Amir Danesh-Yazdi, Penn State Behrend (USA) . . . . . [10595-49]

2:20 pm: **Piezoelectric valve based by dual-bimorph actuator**, Yin Huang, National Taiwan Univ. (Taiwan). . [10595-50]

2:40 pm: **Experimentally validated modeling of electroelastic nonlinearities in ultrasound acoustic energy transfer systems**, Vamsi C. Meesala, Muhammad R. Hajj, Shima Shahab, Virginia Polytechnic Institute and State Univ. (USA). . [10595-51]

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

CONFERENCE 10596

SESSION 8

LOCATION: ASPEN A
WED 1:40 PM TO 3:00 PM

Nanocomposites Applications

Session Chairs: **Henry A. Sodano,** Univ. of Michigan (USA); **Reza Rizvi,** The Univ. of Toledo (USA)

1:40 pm: **In-situ electro-mechanical behavior of a carbon fiber based power storage composite,** Constantin Ciocanel, Cindy Browder, Northern Arizona Univ. (USA) . . . . . [10596-38]

2:00 pm: **Anisotropic thermal conductivity of aligned GNPs/polymer composites: a finite element approach**, Xiaojie Wang, Institute of Advanced Manufacturing Technology (China); Xingxing Xu, Chongqing Univ. of Posts and Telecommunications (China) and Institute of Advanced Manufacturing Technology (China); Rui Li, Chongqing Univ. of Posts and Telecommunications (China); Bin Li, Jialu Geng, Institute of Advanced Manufacturing Technology (China) . . . . . [10596-41]

2:20 pm: **Multifunctional energy storage composites: electrochemical and mechanical cycling characterization**, Purim Ladpli, Stanford Univ. (USA); Raphael Nardari, Zenith Aerospace (USA); Fotis Kopsaftopoulos, Fu-Kuo Chang, Stanford Univ. (USA). . . . . [10596-39]

2:40 pm: **Development and characterization of reduced graphene oxide films for transient electronics**, Reza Rizvi, Omkar Bhatkar, Rasel Sheikh, The Univ. of Toledo (USA). . . . . [10596-40]

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

CONFERENCE 10597

SESSION 14

LOCATION: CRYSTAL SALON B/C
WED 1:30 PM TO 2:10 PM

Wearable Medical Devices and 3D Printing I

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

1:30 pm: **3D printing of transcatheter tool for monitoring and treatment of congenital heart defects**, Vijay K. Varadan, The Pennsylvania State Univ. (USA) . . . . . [10597-38]

1:50 pm: **Polymeric based magnetic nanotubes, NEMS, and MEMS and their applications in medicine**, Vijay K. Varadan, Se Chang Oh, Mouli Ramasamy, The Pennsylvania State Univ. (USA) . . . . . [10597-39]

SESSION 15

LOCATION: CRYSTAL SALON B/C
WED 2:10 PM TO 2:35 PM

Wearable Medical Devices and 3D Printing II

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

2:10 pm: **RepRap SWIM-ER: low cost open-source 3D gel printer**, Azusa Saito, Kei Sato, Samiul Basher, Masaru Kawakami, Hidemitsu Furukawa, Yamagata Univ. (Japan) . . . . [10597-45]

2:15 pm: **3D printing for gel robotics**, Kazunari Yoshida, Yuki Takishima, Yuuta Hara, Masaru Kawakami, Hidemitsu Furukawa, Yamagata Univ. (Japan). . . . . [10597-46]

2:20 pm: **3D printing of foods**, Mai Kodama, Ryo Ishigaki, Samiul Basher, Hiroyuki Sasaki, Azusa Saito, Masato Makino, Ajit Khosla, Masaru Kawakami, Hidemitsu Furukawa, Yamagata Univ. (Japan). . . . . [10597-47]

2:25 pm: **Smart material for printing: piezo-electric polymer film**, Go Murasawa, Noriyasu Yamada, Atsuki Shiratori, Yamagata Univ. (Japan). . . . . [10597-48]

2:30 pm: **Fabrication of a 3D nano-printing device**, Jinseo Hong, Yusuke Masuda, Takashi Mineta, Yamagata Univ. (Japan). . . . . [10597-49]

CONFERENCE 10598

Sessions 8A and 8B run concurrently.

SESSION 8A

LOCATION: CRESTONE SALON B
WED 2:00 TO 3:00 PM

Modeling of Smart Materials and Sensor Performance

Session Chairs: **Yooil Kim,** INHA Univ. (Korea, Republic of); **Yang Wang,** Georgia Institute of Technology (USA)

2:00 pm: **Sensing and control of flexible hydrodynamic lifting bodies in multiphase flows**, Yin Lu L. Young, Univ. of Michigan (USA); Casey Harwood, The Univ. of Iowa (USA); Jacob Ward, The Univ. of Maine (USA) . . . . . [10598-59]

2:20 pm: **Fluid-structure coupled acoustic analysis of vibrating Basilar membrane within the cochlea of inner ears,** Yooil Kim, Jeong-Hwan Kim, Gi-Woo Kim, INHA Univ. (Korea, Republic of) [10598-62]

2:40 pm: **Self-sensing characteristics experiment of modified magneto-rheological rubber bearing,** Rui Li, Mengjiao Zhou, Xingxing Xu, Minglian Wang, Lin Liu, Chongqing Univ. of Posts and Telecommunications (China) . . . . . .[10598-61]

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

SESSION 8B

LOCATION: ASPEN B
WED 1:40 TO 3:00 PM

Civil Infrastructure Monitoring I

Session Chairs: **Simon Laflamme,** Iowa State Univ. of Science and Technology (USA); **Jerome P. Lynch,** Univ. of Michigan (USA)

1:40 pm: **Real-time evaluation research of pedestrian-induced footbridge vibration comfort based on smart mobile device**, Deyi Chen, Quansheng Yan, South China Univ. of Technology (China) . . . . . [10598-63]

2:00 pm: **Identification of large scale systems with noisy data using an iterated cubature unscented Kalman filter**, Esmaeil Ghorbani, Young-Jin Cha, Univ. of Manitoba (Canada) . . . . . [10598-64]

2:20 pm: **A cloud-based platform for big data management and data-driven decision-making for 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) . . . . . [10598-65]

2:40 pm: **Strain monitoring in masonry structures using smart bricks**, Antonella D'Alessandro, Univ. degli Studi di Perugia (Italy); Austin Downey, Simon Laflamme, Iowa State Univ. of Science and Technology (USA); Filippo Ubertini, Univ. degli Studi di Perugia (Italy) . . . . . [10598-66]

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

CONFERENCE 10599

SESSION 8

LOCATION: CRYSTAL SALON A
WED 1:40 PM TO 3:00 PM

SHM/NDE Additive Manufacturing

Session Chairs: **Haifeng Zhang,** Univ. of North Texas (USA); **Xiaoyu R. Zheng,** Virginia Polytechnic Institute and State Univ. (USA)

1:40 pm: **Application of high-energy x-rays in additive manufacturing process optimizations**, Dileep Singh, Argonne National Lab. (USA) . . . . . [10599-38]

2:00 pm: **Additive manufacturing and process monitoring of lightweight, high temperature, precision-architected materials**, Xiaoyu R. Zheng, Virginia Polytechnic Institute and State Univ. (USA) . . . . . [10599-39]

2:20 pm: **Demonstration of array eddy current technology for real-time monitoring of laser powder bed fusion additive manufacturing process**, Evgueni I. Todorov, Paul Boulware, Kingsley Gaah, EWI (USA). . . . . [10599-40]

2:40 pm: **In situ real time defect detection of 3D printed parts**, Oliver Hammond, Xiaodong Li, Univ. of Virginia (USA). . [10599-41]

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

CONFERENCE 10600

Sessions 8A and 8B run concurrently.

SESSION 8A

LOCATION: CRIPPLE CREEK 2
WED 1:40 PM TO 3:00 PM

Elastic and Metamaterial II

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

1:40 pm: **Tunable wave propagation in origami-based reconfigurable mechanical metamaterials**, Hiromi Yasuda, Jinkyu Yang, Univ. of Washington (USA) . . . . . [10600-42]

2:00 pm: **Fundamentals of 1D and 2D lattice-based mechanical topological insulators**, Hui Chen, Hussein Nassar, Guoliang Huang, Univ. of Missouri (USA). [10600-43]

2:20 pm: **Butterfly metamaterial for acoustic holographic imaging through superlensing capability**, Hossain Ahmed, Riaz Ahmed, Sourav Banerjee, Univ. of South Carolina (USA) . . . . . [10600-44]

2:40 pm: **Numerical and experimental study of elastic wave mode filtering in anisotropic pentamode material**, Mingye Zheng, Rui Zhu, Xiaoning Liu, Qian Ma, Gengkai Hu, Beijing Institute of Technology (China); Hongchen Miao, Southwest Jiaotong Univ. (China). . [10600-45]

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

SESSION 8B

LOCATION: SILVERTON SALON 1
WED 1:40 PM TO 3:00 PM

Modeling/ Simulation and Experiment for Nonlinear/ Linear Ultrasonic Techniques I

Session Chairs: **Hadi Hafezi,** The Univ. of Arizona (USA); **Mohammad Sadegh Taskhiri,** Univ. of Tasmania (Australia)

1:40 pm: **Nonlinear wave mixing and its applications in nondestructive damage assessment in structural materials** *(Keynote Presentation)*, Jianmin Qu, Tufts Univ. (USA) . . . . . [10600-46]

2:20 pm: **Quantitative evaluation of yield strength degradation by using nonlinear ultrasonic techniques**, Kyung-Young Jhang, Jongbeom Kim, Dong-Gi Song, Chang-Soo Kim, Hanyang Univ. (Korea, Republic of) . . . [10600-47]

2:40 pm: **Flexible multibody dynamics formulation using Peridynamic theory**, Hadi Hafezi, Tribikram Kundu, The Univ. of Arizona (USA) . . . . . [10600-48]

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

WEDNESDAY 7 MARCH

CONFERENCE 10593

SESSION 11

LOCATION: CRIPPLE CREEK 1
WED 3:50 PM TO 4:50 PM

Material Structures II

Session Chair: **Kwang Jin Kim,** Univ. of Nevada, Las Vegas (USA)

3:50 pm: **Versatile strategies for the development of wood-based functional materials** *(Invited Paper)*, Tobias Keplinger, Marion Frey, Ingo Burgert, ETH Zurich (Switzerland) . . . . . .[10593-36]

4:20 pm: **Utilizing concepts of mechanics, transport, and assembly in nature: towards responsive materials** *(Invited Paper)*, LaShanda Korley, Alex M. Jordan, Symone L. M. Alexander, Case Western Reserve Univ. (USA). . .[10593-37]

CONFERENCE 10594

SESSION 8

LOCATION: SILVERTON SALON 2
WED 3:30 PM TO 5:50 PM

Applications of Dielectric Elastomers

Session Chairs: **Brian Trease,** The Univ. of Toledo (USA); **Nancy R. Sottos,** Beckman Institute for Advanced Science and Technology (USA)

3:30 pm: **Review on soft robots using dielectric elastomer actuators** *(Invited Paper)*, Jian Zhu, Hareesh Godaba, National Univ. of Singapore (Singapore) . . . . . .[10594-26]

4:10 pm: **Tremor suppression controller for dielectric elastomer orthosis**, Christopher R. Kelley, Jeffrey L. Kauffman, Univ. of Central Florida (USA) . .[10594-27]

4:30 pm: **Fabrication and characterization of silicone-based dielectric elastomer actuators for mechanical stimulation of living cells**, Alexandre Poulin, Herbert R. Shea, Samuel Rosset, Ecole Polytechnique Fédérale de Lausanne (Switzerland) . . . . . .[10594-28]

CONFERENCE 10595

Sessions 9A and 9B run concurrently.

SESSION 9A

LOCATION: CRESTONE SALON A
WED 3:30 PM TO 5:50 PM

Magnetic and Magneto/ Electrorheological Systems

Session Chairs: **Neil D. Sims,** The Univ. of Sheffield (United Kingdom); **Barkan M. Kavlicoglu,** Advanced Materials and Devices, Inc. (USA)

3:30 pm: **Semi-active inerters using magnetorheological fluids: a feasibility study**, Matthew Tipuric, Predaricka Deastra, David Wagg, Neil D. Sims, The Univ. of Sheffield (United Kingdom). . . . . .[10595-52]

3:50 pm: **A large-scale magnetorheological-based isolation system for three-dimensional seismic mitigation of structures**, Sevki Cesmeci, Faramarz Gordaninejad, Keri Ryan, Walaa Eltahawy, Univ. of Nevada, Reno (USA) . . . . . .[10595-53]

4:10 pm: **The effect of magnetic field on surface roughness of magnetorheological elastomers: a theoretical simulation**, Rui Li, Xi Li, Chongqing Univ. of Posts and Telecommunications (China); Shiwei Chen, Chongqing Univ. of Science and Technology (China) and Institute of Advanced Manufacturing Technology (China); Xiaojie Wang, Institute of Advanced Manufacturing Technology (China) . . . . . .[10595-54]

4:30 pm: **Design and analysis of a magnetorheological damper for airplane landing gear**, Bo-Gyu Kim, Chulhee Han, Kyung-Jae Nam, Seung-Bok Choi, INHA Univ. (Korea, Republic of). . . . . .[10595-55]

SESSION 9B

LOCATION: LEADVILLE
WED 3:30 PM TO 5:50 PM

Piezoelectric Materials and Systems I

Session Chairs: **Steven R. Anton,** Tennessee Technological Univ. (USA); **Andres F. Arrieta,** Purdue Univ. (USA)

3:30 pm: **Design and evaluation of piezoelectric-driven ultrasonic vibrator to reduce wall-wetting in vehicle engines**, Young-Min Han, Ajou Motor College (Korea, Republic of); Bo-Gyu Kim, INHA Univ. (Korea, Republic of) .[10595-59]

3:50 pm: **On the consideration of operational deformation shapes in bi-stable energy harvesters**, Janav P. Udani, Andres F. Arrieta, Purdue Univ. (USA) . . . . . .[10595-60]

4:10 pm: **Detection of compartmental forces and location of contact areas with piezoelectric transducers in total knee arthroplasty**, Mohsen Safaei, Robert Ponder, Steven R. Anton, Tennessee Technological Univ. (USA) . . . . .[10595-61]

4:30 pm: **Multiphysics modeling of mesh piezoelectric atomizers**, Eric Dupuis, Virginia Polytechnic Institute and State Univ. (USA); Ayyoub Momen, Oak Ridge National Lab. (USA); Shima Shahab, Virginia Polytechnic Institute and State Univ. (USA) . . . . . .[10595-62]

CONFERENCE 10596

SESSION 9

LOCATION: ASPEN A
WED 3:30 PM TO 6:00 PM

Magnetostrictive Materials

Session Chairs: **Christopher S. Lynch,** Univ. of California, Los Angeles (USA); **Kwang Jin Kim,** Univ. of Nevada, Las Vegas (USA)

3:30 pm: **Experimental validation of the sedimentation physics of magnetorheological fluids** *(Invited Paper)*, Norman M. Wereley, Stephen Sherman, Mingfu Wen, Univ. of Maryland, College Park (USA) . . . . . .[10596-42]

4:00 pm: **Analysis of the mechanical behavior of single wall carbon nanotubes by a modified molecular structural mechanics model incorporating an advanced chemical force field**, Oliver Eberhardt, TU Dresden (Germany) . . . . . .[10596-43]

4:20 pm: **Uncertainty-enabled design of electromagnetic reflectors with integrated shape control**, Jooyeon Chung, Univ. of Illinois (USA); Samiul Haque, North Carolina State Univ. (USA); Laszio Kindrat, Univ. of New Hampshire (USA); Mykhailo Kuian, Kent State Univ. (USA); Sijing Lui, Louisiana State Univ. (USA); Vikenty Mikheev, Kansas State Univ. (USA); Li Zhang, George Mason Univ. (USA); Jordan Massad, Sandia National Labs. (USA); Ralph C. Smith, North Carolina State Univ. (USA) . . . . .[10596-44]

4:40 pm: **Inverse magnetostrictive characteristics of Fe-Co composite materials using gas-nitriding process**, Kenya Nakajima, Fumio Narita, Tohoku Univ. (Japan) . . . . . .[10596-45]

CONFERENCE 10597

LOCATION: CRYSTAL SALON B/C
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 such as focusing on soft robotics, molecular models, and food. Each demonstration will include a brief oral talk describing the technology. All registered attendees are welcome.

See the full program and descriptions of the Wearable Medical Devices and 3D Printing Demo pages 16–17.

Conference End.

CONFERENCE 10598

Sessions 9A and 9B run concurrently.

SESSION 9A

LOCATION: CRESTONE SALON B
WED 3:20 PM TO 6:00 PM

Interrogation of Structures I

Session Chairs: **Chin-Hsiung Loh,** National Taiwan Univ. (Taiwan); **Fabio Semperlotti,** Purdue Univ. (USA)

3:20 pm: **Control of equipment isolation system using wavelet-based decentralized sliding mode control**, Shieh-Kung Huang, Chin-Hsiung Loh, National Ctr. for Research on Earthquake Engineering (Taiwan) . . [10598-67]

3:40 pm: **Damage prognosis of China ancient wooden buildings based on structural health monitoring system**, Shaofei Jiang, Ni-Lei Li, Ming-Hao Wu, Sheng Shen, Fuzhou Univ. (China) . . . . . [10598-68]

4:00 pm: **Discussion of using SSI-COV, EFDD, and multivariate AR model on identification of structural system with close space modes**, Chin-Hsiung Loh, Tsai-Jung Kuo, National Taiwan Univ. (Taiwan) . . . . . [10598-69]

4:20 pm: **Heterogeneous data fusion for impact force identification in truss structures**, Muhammad Saleem, The Univ. of Arizona (USA) and Univ. of Engineering and Technology Lahore (Pakistan); Hongki Jo, The Univ. of Arizona (USA) . . . . . [10598-70]

4:40 pm: **Discussion of signal decomposition techniques on feature extraction from structural dynamic response data**, Chin-Hsiung Loh, Chuan-Fu Li, National Taiwan Univ. (Taiwan) . . . . . .[10598-71]

SESSION 9B

LOCATION: ASPEN B
WED 3:20 PM TO 6:00 PM

Civil Infrastructure Monitoring II

Session Chairs: **Jian Li,** The Univ. of Kansas (USA); **Chin-Hsiung Loh,** National Taiwan Univ. (Taiwan)

3:20 pm: **Advanced structural health monitoring system for USGS instrumented buildings**, Erol Kalkan, Jon P. Fletcher, U.S. Geological Survey (USA); Paul Friberg, Instrumental Software Technologies, Inc. (USA); Lawrence M. Baker, U.S. Geological Survey (USA); Juan Archilla, U.S. Dept. of Veterans Affairs (USA) . [10598-75]

3:40 pm: **Telemetry techniques for continuous monitoring of partially submerged large civil infrastructure,** Quincy Alexander, Anton Netchaev, Matthew Smith, U.S. Army Engineer Research and Development Ctr. (USA) . . . . . [10598-76]

4:00 pm: **Pedestrian-induced vibration comfort evaluation of footbridge with smart mobile device**, Deyi Chen, Quansheng Yan, Xiaolin Yu, Zheng Yang, South China Univ. of Technology (China) . . . . . [10598-77]

4:20 pm: **Vibration monitoring of a tall building applying DBF based imaging radar: VirA**, Hideaki Iwaki, Chiba Institute of Technology (Japan); Hitoshi Nohmi, Akira Nohmi, Ikuo Shirai, Alouette Technology Inc. (Japan); Kazuo Tamura, Chiba Institute of Technology (Japan). . . . . [10598-78]

4:40 pm: **Flood fragility analysis of in stream bridge**, Touhid Ahamed, Jaeho Shim, Hongki Jo, Jennifer G. Duan, The Univ. of Arizona (USA) . . . . . [10598-79]

CONFERENCE 10599

SESSION 9

LOCATION: CRYSTAL SALON A
WED 3:30 PM TO 5:50 PM

Radar SHM/NDE

Session Chairs: **Tian Xia,** The Univ. of Vermont (USA); **Yan Wan,** The Univ. of Texas at Arlington (USA)

3:30 pm: **Characterization of steel rebar grids using synthetic aperture radar imaging,** Jie Hu, Jones Owusu Twumasi, Tzuyang Yu, Univ. of Massachusetts Lowell (USA) . . . . . [10599-42]

3:50 pm: **Characterization of the range effect in synthetic aperture radar images of concrete specimens for width estimation**, Ahmed Alzeyadi, Tzuyang Yu, Univ. of Massachusetts Lowell (USA) . . . . . [10599-43]

4:10 pm: **Electromagnetic characterization of white spruce at different moisture contents using synthetic aperture radar imaging**, Christopher M. Ingemi, Jones Owusu Twumasi, Tzuyang Yu, Univ. of Massachusetts Lowell (USA) . . . . . [10599-44]

4:30 pm: **Synthetic Aperture Radar (SAR) image reconstruction with very sparse measurements,** Xiahan Yang, Yahong R. Zheng, Missouri Univ. of Science and Technology (USA) . . . . . [10599-45]

CONFERENCE 10600

Sessions 9A and 9B run concurrently.

SESSION 9A

LOCATION: CRIPPLE CREEK 2
WED 3:20 PM TO 6:00 PM

Elastic and Metamaterial III

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

3:20 pm: **Inducing and tuning edge-states in a weak topological phononic waveguide**, Ting-Wei Liu, Fabio Semperlotti, Purdue Univ. (USA) . . . . . [10600-49]

3:40 pm: **Topologically tunable metamaterial based on bi-stable Stewart platform**, Ying Wu, Harbin Institute of Technology (China) and Univ. of Washington (USA); Hiromi Yasuda, Rajesh Chaunsali, Univ. of Washington (USA); Kaiping Yu, Harbin Institute of Technology (China); Jinkyu Yang, Univ. of Washington (USA). . . . [10600-50]

4:00 pm: **Dissipative nonlinear elastic metamaterials for broadband wave attenuation**, Xianchen Xu, Miles Barnhart, Guoliang Huang, Univ. of Missouri (USA) . . . . . [10600-51]

4:20 pm: **Level repulsion and band sorting in phononic crystals**, Yan Lu, Ankit Srivastava, Illinois Institute of Technology (USA). . . [10600-52]

4:40 pm: **Reconfigurable metasurfaces for directional acoustic sensing**, Charles Rohde, Alec K. Ikei, Mathew D. Guild, David C. Calvo, Gregory J. Orris, U.S. Naval Research Lab. (USA) . . . . . [10600-53]

SESSION 9B

LOCATION: SILVERTON SALON 1
WED 3:30 PM TO 5:50 PM

Composite Monitoring

Session Chairs: **Wieslaw M. Ostachowicz,** The Szewalski Institute of Fluid-Flow Machinery (Poland); **Sridhar Krishnaswamy,** Northwestern Univ. (USA)

3:30 pm: **A damage index for identifying incipient delamination in CFRP laminated plates relying on 2D multi-resolution modal Teager-Kaiser energy**, Wei Xu, Maosen Cao, Hohai Univ. (China); Maciej Radzieński, Wiesław Ostachowicz, The Szewalski Institute of Fluid-Flow Machinery (Poland). . . . . [10600-57]

3:50 pm: **Effect of multiscale precursor damage on wave propagation through modulated constitutive properties of composite materials**, Vahid Tavaf, Sajan Shrestha, Mohammadsadegh Saadatzi, Sourav Banerjee, Univ. of South Carolina (USA) . . [10600-58]

4:10 pm: **Single-sensor acoustic emission source localization in plate-like structures: a deep learning approach**, Arvin Ebrahimkhanlou, Salvatore Salamone, The Univ. of Texas at Austin (USA) . . . . . [10600-59]

4:30 pm: **Effect of bond stiffness degradation on sensor signals under dynamic loading,** Subir Patra, Sourav Banerjee, Univ. of South Carolina (USA) . . . . . [10600-60]

CONFERENCE 10593

SESSION 12

LOCATION: CRIPPLE CREEK 1
WED 4:50 PM TO 5:50 PM

Tutorial Lecture

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

4:50 pm: **Engineered biomimicry for human health** *(Keynote Presentation)*, Bert Müller, Univ. Basel (Switzerland) [10593-38]

Conference End.

CONFERENCE 10594

SESSION 8 CONTINUED

4:50 pm: **Analysis of maximum performance of dielectric fluid transducers,** Mattia Duranti, Univ. degli Studi di Trento (Italy); Giacomo Moretti, Scuola Superiore Sant'Anna (Italy); Rocco Vertechy, Univ. degli Studi di Bologna (Italy); Marco Fontana, Univ. degli Studi di Trento (Italy) . . . . . [10594-29]

5:10 pm: **Wearable operation device with different types of dielectric elastomer sensors**, Holger Böse, Fraunhofer-Institut für Silicatforschung ISC (Germany) . . . . . [10594-30]

5:30 pm: **Adaptive sliding mode impedance and position control for dielectric elastomer transducers**, Thorben Hoffstadt, Technische Univ. Berlin (Germany) . . . . . [10594-31]

CONFERENCE 10595

Sessions 9A and 9B run concurrently.

SESSION 9A CONTINUED

4:50 pm: **Compressible magnetorheological fluid damper**, Barkan M. Kavlicoglu, Huseyin Sahin, Michael McKee, Yanming Liu, Advanced Materials and Devices, Inc. (USA) . . . . . [10595-56]

5:10 pm: **Experimental evaluation of a miniature haptic actuator based on electrorheological fluids**, Alex Mazursky, Jeong-Hoi Koo, Miami Univ. (USA); Tae-Heon Yang, Korea Research Institute of Standards and Science (Korea, Republic of) . . . . . [10595-57]

5:30 pm: **Microscale multiferroic motors**, John P. Domann, Univ. of California, Los Angeles (USA) . . . . . [10595-58]

SESSION 9B CONTINUED

4:50 pm: **Experimental study of an adaptive CFRC reflector for high order wave-front error correction**, Lan Lan, Houfei Fang, Shanghai YS Information Technology Co., Ltd. (China); Ke Wu, Shanghai YS Information Technology Co., Ltd. (China); Shui-Dong Jiang, Yang Zhou, Shanghai YS Information Technology Co., Ltd. (China) . . . . . [10595-63]

5:10 pm: **Flywheel piezoelectric actuator for active vibration control applications**, Aleksander Kras, Univ. degli Studi di Udine (Italy) . . . . . [10595-64]

5:30 pm: **Design of piezo actuated torsional resonator for fluid viscosity measurement,** Suresh Kaluvan, Chen Zhang, Celena Lipscomb, Haifeng Zhang, Univ. of North Texas (USA) . . . . [10595-65]

CONFERENCE 10596

SESSION 9 CONTINUED

5:00 pm: **Real-time mapping of the effect of mechanical stress on magnetic domains evolution in Ni2MnGa,** Constantin Ciocanel, Glen D'Silva, Northern Arizona Univ. (USA) . . . . . [10596-46]

5:20 pm: **A performance prediction for magnetostrictive actuator using simplified model**, JinHyeong Yoo, Naval Surface Warfare Ctr. Carderock Div. (USA) . . . . . [10596-47]

5:40 pm: **Shape function and memory mechanism based hysteresis modeling of magnetorheological fluid actuators**, Peng Chen, Xian-Xu Bai, Li-Jun Qian, Hefei Univ. of Technology (China) . . . . [10596-48]

CONFERENCE 10598

Sessions 9A and 9B run concurrently.

SESSION 9A CONTINUED

5:00 pm: **Analysis of dispersion and propagation properties in a periodic rod via fractional wave equation**, John P. Hollkamp, Fabio Semperlotti, Purdue Univ. (USA) . . . . . [10598-72]

5:20 pm: **Characterization and modeling of a MR elastomer**, Jorge de-J Lozoya-Santos, Jonathan Rivas, Santiago Cruz, Univ. de Monterrey (Mexico); Andrea Spaggiari, Univ. degli Studi di Modena e Reggio Emilia (Italy) . . . . . [10598-73]

5:40 pm: **Detecting the onset of delamination in a post-tensioned curved concrete structure using hidden Markov modeling of acoustic emissions**, Arvin Ebrahimkhanlou, Jongkwon Choi, Trevor D. Hrynyk, Salvatore Salamone, Oguzhan Bayrak, The Univ. of Texas at Austin (USA) . . . . . [10598-74]

SESSION 9B CONTINUED

5:00 pm: **Joint input-state estimation for earthquake-excited building structures using acceleration measurements**, Sdiq Taher, Jian Li, Huazhen Fang, The Univ. of Kansas (USA) . . . . . .[10598-80]

5:20 pm: **Finite element model updating of an in-service highway bridge using dynamic experimental data**, Xinjun Dong, Yang Wang, Xi Liu, Georgia Institute of Technology (USA) . . . . . .[10598-81]

5:40 pm: **Seismic damage assessment of bridge structure using recursive subspace identification algorithms**, Chin-Hsiung Loh, I-No Yu, National Taiwan Univ. (Taiwan) . . . . . .[10598-82]

CONFERENCE 10599

SESSION 9 CONTINUED

4:50 pm: **Extracting and identifying ballastless track structural defects in GPR images**, Qiling Ye, Nanjing Univ. of Posts and Telecommunications (China); Tian Xia, The Univ. of Vermont (USA); Liangbao Jiao, Nanjing Institute of Technology (China); Dryver Huston, The Univ. of Vermont (USA); Xuehong Cao, Nanjing Institute of Technology (China) . . . . . [10599-46]

5:10 pm: **Study of GPR signal propagation and imaging of multilayer rebar mesh structure,** Jialei Tian, Nanjing Univ. of Posts and Telecommunications (China); Tian Xia, The Univ. of Vermont (USA); Liangbao Jiao, Nanjing Institute of Technology (China); Dryver Huston, The Univ. of Vermont (USA); Xuehong Cao, Nanjing Institute of Technology (China) . . . . . .[10599-47]

5:30 pm: **Strain sensing rosettes using passive patch antennas**, Yang Wang, Georgia Institute of Technology (USA) . . . . . .[10599-68]

CONFERENCE 10600

Sessions 9A and 9B run concurrently.

SESSION 9A CONTINUED

5:00 pm: **Design of smart metamaterials for vibration control: extension of Bloch approach to handle finite system boundary conditions**, Kévin Billon, Morvan Ouisse, Emeline Sadoulet-Reboul, FEMTO-ST (France); Manuel Collet, Lab. de Tribologie et Dynamique des Systèmes (France) . . . . . .[10600-54]

5:20 pm: **Optimal dispersion in numerical models for elastic wave propagation**, Pawel Packo, AGH Univ. of Science and Technology (Poland); Michael J. Leamy, Georgia Institute of Technology (USA); Piotr Kijanka, Mateusz Gawronski, Wieslaw J. Staszewski, AGH Univ. of Science and Technology (Poland) . . . . . .[10600-55]

5:40 pm: **Nonlinear elastic wave dispersion in a slender metamaterial rod**, Romik Khajehtourian, Mahmoud I. Hussein, Univ. of Colorado Boulder (USA) . . . . . .[10600-56]

SESSION 9B CONTINUED

4:50 pm: **Mechanical characterization of bistable laminates for very small aircraft morphing applications**, Gennaro Scarselli, Alfonso Maffezzoli, Francesco Nicassio, Univ. del Salento (Italy) . . . . . .[10600-61]

5:10 pm: **Composite samples with different contaminations analysed with THz spectrometry**, Magdalena Mieloszyk, Katarzyna Majewska, Polish Accademy of Sciences (Poland); Wieslaw Ostachowicz, Polish Academy of Sciences (Poland) . . . . . .[10600-62]

5:30 pm: **Numerical and experimental investigations on the Lamb wave propagation in a complex GFRP aircraft structure**, Alessandro De Luca, Univ. degli Studi della Campania Luigi Vanvitelli (Italy); Angelo De Fenza, Giuseppe Petrone, Univ. degli Studi di Napoli Federico II (Italy); Donato Perfetto, Francesco Caputo, Univ. degli Studi della Campania Luigi Vanvitelli (Italy) . . . . . .[10600-63]

WEDNESDAY POSTER SESSION

Wednesday 7 March | 6:00 to 7:30 pm

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 Wednesday 7 March.

CONFERENCE 10593

Bioinspiration, Biomimetics, and Bioreplication VIII

An ocean port that is built and functions using the chemistry of seawater, Carolyn M. Dry, Natural Process Design, Inc. (USA) . . . . . .[10593-39]

A biomimetic coating for concrete that takes up CO2 while strengthening the concrete, Carolyn M. Dry, Natural Process Design, Inc. (USA). . . . . .[10593-40]

Direct measurement of modal fluctuations in PVDF based artificial Basilar membrane using a high-resolution data acquisition board, Mohammad Sadegh Saadatzi, Sourav Banerjee, Univ. of South Carolina (USA) . . . . . .[10593-41]

Biomimetic parallel computing approach to processing, Blaine Allen, Stephen Trotnic, Steve E. Watkins, Missouri Univ. of Science and Technology (USA); Benjamin Cooper, Core Memory Circuits, LLC (USA) . . . . . .[10593-42]

CONFERENCE 10595

Active and Passive Smart Structures and Integrated Systems XII

A parameter tuning method of negative capacitor circuit for piezoelectric shunt damping, Takuya Honda, Ichiro Jikuya, Kanazawa Univ. (Japan); Kentaro Takagi, Nagoya Univ. (Japan) . . . . . .[10595-5]

Structural vibration-based damage classification of delaminated smart composite laminates, Heung Soo Kim, Asif Khan, Dongguk Univ. (Korea, Republic of); Jung Woo Sohn, Kumoh National Institute of Technology (Korea, Republic of) . . . . . .[10595-78]

Deploying test of a shape memory polymer composite hinge at low temperature, Nam Seo Goo, Van Luong Le, Konkuk Univ. (Korea, Republic of); Woong-Ryeol Yu, Seoul National Univ. (Korea, Republic of) . . . . . .[10595-87]

Design and modeling of macroscale velocity driven harvester using galfenol, Mojtaba Ghodsi, Hamidreza Ziaiefar, Sultan Qaboos Univ. (Oman); Farag Omar, United Arab Emirates Univ. (United Arab Emirates); Khurshid Alam, Morteza Mohamadzaheri, Sultan Qaboos Univ. (Oman); Mohammad Reza Sheykholeslami, Arak Univ. (Iran, Islamic Republic of); Amur Al-Yahmadi, Issam Bahadur, Sultan Qaboos Univ. (Oman) . . . . . .[10595-99]

Modeling and control of a 1/4 magnetorheological semi-active suspension, Zhen-Ning Zhu, Xian-Xu Bai, Li-Jun Qian, Hefei Univ. of Technology (China) . . . . . [10595-103]

Impact analysis of fiber-reinforced composites by means of CNTs, Simone Cinquemani, Claudio Sbaruffatti, Diego Scaccabarozzi, Politecnico di Milano (Italy) . . . . . [10595-111]

Numerical study of the of ultrasonic vibration in deep drawing process of circular sections with rubber die, Simone Cinquemani, Politecnico di Milano (Italy); Mohammad Sheykholeslami, Arak Univ. (Iran, Islamic Republic of) [10595-112]

Decentralized control of vibration with active smart dampers, Simone Cinquemani, Andrea Costa, Ferruccio Resta, Politecnico di Milano (Italy) . . . . . [10595-113]

Preliminary studies on SMA embedded in wind turbine blades for passive control of vibration, Simone Cinquemani, Pouya Haghdoust, Antonietta Lo Conte, Politecnico di Milano (Italy) . . . [10595-114]

Design and testing of a novel audio transducer to train string musical instruments, Simone Cinquemani, Politecnico di Milano (Italy) . . . [10595-116]

Towards the development of a triple SMA actuated vertical tube , Bardia Konh, Univ. of Hawai'i at Manoa (USA) . . . . . [10595-117]

Design and development of active bimorph structure for deployable space application, Rupal Srivastava, Indian Institute of Technology Kanpur (India). . . . . [10595-118]

Low frequency dual-purpose energy harvesting vibration isolation system, Hamzeh K. Bardaweel, S. M. Mahdi Mofidian, Louisiana Tech Univ. (USA) . . . . . [10595-120]

Theoretical modeling of a 2D nano-energy harvester, Somayajulu Dhulipala, Arunachalakasi Arockiarajan, Ali Shaikh Faruq, Indian Institute of Technology Madras (India) . . . . . [10595-121]

Analysis of systems with hysteretic damping via the monodromy matrix, Luis Moreno-Ahedo, Univ. Autónoma de Baja California (Mexico) . . . . . [10595-122]

Phosphor-free III-nitride nanowire white-light-emitting diodes for visible light communication, Moab Rajan Philip, Thang Ha Quoc Bui, Mehrdad Djavid, Md Nasir Uddin Bhuyian, Hieu P. Nguyen, New Jersey Institute of Technology (USA) . . . . . [10595-123]

Enhanced performance of piezoelectric wind energy harvester based on magnetic boundary constraint, Fengrui Liu, Wen-Ming Zhang, Hong-Xiang Zou, Han Yan, Shanghai Jiao Tong Univ. (China) . . . . . [10595-125]

Development of 3D printed coils for vibration driven electromagnetic power generation, S. M. Mahdi Mofidian, Stephen Bierschenk, Hamzeh K. Bardaweel, Louisiana Tech Univ. (USA) . . . . . [10595-126]

Experimental verification of a tuned inertial mass electromagnetic transducer, Yuta Watanabe, Keita Sugiura, Takehiko Asai, Univ. of Tsukuba (Japan). . . . . [10595-127]

A new method for Poisson's ratio measurement with time-of-flight technique: application to the preliminary design of smart composite structures, Xianlong Chen, Yann Meyer, Rémy Lachat, Univ. Bourgogne Franche-Comté (France) and Univ. of Technology of Belfort-Montbéliard (France); Morvan Ouisse, FEMTO-ST (France) and Univ. Bourgogne Franche-Comté (France) . . . . . [10595-128]

Finite element study of main effective parameters in UT probe resolution, Mohammad Reza Sheykholeslami, Arak Univ. (Iran, Islamic Republic of); Mojtaba Ghodsi, Sultan Qaboos Univ. (Oman); M. Bagheri, M. Allahdadi, M. Amin, Arak Univ. (Iran, Islamic Republic of). . . . . [10595-129]

Optimum design of multi-resonance transducer, Mohammad Reza Sheykholeslami, Arak Univ. (Iran, Islamic Republic of); Mojtaba Ghodsi, Sultan Qaboos Univ. (Oman); Simone Cinquemani, Politecnico di Milano (Italy); Siamak Mazdak, Tafresh Univ. (Iran, Islamic Republic of). . . . . [10595-130]

Soft printable grippers made of polymer-paper based bilayer composite, Wei Wang, Sung-Hoon Ahn, Seoul National Univ. (Korea, Republic of). . . . . [10595-132]

An modified control plan to improve performance of tuned vibration absorber, Ning Han, Qiang Gao, Yanqing Zhao, Chang'an Univ. (China); Guoliang Huang, Univ. of Missouri (USA) [10595-135]

Design of a semi-active vibration isolate system magnetic circuit for a bush utilizing a magneto-rheological elastomer, Seung-Bok Choi, Yujin Park, Tae Hoon Lee, INHA Univ. (Korea, Republic of) . . . . . [10595-137]

CONFERENCE 10596

Behavior and Mechanics of Multifunctional Materials and Composites XII

Evaluation of oil-leakage of multi-layered resin-hose clamped with metal nipple and sleeve, Kenta Matsuoka, Kazuya Okubo, Toru Fujii, Doshisha Univ. (Japan); Yushi Fujishita, Fuko Kusu, Masato Matsushita, Ryota Yoshihara, Nitta Corp. (Japan). . . . . .[10596-59]

Precise prediction of giant magnetostrictive transducer behavior, Simone Cinquemani, Politecnico di Milano (Italy); Mohammad Sheykholeslami, Arak Univ. (Iran, Islamic Republic of); Siamak Mazdak, Tafresh Univ. (Iran, Islamic Republic of); Yousef Hojjat, Tarbiat Modares Univ. (Iran, Islamic Republic of); Soheil Talebian, Razi Univ. (Iran, Islamic Republic of); Mojtaba Ghodsi, Sultan Qaboos Univ. (Oman) . . . . . .[10596-60]

Effects of the content of isocyanate and particle structures on acoustic absorption properties of magnetic polyurethane foam, Xiaojie Wang, Caiping Wang, Institute of Advanced Manufacturing Technology (China); Honglang Zhu, Chongqing Univ. of Posts and Telecommunications (China) and Institute of Advanced Manufacturing Technology (China); Rui Li, Chongqing Univ. of Posts and Telecommunications (China); Jialu Geng, Bin Li, Institute of Advanced Manufacturing Technology (China). . . . . .[10596-61]

The electrical resistivity and percolation threshold of MWCNTs/polymer composites filled with a few aligned carbonyl iron particles, Shuai Dong, Xiaojie Wang, Institute of Advanced Manufacturing Technology (China). . . . . .[10596-62]

Numerical model for an epoxy beam reinforced with superelastic shape memory alloy wires, Nguyen Viet, Khalifa Univ. of Science, Technology and Research (United Arab Emirates) . . . . . .[10596-63]

Characteristics of energy harvesting using BaTiO3/Cu laminates with changes in temperature, Kotaro Mori, Ibaraki Univ. (Japan); Hiroki Takeuchi, Fumio Narita, Tohoku Univ. (Japan) . . . . . .[10596-64]

High strength and modulus graphene-based composites fiber, Hyunsoo Kim, Seon Jeong Kim, Hanyang Univ. (Korea, Republic of). . . . . .[10596-65]

Topology optimization of phononic crystals with near-zero refractive index, Longxiang Xie, Jian Liu, Hunan Univ. (China); Guoliang Huang, Univ. of Missouri (USA) . . . . . .[10596-66]

Modeling the effects of geometric defects and strain profiles on precessional magnetic switching in multiferroic heterostrucutres, Andres C. Chavez, Auni A. Kundu, Christopher S. Lynch, Gregory P. Carman, Univ. of California, Los Angeles (USA) . .[10596-67]

Safety concerns in composite manufacturing, Eylem Asmatulu, Wichita State Univ. (USA) . . . . . .[10596-68]

Sustainability of fiber reinforced laminate and honeycomb composites in manufacturing industries, Eylem Asmatulu, Muhammet M. Rahman, Wichita State Univ. (USA) . . . . . .[10596-69]

Nonlinear analysis of concrete gravity dams using generalized Prandtl neural networks and damage detection, Mehrdad Shafiei Dizaji, Univ. of Virginia (USA) . . . . . .[10596-70]

A novel and facile paradigm for highly conductive silver printing at room t emperature, Xingyun Yang, Ximin He, Univ. of California, Los Angeles (USA) . . . . . .[10596-75]

CONFERENCE 10598

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

Simulation of strain dependent damping in SMA embedded hybrid beams, Simone Cinquemani, Pouya Haghdoust, Antonietta Lo Conte, Nora Lecis, Politecnico di Milano (Italy) . . . . . .[10598-130]

An optical fiber extrinsic Fabry-Perot interferometer based displacement sensor with centimeter measurement range, Chen Zhu, Jie Huang, Missouri Univ. of Science and Technology (USA) . . . . . .[10598-131]

Comparison of binary and multi-level logic processing for an optical encoder, Caitlyn M. Renne, U.S. Air Force Academy (USA); Steve E. Watkins, Missouri Univ. of Science and Technology (USA); John G. Ciezki, U.S. Air Force Academy (USA) . . . . . .[10598-132]

A high-linear sweep laser source to interrogate sub-terahertz range fiber sensors for dynamic strain sensing applications, Zhen Chen, Zheyi Yao, Gerald Hefferman, Tao Wei, The Univ. of Rhode Island (USA) . . . . . .[10598-133]

Design of a new hybrid brake for control torque of knee-exoskeleton featuring magneto-rheological fluid, Xuan Phu Do, Vietnamese-German Univ. (Viet Nam) and INHA Univ. (Korea, Republic of); Seung-Bok Choi, INHA Univ. (Korea, Republic of); Huy Ta Duc, Le Tran Huy Thang, Vietnamese-German Univ. (Viet Nam) . . . . .[10598-134]

Design of a new damper for vibration control of knee-exoskeleton featuring magneto-rheological fluid, Xuan Phu Do, INHA Univ. (Korea, Republic of) and Vietnamese-German Univ. (Viet Nam); Seung-Bok Choi, INHA Univ. (Korea, Republic of); Nguyen Vu Duc, Long Mai Bui Quoc, Vietnamese-German Univ. (Viet Nam) . . . . . .[10598-135]

Wide-range displacement sensor based on a hollow coaxial cable Fabry-Perot resonator, Chen Zhu, Jie Huang, Missouri Univ. of Science and Technology (USA) . . . . . .[10598-136]

Buckled beam based optical interferometric pressure sensor with low temperature cross-sensitivity, Chen Zhu, Jie Huang, Missouri Univ. of Science and Technology (USA) . . . . . .[10598-137]

Numerical study of cornea applanation by using a portable force-displacement sensor for intraocular pressure measurements, Ting Yao, Baoqing Nie, Xinjian Chen, Soochow Univ. (China) . . . . . .[10598-138]

Design and realization of data loss compensation system based on compressed sensing, Ruidan Xue, Yi Zhang, Yan Yu, Dalian Univ. of Technology (China) . . . . . .[10598-139]

Design and verification of an indoor wireless UWB positioning system for civil structures, Ting Lei, Xuefeng Cao, Jie Wang, Yan Yu, Dalian Univ. of Technology (China) . . . . . .[10598-140]

Inertial monolithic sensors for low frequency acceleration measurement of spacecrafts and satellites, Fabrizio Barone, Gerardo Giordano, Univ. degli Studi di Salerno (Italy) . . . . . .[10598-141]

A novel method to monitoring convergence deformation of metro tunnels, Shulin Xie, Xuefeng Zhao, Peng Liu, Lixiao Zhang, Dalian Univ. of Technology (China) . . . . . .[10598-142]

Convolutional neural networks-based crack detection for real concrete surface, Shengyuan Li, Xuefeng Zhao, Dalian Univ. of Technology (China) . . . . . .[10598-143]

Frequency domain fiber loop ring-down system for liquid refractive index sensing, Yiyang Zhuang, Jie Huang, Missouri Univ. of Science and Technology (USA) . . . . . .[10598-144]

A high resolution extrinsic Fabry-Perot interferometer-based two-dimensional optical fiber inclinometer, Yiyang Zhuang, Jie Huang, Missouri Univ. of Science and Technology (USA) . . . . . .[10598-145]

A novel high temperature sensor based on a hollow coaxial cable Fabry-Perot resonator, Yiyang Zhuang, Mohammed F. Ahmed, Jie Huang, Missouri Univ. of Science and Technology (USA) [10598-146]

A mechanical designed EFPI using buckling beam mechanism for strain sensing, Yang Du, Jie Huang, Missouri Univ. of Science and Technology (USA) . . . . . .[10598-147]

A comparison between electro-mechanical impedance sensing and optical fiber Bragg gratings for defect detection, Craig Lopatin, Technion-Israel Institute of Technology (Israel) . [10598-148]

Mixed-effect nested models for evaluation of falling-weight deflectometers, Peter Bajorski, Rochester Institute of Technology (USA). . [10598-149]

Principle of a smart clutch-based test bench for 1/4 vehicular braking systems, Xian-Xu Bai, Yang Li, Yang Liu, Hefei Univ. of Technology (China) . . . . . .[10598-150]

Research on the Great Wall features identification based on deep learning method, Niannian Wang, Zheng Zou, Dalian Univ. of Technology (China); Linan Wang, China Academy of Cultural Heritage (China); Xuefeng Zhao, Dalian Univ. of Technology (China) . . . . . .[10598-151]

Optimal sensor placement for continuous optical fiber sensors, Gabriele Cazzulani, Martina Chieppi, Andrea Colombo, Politecnico di Milano (Italy) . . . . . .[10598-152]

Self-aligned epitaxial silicon nano-wire arrays for sensor applications, Jung-Hwan Hyung, Jae Hong Park, National Nanofab Ctr. (Korea, Republic of) . . . . . .[10598-153]

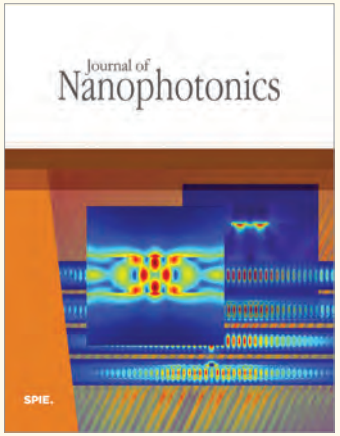
Integrating 3D scanning within a simulation framework for structural mechanics, Devin K. Harris, Mehrdad Shafiei Dizaji, Shuzhen Yang, Univ. of Virginia (USA) . . . . . .[10598-154]

Penetrating telemetry and subsurface sensing with low-frequency magnetic fields using compact mechanical sources, Dryver R. Huston, Robert Farrell, Daniel Orfeo, Dylan Burns, Tian Xia, The Univ. of Vermont (USA) . . . . . .[10598-155]

Modal analysis from compressed measurements using the multivariate AR model, Zhongdong Duan, Jie Kang, Harbin Institute of Technology Shenzhen Graduate School (China) . . . . .[10598-157]

Finite element analysis of RC beam strengthened with FOS embedded carbon fiber sheet, Byeong Cheol Kim, Kitae Park, Kyusan Jung, Joonseok Park, Korea Institute of Civil Engineering and Building Technology (Korea, Republic of) . . . . . .[10598-158]

Experimental investigation on the FOS embedded carbon fiber sheet for bridge sensing and reinforcement, Byeong Cheol Kim, Kitae Park, Kyusan Jung, Joonseok Park, Korea Institute of Civil Engineering and Building Technology (Korea, Republic of) . . . . . .[10598-159]



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THURSDAY 8 MARCH

CONFERENCE 10594

Electroactive Polymer Actuators and Devices (EAPAD) XX

Sessions 9A and 9B run concurrently.

SESSION 9A

LOCATION: SILVERTON SALON 2
THU 8:00 AM TO 10:00 AM

EAP Fabrication Processes

Session Chairs: **Mircea Badescu,** Jet Propulsion Lab. (USA); **Holger Böse,** Fraunhofer-Institut für Silicatforschung ISC (Germany)

8:00 am: **On the performance of helical dielectric elastomer actuator with additive manufacturing**, Jang Ho Park, Daewon Kim, Eduardo Divo, Embry-Riddle Aeronautical Univ. (USA) . . . . . .[10594-32]

8:20 am: **Fully inkjet printed dielectric elastomer actuator with 5 µm thick silicone membrane**, Samuel Schlatter, Ecole Polytechnique Fédérale de Lausanne (Switzerland); Samuel Rosset, The Univ. of Auckland (New Zealand); David McCoul, Wake Forest Institute for Regenerative Medicine (USA); Herbert Shea, Ecole Polytechnique Fédérale de Lausanne (Switzerland) . . . . . .[10594-33]

8:40 am: **3D printing with light: towards additive manufacturing of soft, electroactive structures**, Djen T. Kuhnel, Jonathan M. Rossiter, Charl F. J. Faul, Univ. of Bristol (United Kingdom) . . . .[10594-34]

9:00 am: **A stretchable, conductive fabric for simplified manufacturing of dielectric elastomer electrodes**, David Allen, Sophie Farmer, Robert Gregg, Walter Voit, The Univ. of Texas at Dallas (USA) . . . . . .[10594-35]

9:20 am: **Controlling dielectric loss and ionic conductivity through film processing optimization of fluorinated electrostrictive polymers**, Francesco Pedroli, INSAVALOR (France); Mathieu Tauban, Solvay S.A. (France); Pierre-Jean Cottinet, INSAVALOR (France); Olivier Sanseau, Solvay S.A. (France); Jean-Fabien Capsal, INSAVALOR (France). . .[10594-36]

9:40 am: **Elastomeric electrode and casting process for manufacturing multilayer dielectric elastomer actuators**, Zhuoyuan Li, Pengfei Dong, Tianlin Shi, Chao Tang, Hualing Chen, Xi'an Jiaotong Univ. (China). . . . . .[10594-37]

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

SESSION 9B

LOCATION: CRIPPLE CREEK 1
THU 8:00 AM TO 10:00 AM

Applications of EAP I

Session Chairs: **E.-F. Markus Henke,** The Univ. of Auckland (New Zealand); **Thomas Wallmersperger,** TU Dresden (Germany)

8:00 am: **Electroactive catheter design using conducting interpenetrating polymer networks actuators**, Vincent Woehling, Giao T. M. Nguyen, Cédric Plesse, Univ. de Cergy-Pontoise (France); Meisam Farajollahi, John D. W. Madden, The Univ. of British Columbia (Canada); Frédéric Vidal, Univ. de Cergy-Pontoise (France) . . . . . .[10594-38]

8:20 am: **Fully embedded actuators in elastomeric skin for use in humanoid robots**, Yara Almubarak, Nicole Xiu Maly, Yonas Tadesse, The Univ. of Texas at Dallas (USA) . . . . . .[10594-39]

8:40 am: **Biorobotic systems design and development using TCP muscles,** Lianjun Wu, Farzad Karami, Yonas Tadesse, The Univ. of Texas at Dallas (USA) . .[10594-40]

9:00 am: **Design and development of soft robot for head and neck cancer radiotherapy**, Yara Almubarak, Olalekan Ogunmolu, Nick Gans, The Univ. of Texas at Dallas (USA); Xuejun Gu, Steve Jiang, The Univ. of Texas Southwestern Medical Ctr. at Dallas (USA); Yonas Tadesse, The Univ. of Texas at Dallas (USA) . . . . . .[10594-41]

9:20 am: **Aerodynamic characteristics of soft active membrane wings**, Alyssa J. Skulborstad, Gurmeet Singh, Nakhiah C. Goulbourne, Univ. of Michigan (USA) . . . . . .[10594-42]

9:40 am: **Dielectric breakdown test of dielectric silicone membranes under different temperature and humidity conditions**, Felix Welsch, Univ. des Saarlandes (Germany); Bettina Fasolt, ZeMA GmbH (Germany) . . . . . .[10594-43]

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

CONFERENCE 10595

Active and Passive Smart Structures and Integrated Systems XII

Sessions 10A and 10B run concurrently.

SESSION 10A

LOCATION: CRESTONE SALON A
THU 8:00 AM TO 10:00 AM

Energy Harvesting IV: Design and Optimization

Session Chairs: **Soobum Lee,** Univ. of Maryland, Baltimore County (USA); **Lei Zuo,** Virginia Polytechnic Institute and State Univ. (USA)

8:00 am: **Experimental verification of tire energy harvester designed via reliability based design optimization method**, Amin Toghi Eshghi, Soobum Lee, Univ. of Maryland, Baltimore County (USA); Mohammad Kazem Sadoughi, Chao Hu, Iowa State Univ. of Science and Technology (USA); Young-Cheol Kim, Jong-Ho Seo, Korea Institute of Machinery & Materials (Korea, Republic of) . . . . . [10595-66]

8:20 am: **Modeling and design of electromagnetic and piezoelectric chest strain energy harvesters including soft tissue effects**, Tahzib Safwat, Zoubeida Ounaies, Christopher D. Rahn, The Pennsylvania State Univ. (USA) . . . . . [10595-67]

8:40 am: **Design parameter study on piezoelectric energy harvester for scavenging human mandible deformation energy**, Richard Fan, Danny Joe, Poojan Shah, Hyun Jun Jung, Soobum Lee, Univ. of Maryland, Baltimore County (USA); Mary Anne Melo, Radi Masri, Univ. of Maryland, Baltimore (USA). . . . . [10595-68]

9:00 am: **Design of an impact-driven piezoelectric energy harvester with gravity-induced rotator for wind turbine blade monitoring system**, Hyun Jun Jung, Stanley Chervin, Miles Smith, Soobum Lee, Univ. of Maryland, Baltimore County (USA) . . [10595-69]

9:20 am: **Design and characterization of a novel ocean wave energy converter for self-powered lifejacket using mechanical motion rectifier**, Jia Mi, Lin Xu, Chenyang Wang, Wuhan Univ. of Technology (China); Yaling Yang, Virginia Polytechnic Institute and State Univ. (USA) and Industry-Univ. Cooperative Research Ctrs. Program, National Science Foundation (USA); Lei Zuo, Virginia Polytechnic Institute and State Univ. (USA) and Industry-Univ. Cooperative Research Ctrs. Program, National Science Foundation (USA) . . . . . [10595-70]

9:40 am: **Design, modeling, and experiment of an energy harvesting backpack**, Jia Mi, Lin Xu, Wuhan Univ. of Technology (China); Lei Zuo, Virginia Polytechnic Institute and State Univ. (USA) . . . . . .[10595-71]

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

SESSION 10B

LOCATION: LEADVILLE
THU 8:00 AM TO 10:00 AM

Passive and Active Vibration Isolation Attenuation II

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

8:00 am: **Experimental verification of electromagnetic damper for mitigating cable vibration**, Ho Yeon Jung, Seung-Kyung Kye, Hyung-Jo Jung, KAIST (Korea, Republic of) . . . . . [10595-72]

8:20 am: **Active mass damper system for high-rise buildings using neural oscillator and position controller: generation method for desired stroke of auxiliary mass using synchronous detection**, Junichi Hongu, Tottori Univ. (Japan); Daisuke Iba, Kyoto Institute of Technology (Japan). . . . [10595-73]

8:40 am: **Nonlinear adaptive piezoelectric circuit for stiffness control**, Tarcisio M. Silva, Carlos De Marqui Jr., Escola de Engenharia de São Carlos da Univ. de São Paulo (Brazil) . . . . . .[10595-74]

9:00 am: **LPV control for an active suspension quarter of car-one parameter case**, Jorge de-J. Lozoya-Santos, Juan Carlos Tudon-Martinez, Univ. de Monterrey (Mexico); Ricardo Ramirez-Mendoza, Tecnológico de Monterrey (Mexico); Olivier Sename, GIPSA-lab (France) and Institut National Polytechnique de Grenoble (France) . . . . . [10595-75]

9:20 am: **Research on seismic performance of a new type energy dissipating coupling beam damper**, Min Liu, Liangfu Zheng, Liqiang Wang, Harbin Institute of Technology (China) . . . . . [10595-76]

9:40 am: **Panel with piezoelectric patches connected to multi-resonant shunts tuned to maximize electrical power absorption**, Michal Zientek, Paolo Gardonio, Univ. degli Studi di Udine (Italy) . . . [10595-77]

Coffee BreakThu 10:00 am to 10:30 am

CONFERENCE 10596

Behavior and Mechanics of Multifunctional Materials and Composites XII

SESSION 10

LOCATION: ASPEN A
THU 8:00 AM TO 10:00 AM

Mechanics of Multifunctional Materials

Session Chair: **William S. Oates,** Florida State Univ. (USA)

8:00 am: **Sample containerization and planetary protection using brazing for breaking the chain of contact to Mars by synchronously separating, seaming, sealing, and sterilizing the container,** Yoseph Bar-Cohen, Mircea Badescu, Stewart Sherrit, Xiaoqi Bao, Cameron Lindsey, Thomas Kutzer, Eduardo Salazar, Jet Propulsion Lab. (USA) . . . . .[10596-49]

8:20 am: **The effects of surface topography control using liquid crystal elastomers on bodies in flow**, Michael Settle, Richard Beblo, Univ. of Dayton Research Institute (USA) and Air Force Research Lab. (USA); Gregory W. Reich, Timothy White, Air Force Research Lab. (USA); Tyler Guin, Air Force Research Lab. (USA) and Azimuth Corp. (USA).[10596-50]

8:40 am: **Strength and failure analysis of composite-to-composite adhesive bonds with different surface preparations**, Nikhil Paranjpe, Eylem Asmatulu, Muhammad M. Rahman, Ramazan Asmatulu, Wichita State Univ. (USA) . . . . . .[10596-51]

9:00 am: **Isolation of Aramid nanofibers for high strength multiscale fiber reinforced composites,** Jiajun Lin, Univ. of Michigan (USA); Brendan A. Patterson, Univ. of Florida (USA); Mohammad H. Malakooti, Henry A. Sodano, Univ. of Michigan (USA) . . . . . .[10596-52]

9:20 am: **Passive flow-induced vibration response and stability of flexible composite plates in viscous flows,** Deniz Tolga Akcabay, Yin Lu Young, Univ. of Michigan (USA) . . . . . .[10596-53]

9:40 am: **Evaluation of thermally aged carbon fiber/epoxy composites using acoustic emission, electrical resistance, and thermogram**, Joung-Man Park, Gyeongsang National Univ. (Korea, Republic of) and The Univ. of Utah (USA); Pyung-Su Shin, Jong-Hyun Kim, Young-Min Baek, Ha-Sung Park, Gyeongsang National Univ. (Korea, Republic of); Lawrence K. DeVries, The Univ. of Utah (Korea, Republic of) . . . . . .[10596-54]

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

CONFERENCE 10598

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

Sessions 10A and 10B run concurrently.

SESSION 10A

LOCATION: CRESTONE SALON B
THU 8:20 AM TO 10:20 AM

Fiber Optic Sensors for Structural Health Monitoring I

Session Chairs: **Ying Huang,** North Dakota State Univ. (USA); **R. Brian Jenkins,** U.S. Naval Academy (USA)

8:20 am: **In-pavement fiber Bragg grating sensor for vehicle speed and wheelbase estimation**, Mu'ath Al-Tarawneh, Ying Huang, North Dakota State Univ. (USA)[10598-84]

8:40 am: **Strain measurement on the surface of diametrically loaded acrylic sphere with a distributed fiber optic sensor**, Matthew Klegseth, Yi Bao, Genda Chen, Missouri Univ. of Science and Technology (USA) . . . . . [10598-85]

9:00 am: **A pendulum based optical fiber inclinometer with nanoradian resolution,** Yiyang Zhuang, Jie Huang, Missouri Univ. of Science and Technology (USA) . . . . . [10598-86]

9:20 am: **Response of an embedded distributed optical fiber sensor to directed energy and applied strain**, R. Brian Jenkins, Peter Joyce, Charles Nelson, U.S. Naval Academy (USA) . . . . . [10598-87]

9:40 am: **A distributed optical fiber sensing system for data center thermal monitoring**, Zhen Chen, Shuyi Pei, The Univ. of Rhode Island (USA); Bo Tang, Hofstra Univ. (USA); Gerald Hefferman, The Univ. of Rhode Island (USA) and Brown Univ. (USA); Haibo He, Qing Yang, Tao Wei, The Univ. of Rhode Island (USA) . . . . . [10598-88]

10:00 am: **Research on subsea pipeline scour monitoring using distributed Raman optical sensing technique**, Xinwang Zhang, China Construction Eighth Engineering Division (China); Xuefeng Zhao, Dalian Univ. of Technology (China) . . . . [10598-89]

Coffee BreakThu 10:20 to 10:50 am

SESSION 10B

LOCATION: ASPEN B
THU 8:20 AM TO 10:00 AM

Novel Sensing Technologies III

Session Chairs: **Sridhar Krishnaswamy,** Northwestern Univ. (USA); **Ying Huang,** North Dakota State Univ. (USA)

8:20 am: **Bolt looseness detection using pulsed laser scanning system**, Jooyoung Park, Seunghee Park, Changgil Lee, Kassahun Demmisie Tola, Sungkyunkwan Univ. (Korea, Republic of). . . . . [10598-90]

8:40 am: **The development of shape information model for efficient BIM by 3D laser scanning and the Octree ,** Gichun Cha, Seunghee Park, Sungkyunkwan Univ. (Korea, Republic of). . . . . [10598-91]

9:00 am: **Pavement bottom-up crack detection using in-pavement point sensors**, Mohanad Alshandah, Ying Huang, Pan Lu, Denver Tolliver, North Dakota State Univ. (USA)[10598-93]

9:20 am: **Monitoring solid metal structures with a nervous system embedded with ultrasonic 3D printing**, Jonathan D. Suter, Curtis Larimer, Kayte Denslow, Pacific Northwest National Lab. (USA) . . . . . [10598-94]

9:40 am: **Grating based high-frequency ultrasonic sensors**, Heming Wei, Abhishek Amrithanath, Sridhar Krishnaswamy, Northwestern Univ. (USA) . . . . . [10598-95]

Coffee BreakThu 10:00 to 10:30 am

CONFERENCE 10599

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

Sessions 10A and 10B run concurrently.

SESSION 10A

LOCATION: CRYSTAL SALON A
THU 8:00 AM TO 10:00 AM

Guided Wave SHM/ NDE

Session Chairs: **Xiaoning Jiang,** North Carolina State Univ. (USA); **Peter J. Shull,** The Pennsylvania State Univ. (USA)

8:00 am: **High temperature ultrasound NDT using photoacoustic Lamb waves and AlN sensors**, Taeyang Kim, Jinwook Kim, Xiaoning Jiang, North Carolina State Univ. (USA) . . . . . [10599-48]

8:20 am: **Fatigue disbonding analysis of wide composite panels by means of Lamb waves**, Lenka Michalcová, VZLÚ, a.s. (Czech Republic). . . . . [10599-49]

8:40 am: **Recent developments on the generation and detection of highly nonlinear solitary waves for NDE applications**, Amir Nasrollahi, Piervincenzo Rizzo, Univ. of Pittsburgh (USA)[10599-50]

9:00 am: **Standing surface acoustic wave technology applied for micro-particle concentration in oil**, Ziping Wang, Xian Xue, Ying Luo, Jiangsu Univ. (China); Fuh-Gwo Yuan, North Carolina State Univ. (USA) . . . . . [10599-51]

9:20 am: **Non-destructive inspection of debond in reinforced concrete structures using guided wave**, Wei Shen, Dongsheng Li, Jinping Ou, Dalian Univ. of Technology (China) . . . . . [10599-52]

9:40 am: **A multiple stage method of damage detection based on Lamb waves**, Zheng Li, Jiahong Qi, Jianlin Chen, Peking Univ. (China) . . . . . [10599-53]

Coffee BreakThu 10:00 to 10:30 am

SESSION 10B

LOCATION: QUARTZ BOARDROOM
THU 8:00 AM TO 11:50 AM

SHM/NDE Sensor Modeling

Session Chairs: **Piotr Omenzetter,** Univ. of Aberdeen (United Kingdom); **Simon Laflamme,** Iowa State Univ. of Science and Technology (USA)

8:00 am: **Toward passive sensing through reconstructed Green's function in structural health monitoring**, YuSheng Chang, National Institute of Aerospace (USA) and North Carolina State Univ. (USA) . . . . . [10599-54]

8:20 am: **Assessment of dye penetrant crack detectability in external corners using similarity analysis**, Ajay M. Koshti, NASA Johnson Space Ctr. (USA)[10599-55]

8:40 am: **Eddy current crack detection capability assessment approach using crack specimens with differing electrical conductivity**, Ajay M. Koshti, NASA Johnson Space Ctr. (USA)[10599-56]

9:00 am: **Finite element simulation of photoacoustic fiber optic sensors for surface corrosion detection on a steel rod**, Qixiang Tang, Jones Owusu Twumasi, Jie Hu, Xingwei Wang, Tzuyang Yu, Univ. of Massachusetts Lowell (USA) . . . . . [10599-57]

9:20 am: **Determination of elastic constants of Langatate single crystals through ultrasound velocity measurements**, Haifeng Zhang, Univ. of North Texas (USA) . . . . . [10599-58]

9:40 am: **Bayesian estimation of material damage pattern using through-thickness dielectric measurements,** Mushuang Liu, Yan Wan, The Univ. of Texas at Arlington (USA) . . . . . [10599-59]

Coffee BreakThu 10:00 to 10:30 am

CONFERENCE 10600

Health Monitoring of Structural and Biological Systems XII

Sessions 10A and 10B run concurrently.

SESSION 10A

LOCATION: CRIPPLE CREEK 2
THU 8:00 AM TO 10:00 AM

Elastic and Metamaterial IV

Session Chairs: **Fabio Semperlotti,** Purdue Univ. (USA); **Mostafa A. Nouh,** Univ. at Buffalo (USA)

8:00 am: **Interpreting phononic Bragg band gaps through finite system dynamics and transfer functions**, Hasan Al Ba'ba'a, Mostafa A. Nouh, Tarunraj Singh, Univ. at Buffalo (USA) . . [10600-64]

8:20 am: **Investigation on multi-occurrence of Dirac cone and exceptional ring,** Mustahseen Indaleeb, Hossain Ahmed, Sourav Banerjee, Univ. of South Carolina (USA) . . . . . [10600-65]

8:40 am: **An active metasurface for real-time multifunctional elastic wave control,** Yangyang Chen, Xiaopeng Li, Guoliang Huang, Univ. of Missouri (USA) . . . . . [10600-66]

9:00 am: **Achieving double-zero effective properties in elastic waveguides,** Hongfei Zhu, Univ. of Notre Dame (USA); Fabio Semperlotti, Purdue Univ. (USA) . . . . . [10600-67]

9:20 am: **3D phononic crystal with ultra-wide bandgaps**, Amir Ashkan Mokhtari, Yan Lu, Ankit Srivastava, Illinois Institute of Technology (USA) . . . . . [10600-68]

9:40 am: **Nanoscale surface phononic crystals for characterization of complex and periodic materials using extreme ultraviolet light**, Travis Frazer, Joshua L. Knobloch, Begoña Abad Mayor, Jorge N. Hernandez-Charpak, Henry Kapteyn, Margaret Murnane, JILA (USA) . . [10600-69]

Coffee BreakThu 10:00 to 10:30 am

SESSION 10B

LOCATION: SILVERTON SALON 1
THU 8:20 AM TO 10:00 AM

Modeling/Simulation and Experiment for Nonlinear/ Linear Ultrasonic Techniques II

Session Chairs: **Kyung-Young Jhang,** Hanyang Univ. (Korea, Republic of); **Hadi Hafezi,** The Univ. of Arizona (USA)

8:20 am: **A spectral method for computing guided waves in stressed plates and rods**, Brennan Dubuc, Arvin Ebrahimkhanlou, Salvatore Salamone, The Univ. of Texas at Austin (USA) . . . . . [10600-70]

8:40 am: **Passive and active monitoring for defect detection and quantification in composites**, Neha Chandarana, Constantinos Soutis, Matthieu Gresil, The Univ. of Manchester (United Kingdom) . . . . . [10600-71]

9:00 am: **On the modeling of acoustic wave propagation for the interpretation of acoustoelastic experiments,** Anna Castellano, Aguinaldo Fraddosio, Mario Daniele Piccioni, Politecnico di Bari (Italy) [10600-72]

9:20 am: **Non-destructive evaluation of the damage in an adhesive bonding using nonlinear ultrasonic technique**, Guoshuang Shui, Beijing Jiaotong Univ. (China) . . . . . [10600-74]

9:40 am: **Non-destructive assessment of knot free timber in plantation eucalypts: a case study in a Tasmania eucalyptus niten plot**, Mohammad Sadegh Taskhiri, Paul Turner, Univ. of Tasmania (Australia) . . . [10600-75]

Coffee BreakThu 10:00 to 10:30 am

THURSDAY 8 MARCH

CONFERENCE 10594

Sessions 10A and 10B run concurrently.

SESSION 10A

LOCATION: SILVERTON SALON 2
THU 10:30 AM TO 11:50 AM

Applications of IPMC

Session Chairs: **Jian Zhu,** National Univ. of Singapore (Singapore); **Lenore Rasmussen,** Ras Labs., LLC (USA)

10:30 am: **IPMC flow sensor exploiting self-generated vortices**, Montassar Aidi A. Sharif, Xiaobo Tan, Michigan State Univ. (USA) . . . . . [10594-44]

10:50 am: **Fabrication of ultra-thin IPMC actuator for flapping motion**, Yanjie Wang, Hohai Univ. (China); Bin Luo, Xi'an Jiaotong Univ. (China); Denglin Zhu, Hohai Univ. (China) . . . . . [10594-45]

11:10 am: **Optimal position control of ionic polymer metal composite using particle swarm optimization**, Sujoy Mukherjee, PDPM Indian Institute of Information Technology, Design & Manufacturing Jabalpur (India) .[10594-46]

11:30 am: **Six-legged terrestrial walking robot using spatial 2DOF Ionic Polymer-Metal Composite (IPMC) structures**, Changsheng Bian, Chao Tang, Zicai Zhu, Zhuoyuan Li, Hualing Chen, Xi'an Jiaotong Univ. (China) . . . . . [10594-47]

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

SESSION 10B

LOCATION: CRIPPLE CREEK 1
THU 10:30 AM TO 11:50 AM

Conducting Polymers

Session Chairs: **Rocco Vertechy,** Univ. degli Studi di Bologna (Italy); **Xin Lan,** Harbin Institute of Technology (China)

10:30 am: **Artificial muscle from graphene and carbon nanotube**, Jae Sang Hyeon, Seon Jeong Kim, Hanyang Univ. (Korea, Republic of). . . . . [10594-48]

10:50 am: **Bio-inspired high-performance artificial muscles using 3D-networked carbon nanostructures**, Jaehwan Kim, Il-Kwon Oh, KAIST (Korea, Republic of) . . . . . [10594-49]

11:10 am: **Mechanical and actuating properties of Ppy/DBS dependency with the synthesis parameters**, Victor H. Pascual, Toribio Otero, Univ. Politécnica de Cartagena (Spain); Johanna Schumacher, Arquimea Ingeniería, S.L.U. (Spain); Laura Valero, Univ. Politécnica de Cartagena (Spain) . . . . . [10594-50]

11:30 am: **All-solid state ionic actuator based on polymeric ionic liquids and electronic conducting polymer**, Frédéric Braz Ribeiro, Cédric Plesse, Giao T. M. Nguyen, Lab. de Physicochimie des Polymères et des Interfaces, Univ. de Cergy-Pontoise (France); Sofia M. Morozova, A.N. Nesmeyanov Institute of Organoelement Compounds (Russian Federation); Eric Drockenmuller, Univ. Claude Bernard Lyon 1 (France); Alexander S. Shaplov, Luxembourg Institute of Science and Technology (Luxembourg); Frédéric Vidal, Lab. de Physicochimie des Polymères et des Interfaces, Univ. de Cergy-Pontoise (France) . . . . . [10594-51]

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

CONFERENCE 10595

Sessions 11A and 11B run concurrently.

SESSION 11A

LOCATION: CRESTONE SALON A
THU 10:30 AM TO 11:50 AM

Smart Sensing and Signal Processing for Diagnostics

Session Chairs: **Heung Soo Kim,** Dongguk Univ. (Korea, Republic of); **Fabrizio Barone,** Univ. degli Studi di Salerno (Italy)

10:30 am: **New control strategies with inertial monolithic sensors: advantages and limitations in the control of benches and platforms for seismic isolation**, Fabrizio Barone, Gerardo Giordano, Univ. degli Studi di Salerno (Italy) . . . . [10595-79]

10:50 am: **Using structural control force as a feature in structural health monitoring systems**, Maryam Bitaraf, Hooman Shirzadi D.D.S., Hossein Kharrazi, Univ. of Tehran (Iran, Islamic Republic of) . . . . . [10595-80]

11:10 am: **A rotational energy harvester for wireless health condition monitoring by utilizing intrinsic structure of bearing**, Ying Zhang, Ying Zhang, Junyi Cao, Jing Lin, Xi'an Jiaotong Univ. (China). [10595-81]

11:30 am: **Exploiting self sensing features of CNT composite structures for active control of vibration**, Simone Cinquemani, Diego Scaccabarozzi, Claudio Sbaruffatti, Politecnico di Milano (Italy); Alberto J. Suarez, Univ. Rey Juan Carlos (Spain) . . . . . [10595-115]

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

SESSION 11B

LOCATION: LEADVILLE
THU 10:30 AM TO 11:50 AM

Piezoelectric Materials and Systems II

Session Chairs: **Ahmet Ozkan Ozer,** Western Kentucky Univ. (USA); **Shahrzad Towfighian,** Binghamton Univ. (USA)

10:30 am: **Modeling of a multi-electrode traveling wave piezoelectric element**, Thomas Martinez, Lab. SATIE (France); Gaël Pillonnet, CEA-LETI (France); Dejan Vasic, Lab. SATIE (France) and Univ. de Cergy-Pontoise (France); François Costa, Lab. SATIE (France) and Univ. Paris-Est Créteil (France) . . . . . [10595-82]

10:50 am: **Modeling and stabilization of a nonlinear piezoelectric laminate**, Ahmet Ozkan Ozer, Western Kentucky Univ. (USA) . . . . . [10595-83]

11:10 am: **Driving frequency optimization for a one-frequency-two-mode piezoelectric linear motor**, Chu Tsung-Yu, National Taiwan Univ. (Taiwan). .[10595-84]

11:30 am: **Internal resonance of T-shaped structure for energy harvesting with magnetic nonlinearity**, Amirhassan Abbasi, Alwathiqbellah Ibrahim, The State Univ. of New York at Binghamton (USA); Shahrzad Towfighian, The State Univ.of New York at Binghamton (USA) .[10595-85]

Lunch Break . . . . Thu 11:50 am to 1:00 pm

CONFERENCE 10596

SESSION 11

LOCATION: ASPEN A
THU 10:30 AM TO 11:50 AM

Physically Responsive Materials

Session Chairs: **Ralph C. Smith,** North Carolina State Univ. (USA); **Reza Rizvi,** The Univ. of Toledo (USA)

10:30 am: **Various design approaches to achieve electric field-driven segmented folding actuation of electroactive polymer (EAP) sheets**, Zoubeida Ounaies, The Pennsylvania State Univ. (USA) . . . . . [10596-71]

10:50 am: **Time-dependent chemo-electro-mechanical behavior of hydrogel-based structures**, Peter Leichsenring, TU Dresden (Germany) . . . . . [10596-55]

11:10 am: **Multi-functional IPMC exhibiting electro-mechanical and pneumatics to create a complex hybrid actuator**, Justin Neubauer, Kwang Jin Kim, Univ. of Nevada, Las Vegas (USA) . . . . . [10596-56]

11:30 am: **A novel photoresponsive soft actuator for morphing applications**, Ashish Kapoor, Kony Chatterjee, Tushar K. Ghosh, North Carolina State Univ. (USA) . . . . . [10596-58]

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

SESSION 12

LOCATION: ASPEN A
THU 1:40 PM TO 3:00 PM

Multifunctional Materials Applications

Session Chairs: **Amir Ameli,** Washington State Univ. Tri-Cities (USA); **Simone Cinquemani,** Politecnico di Milano (Italy)

1:40 pm: **Optimal power, power limit and damping of vibration Piezoelectric power harvesters**, Yabin Liao, Pennsylvania State University - Erie (USA); Henry A. Sodano, Univ. of Michigan (USA) . . . . . [10596-72]

2:00 pm: **Interfacial characterization of flexible hybrid electronics**, Sara Najafian, Scott Stapleton, Alireza Vakil Amirkhizi, Univ. of Massachusetts Lowell (USA) . . . . . [10596-73]

Conference End.

CONFERENCE 10598

Sessions 11A and 11B run concurrently.

SESSION 11A

LOCATION: CRESTONE SALON B
THU 10:50 AM TO 12:10 PM

Sensor Development and Applications

Session Chairs: **Hae-Bum A. Yun,** Univ. of Central Florida (USA)

10:50 am: **Comparison of attitude and heading reference systems using foot mounted MIMU sensor data: basic, Madgwick, and Mahony**, Simone Ludwig, Kaleb Burnham, North Dakota State Univ. (USA); Antonio Jimenez, Consejo Superior de Investigaciones Científicas (Spain); Pierre Touma, Axelo Inc. (USA) .[10598-96]

11:10 am: **An FPGA-based coherence enhancement method in frequency chirped lasers toward lidar and distributed sensing applications in future smart cities**, Zheyi Yao, Zhen Chen, Gerald Hefferman, Tao Wei, The Univ. of Rhode Island (USA). . . .[10598-97]

11:30 am: **Electronic properties of cement-based composite contains carbon black**, Tao Du, Huigang Xiao, Hui Li, Harbin Institute of Technology (China). . . . . .[10598-98]

11:50 am: **Real-time roadside sign detection using R-CNNs on low-power high-performance portable computer**, Hae-Bum A. Yun, Gerardo Leon, Univ. of Central Florida (USA) . . . . . .[10598-99]

Lunch Break . . . . Thu 12:10 pm to 2:00 pm

SESSION 11B

LOCATION: ASPEN B
THU 10:30 AM TO 12:30 PM

New Technological Advances

Session Chair: **Wei-Hsin Liao,** The Chinese Univ. of Hong Kong (Hong Kong, China)

10:30 am: **Study on mix proportion for self-stress non-dispersible underwater C30 concrete**, Fashui Liu, Fuzhou Highway Bureau (China); Shaofeng Wu, Shaofei Jiang, Sheng Shen, Heng Zhang, Fuzhou Univ. (China). . . . . .[10598-100]

10:50 am: **A smart energy harvester for capturing negative work of human ankle dorsiflexion**, Mingjing Cai, Wei-Hsin Liao, The Chinese Univ. of Hong Kong (Hong Kong, China) . . . . . .[10598-101]

11:10 am: **The effects of damage accumulation in optimizing a piezoelectric energy harvester configuration**, Eric J. Kjolsing, Structural Integrity Associates, Inc. (USA); Michael D. Todd, Univ. of California, San Diego (USA). . . . . .[10598-102]

11:30 am: **The possibility of harvesting electrical energy from industrial noise barriers using meta-wall bricks**, Fariha Mir, Mohammad Sadegh Saadatzi, Sourav Banerjee, Univ. of South Carolina (USA). . . . . .[10598-103]

11:50 am: **Output analysis of swarm of neural oscillators stimulated by earthquake-induced acceleration responses of a structure,** Hideya Tokumura, Daisuke Iba, Kyoto Institute of Technology (Japan); Junichi Hongu, Tottori Univ. (Japan); Sohei Shima, Ichiro Moriwaki, Kyoto Institute of Technology (Japan). . . . . .[10598-104]

12:10 pm: **Smart cements: repairs and sensors for concrete assets**, Lorena Biondi, Andrea Hamilton, Univ. of Strathclyde (United Kingdom) .[10598-105]

Lunch Break . . . . Thu 12:30 pm to 1:30 pm

CONFERENCE 10599

SESSION 10B CONTINUED

10:30 am: **Comparison of two optimization algorithms for fuzzy finite element model updating for damage detection in wind turbine blades,** Piotr Omenzetter, Univ. of Aberdeen (United Kingdom) . . . . . [10599-60]

10:50 am: **International Roughness Index (IRI) measurement using Hilbert-Huang transform**, Wenjin Zhang, Ming Wang, Northeastern Univ. (USA). . . . . [10599-61]

11:10 am: **A tomography reconstruction method for damage diagnosis of wood structure in construction field**, Qiwen Qiu, Denvid Lau, City Univ. of Hong Kong (Hong Kong, China)[10599-62]

11:30 am: **Durability assessment of soft elastomeric capacitor skin for SHM of wind turbine blades**, Anna Laura Pisello, Elena Fortunati, Univ. degli Studi di Perugia (Italy); Austin Downey, Iowa State Univ. of Science and Technology (USA); Claudia Fabiani, Franco Cotana, Filippo Ubertini, Univ. degli Studi di Perugia (Italy); Simon Laflamme, Iowa State Univ. of Science and Technology (USA) . . . .[10599-12]

SESSION 11

LOCATION: CRYSTAL SALON A
THU 10:30 AM TO 11:50 AM

Industrial-Process Control NDE/NDT I

Session Chairs: **Zhili Feng,** Oak Ridge National Lab. (USA); **Lei Zuo,** Virginia Polytechnic Institute and State Univ. (USA)

10:30 am: **Monitoring and evaluation of wire mesh forming life**, Emmanuel Enemuoh, Univ. of Minnesota Duluth (USA); Ping Zhao, Alec Kadlec, Univ. of Minnesota, Duluth (USA). . . . [10599-63]

10:50 am: **Pulsed infrared thermography for assessment of ultrasonic welds**, Megan McGovern, Teresa Rinker, Ryan Sekol, General Motors Global Research and Development (USA). . . . . [10599-64]

11:10 am: **Real-time nondestructive monitoring of the gas metal arc welding (GMAW) process by combined airborne acoustic emission and non-contact ultrasonics**, Lu Zhang, Alexandra-Del-Carmen Basantes-Defaz, Zeynab Abbasi, Univ. of Illinois at Chicago (USA); Donald E. Yuhas, Industrial Measurement Systems Inc. (USA); Didem Ozevin, Ernesto Indacochea, Univ. of Illinois at Chicago (USA) . . . . . [10599-65]

11:30 am: **Laser process monitoring: where we are now, where we want to be, and what is needed to get there**, Mark Rodighiero, Amada Miyachi America, Inc. (USA). . . . . [10599-66]

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

CONFERENCE 10600

Sessions 11A and 11B run concurrently.

SESSION 11A

LOCATION: CRIPPLE CREEK 2
THU 10:30 AM TO 11:50 AM

Elastic and Metamaterial V

Session Chairs: **Zhongqing Su,** The Hong Kong Polytechnic Univ. (Hong Kong, China); **Andrei N. Zagrai,** New Mexico Institute of Mining and Technology (USA)

10:30 am: **Challenges and constraints in the application of resonance-based metamaterials for vibration isolation**, William Johnson, Massimo Ruzzene, Georgia Institute of Technology (USA). . . . . .[10600-76]

10:50 am: **Lightweight tensegrity metastructure for tunable vibration suspension and wave control**, Yitian Wang, Rui Zhu, Gengkai Hu, Xiaoning Liu, Beijing Institute of Technology (China). . . . . .[10600-77]

11:10 am: **Non-reciprocal acoustic transmission through a dissipative phononic crystal with asymmetric scatterers**, Arkadii Krokhin, Arup Neogi, Ezekiel Walker, Andrey Bozhko, Univ. of North Texas (USA). .[10600-78]

11:30 am: **Elastic wave propagation and scattering in layered phononic crystals with periodically and stochastically distributed planar cracks and delaminations**, Mikhail Golub, Olga V. Doroshenko, Kuban State Technological Univ. (Russian Federation); Chuanzeng Zhang, Univ. Siegen (Germany). . . . . .[10600-79]

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

SESSION 11B

LOCATION: SILVERTON SALON 1
THU 10:30 AM TO 11:50 AM

Modeling/Simulation and Experiment for Nonlinear/Linear Ultrasonic Techniques III

Session Chairs: **Hadi Hafezi,** The Univ. of Arizona (USA); **Mohammad Sadegh Taskhiri,** Univ. of Tasmania (Australia)

10:30 am: **Analysis of S0/A0 guided wave mode conversion phenomenon**, Tomasz Wandowski, Pawel Malinowski, Pawel Kudela, Wieslaw Ostachowicz, The Szewalski Institute of Fluid-Flow Machinery (Poland). . . . . [10600-80]

10:50 am: **Numerical techniques for the simulation of the Lamb wave propagation in a blended GFRP winglet**, Alessandro De Luca, Donato Perfetto, Univ. degli Studi della Campania Luigi Vanvitelli (Italy); Giuseppe Petrone, Angelo De Fenza, Univ. degli Studi di Napoli Federico II (Italy); Francesco Caputo, Univ. degli Studi della Campania Luigi Vanvitelli (Italy) . . . . . .[10600-81]

11:10 am: **Elastic wave propagation in soft laminates undergoing large deformation**, Stephan Rudykh, Pavel Galich, Technion-Israel Institute of Technology (Israel) . . . . . .[10600-84]

11:30 am: **SHM of aerospace bonded structures with improved techniques based on NEWS**, Gennaro Scarselli, Francesco Nicassio, Stefano Carrino, Univ. del Salento (Italy). . . . [10600-96]

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

CONFERENCE 10594

Sessions 11A and 11B run concurrently.

SESSION 11A

LOCATION: SILVERTON SALON 2
THU 1:20 PM TO 3:00 PM

EAP Sensors

Session Chairs: **Samuel Rosset,** Ecole Polytechnique Fédérale de Lausanne (Switzerland); **Liwu Liu,** Harbin Institute of Technology (China)

1:20 pm: **Robust automatic self-sensing based charge management for dielectric elastomer generators**, Plinio Rodrigues de Oliveira Zanini, Univ. of Bristol (United Kingdom); Gianluca Rizzello, Stefan Seelecke, Univ. des Saarlandes (Germany); Martin Homer, Jonathan Rossiter, Univ. of Bristol (United Kingdom) . . . . . .[10594-52]

1:40 pm: **Pressure monitoring inside a polymer tube based on a dielectric elastomer membrane sensor**, Philipp Loew, Gianluca Rizzello, Stefan Seelecke, Univ. des Saarlandes (Germany)[10594-53]

2:00 pm: **A variable R-C transmission line model for resistive stretch sensors**, Andreas Tairych, The Univ. of Auckland (New Zealand); Iain A. Anderson, The Univ. of Auckland (New Zealand) and StretchSense (New Zealand) . . .[10594-54]

2:20 pm: **An uncooled pyroelectric infrared detector with high performance based on P(VDF-TrFE)**, Liwu Liu, Guanghua Hou, Yanju Liu, Jinsong Leng, Harbin Institute of Technology (China) . . . . . .[10594-55]

2:40 pm: **Capacitive coupling as a new form of signal transmission in underwater dielectric elastomer sensing**, Christopher R. Walker, Samuel Rosset, The Univ. of Auckland (New Zealand); Iain A. Anderson, The Univ. of Auckland (New Zealand) and StretchSense (New Zealand). . . . . .[10594-56]

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

SESSION 11B

LOCATION: CRIPPLE CREEK 1
THU 1:20 PM TO 3:00 PM

Applications of EAP II

Session Chairs: **Herbert R. Shea,** Ecole Polytechnique Fédérale de Lausanne (Switzerland); **Marco Fontana,** Univ. degli Studi di Trento (Italy)

1:20 pm: **Beyond dielectric elastomer generators: energy harvesting with variable electric double layer capacitors**, Timothy G. Morrissey, Alex Jaros D.D.S., Shane K. Mitchell, Univ. of Colorado Boulder (USA); Eric Ambos, StretchSense (USA); Christoph Keplinger, Univ. of Colorado Boulder (USA). . . . . .[10594-57]

1:40 pm: **A pressure gradient sensor inspired by canal neuromasts of fish**, Montassar Aidi A. Sharif, Xiaobo Tan, Michigan State Univ. (USA) . . . .[10594-58]

2:00 pm: **Autonomous electrostatic generator for energy harvesting applications under inertial load**, Clara Lagomarsini, Achraf Kachroudi, G2Elab (France); Skandar Basrour, TIMA Lab. (France); Claire Jean-Mistral, LaMCoS, Institut National des Sciences Appliquées de Lyon (France); Alain Sylvestre, G2Elab (France) . . . . . .[10594-59]

2:20 pm: **Design and experiment of an omnidirectional creeping soft robot driven by dielectric elastomer**, Li Wen-Bo, Zhang Wen-Ming, Li Xin-Qiang, Shanghai Jiao Tong Univ. (China)[10594-60]

2:40 pm: **Smart squid skin: patterns in networks of artificial chromatophores**, Aaron Fishman, Sal Catsis, Martin Homer, Jonathan M. Rossiter, Univ. of Bristol (United Kingdom) . . . . . .[10594-61]

CONFERENCE 10595

Sessions 12A and 12B run concurrently.

SESSION 12A

LOCATION: CRESTONE SALON A
THU 1:20 PM TO 3:00 PM

Shape Memory Materials and Systems

Session Chairs: **Alexandros Solomou,** Texas A&M Univ. (USA); **Darren J. Hartl,** Texas A&M Univ. (USA)

1:20 pm: **Force and position control of SMA spring bundle-based artificial muscle actuated by hot and cool water**, Cheol Hoon Park, Young Su Son, Korea Institute of Machinery & Materials (Korea, Republic of). . . . . .[10595-86]

1:40 pm: **Constitutive response of precipitation hardened NiTiHf through micromechanical modeling,** Jobin K. Joy, Alexandros Solomou, Theocharis Baxevanis, Dimitris C. Lagoudas, Texas A&M Univ. (USA). . . . . .[10595-88]

2:00 pm: **Focused ultrasound actuated shape-memory polymer drug delivery containers**, Aarushi Bhargava, Shima Shahab, Reza Mirzaeifar, Ben Ailinger, Kaiyuan Peng, Virginia Polytechnic Institute and State Univ. (USA). . . . . .[10595-89]

2:20 pm: **Demonstration of a shape memory alloy torque tube-based morphing radiator**, Jorge B. Chong, Darren J. Hartl, Texas A&M Univ. (USA). . . . . .[10595-90]

2:40 pm: **A two-way architectural actuator using NiTi SE wire and SME spring**, Mohammadreza Nematollahi, Reza Mehrabi, Miguel A. Callejas, Hedyeh Elahinia, Mohammad Elahinia, The Univ. of Toledo (USA). . . . . .[10595-134]

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

SESSION 12B

LOCATION: LEADVILLE
THU 1:00 PM TO 3:00 PM

Metamaterials and Metastructures II

Session Chairs: **Jiong Tang,** Univ. of Connecticut (USA); **M. Amin Karami,** Univ. at Buffalo (USA)

1:00 pm: **Source illusion of Lamb waves controlled by adaptive elastic metasurfaces**, Shilong Li, Jiawen Xu, Pei Cao, Jiong Tang, Univ. of Connecticut (USA). . . . . .[10595-91]

1:20 pm: **Tailoring vibration mode of a uniform beam by acoustic metamaterial synthesis**, Jiong Tang, Jiawen Xu, Univ. of Connecticut (USA) . . . . . .[10595-92]

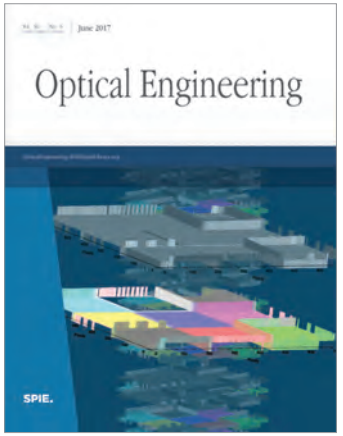
1:40 pm: **Why is a defect band created within bandgap of elastic metamaterials?**, Soo-Ho Jo, Heonjun Yoon, Yong Chang Shin, Byeng Dong Youn, Seoul National Univ. (Korea, Republic of) . . . . . .[10595-93]

2:00 pm: **Active break of wave transmission reciprocity through spatio-temporal periodic structures**, Gabriele Cazzulani, Jacopo Marconi, Francesco Braghin, Politecnico di Milano (Italy) . . . . . .[10595-94]

2:20 pm: **Flexural wave propagation in nonlinear foldable metamaterial**, Aditya Nanda, M. Amin Karami, Univ. at Buffalo (USA). . . . . .[10595-95]

2:40 pm: **Minimization of evanescent field in one-dimensional finite elastic metamaterial**, Yong Chang Shin, Heonjun Yoon, Soo-Ho Jo, Byeng Dong Youn, Seoul National Univ. (Korea, Republic of) . . . . . .[10595-133]

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



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CONFERENCE 10598

Sessions 12A and 12B run concurrently.

SESSION 12A

LOCATION: CRESTONE SALON B
THU 2:00 PM TO 3:00 PM

Integration of Smart Sensing Systems

Session Chairs: **Gi-Woo Kim,** INHA Univ. (Korea, Republic of); **Ying Huang,** North Dakota State Univ. (USA)

2:00 pm: **Simultaneous velocity and pressure measurement in air using pressure-sensitive flow tracers**, Peng Zhang, NYU Tandon School of Engineering (USA); Sean D. Peterson, Univ. of Waterloo (Canada); Maurizio Porfiri, NYU Tandon School of Engineering (USA) . . . . . [10598-106]

2:20 pm: **Auto-Gopher-II: a wireline rotary-hammer ultrasonic drill that operates autonomously**, Mircea Badescu, Yoseph Bar-Cohen, Stewart Sherrit, Xiaoqi Bao, Shannon Jackson, Brandon C. Metz, Alan C. Simonini, Jet Propulsion Lab. (USA); Kris Zacny, Bolek Mellerowicz, Daniel Kim, Gale L. Paulsen, Honeybee Robotics (USA) . . . . . [10598-107]

2:40 pm: **System identification and vibration based damage detection in a concrete shear wall system**, Ali Soltani, Ardalan Sabamehr, Ashutosh Bagchi, Concordia Univ. (Canada) . . . . . [10598-109]

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

SESSION 12B

LOCATION: ASPEN B
THU 1:30 PM TO 3:10 PM

Interrogation of Structures II

Session Chairs: **Jung-Wuk Hong,** KAIST (Korea, Republic of); **Wanqiu Liu,** Dalian Univ. of Technology (China)

1:30 pm: **Determination of wave velocity for source location of foundation**, Minkoan Kim, Hyunwoo Kim, Tae-Min Oh, Jong-Won Lee, Korea Institute of Geoscience & Mineral Resources (Korea, Republic of) . . .[10598-110]

1:50 pm: **A study on the detection of compressed microcrack by nonlinear wave modulation technique**, Sang Eon Lee, Hyung Jin Lim, Suyeong Jin, Hoon Sohn, Jung-Wuk Hong, KAIST (Korea, Republic of). . . . . .[10598-111]

2:10 pm: **3D printed origami as a realization of analysis-driven morphing structures**, Alexander M. Pankonien, Air Force Research Lab. (USA); Kazuko Fuchi, Nitin Bhagat, Univ. of Dayton Research Institute (USA); Ryan Durscher, Andrew S. Gillman, Air Force Research Lab. (USA) . .[10598-112]

2:30 pm: **Variability analysis of asphalt mixture beam bending test**, Wanqiu Liu, Wen Lu, Xu Liu, Dalian Univ. of Technology (China); Lei Zhang, Key Laboratory of Road Structure & Material Ministry of Transport (China) . . . . .[10598-113]

2:50 pm: **Enable finite element model updating for electrical impedance tomography upon identifying damage with different levels of severity**, Yingjun Zhao, Martin Schagerl, Johannes Kepler Univ. Linz (Austria) . . . .[10598-114]

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

CONFERENCE 10599

SESSION 12

LOCATION: CRYSTAL SALON A
THU 1:20 PM TO 2:0 0 PM

Industrial/Process Control NDE/NDT II

Session Chairs: **Zhili Feng,** Oak Ridge National Lab. (USA); **Lei Zuo,** Virginia Polytechnic Institute and State Univ. (USA)

1:20 pm: **Photo-elastic stress metrology for flat panel and flexible displays**, Wojtek J. Walecki, Frontier Semiconductor, Inc. (USA) . . . . . [10599-67]

1:40 pm: **Ultrasonic guided wave inspection of defects in stiffener on a plate**, Md Yeasin Bhuiyan, Mohammad Faisal Haider, Univ. of South Carolina (USA); Banibrata Poddar, Intelligent Automation, Inc. (USA); Victor Giurgiutiu, Univ. of South Carolina (USA) . . [10599-91]

Conference End.

CONFERENCE 10600

Sessions 12A and 12B run concurrently.

SESSION 12A

LOCATION: CRIPPLE CREEK 2
THU 1:40 PM TO 4:30 PM

Civil Infrastructure Monitoring II

Session Chairs: **Henrique L. Reis,** Univ. of Illinois (USA); **Victor Giurgiutiu,** Univ. of South Carolina (USA)

1:40 pm: **Monitoring-based decision support system for optimal management of Colle Isarco viaduct**, Andrea Verzobio, Univ. of Strathclyde (United Kingdom); Daniel Tonelli, Denise Bolognani, Carlo Cappello, Oreste Salvatore Bursi, Univ. degli Studi di Trento (Italy); Daniele Zonta, Univ. of Strathclyde (United Kingdom) . . . . . [10600-85]

2:00 pm: **The conditional value of information of SHM: what if the manager is not the owner?,** Daniel Tonelli, Univ. degli Studi di Trento (Italy); Andrea Verzobio, Univ. of Strathclyde (United Kingdom); Denise Bolognani, Emiliano Debiasi, Carlo Cappello, Univ. degli Studi di Trento (Italy); Daniele Zonta, Univ. of Strathclyde (United Kingdom) . . . . . [10600-87]

2:20 pm: **Evaluation of reliable data delivery for bridge structural monitoring and warning system deployment guideline**, Ittipong Khemapech, Univ. of the Thai Chamber of Commerce (Thailand) [10600-88]

2:40 pm: **Identification of corrosion in pipeline by using EWT-based outlier analysis for guided wave structural monitoring**, Xiaojuan Wang, Xi'An Univ. of Technology (China); Chen Qin, Yunfei Wang, Xi'an Univ. of Technology (China) . . . . . [10600-89]

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

3:30 pm: **Smartphone as a city sensor before, during, and after earthquake**, Xuefeng Zhao, Botao Xie, Dalian Univ. of Technology (China); Zheng He, Dalian Univ. of Technology (China); Jinke Li, Ruicong Han, Dalian Univ. of Technology (China); Jinping Ou, Dalian Univ of Technology (China) and Harbin Institute of Technology (China). . . . . [10600-90]

3:50 pm: **On-line damage monitoring of pressure-retaining equipment in nuclear power plants: a review**, Jiuhong Jia, Xuecheng Liu, Xueling Yang, Yu Tu, Shan-Tung Tu, East China Univ. of Science and Technology (China). . . . . [10600-91]

4:10 pm: **The circumferential strain behavior of concrete cylinder in a freezing-thawing environment**, Haifeng Lv, Dalian Univ. of Technology (China); Kaixing Liao, Xianglong Kong, Suzhou Nuclear Power Research Institute (China); Changsen Sun, Xuefeng Zhao, Dalian Univ. of Technology (China). . . . . [10600-92]

SESSION 12B

LOCATION: SILVERTON SALON 1
THU 1:20 PM TO 5:30 PM

Emerging and Futuristic Techniques

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

1:20 pm: **Statistical damage detection based on full-field covariance of ultrasonic circumference measurement**, See Yenn Chong, Univ of California, San Diego (USA); Michael D. Todd, Univ. of California, San Diego (USA) . . . . . [10600-93]

1:40 pm: **Structural mode shape estimation via a fully automated hybrid computer-vision algorithm**, Aral Sarrafi, Zhu Mao, Univ. of Massachusetts Lowell (USA). . . . . .[10600-94]

2:00 pm: **Integration of AE, GUWs, and EMI**, Piervincenzo Rizzo, Univ. of Pittsburgh (USA); Wen Deng, Northwestern Polytechnical Univ. (China); Amir Nasrollahi, Univ. of Pittsburgh (USA). . . . . .[10600-95]

2:20 pm: **Piezoelectric self-sensing vibration control based on mirror circuit and neural network with automatic phase adjustment feedback loop**, Bin Ju, Yongbin Liu, Zhihua Guo, Anhui Univ. (China) . . .[10600-97]

2:40 pm: **A sparse Bayesian learning wavenumber analysis approach for guide wave damage detection,** Pei Cao, Univ. of Connecticut (USA); Xinyao Tang, Case Western Reserve Univ. (USA); Shilong Li, Jiong Tang, Univ. of Connecticut (USA) . . . . . .[10600-98]

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

3:30 pm: **Structural health monitoring based on omni-directional SH wave piezoelectric transducers,** Qiang Huan, Faxin Li, Peking Univ. (China) . . . . . .[10600-99]

3:50 pm: **Improved statistical damage classification in an experimental wind turbine blade using vector autoregressive coefficients and sequential projection pursuit**, Piotr Omenzetter, Univ. of Aberdeen (United Kingdom); Simon Hoell, Bauhaus Univ. Weimar (Germany) . . . . . .[10600-100]

4:10 pm: **Enhanced time reversed Lamb wave based damage detection using frequency mixing**, Vivek SA, Christudas R. Bijudas, Indian Institute of Space Science and Technology (India) . . . . . .[10600-101]

4:30 pm: **Reliability of surface response to excitation method for data driven prognostics using neural networks and Gaussian processes**, Hadi Fekrmandi, Yunseok Gwon, South Dakota School of Mines and Technology (USA). . . . . .[10600-102]

4:50 pm: **Problems of modeling and identification of mechanical properties of Achilles tendon with application to health monitoring**, Lukasz Ambrozinski, Tadeusz Uhl, AGH Univ. of Science and Technology (Poland). . . . . .[10600-103]

5:10 pm: **Noninvasive assessment of vertebral strength and fracture risk using QCT images and computational modeling**, Asra Asgari, Shahid Beheshti Univ. of Medical Sciences (Iran, Islamic Republic of); Mohammad Nikkhoo, Islamic Azad Univ. (Iran, Islamic Republic of) . .[10600-105]

Conference End.

CONFERENCE 10594

Sessions 12A and 12B run concurrently.

SESSION 12A

LOCATION: SILVERTON SALON 2
THU 3:30 PM TO 5:30 PM

Applications of EAP III

Session Chairs: **Adrian Koh,** National Univ. of Singapore (Singapore); **Caleb Christianson,** Univ. of California, San Diego (USA)

3:30 pm: **Understanding the thermal properties of IPMC-ionomers to optimize an injection molding process**, Sarah Trabia, Univ. of Nevada, Las Vegas (USA); Kisuk Choi, Sungkyunkwan Univ. (Korea, Republic of); Zakai Olsen, Taeseon Hwang, Univ. of Nevada, Las Vegas (USA); Jae-Do Nam, Sungkyunkwan Univ. (Korea, Republic of); Kwang Jin Kim, Univ. of Nevada, Las Vegas (USA). . . . [10594-62]

3:50 pm: **An untethered swimming robot powered by dielectric elastomer actuators**, Mihai Duduta, Harvard Univ. (USA); Florian C. Berlinger, Hudson Gloria, Harvard John A. Paulson School of Engineering and Applied Sciences (USA); Radhika Nagpal, Harvard John A. Paulson School of Engineering and Applied Sciences (USA) and Wyss Institute for Biologically Inspired Engineering, Harvard Univ. (USA); Robert J. Wood, Wyss Institute for Biologically Inspired Engineering, Harvard Univ. (USA); David R. Clarke, Harvard Univ. (USA) . . . . . [10594-63]

4:10 pm: **ANSWER: Autonomous Soft Robots without Electronics**, E.-F. Markus Henke, The Univ. of Auckland (New Zealand) and TU Dresden (Germany); Katherine E. Wilson, Iain A. Anderson, The Univ. of Auckland (New Zealand) . . . . . [10594-64]

4:30 pm: **Polypyrrole polymerized in polyethylene oxide: linear actuation in organic and aqueous electrolytes**, Rudolf Kiefer, Ton Duc Thang Univ. (Viet Nam); Roshan Khadka, The Univ. of Auckland (New Zealand) and The MacDiarmid Institute for Advanced Materials and Nanotechnology (New Zealand); Zane Zondaka, Univ. of Tartu (Estonia); Jadranka Travas-Sejdic, The Univ. of Auckland (New Zealand) and The MacDiarmid Institute for Advanced Materials and Nanotechnology (New Zealand); Tarmo Tamm, Univ. of Tartu (Estonia). . . . . [10594-65]

4:50 pm: **LbL based PEDOT:PSS microactuators**, Kätlin Rohtlaid, Cédric Plesse, Giao T. M. Nguyen, Univ. de Cergy-Pontoise (France); Caroline Soyer, Eric Cattan, Univ. de Valenciennes et du Hainaut-Cambrésis (France); Frédéric Vidal, Univ. de Cergy-Pontoise (France) . . . . . [10594-66]

5:10 pm: **Fabrication of carbon polymer composite manipulated multi-degree motion platform**, Sunjai Nakshatharan Shanmugam, Andres Punning, Urmas Johanson, Alvo Aabloo, Univ. of Tartu (Estonia) . . . . . [10594-68]

SESSION 12B

LOCATION: CRIPPLE CREEK 1
THU 3:30 PM TO 5:30 PM

Applications of EAP IV

Session Chair: **Iain A. Anderson,** The Univ. of Auckland (New Zealand)

3:30 pm: **Frequency adjustable soft oscillators**, Katherine E. Wilson, The Univ. of Auckland (New Zealand); E.-F. Markus Henke, The Univ. of Auckland (New Zealand) and TU Dresden (Germany); Geoffrey A. Slipher, U.S. Army Research Lab. (USA); Iain A. Anderson, The Univ. of Auckland (New Zealand) and StretchSense (New Zealand) . . . . . [10594-69]

3:50 pm: **Surface morphology control of elastomeric actuator and their application for haptic device**, Kiwoo Jun, Jongnam Kim, Il-Kwon Oh, KAIST (Korea, Republic of) . . . . . [10594-70]

4:10 pm: **The development and understanding of composite yarn hydrogel actuators**, David Shepherd, Geoffrey M. Spinks, Univ. of Wollongong (Australia) . . . . . [10594-71]

4:30 pm: **Fabrication of ionic polymer-carbon composites based on carbon nanotube film and ionic liquid and the influence of ionic liquid content**, Jie Ru, Zicai Zhu, Xi'an Jiaotong Univ. (China); Yanjie Wang, Hohai Univ. (China); Hualing Chen, Changsheng Bian, Xi'an Jiaotong Univ. (China). . . . . [10594-72]

4:50 pm: **Spatially tunable light modulation device using deformable soft dielectrics on bendable substrates**, Kezi Cheng, Harvard Univ. (USA). . . . . [10594-73]

5:10 pm: **Controller design based on disturbance observer for twisted and coiled polymer actuators**, Motoya Suzuki, Norihiro Kamamichi, Tokyo Denki Univ. (Japan) . . . . . .[10594-74]

Conference End.

CONFERENCE 10595

Sessions 13A and 13B run concurrently.

SESSION 13A

LOCATION: CRESTONE SALON A
THU 3:30 PM TO 5:50 PM

Energy Harvesting V: General

Session Chairs: **Shahrzad Towfighian,** Binghamton Univ. (USA); **Ya S. Wang,** Stony Brook Univ. (USA)

3:30 pm: **Simultaneous vibration control and energy harvesting using actor-critic based reinforcement learning**, Cheng Ning Loong, Chih Chen Chang, Ilias G. Dimitrakopoulos, Hong Kong Univ. of Science and Technology (Hong Kong, China) . . . . . [10595-96]

3:50 pm: **Exact dynamics of angle-shaped resonator for energy scavenging applications**, Francesco Danzi, Politecnico di Torino (Italy) . . . . . [10595-97]

4:10 pm: **Active tuned mass damper to generate power from the propagating ocean waves**, Isao Nishimura, Tokyo City Univ. (Japan) . . . . . [10595-98]

4:30 pm: **A systematic study of dual resonant rectilinear-to-rotary oscillation converter for energy harvesting**, Ya S. Wang, Jingfan Chen, Stony Brook Univ. (USA); Benjamin L. Grisso, Naval Surface Warfare Ctr. Carderock Div. (USA). . . . . [10595-100]

4:50 pm: **Multi-frequency three-directional energy harvesting from a unit-cell acoustic metamaterial**, Mohammad Sadegh Saadatzi, Univ. of South Carolina (USA); Mohammad Nasser Saadatzi, Univ. of Louisville (USA); Vahid Tavaf, Sourav Banerjee, Univ. of South Carolina (USA) . . . . . .[10595-101]

5:10 pm: **Parametric resonance of a magnetically coupled harvester**, Wei Yang, Shahrzad Towfighian, Binghamton Univ. (USA). . . . . [10595-102]

5:30 pm: **Parametric studies of the passive hydroelastic responses and stability boundaries of flexible hydrodynamic lifting bodies**, Eun Jung Chae, California State Univ., Long Beach (USA); Yin Lu Young, Univ. of Michigan (USA) . . . . . .[10595-131]

SESSION 13B

LOCATION: LEADVILLE
THU 3:30 PM TO 5:30 PM

Magnetorheological Systems

Session Chairs: **Jürgen Maas,** Ostwestfalen-Lippe Univ. of Applied Sciences (Germany); **Barkan M. Kavlicoglu,** Advanced Materials and Devices, Inc. (USA)

3:30 pm: **Characterization and application of a MRE for sensing applications**, Jorge de-J. Lozoya-Santos, Jonathan Rivas, Juan Carlos Tudon-Martinez, Univ. de Monterrey (Mexico); Ricardo Ramírez Mendoza, Tecnológico de Monterrey (Mexico); Andrea Spaggiari, Univ. degli Studi di Modena e Reggio Emilia (Italy) . . . . . [10595-104]

3:50 pm: **A new liquid spring: friction type magnetorheological damper system**, Barkan M. Kavlicoglu, Christopher Rosa, Blake Muzinich, Matt Levy, Advanced Materials and Devices, Inc. (USA) . . . . . [10595-106]

4:10 pm: **Design of new prosthetic leg for above knee amputees using magnetorheological damper activated by permanent magnet**, Aeri Cha, Jiyoung Yoon, Tae-hoon Lee, Seung-Bok Choi, INHA Univ. (Korea, Republic of) . . . . . [10595-107]

4:30 pm: **A large-scale, two-way controllable magnetorheological elastomer shock and vibration mitigating mount**, Barkan M. Kavlicoglu, Michael McKee, Huseyin Sahin, Yanming Liu, Advanced Materials and Devices, Inc. (USA) . . . . . [10595-108]

4:50 pm: **Design and investigation of a full-sized MRF-based coupling element in a dedicated hybrid transmission**, Christian Hegger, Jürgen Maas, Technische Univ. Berlin (Germany) . . . . . [10595-109]

5:10 pm: **Vibration control of a cabin mount in construction vehicles utilizing a magneto-rheological damper,** Dalseong Yoon, Seung-Bok Choi, Seong-Hwan Kim, INHA Univ. (Korea, Republic of) . . . . . .[10595-110]

Conference End.

CONFERENCE 10598

Sessions 13A and 13B run concurrently.

SESSION 13A

LOCATION: CRESTONE SALON B
THU 3:30 PM TO 6:10 PM

Fiber Optic Sensors for Structural Health Monitoring II

Session Chairs: **Xingwei Wang,** Univ. of Massachusetts Lowell (USA); **Genda Chen,** Missouri Univ. of Science and Technology (USA)

3:30 pm: **Real time corrosion detection of rebar reinforced by using embeddable fiber optic ultrasound sensor,** Cong Du, Siwen Bi, Jones Owusu Twumasi, Qixiang Tang, Nan Wu, Tzuyang Yu, Xingwei Wang, Univ. of Massachusetts Lowell (USA)[10598-115]

3:50 pm: **Graphene coated LPFG sensors for high sensitivity corrosion monitoring**, Chuanrui Guo, Chenglin Wu, Genda Chen, Missouri Univ. of Science and Technology (USA) . . . . . .[10598-116]

4:10 pm: **Monitoring of soil nailed slope stabilizations using distributed fiber optic sensing**, Christoph Monsberger, Werner Lienhart, Technische Univ. Graz (Austria); Sebastian Hirschmueller, Hochschule für angewandte Wissenschaften (Germany); Roman Marte, Technische Univ. Graz (Austria) . . . . . .[10598-117]

4:30 pm: **Pipeline internal corrosion sensor based on fiber optics and permanent magnets**, Safieh Almahmoud, Oleg Shiryayev, Nader Vahdati, Paul Rostron, The Petroleum Institute (United Arab Emirates) and Khalifa Univ. of Science, Technology and Research (United Arab Emirates). . . . . .[10598-118]

4:50 pm: **The development of a fiber Bragg grating based smart washer,** Linsheng Huo, Dongdong Chen, Hong-Nan Li, Dalian Univ. of Technology (China) . . . . . .[10598-119]

5:10 pm: **Effect of continuous optical fiber bonding on ultrasonic detection using fiber Bragg grating**, Junghyun Wee, Drew Hackney, Philip Bradford, Kara Peters, North Carolina State Univ. (USA). . [10598-120]

5:30 pm: **Damage detection at web/flange junction of welded I-section steel beam based on impact-optic technique**, Ying Xu, Li Niu, Hongguang Zu, Harbin Institute of Technology Shenzhen Graduate School (China). . . . . .[10598-121]

5:50 pm: **A three-dimensional sliding and debonding sensor based on triaxial optical fiber Fabry-Perot interferometers**, Chen Zhu, Jie Huang, Missouri Univ. of Science and Technology (USA) . . . . . [10598-122]

SESSION 13B

LOCATION: ASPEN B
THU 3:40 PM TO 6:00 PM

Internet of Things Sensor Network

Session Chairs: **Dryver R. Huston,** The Univ. of Vermont (USA); **Simon Laflamme,** Iowa State Univ. of Science and Technology (USA)

3:40 pm: **Crack detection in RC structural components using a collaborative data fusion approach based on smart concrete and large-area sensors**, Austin R. J. Downey, Iowa State Univ. of Science and Technology (USA); Antonella D'Alessandro, Filippo Ubertini, Univ. degli Studi di Perugia (Italy); Simon Laflamme, Iowa State Univ. of Science and Technology (USA) . . . . . [10598-123]

4:00 pm: **Underground utility sensing network using LoRa and magnetic telemetry**, Daniel Orfeo, Dylan Burns, Connie Ou, Robert Farrell, Tian Xia, Dryver R. Huston, The Univ. of Vermont (USA) . . . . . .[10598-124]

4:20 pm: **Road sensor network for smart city applications**, Ying Huang, Pan Lu, North Dakota State Univ. (USA) . . . . . [10598-125]

4:40 pm: **An FPGA-based parallel signal processing method for fiber-optic dynamic sensing towards future smart city applications**, Zheyi Yao, Zhen Chen, Gerald Hefferman, Tao Wei, The Univ. of Rhode Island (USA) . . . . . [10598-126]

5:00 pm: **Surrogate model for condition assessment of structures using a dense sensor network**, Jin Yan, Alessandro Cancelli, Austin Downey Jr., Simon Laflamme, An Chen, Iowa State Univ. of Science and Technology (USA); Filippo Ubertini, Univ. degli Studi di Perugia (Italy) . . . . . [10598-127]

5:20 pm: **Internet-of-things and cloud computing powered sensing network for green infrastructure monitoring**, ZhiQiang Chen, Univ. of Missouri-Kansas City (USA) . . . . . [10598-128]

5:40 pm: **Sparse sensor networks for active structural health monitoring using highly integrated CMOS transceivers**, Xinyao Tang, Case Western Reserve Univ. (USA); Joel Harley, The Univ. of Utah (USA); Kevin Bi, Tayfun Özdemir, Virtual EM Inc. (USA); Soumayjit Mandal, Case Western Reserve Univ. (USA) . . . . . [10598-129]

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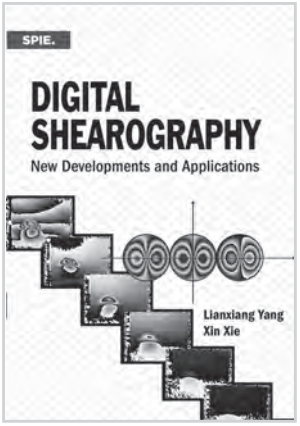

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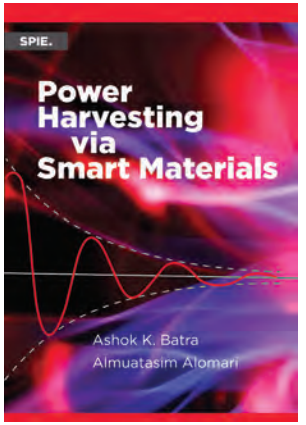

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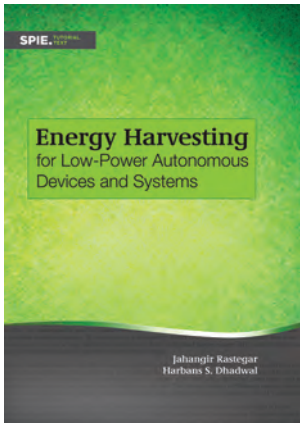

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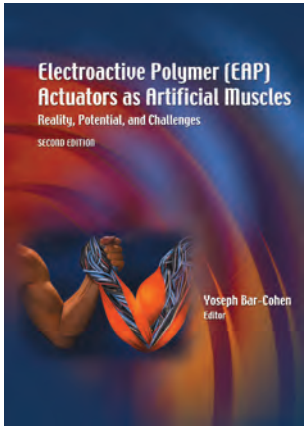

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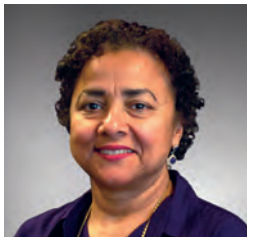

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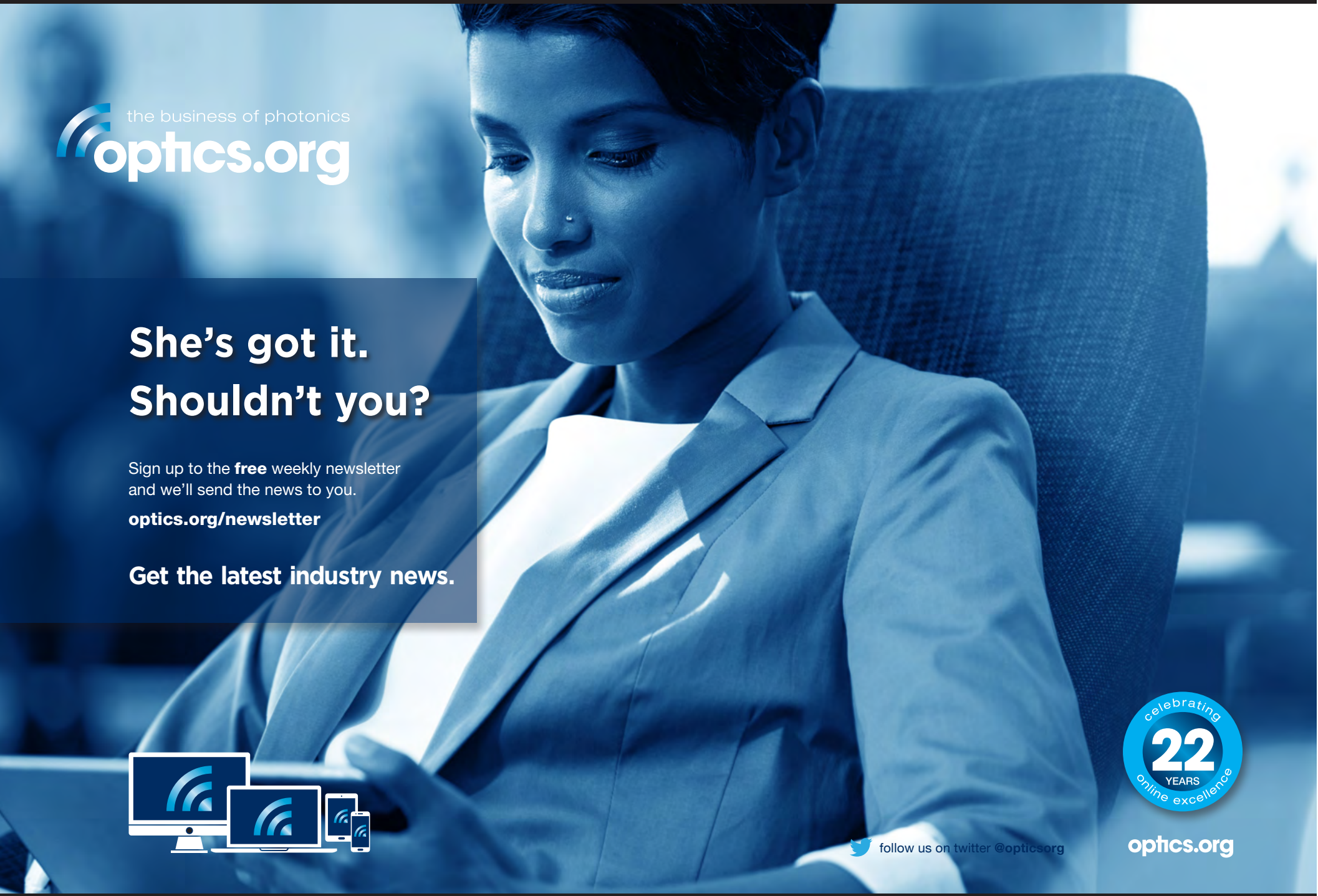

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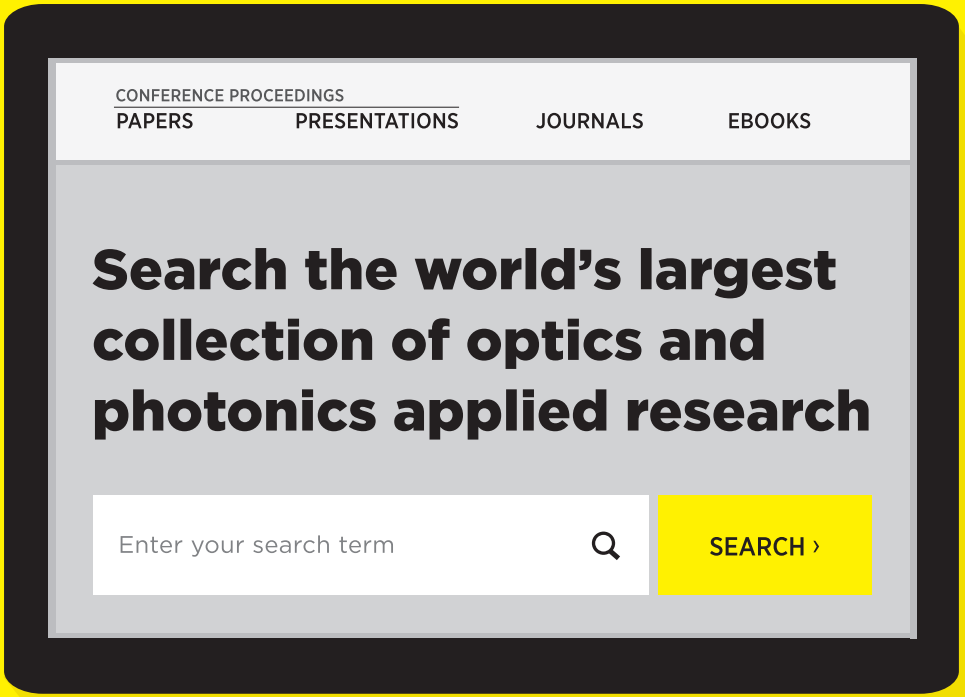

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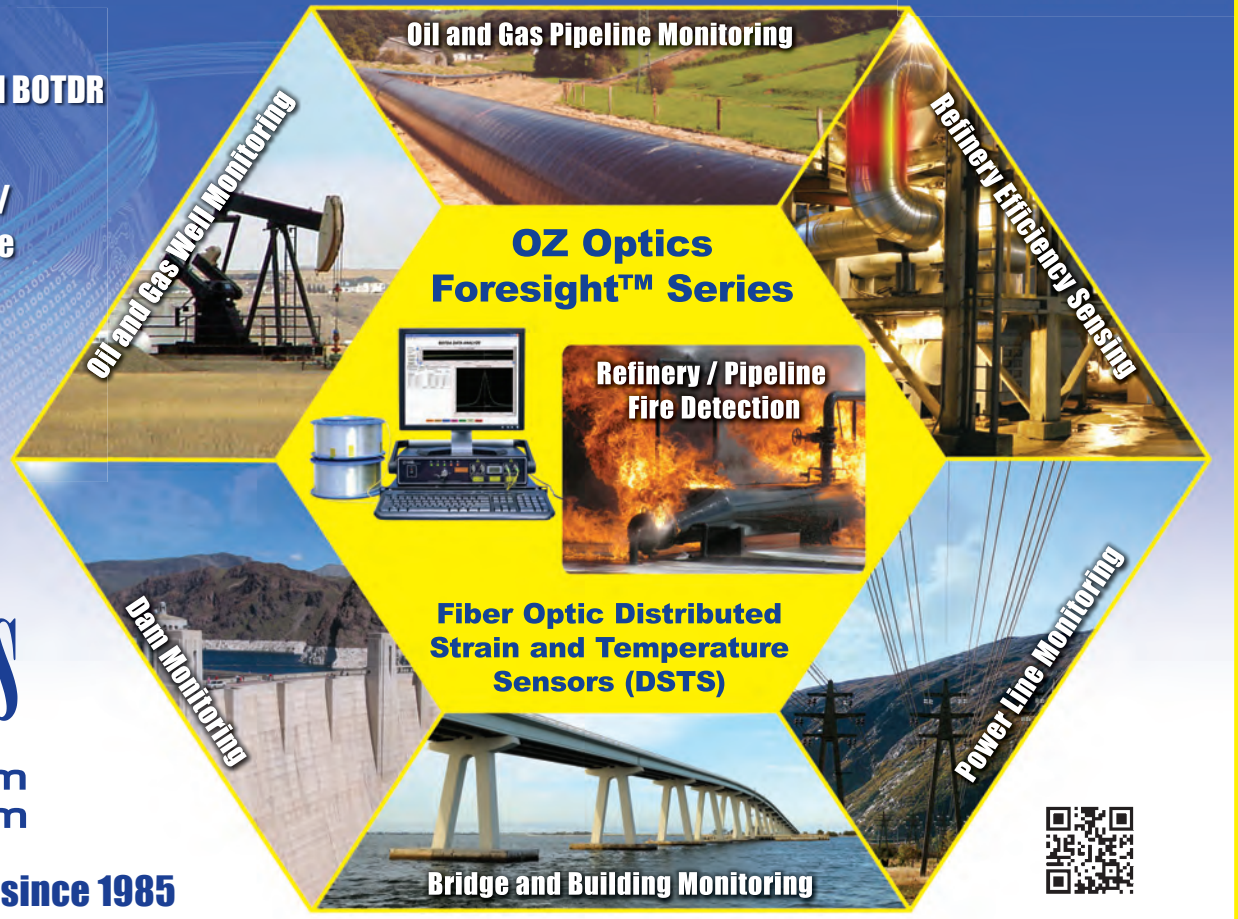

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