ASME® 2019 SMASIS

CONFERENCE ON SMART MATERIALS, ADAPTIVE STRUCTURES, & INTELLIGENT SYSTEMS (SMASIS)

SYMPOSIUM
September 9–11, 2019

Louisville, Kentucky

Program

The American Society of Mechanical Engineers®
ASME®

ASME
SETTING THE STANDARD

Welcome

DEAR SMASIS ATTENDEE:

We welcome you to the 12th annual meeting of the ASME Smart Materials, Adaptive Structures, and Intelligent Systems (SMASIS) Conference. As in the years past, our goal is to provide a friendly, casual forum for the exchange of ideas and latest results. Our sincere appreciation goes to all the presenters for choosing to share their very best work at this conference.

SMASIS is divided into eight symposia, which span basic research, applied technological design and development, and industrial and governmental integrated system and application demonstrations:

Symposium 1: Development & Characterization of Multi-functional Materials

Symposium 2: Mechanics and Behavior of Active Materials

Symposium 3: Modeling, Simulation and Control of Adaptive Systems

Symposium 4: Integrated System Design and Implementation

Symposium 5: Structural Health Monitoring

Symposium 6: Bioinspired Smart Materials and Systems

Symposium 7: Energy Harvesting

Symposium 8: Emerging Technologies

As in the past, we will continue our tradition of honoring the ASME Adaptive Structures Prize winner, Dr. Nancy Johnson, who will deliver a keynote presentation.

We have a Welcome Reception on Monday; exhibits on Tuesday with the participating companies listed below; networking breakfasts and lunches, Monday through Wednesday; and our Pioneer Banquet at the Kentucky Derby Museum in Churchill Downs, home of the Kentucky Derby, on Tuesday evening. We hope that these social events provide you the opportunity to expand your own personal community and broaden your horizons.

SMASIS is dedicated to developing future leaders in science, technology, and engineering. This is an emphasis of our Student and Young Professional Development group. Highlights of their symposium are the two student competitions on Monday, with the Best Paper Competition in the morning and Hardware Competition in the afternoon. In addition, several student events are planned to provide networking. We are very proud that our students and young professionals are always seeking ways to give back to the community. Please take advantage of these opportunities to see our rising stars and to meet your future colleagues and our future leaders!

The planning for this conference has been a significant team effort, including members of the ASME Aerospace Division Adaptive Structures and Material Systems Branch. Our executive committee provided tremendous support and guidance, and we could not have proceeded without all the contributions of the symposia chairs, co-chairs, and organizing committees. Our thanks go to them for assembling such outstanding technical programs. We also recognize all the authors, keynote and invited speakers, and panel participants who are the major contributors to the success of SMASIS. Finally, we have received generous support from our sponsor/exhibitors: New York University/Abu Dhabi, Polytec, IOP Publishing, and Dynalloy, all of which is sincerely appreciated.

We want to thank each of you for participating in this event and for coming back each year with your best work. To those of you we know personally, we look forward to seeing you again. And to those of you we have yet to meet, we look forward to making your acquaintance and to insightful technical discussions.

Sincerely,

Mohammed F. Daqaq
General Chair
New York University, Abu Dhabi

Oliver Myers
Technical Chair
Clemson University

Andy Sarles
Technical Co-Chair
University of Tennessee, Knoxville

Contents

General Information

REGISTRATION

Registration will be located each day in the Pre-function area of Olmsted Ballroom 4 located on Level 2. The hours are as follows:

Sunday, September 8
4:00PM–6:00PM

Monday, September 9
7:00AM–6:00PM

Tuesday, September 10
7:00AM–6:00PM

Wednesday, September 11
7:00AM–4:00PM

ACKNOWLEDGMENT

The ASME Conference on Smart Materials, Adaptive Structures, and Intelligent Systems is sponsored by the Aerospace Division of the American Society of Mechanical Engineers.

HOTEL

Reflecting the past, present, and future of a vibrant Kentucky town, Omni Louisville Hotel is the new cornerstone of downtown. In addition to 612 elegantly appointed guest rooms and 70,000 square feet of flexible event space, the hotel boasts several unique dining experiences. The Water Company pool and bar is perfect for sharing cocktails with the downtown skyline as the backdrop, and Pin + Proof offers classic food and drink selections complemented by four bowling alleys. Blending the historic surroundings with modern comforts, Omni Louisville Hotel reflects the essence of the city and invites you into an unforgettable stay.

NAME BADGES

Please wear your name badge at all times. Admission to all conference functions will be by the badges only (unless noted otherwise). Your badge also provides a helpful introduction to other attendees.

TICKETED FUNCTIONS/ITEMS

Entrance to all social functions is allowable by wearing your conference badge. If you have purchased additional tickets for your spouse and/or guests, they will be included inside your registration packet.

TAX DEDUCTIBILITY

The expense of attending a professional meeting, such as registration fees and costs of technical publications, are tax deductible as ordinary and necessary business expenses for U.S. citizens. However, recent changes in the tax code have affected the level of deductibility.

HANDICAPPED REGISTRANTS

Whenever possible, we are pleased to make arrangements for handicapped registrants. Advance notice may be required for certain requests. For on-site assistance, please visit the registration area and ask to speak with a conference representative.

HAVE QUESTIONS ABOUT THE MEETING?

If you have any questions or need assistance, an ASME representative will be located at the registration area.

SHORT COURSE

Sunday September 8

1:00PM–4:30PM, Rye, Level 3

Instructor: Suyi Li

Course Title: Mechanics Under the Fold: How to Use Origami to Architect Desirable Material and Structural Properties

Description:

Since their creation many centuries ago, origami has gone through explosive evolutions in its beauty and complexity. The seemingly infinite possibilities of developing 3D geometries via folding have inspired many deployable systems that are starting to shape our modern lives. However, current state of the art primarily focuses on exploiting the kinematics (or geometry) of folding without considering the elastic deformations or dynamic responses. Therefore, we are just scratching the surface of the potential offered by infusing this inspiring ancient art into engineered systems.

This short course aims to teach the fundamentals of an emerging domain: folding-induced mechanics and dynamics. That is, how to use the intricate origami geometry to architect desirable and nonlinear mechanical properties like negative Poisson's ratio, negative stiffness, and multi-stability. We will discuss how to formulate reduced-order mechanics models for the origami structures and explore how these folding-induced properties can apply to mechanical metamaterials, adaptive structures, and soft robots.

This short course includes different modules, including short presentations, hands-on folding exercises, numerical modeling tutorials, and poster sessions with questions and answers.

Learning Outcomes

The audience will get a chance to

- Obtain a big picture overview of the history and future of origami engineering
- Understand the fundamentals in folding-induced mechanics and dynamics
- Practice folding, both hands-on and using numerical simulation
- Explore potential research ideas and foster future collaborations

Intended Audience

The attendees of ASME SMASIS2019 conference, including faculty, industry experts, graduate students, and senior undergraduate students, are the intended audience.

Course Level

The attendees are expected to have at least a senior undergraduate level of expertise in solid mechanics and system dynamics.

Course Length

Half day (3.5 hours)

Biography

This course will be taught by Dr. Suyi Li from Clemson University. Dr. Suyi Li is an assistant professor of mechanical engineering at Clemson University. He received his Ph.D. at the University of Michigan in 2014. After spending two additional years at Michigan as a postdoctoral research fellow, he moved to Clemson in 2016 and established a research group on dynamic matters. His technical interests are in origami-inspired adaptive structures, multi-functional mechanical metamaterials, and bio-inspired robotics. Within less than four years at Clemson, Dr. Li has secured close to two million dollars of research funding from NSF, including the prestigious CAREER award. His paper on fluidic origami received the Best Paper Award by the ASME Branch of Adaptive Structures and Material Systems.

Additional Comments

It is recommended, but not required, to have a laptop with a MATLAB license to take full advantage of the hands-on portion of the tutorial.

Special Events

SHORT COURSE

Sunday September 8
1:00PM–4:30PM, Barley, Level 3
Instructor: Darren Hartl
Course Title: Shape Memory Alloys: Behaviors, Modeling, Analysis, and Design

Description:

Shape memory alloys are one of the most investigated active materials because of their impressive ability to recover large strains under high loads, and new application concepts are constantly being introduced. This course will provide engineers and researchers with a background in the response of these unique metals, especially as compared with other active materials. The empirical understanding developed will then be used to motivate one-dimensional mathematical constitutive models, one derived directly from experiments and a second considering thermodynamic constraints. Three-dimensional finite element analysis techniques will be reviewed, and design case studies from the aerospace and medical sectors will be presented and discussed. Attendees will be provided with working finite element models (Abaqus-based) and associated user instructions to continue their own investigations.

Learning Outcomes:

By the end of the course, attendees will:

- Understand the engineering responses of SMAs and how these enable unique applications
- Be able to derive one-dimensional constitutive models based on both experimental data and thermodynamic constraints
- Have exposure to the finite element analysis of three-dimensional SMA components and have the ability to run their own analyses
- Understand multiple case studies regarding the design of SMA components and applications.

Intended Audience:

Graduate students with background in the mechanics of materials; M.S. and Ph.D. researchers in both academia and industry; all those interested in the potential of shape memory alloys

Course Level:

Course will be taught at the graduate level.

Course Length:

Half day (3.5 hours); 0.35 CEU

Biography:

This course will be taught by Dr. Darren Hartl (Ph.D. 2009, Texas A&M Aerospace Engineering). Dr. Hartl is an Assistant Professor at Texas A&M, and his work bridges the topics of advanced multifunctional material systems and their integration into aerospace platforms. Before his return to academia, Dr. Hartl held joint appointments at the Air Force Research Laboratory (AFRL) in the Materials and Manufacturing Directorate and Aerospace Systems Directorate. He has over 17 years of experience working with shape memory alloys (SMAs) and morphing structures and has co-authored 165 technical publications on the topics of active materials modeling, testing, and integration into morphing structures, most of these related to SMAs. He serves as an Associate Editor for the Journal of Intelligent Material Systems and Structures and was selected as the 2016 recipient of the ASME Gary Anderson Early Achievement Award. He is Chair of the ASME Adaptive Structures and Materials Systems Branch.

Additional Comments:

The provided Abaqus-based finite element input files are intended to serve as a hands-on computational lab activity to be undertaken after conclusion of the course. However, should students bring their own devices and have access to Abaqus (e.g., via Remote Desktop, etc.), accommodations will be made for real-time support of these activities.

For those interested in background study and prior preparation, Chapters 1–3 of the Shape Memory Alloy textbook by Lagoudas et al. will be most useful. This text is available for free to many organizations via the following link:
https://link.springer.com/book/10.1007/978-0-387-47685-8.

BREAKFAST

Monday, September 9 – Wednesday, September 11
7:00AM–8:00AM
Olmsted Ballroom 4, Level 2

Each morning prior to the start of the technical sessions, a continental breakfast will be held. All conference attendees are welcome! Immediately following the breakfast, will be the daily Keynote Presentation. See the Keynote section of this program for more details about the individual plenary sessions taking place.

COFFEE BREAKS

Monday, September 9 – Wednesday, September 11
10:30AM–10:50AM and 3:20PM–3:40PM
Olmsted Ballroom 4 Pre-function, Level 2

LUNCHES

Monday, September 9 – Wednesday, September 11
12:10PM–1:40PM
Olmsted Ballroom 4, Level 2

STUDENT POWERPOINT KARAOKE/LUNCH

12:10PM–1:40PM
Monday, September 9
Germantown, Level 2

PowerPoint Karaoke is an improv activity in which an individual is given a set time to pitch a smart materials-based slideshow presentation to an audience without prior knowledge of the contents of the slide they're presenting. The event challenges both the author of a slide and the presenter to improve their communications skills while under a strict time limit. It gets people laughing, keeps everyone wondering what will happen next, and there are prizes!
Come for the networking, stay for the prizes!

WELCOME RECEPTION

6:00PM–7:30PM
Monday, September 9
Olmsted Ballroom 5-6, Level 2

STUDENT OUTING

7:45PM–10:30PM
Monday, September 9
Escape LOU, Meet in Lobby

Can you work with your new friends and colleagues to escape the room? You'll have 60 minutes to work together to solve puzzles and earn your freedom. This is a casual event, wear comfortable clothes and shoes. Meet in the hotel lobby at 7:45PM to board a bus that will transport the group to the venue.

EXHIBITS

9:00AM–6:00PM
Tuesday, September 10
Olmsted Ballroom 4 Pre-function, Level 2

Take advantage of the opportunity to visit the booths of the leading industries in the field that are making it happen! Experts will be on hand to talk with you from New York University/Abu Dhabi, and Polytec, Inc. Please stop by. Our exhibitors help support the conference, so let's support them!

EXHIBITOR SCHEDULE

Setup

Monday, September 9, 3:00PM–6:00PM

Exhibits Open

Tuesday, September 10, 9:00AM–6:00PM

Exhibit Breakdown:

Tuesday, September 10, 6:00PM–8:00PM

STUDENT PROFESSIONAL DEVELOPMENT PANEL/LUNCH

12:10PM–1:40PM
Tuesday, September 10
Copper, Level 3

Academia and industry and national lab, oh my! A panel of professionals from academia, industry, and government laboratories will be at lunch to discuss their career trajectories and responsibilities and answer questions about career options in their positions.

PIONEER AWARDS CEREMONY BANQUET

6:30PM–9:00PM
Tuesday, September 10
Kentucky Derby Museum, Churchill Downs (Home of the Kentucky Derby)

Join us for a very special evening at The Kentucky Derby Museum, one of the premiere attractions in the Louisville region, celebrating the tradition, history, hospitality, and pride of the world-renowned event that is the Kentucky Derby. Each year, the Museum welcomes over 230,000 visitors. Visitors can enjoy two floors of family-friendly interactive exhibits, get your heart and emotions racing and soaring watching the Museum's signature 18-minute movie, "The Greatest Race," on a 360°, 4K high-resolution screen.

The new second floor exhibit space houses two new impressive exhibits featuring the legacy, possessions, trophies, and history of two Hall of Famers: legendary trainer, D. Wayne Lukas, and jockey, Bill Shoemaker.

A Kentucky inspired sit-down dinner will be provided as well as transportation from/to the Omni hotel. The buses will begin boarding at 5:45PM for a 6:00PM departure. A guided tour will be provided from 6:30PM to 7:00PM followed by dinner and the Awards presentations. Buses will begin departing back to the Omni from 8:45 PM to 900PM. The ASME technical committees will honor their 2019 awards 2018 award recipients along with the best student papers and hardware from the SMASIS conference.

STUDENT GAME NIGHT

10:00PM–12:00AM
Tuesday, September 10
Library Bar, Lobby

Keep the party going at the post-banquet game night. Everyone is welcome to mingle while playing board and card games at Library Bar in the Omni Louisville Hotel.

Student Events

Symposium 9

BEST STUDENT PAPER COMPETITION I – FINALISTS

9:30AM–10:40AM
Monday, September 9
Copper, Level 3

BEST STUDENT PAPER COMPETITION II – FINALISTS

10:50AM–12:10PM
Monday, September 9
Copper, Level 3

The ASME Adaptive Structures and Material Systems branch organized the Best Student Paper Competition as part of the ASME/AIAA Conference on Smart Materials, Adaptive Structures, and Integrated Systems (SMASIS). Entrants were judged by a committee of smart materials and structures experts. Finalists are required to present their papers at The Student Best Paper Sessions on Monday, September 9. All finalists will be honored during the Pioneer Banquet, Tuesday, September 10.

BEST STUDENT HARDWARE COMPETITION I – FINALISTS

1:40PM–3:20PM
Monday, September 9
Copper, Level 3

BEST STUDENT HARDWARE COMPETITION II – FINALISTS

3:40PM–5:20PM
Monday, September 9
Copper, Level 3

The ASME Adaptive Structures and Material Systems branch organized the Best Student Hardware Paper Competition as part of the ASME/AIAA Conference on Smart Materials, Adaptive Structures, and Intelligent Systems (SMASIS). Entrants in the competition will be judged by a committee of smart materials and structures experts, and a list of finalists will be determined based upon the technical paper. Finalists are required to present their papers at a regular conference session and must participate in a special exhibit session on September 9, 2019 to demonstrate hardware operation and to present a poster explaining the nature of the project. All finalists will be honored during the Pioneer Banquet on Tuesday, September 10, 2019.

STUDENT POWERPOINT KARAOKE/LUNCH

12:10PM–1:40PM
Monday, September 9
Germantown, Level 2

PowerPoint Karaoke is an improv activity in which an individual is given a set time to pitch a smart materials-based slideshow presentation to an audience without prior knowledge of the contents of the slide they're presenting. The event challenges both the author of a slide and the presenter to improve their communications skills while under a strict time limit. It gets people laughing, keeps everyone wondering what will happen next, and there are prizes!
Come for the networking, stay for the prizes!

STUDENT OUTING

7:45PM–10:30PM
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STUDENT PROFESSIONAL DEVELOPMENT PANEL/LUNCH

12:10PM–1:40PM
Tuesday, September 10
Copper, Level 3

Academia and industry and national lab, oh my! A panel of professionals from academia, industry, and government laboratories will be at lunch to discuss their career trajectories and responsibilities and answer questions about career options in their positions.

STUDENT GAME NIGHT

10:00PM–12:00AM
Tuesday, September 10
Library Bar, Lobby

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STUDENT TRIVIA LUNCH

12:10PM–1:40PM
Wednesday, September 11
Olmsted Ballroom 4, Level 2

Everyone is invited to test their knowledge of random facts during the Trivia Lunch. Participants are encouraged to form multicultural, intergenerational teams by sitting at the same lunch table. A quizmaster will guide the teams through a multi-round “Pub” Style trivia competition, which covers a wide array of nontechnical topics.

Committee Meeting Schedule

SUNDAY, SEPTEMBER 8

Committee	Time	Room
Shape Memory Alloys (SMAs) (Darren Hartl)	1:00PM–4:30PM	Rye
Mechanics Under the Fold (Suyi Li)	1:00PM–4:30PM	Barley
CASMART Meeting	3:00PM–5:00PM	Hikes Point
Leadership Summit	4:00PM–7:00PM	Butchertown
SMASIS Symposia Chair Planning Dinner and Meeting (by invitation only)	7:00PM–9:00PM	Hikes Point

MONDAY, SEPTEMBER 9

Active Materials and/or Multifunctional Materials Technical Committee Meeting	12:10PM–1:40PM	Charred
Adaptive Systems Dynamics and Controls Technical Committee Meeting	12:10PM–1:40PM	Barrel
Structural Health Monitoring Technical Committee Meeting	12:10PM–1:40PM	Oak
Active Material Technologies and Integrated Systems Technical Committee Meeting	12:10PM–1:40PM	Barley
Bio-Inspired Structures and Systems Technical Committee Meeting	12:10PM–1:40PM	Rye
Energy Harvesting Technical Committee Meeting	12:10PM–1:40PM	Malt
AIAA Adaptive Structures Technical Lunch Meeting	12:10PM–1:40PM	Olmstead 7
ASME ASMS Branch Meeting	7:30PM–10:00PM	Olmstead 1-2

TUESDAY, SEPTEMBER 10

Journal of Intelligent Material Systems and Structures Editorial Board Meeting	12:10PM–1:40PM	Hikes Point

WEDNESDAY, SEPTEMBER 11

Aerospace Division Executive Meeting	12:10PM–1:40PM	Hikes Point

Keynote Speakers

Francesco Lanza di Scalea
Director, Experimental Mechanics and NDE Laboratory
University of California San Diego

MATERIALS AND STRUCTURAL TESTING USING ELASTIC WAVES
MONDAY, SEPTEMBER 9
OLMSTEAD 1-2, LEVEL 3 8:00AM–9:20AM

Abstract

The detection and quantification of internal defects as well as the measurement of in-situ stresses in materials and structures can be well accomplished by using elastic waves propagating in the ultrasonic regime (> 20 kHz). The talk will present four research topics related to this theme. The first topic is the passive-only extraction of the Green's function (or transfer function) of the test piece subjected to an unknown, and generally nonstationary excitation. This concept is being successfully utilized to defect internal defects in rail tracks using solely (non-contact) ultrasonic receivers and exploiting the natural train wheels as the acoustic excitation. Several other opportunities exist to passively monitor structures subjected to natural operational loads. The second topic deals with the nonlinear wave propagation regime and the increased sensitivity that this brings to nondestructive material state awareness compared to the conventional linear wave regime. Nonlinear wave propagation will be presented for the case of waveguides, affected by multimode and dispersive behavior, and for the case of constrained solids subjected to thermal excursions. One application of the latter case is the nondestructive assessment of in-situ thermal stresses for the prevention of thermal buckling failures. The third topic consists of improvements to the application of ultrasonic Synthetic Aperture Focus (SAF) that utilizes multi-element ultrasonic arrays to image defects in engineering solids and biological materials. Applications will be shown to image internal defects in aluminum and steel bulk parts. The fourth topic is the identification of the elastic constants of multilayered composite materials based on guided wave propagation and optimization algorithms.

Biography

Francesco Lanza di Scalea (Ph.D. 1997 University of Palermo-Italy, Post-doc 1998–1999 Johns Hopkins University) is currently a Professor of Structural Engineering and the Director of the Experimental Mechanics & NDE Laboratory at the University of California, San Diego. His research and teaching interests are in the fields of experimental mechanics, non-destructive evaluation and structural health monitoring. Lanza di Scalea was awarded the UCSD Structural Engineering Teacher of the Year Award twice (2011 and 2018), the Structural Health Monitoring Person of the Year Award (2007), the American Society for Nondestructive Testing Research Fellowship Award (2002, 2006, and 2010), the American Society for Nondestructive Testing Faculty Grant Award (2003), the UCSD Hellman Faculty Fellowship (2000 and 2002), and the Fulbright Scholarship (1995). He currently serves on the Editorial Board of the following journals: *Journal of Intelligent Materials Systems and Structures, Structural Health Monitoring, Research in Nondestructive Evaluation, ASME Journal of Nondestructive Evaluation, Diagnostics and Prognostics of Engineering Systems, and SEM's Experimental Mechanics.* He is a Fellow of the following societies: American Society for Nondestructive Testing (ASNT), Acoustical Society of America (ASA), and Society for Experimental Mechanics (SEM). He is a Senior Member of IEEE.

Kon-Well Wang
Division Director
Division of Engineering Education and Centers
Directorate for Engineering
National Science Foundation

PRESENTATION: ENGINEERING RESEARCH CENTERS – PAST, CURRENT AND FUTURE
TUESDAY, SEPTEMBER 10
OLMSTEAD 1-2, LEVEL 3 8:00AM-9:20AM

Abstract

During the recent decades, the scientific and engineering community and the federal agencies have explored the potential of large-scale center-type research programs. It has been recognized that many of the most challenging and complex technical problems can only be addressed if researchers with diverse expertise combine their efforts and work across the boundaries between disciplines. The National Science Foundation (NSF) Engineering Research Center (ERC) program is a flagship program in this regard. The ERCs are interdisciplinary, multi-institutional centers that join academia, industry, and government in partnership to produce transformational engineered systems and educate individuals that are adept at innovation and primed for leadership in the global economy. They operate at the interface between the discovery-driven culture of science and the innovation-driven culture of engineering. Since the ERC program's inception in 1984, NSF has funded over 70 ERCs across the United States. The NSF funding level has been at about $4 million per year for each ERC for up to 10 years, during which time the centers would develop partnerships with industry, universities, and other government entities to sustain them upon graduation from NSF support. Throughout the years, the ERCs have contributed significantly to the technical community and the nation; educated more than 12,000 engineering graduates with interdisciplinary training; and produced a tremendous amount of high impact publications, patents and licenses, and spin-off companies. Studies have estimated that the total downstream market value of ERC innovations to the U.S. economy is well over tens of billions of dollars. Recently, NSF funded the National Academies of Sciences, Engineering, and Medicine (NASEM) to conduct a study to create a vision for future research centers in engineering (A New Vision for Center-Based Engineering Research, 2017, The National Academies Press). Building upon the NASEM's recommendations, NSF developed a roadmap for the next generation of ERCs (Gen-4), which emphasizes cutting-edge research efforts that are convergent and will lead to strong societal impact. A Gen-4 ERC will have interacting foundational components that cover convergent research, workforce development, culture of diversity and inclusion, and innovation ecosystem. In this presentation, he will provide an overview of the NSF ERC program to date, as well as new opportunities for the Gen-4 ERCs.

Biography

Dr. Kon-Well Wang is the Stephen P. Timoshenko Professor of Mechanical Engineering at the University of Michigan in Ann Arbor, Michgan. He is also on an Executive IPA (Intergovernmental Personnel Act) appointment as Division Director of the Division of Engineering Education and Centers (EEC), Directorate of Engineering, at the National Science Foundation (NSF) in Alexandria, Virginia, since January 2019. The NSF EEC invests in the creation of 21st century engineers and the discovery of technologies through transformational center-based research, including the Engineering

Keynote Speakers

Research Centers (ERCs), research in education and inclusion, and research opportunities for students and teachers.

Dr. Wang received his Ph.D. degree in Mechanical Engineering from the University of California at Berkeley in 1985, worked at the General Motors Research Labs as a Senior Research Engineer, and started his academic career as a faculty member at the Pennsylvania State University in 1988. During his Penn State years, Dr. Wang served as the William E. Diefenderfer Chaired Professor in Mechanical Engineering, Director of the Structural Dynamics and Controls Lab, Associate Director of the Vertical Lift Research Center of Excellence, and Group Leader for the Center for Acoustics and Vibration. Dr. Wang joined the University of Michigan Department of Mechanical Engineering in 2008 and has been the Stephen P. Timoshenko Professor since then. For ten years, he served as the Department Chair of Mechanical Engineering (2008–2018) and assumed the title of the Tim Manganello/BorgWarner Department Chair from 2013 to 2018.

Dr. Wang's main technical interests are in the emerging fields of structural dynamics and controls, including adaptive structures and materials systems, tunable metamaterials and metastructures, and origami mechanics; dynamics and controls, with applications in shape, vibration, and wave controls; vibration energy harvesting; structural health monitoring; and vehicle and robotics system dynamics and controls. He has received various recognitions for his accomplishments, such as the Pi Tau Sigma-ASME Charles Russ Richards Memorial Award, the ASME J.P. Den Hartog Award, the SPIE Smart Structures and Materials Lifetime Achievement Award, the ASME Adaptive Structures and Materials Systems Prize, the ASME N.O. Myklestad Award, the ASME Rudolf Kalman Award, the ASME Adaptive Structures and Material Systems Best Paper Awards, the NASA Tech Brief Award, and the SAE Ralph Teetor Award. His major leadership activities in the professional community include being Chair of the ASME Technical Committee on Vibration and Sound, Chair of the ASME Mechanical Engineering Department Heads Executive Committee, member of the ASME Design Engineering Division Executive Committee, General Chair of the SPIE Damping and Isolation Conference and of the ARO Workshop on Smart Structures, Chief Editor for the *ASME Journal of Vibration and Acoustics,* Associate Editor of the *Journal of Intelligent Material Systems and Structures,* and Editorial Advisory Board Member for the *Journal of Sound and Vibration.* Dr. Wang is a Fellow of the ASME, AAAS, and IOP.

Nancy Johnson
Lab Group Manager and Technical Fellow
General Motors Research and Development

PRESENTATION: SMASIS: PAST, PRESENT & FUTURE
WEDNESDAY, SEPTEMBER 11
OLMSTEAD 1-2, LEVEL 3 8:00AM–9:20AM

Abstract

When the SMASIS conference began, many of the technologies we are focused on today were in their infancy or not even started. The use of smart materials has gradually evolved from high-end, one of kind products for medical, military and aerospace applications to the point of viability for mainstream, high yield/low cost products for automotive applications. Many industries can benefit from the technology areas being addressed by the adaptive structures community. For the automotive industry, there are significant potential benefits to be realized, including reduction in vehicle mass, added design flexibility and reduction in component size and cost.

This presentation will provide a history of SMASIS over the past 10 years. A review of the conference with anecdotes of experiences during the conference will be covered along with a review of the changes in technical focus. Key technology areas and symposium topics will be covered, and an outlook of future trends will be provided, especially as it relates to the automotive industry and our customers. Research in multifunctional systems and inflatable structures will be discussed.

SYMPOSIUM 1

SELECTIVE LASER MELTING OF NITI AND NITIHF SHAPE MEMORY ALLOYS

Haluk Karaca
Associate Professor
Department of Mechanical Engineering
University of Kentucky

Abstract

Shape Memory Alloys (SMAs) exhibit unique functional properties such as shape memory effect and superelasticity. The traditional fabrication methods of SMAs are challenging and not flexible to produce porous and complex structures. An additive manufacturing method of Selective Laser Melting (SLM) is an attractive method that employs CAD data to selectively melt the metal powder via a laser beam to fabricate complex parts. The SLM parameters such as laser power, powder layer thickness, scanning speed, spacing, and strategy can be used to tailor the microstructural characteristics and thus the shape memory properties of the fabricated part. In this talk, the recent developments, challenges, opportunities, and results on the SLM fabricated NiTi and NiTiHf shape memory alloys will be presented.

Biography

Dr. Haluk Karaca is an Associate Professor at the Mechanical Engineering Department of University of Kentucky. He is a recipient of NSF Career award and Associate Editor of the *Journal of Intelligent Materials and Systems*. He received his Ph.D. from Texas A&M University in 2007. He has worked on the characterization and processing of conventional, high temperature and magnetic SMAs, indentation response of SMAs and shape memory composites, and published more than 70 journal articles in this field.

SYMPOSIUM 1

PIEZORESISTIVE NANOCOMPOSITES FOR STRAIN AND DAMAGE SENSING: EXPERIMENTAL AND COMPUTATIONAL OBSERVATIONS

Gary Seidel
Associate Professor
Kevin T. Crofton Department of Aerospace and Ocean Engineering
Virginia Tech

Abstract

The addition of small amounts of conducting and semi-conducting nanomaterials such as carbon nanotubes and graphene to non-conducting polymers has been observed to yield nanocomposites which demonstrate a strong piezoresistive effect, especially near the percolation concentration. Gauge factors for strain sensing for these nanocomposites can range from values comparable to metallic wire strain gauges to values that are an order of magnitude or more higher, depending on the concentration, dispersion, and orientation distribution of the nanomaterials used. However, the real advantage of these piezoresistive nanocomposites compared to conventional strain gauges is that they can readily be embedded within structural members and structural materials, particularly those that make use of polymer matrix composites. Moreover, the gauge factors for these nanocomposites have been observed to grow dramatically as damage initiates and propagates through these composites providing embedded damage sensing and, hence, an opportunity for use in structural health monitoring applications. Further distinguishing piezoresistive nanocomposites from metallic wire strain gauges is their ability to make use of both inherent effective piezoresistivity and geometric piezoresistance, the latter being tied solely to elastic properties where the former derives from direct changes in resistivity in response to strain. The mechanisms believed to be driving the inherent effective piezoresistive response originate chiefly at the nano- and microscales. At the nanoscale, nanomaterials can exhibit inherent piezoresistivity and electron hopping or quantum tunneling. At the microscale, the dispersion of nanomaterials leads to the formation of conductive networks which can increase or decrease in number of conductive paths in response to applied strain or damage initiation and propagation. This talk will provide an overview of both experimental and computational observations of the piezoresistive response of nanocomposites as applied to both strain and damage sensing. Nanocomposites will be discussed in the context of the effects of concentration, dispersion, and orientation distribution. Composites with embedded sensing will be discussed in the context of applications for fuzzy fibers in composite laminates and piezoresistive binders in energetic materials. Lastly, the talk will emphasize the need for and application of multiscale multiphysics modeling tools for both understanding and engineering piezoresistive nanocomposites.

Biography

Dr. Gary Seidel is an Associate Professor in the Kevin T. Crofton Department of Aerospace and Ocean Engineering at Virginia Tech and an affiliate faculty member in Engineering Mechanics and Mechanical Engineering. His primary research interests are in development of multiscale modeling approaches for multifunctional materials and for materials with evolving microstructures and damage evolution. Present focus is on the area of multiscale modeling of polymer nanocomposites as embedded sensors for deformation and damage detection in composites. Prior to his current position, Dr. Seidel was a postdoctoral research associate in the Aerospace Engineering Department at Texas A&M University supported by the Texas Institute for Intelligent Bio-Nano Materials and Structures for Aerospace Vehicles (TiiMS). He received Ph.D., M.Sc., and B.Sc. degrees in Aerospace Engineering from Texas A&M University in 2007, 2002, and 1999, respectively, and was the inaugural recipient of the Sandia National Laboratories/Texas A&M University Doctoral Fellowship in Engineering. Dr. Seidel has authored or co-authored over 80 scientific publications in the area of multiscale modeling and characterization of multifunctional nanocomposites and in the area of multiscale modeling of damage initiation and evolution in composites, including a 2016 ASME/Boeing Best Paper Award. He is the recipient of the 2010 Oak Ridge Associated Universities Ralph E. Powe Junior Faculty Enhancement Award, has been twice selected as an AFRL Summer Faculty Fellow, and is an Associate Fellow of the American Institute of Aeronautics and Astronautics (AIAA).

SYMPOSIUM 2

TRANSDUCTION USING FUNCTIONAL MATERIALS; BASIC SCIENCE, AND UNDERSTANDING AT THE U. S. NAVAL RESEARCH LABORATORY

Virginia DeGiorgi
Head of the Multifunctional Materials Branch
Naval Research Laboratory

Abstract

Recently, NRL researchers have embarked on a basic research effort, “Tuning Giant Magnetoelectric Properties in Phase Transformation Multiferroics,” focused on multifunctional materials for energy transduction and conversion. Multiferroic materials combine at least two coupled ferroic properties and are used in multiple applications, including magnetic field sensors, energy harvesting devices, non-volatile memory, and antennas. There are very few single phase multiferroic materials, and they normally have a relatively low magnetoelectric (ME) coupling coefficient. In contrast, engineered materials such as ME composites fabricated from piezoelectric and magnetostrictive materials can show multiple orders of magnitudes increase in the ME coupling coefficient. The optimal design of ME composites would lead to conditions of maximum response (strain, induced voltage, or field) with minimum applied electric or magnetic fields, providing advanced materials for transduction, sensing, energy harvesting, and other applications. That is why NRL researchers are working on piezoelectric materials with enhanced properties due to a phase transformation that would minimize the stimuli needed to achieve large strains. Key to the successful design and fabrication of ME composites is an understanding of interface characteristics as well as individual material components. In this paper, we will review the current status of work at NRL on engineered multiferroic composites comprised of piezoelectric and magnetostrictive materials coupled through strain. There are still many open questions about the interfacial properties as well as the individual component materials. Details will be presented from recent work on material characterization under repetitive cycling, interface characteristics, and stress/electric/thermal effects on driving the phase transition in a relaxor ferroelectric single crystal.

Biography

Dr Virginia G. DeGiorgi is Head of the Multifunctional Materials Branch at the Naval Research Laboratory. She has more than 35 years of experience in materials research. She received her B.Sc. and M.Eng. in Civil Engineering from the University of Louisville in 1980 and her Ph.D. in Engineering Mechanics from Southern Methodist University in 1986. Immediately after receiving her Master’s from the University of Louisville, she became a member of the Breeder Reactor Components Project at Westinghouse Electric Corp. While at Westinghouse she became the first woman and youngest employee at the time, to be awarded the prestigious corporate B. G. Lamme Scholarship, which enabled her to pursue her Ph.D. She joined NRL in 1986. Highlights of her research at NRL include application of computational modeling techniques to diverse fields of study, including electrochemical corrosion, fracture of metals, pit growth within a microstructure, smart materials, electromagnetic rail gun performance, and investigation of the interaction between structural response and coatings failure for Navy ship components. Over the years she has received numerous awards. She is a Fellow of ASME and the Wessex Institute of Technology in Great Britain. She is an American Business Women’s Association Top Ten. She has received the Professional Award in Engineering from the J. B. Speed School of Engineering at the University of Louisville. In 2017, her team received the ASME Computers and Information Engineering Division’s Advanced Modeling and Simulation Best Paper Award (Towards an Analytical, Computational and Experimental Framework for Predicting Aging of Cathodic Surfaces). In 2018, her team received NRL’s Alan Berman Research Publication Award [Microstructure-sensitive modeling of pitting corrosion: Effect of the crystallographic orientation, *Corrosion Science,* 129(2017) 54–69].

SYMPOSIUM 2

ON THE MECHANICS OF OVERLOAD AND FATIGUE FAILURE IN SHAPE MEMORY ALLOYS

Theocharis Baxevanis
Assistant Professor
Department of Mechanical Engineering
University of Houston

Abstract

Since the discovery of Shape Memory Alloys (SMAs), the SMA industry has been dominated by products for biomedical applications with geometrically small feature sizes, especially endovascular stents. For such products, emphasis is being placed on preventing crack nucleation rather than controlling crack growth. However, the successful integration of SMAs into commercial actuation, energy absorption, and vibration damping applications requires understanding and practice of fracture mechanics and fatigue damage-tolerant concepts in SMAs. The development of such concepts is rather complex owing to the reversibility of phase transformation, detwinning and reorientation of martensitic variants, the possibility of overload and transformation-induced plastic deformation, and the strong thermomechanical coupling. Large-scale phase transformation under actuation loading paths, i.e., combined thermomechanical loading, and the associated configuration dependence complicate the failure response even further and question the applicability of single parameter fracture mechanics theories. In this talk, the existing knowledge base on the mechanics of failure of SMAs under mechanical loading will be briefly reviewed and recent developments in actuation-induced SMA overload and fatigue failure will be presented along with deficiencies of the classical elastic-plastic fracture mechanics theories and standards to treat the observed response and possible remedies to overcome those deficiencies.

Biography

Dr. Theocharis Baxevanis received his Ph.D. in Civil Engineering in 2003 from the Aristotle University of Thessaloniki, Greece. Currently, he resides in Houston, Texas. Dr. Baxevanis is an assistant professor in the Mechanical Engineering Department at the University of Texas. Previously, he worked as a TEES research assistant professor in the Aerospace Engineering Department at Texas A&M University and as director of operations in the Center for Intelligent and Multifunctional Materials and Structures (CIMMS). He also taught at the University of Crete, Greece, in the Department of Applied Mathematics from 2005 to 2010 and worked as a researcher in Ecole Centrale de Nantes, France, in 2004 and in SINTEF Petroleum, Norway, in 2003.

Dr. Baxevanis has a broad range of interests in the mechanics of materials, including constitutive modeling, fracture mechanics, damage, and micromechanics in active, conventional structural, and composite materials. His current research focus is on the fundamental understanding of the deformation and failure response of shape memory alloys and on accelerating their development cycle for specific applications.

SYMPOSIUM 3

MODAL CHARACTERISTICS OF STRING NETWORKS

James Gibert
Assistant Professor
Purdue University

Abstract

The objective of this work is to investigate the dynamic behavior of string structures, specifically in terms of their modal frequencies and corresponding vibration modes. The modal characteristics of the structures are a function of the geometry of the structure, as well as its material properties, the tension in the individual strings, and boundary conditions of the structure. In order to accomplish this goal, we assume the three-dimensional wave equation describes the dynamic behavior of an individual string in the network. A Chebyshev collocation scheme is used to discretize the partial differential equation. This discretized equation is used to form a generalized eigenvalue problem with appropriate to boundary conditions. The approach is validated by comparing the predictions of the present model obtained with analytical solutions from known simple geometric configurations. The approach is extended to modeling geometrically complex web-like structures and examines the effect of tension and boundary on the modal behavior of the network. Results indicate that these structures are characterized by being modally dense, having repeated modal frequencies, and 1:2 and 1:3 proportionality between modal frequencies. It is envisioned that this modeling effort will aid in the study of internal resonance interactions and possible saturation phenomenon in these structural systems and inspire new concepts in adaptive string networks to avoid unwanted nonlinear resonant interaction or to design networks structures that absorb, localize, or divert vibrational energy.

Biography

Dr. James Gibert received B.S., M.S., and Ph.D. degrees in Mechanical Engineering from Clemson University in 2002, 2004, and 2009, respectively. Previously, he held a position in the Department of Mechanical and Aeronautical Engineering at Clarkson University as an Assistant Professor. Before joining Clarkson University, he was a consultant for MOOG CSA, a Visiting Professor in the Department of Civil Engineering at Clemson University, and a Postdoctoral Research Associate in the Department of Mechanical Engineering at Clemson University. In 2015, he joined the School of Mechanical Engineering at Purdue University. Currently, he is a member of ASME and active in the Aerospace Division and the Design Engineering Division's Technical Committee on Vibration and Sound. His research lies at the intersection of dynamics, smart materials, and manufacturing. He has won several research awards, including Outstanding Journal Paper of the year in the *Rapid Prototyping Journal,* and his dissertation was named Highly Commended for the Emerald Engineering Outstanding Doctoral Award. His work is supported by organizations ranging from the National Science Foundation to the International Safe Transit Association.a

SYMPOSIUM 3

NONLINEAR DYNAMICS OF SHAPE MEMORY ALLOY SYSTEMS AND STRUCTURES

Marcelo A. Savi
Universidade Federal do Rio de Janeiro
COPPE - Department of Mechanical Engineering
Center for Nonlinear Mechanics

Abstract

Bioinspiration is a paradigm that extracts design principles from biological and natural systems. Based on that, it is possible to create systems and structures with adaptive behavior according to its environment. Smart materials have an essential importance on this idea being used as sensors and actuators that define the remarkable system characteristics. Besides this, natural rhythms are inspiring new situations and therefore, the investigation of nonlinear dynamics, chaos, and control is establishing other design paradigms. The use of bioinspired smart systems is now evolving to create origami systems based on the ancient Japanese art of paper folding. Basically, the main idea of the origami is to create a three-dimensional structure from a plane source. Adaptive origamis have been explored in order to produce foldable, adaptive structures that can be applied in several areas of the human knowledge. This seminar presents a general overview of nonlinear mechanics of shape memory alloy (SMA) systems and structures. The presentation discusses SMA applications and their thermomechanical behaviors. System modeling is also presented showing interesting behaviors for potential applications. Shape memory alloy systems include devices for vibration attenuation, general structures, and origamis. Chaos and chaos control are some subjects presented to give a general idea of challenges for innovative applications. The rich, complex dynamical response of these systems is of special concern.

Biography

Marcelo A. Savi is a Ph.D. in Mechanical Engineering and Professor at Federal University of Rio de Janeiro (COPPE - Department of Mechanical Engineering), where he develops research and teaching activities, being the Head of the Center for Nonlinear Mechanics. He has published over 400 journal and conference papers, 5 books and about 15 book chapters. He is actively involved as advisor of graduate and undergraduate students, summing more than 150 works. He has administrative experience as head of department, graduate coordinator, and university committees. He serves as Associate Editor of some journals, where it is important to highlight: *ASME Journal of Computational and Nonlinear Dynamics* (2019–present), *International Journal of Mechanical Sciences* (2018–present), *Journal of Vibration and Control* (2017–present), *Mathematical Problems in Engineering* (2018–present), *Journal of the Brazilian Society of Mechanical Sciences and Engineering* (2006–2016), *Journal of Applied Mathematics* (2012–2014) and *Open Journal of Acoustics* (2007–2013). Research interests are related to nonlinear mechanics, where smart material and structures; nonlinear dynamics, chaos, and control; biomechanics; and ecology should be highlighted.

SYMPOSIUM 4

SELECTIVE STIFFNESS APPROACHES FOR SHAPE ADAPTATION, EXPANDABLE STRUCTURES AND DEPLOYABLE SYSTEMS

Paolo Ermanni
Professor
Department of Mechanical and Process Engineering
ETH, Zürich

Abstract

Fibre Reinforced Polymers have been used for decades in high performance lightweight structural applications, requiring outstanding mechanical properties in terms of stiffness and strength, fatigue, and environmental resistance. Furthermore, the layered nature of the laminate and the anisotropic material response are significantly enlarging the available design space, therefore enabling the implementation of novel functionality in the structural systems. The possibility to locally tailor the material properties and deformation behavior is a key approach to

successfully address the challenge of concurrently achieving high deformability and load-carrying properties in lightweight structures, therefore designing adaptive systems for, e.g., conformal shape adaptation, highly expandable, as well as deployable structures. Besides relying on material tailoring, methods and approaches to achieve selective stiffness response include topology optimization for compliant design concepts, semi-active variable stiffness solutions, and structural elasticity related variable stiffness. The talk is presenting current research at CMASLab, focusing on methods exploiting elastic instability.

Mechanical metamaterial lattices exploit structural interactions at different hierarchical levels to achieve a remarkably rich macroscopic mechanical response, which can often not be realized in conventional structures. Furthermore, tailorability can be radically enhanced by the implementation, at a micromechanical level, of buckling-induced stiffness variability. Recently, we have proposed a periodic structure based on a hexagonal chiral lattice topology, modified by introducing transverse curvature in the ligaments. Engineering the geometrical design parameters of the lattice opens up the possibility to realize extreme stiffness variations as a function of the deformation level and spatial location as well as a large macroscopic shape deformation with limited local microscopic strains. We have successfully used these chiral metastructures to tune the deformation of compliant structures in morphing applications. Further applications include noise, vibration, and wave propagation control. Regarding application in deployable systems, we show that the incorporation of tape-springs in novel metamaterial lattices can dramatically improve the deformability of high stiffness metamaterial structures made of fibre reinforced composites. We are currently investigating different architectures and are also considering efficient fabrication routes and applications in deployable antennas.

Periodic lattice structures, which are filled with compliant elastomeric materials to realize a closed, compliant cover, can also be used for the realization of an extreme anisotropic deformation behaviour in load-carrying skin structures for morphing applications. The drawback of this approach lies in the generally poor out-of-plane mechanical properties of the metastructure. Current research at CMASLab shows that the combination of high out-of-plane stiffness and high in-plane deformability can be elegantly achieved by the realization of unfolding skin units embedding tape spring ligaments. We show that the proposed design can be tailored to exhibit substantial in-plane deformability, while maintaining a remarkable out-of-plane stiffness.

Relevant applications for elastic instability related shape adaption also include radially expandable cylindrical structures for utilization ranging from expandable stiffening space structures to medication delivery and cardiovascular implants. The concurrent realization of large expansion and delivering structural support is challenging. We propose a fully novel design that overcomes the limited deformability and brittle behaviour of thin composite cylinders by implementing a purely elastic deformation, which relies on a self-expandable buckling-inspired folding pattern in conjunction with the high anisotropic material properties.

Biography

Dr. Paolo Ermanni is Professor of Composite Materials and Adaptive Structures at ETH Zürich, in the Department of Mechanical and Process Engineering (2003–present). He earned his Dr. Sc. Techn. (1990) and Diploma (MSc., 1984) in mechanical engineering from ETH Zürich. He Previously, Dr. Ermanni was Associate Professor of Structure Technologies in the department from 1998 to 2003. His past experience includes 1997–1998 consultant (manager), A.T. Kearney, Milan; 1991–1997 senior engineer, structure-pre-development and later project manager, Airbus Germany, Hamburg; 1985–1991 research and teaching assistant, ETH Zürich, Institute of Design Methods and Construction; and 1985 research assistant, ETH Zürich, Institute of Biomedical Engineering.

Dr. Ermanni is bridging material science and engineering applications and conducting research in structural mechanics, design, and fabrication processes of multi-functional lightweight structures. Research is inspired by practical problems and driven by the ambition to improve the efficiency, the reliability, and the functionality of structural composite systems. Research areas include shape adaptable systems, advanced processing routes for high performance thermoplastic composites, and additive manufacturing of adaptive and composite systems.

SELECTED INSTITUTIONAL RESPONSIBILITIES

2015–present, Vice-Rector for Continuing Education, ETH Zürich

2011–2017, Member of the Admission Committee, Department of Mechanical and Process Engineering

2010–2018, Member of the Tenure and Promotion Committee, Department of Mechanical and Process Engineering

2007–present, Director, Conferences Stefano Franscini (CSF) of ETH Zürich

2003–2005, Director of Studies, Department of Mechanical and Process Engineering

2001–2003, Head, Institute of Mechanical Systems

BOARDS

2013–2018 Carbon Composites Schweiz, Board of Directors

2011–2014 Inspire AG, Board of Directors

2009–2015 Acutronic Schweiz AG, Board of Directors

Symposia Invited Speakers

SYMPOSIUM 4

ADDRESSING AVIATION AND EDUCATION CHALLENGES WITH NASA UNIVERSITY LEADERSHIP INITIATIVE

Koushik Datta
University Innovation Project Manager
NASA Aeronautics

Abstract

NASA Aeronautics' University Leadership Initiative (ULI) provides the opportunity for university teams to exercise technical and organizational leadership in proposing unique technical challenges, defining interdisciplinary solutions, establishing peer review mechanisms, and applying innovative teaming strategies to strengthen the research impact. This presentation will summarize the goals of ULI and the aeronautics research projects awarded under ULI. In particular, it will highlight two of the awards with adaptive structures research and the system level problems addressed by the research.

Biography

Koushik Datta is the University Innovation Project Manager for NASA Aeronautics and manages the University Leadership Initiative and University Students Research Challenge. Previously, Koushik was the manager of the LEARN Project and prior to that he was acting Deputy Director for, and helped establish, NASA Aeronautics Research Institute (NARI). While at NASA Ames Research Center, Koushik has worked on multiple NASA projects: Lunar Atmosphere and Dust Environment Explorer (LADEE), Orion 80-AS Test, Lunar Crater Observation and Sensing Satellite (LCROSS), Stratospheric Observatory for Infrared Astronomy (SOFIA), Integrated Vehicle Health Management (IVHM) for the Space Launch Initiative (SLI), and Advanced Air Transportation Technologies (AATT). He has extensive experience in simulation, modeling and safety-analysis of air traffic systems, science payloads, and space propulsion systems. Koushik received his Ph.D. in Operations Research from UC Berkeley and B.Tech. in Mechanical Engineering from IIT Madras.

SYMPOSIUM 4

TENSEGRITY-CONSTRAINED INFLATABLES: A NEW APPROACH

Jonathan Luntz
Associate Research Scientist
Department of Mechanical Engineering
University of Michigan

Abstract

Inflatable devices have long been a mainstay in a wide range of applications, including aerospace, automotive, medical, and sporting goods, due to their low cost, light weight, simplicity, and ability to compactly stow yet deploy to large sizes with complex shapes. Inflatables, which generally comprise a statically shaped inflatable bladder, are generally lacking in two regards: they do not provide strong structural support with selectively tailorable compliance and they cannot be adjusted in shape once fully inflated. This paper explores a new approach to enhancing the functionality of inflatables through the use of internal tensile elements which both constrain the inflatable's shape as well as guide its deformation under external forces. By leveraging concepts in the field of tensegrity mechanisms, tensegrity-constrained inflatables add additional functionality to inflatables. They differ from traditional tensegrity in that the tensegrity mechanism alone does not fully constrain the inflatable except when coupled with the inflatable bladder. Also, in addition to pure tensile segments, multi-segmented tensile elements with single strings threaded through multiple loops allow structural deformations. This paper is broken into two parts. The first part explores architectures and functionalities provided by tensegrity constrained inflatables. Inflatable devices with controlled compliance are examined which can be designed with soft compliance or high rigidity in selective degrees of freedom, and are validated experimentally in the context of small deployable user controls (knobs, joysticks, etc.) with different mechanical feel. Posable tensegrity devices are also explored which rely on friction between tensile strings and threading loops to enable a user to apply an external force to reshape and pose the structure. The second part describes analytical modeling efforts in two areas: kinematics and mechanics. A linear algebraic approach is used to model the small-deformation kinematics of the tensegrity structure to predict and design the constrained and allowed degrees of freedom. Graphical kinematic approaches, adapted from traditional mechanism design, aid in the design of tensegrity constrained inflatables. An analytical model of the large-deflection inflation mechanics of cylindrical elastomer bladders is also presented which enables the prediction and design of axial mode rigidity of tensegrity constrained inflatables, including enhancement of structural rigidity through additional circumferential band constraints to inhibit radial inflation in favor of axial inflation. The set of work presented in this new field of tensegrity-constrained inflatables provides the foundation for future exploration and development of a wide class of devices and application which extend the functionality of inflatables.

Biography

Dr. Jon Luntz is an Associate Research Scientist at the Department of Mechanical Engineering at the University of Michigan, which he joined in 2000 after graduating from Carnegie Mellon University with his Ph.D. in 1999 and from SUNY Buffalo with his B.S. in 1992. Early in his career, he was a founding contributor to the field of Distributed Robotic Manipulation and then branched into the field of Smart Materials and Structures. As a thrust area leader in the General Motors/University of Michigan Collaborative Research Lab in Smart Materials and Structures, he worked to develop innovative devices, actuation architectures, and design methodologies, processes, and tools focusing primarily on the use of Shape Memory Alloy actuators. Currently, he works as part of the GM/UM CRL on Multifunctional Vehicle Systems, where he leads innovation on highly functional inflatable architectures and devices under the Multifunctional Active System Technologies thrust, as well as developing systematic design methodologies for customer facing products under the Neurotech thrust, integrating customer perception and technology design. Under the MVS CRL, he also operates the Technology Incubator which focuses on exploratory work for the development of innovative new technologies. Along with his automotive research, he is currently developing a medical device to correct short bowel syndrome, which, with its adoption by the newly formed Teitelbaum Foundation, is approaching the final stages of development for first-in-human clinical trials. As part of these efforts, he has published over 120 referred journal and conference publications and has been awarded 15 US and international patents with 10 pending. For his research, he has been awarded the ASME Best Paper Award in Structures and Structural Dynamics, the Hartwell Award, the Ted Kennedy Team Excellence Award, the UM COE Kenneth M. Reese Outstanding Research Scientist Award, and the NSF CAREER award.

SYMPOSIUM 5

SCALE-BRIDGING FOR STRUCTURAL HEALTH MONITORING

Ed Habtour
Principe Member of Technical Staff
Sandia National Laboratories

Abstract

Most of aerospace vehicles are inherently nonlinear systems, and operate in highly complex environments. Common methods for monitoring and for assessing the structural health of aerospace systems are typically based on linear or simplified models. Consequently, engineers compensate by including multiple safety and correction factors, which often comes with penalties, such as an increase in the vehicle's size, weight, or both. In this talk, we provide promising nonlinear system identification techniques for assessing the health of aerospace structures by connecting nonlinearities across the scales. The talk will also include a discussion on exploiting the sensitivity the nonlinear parameters to fatigue damage precursors. Connecting nonlinearities across the macro- and micro-states is key in monitoring the evolution of damage precursors. This can be achieved when the effects of these connections are included in the equations of motion; i.e. the interplay between local nonlinearities (or materials micro-plasticity) and macro nonlinearities (global dynamic parameters). Technical and scientific challenges, and potential directions for enabling scale-bridging structural health monitoring in aerospace applications will be discussed.

Biography

Dr. Ed Habtour is a Principle Member of Technical Staff at Sandia National Laboratories. Prior to joining Sandia, Ed has held technical and leadership positions at the Space Dynamics Laboratory, ATK (formally Swales Aerospace), Northrop Grumman, and U.S. Army Materiel System Activity Analysis, U.S. Army Research Laboratory (ARL). Ed's research focuses on identifying and understanding the innate nonlinear connections and interactions observed in dynamical systems. The overarching goal is to develop efficient scale-bridging relations that govern nonlinear connections in time-variant systems and utilizing them to achieve novel functions. He earned a B.S. in Mechanical Engineering from Utah State University. He also earned three Master's in Engineering from Johns Hopkins University, Purdue University, and University of Maryland. Currently, he serves as an Associate Editor of the *ASME Journal of Nondestructive Evaluation, Diagnostics and Prognostics,* and a member of Engineering Mechanics Institute Structural Health Monitoring & Control Committee. Ed has served in international technical committees and panels. He published over 70 technical papers. Ed received several awards, including U.S. Dept. of Army Commander's Award, ARL Science Award, U.S. Dept. of Army Achievement Award, U.S. Army Commander's Award, and IEEE Evans/P.K. McElroy Award.

SYMPOSIUM 6

BIOINSPIRED AERIAL AND TERRESTRIAL LOCOMOTION STRATEGIES

Aimy Wissa
Assistant Professor
Mechanical Science and Engineering Department
University of Illinois at Urbana-Champaign

Abstract

Nature has evolved various locomotion (self-propulsion) and shape adaptation (morphing) strategies to survive and thrive in diverse and uncertain environments. Both in air and on the ground, natural organisms

continue to surpass engineered unmanned aerial and ground vehicles. Nature often exploits local elasticity and adaptiveness to simplify global actuation and control. Unlike engineered systems, which rely heavily on active control, natural structures tend to also rely on reflexive and passive control. This approach of diverse control strategies yields multifunctional structures. Two examples of multifunctional structures will be presented in this talk, namely avian-inspired deployable structures and click beetle-inspired legless jumping mechanism. The concept of wings as multifunctional adaptive structures will be discussed and several flight devices found on birds' wings will be introduced as a pathway towards revolutionizing the current design of small-unmanned air vehicles. Experimental, analytical, and numerical results will be presented to discuss the efficacy of such devices. The discussion of avian-inspired devices will be followed by an introduction of a click beetle-inspired jumping mechanism that exploits distributed springs to circumvent muscle limitations, such a mechanism can bypass shortcomings of smart actuators especially in small-scale robotics applications.

Biography

Aimy Wissa is an assistant professor at the Mechanical Science and Engineering department at the University of Illinois at Urbana-Champaign. She is also the director of the Bio-inspired Adaptive Morphology (BAM) Lab. Before arriving at the University of Illinois in 2015, she was a post-doctoral fellow at Stanford University. Wissa earned her doctoral degree in Aerospace Engineering from the University of Maryland in 2014 and B.S. degree in the same field from the Pennsylvania State University. Wissa's work primarily focuses on the design and dynamics of adaptive bioinspired structures and systems, such as morphing wings and robots with multiple modes of locomotion. She has distinguished herself and her research by publishing and presenting several conference papers and peer-refereed journal papers for which she received several best paper awards. Wissa is a McNair Scholar. She is the recipient of the Air Force Research Laboratory Summer Faculty Fellowship and the Air Force Office of Scientific Research Young Investigator Program award.

SYMPOSIUM 6

SOFT RECONFIGURABLE MATERIALS INSPIRED BY CELLULAR MECHANICS

Eric Freeman
Assistant Professor
University of Georgia

Abstract

Cellular organisms have the ability to respond and adapt to changes in their environment, coordinating activities that provide a foundation for the natural world. This is in part accomplished by regulated exchange across a network of membranous barriers within a fluidic environment, often through membrane-embedded stimuli-responsive biomolecules operating as valves or gates between subcompartments of the cell. These membranous barriers are able to adapt and rearrange, modifying the transport both within the cellular interior and with the surrounding environment and providing unparalleled spatiotemporal control over the cytosol contents. Fully replicating these capabilities within a material is infeasible, but it is possible to approximate reconfigurable cellular architectures through a combination of droplet mechanics and biological membranes.

In this talk, replicating these capabilities is accomplished using the droplet interface bilayer approach. Networks of droplets containing dissolved lipids are adhered together in oil reservoirs, forming biomimetic membranes at their intersections. Depositing droplets with varying compositions in desired patterns produces tailored networks of stimuli-responsive membranes that approximate biological tissues. The droplets exhibit a weak elasticity due to minimization of their interfacial energies and may rearrange or adapt in response to external forces or constraints. These adjustments of the droplets in turn influence the properties of the biological membranes, coupling droplet mechanics and membrane activity.

This talk investigates how these coupled phenomena may be used to develop new generations of bioinspired materials as well as providing novel tools for investigating biophysical phenomena. It will provide an overview of our recent discoveries and innovations related to droplet-based bioinspired smart materials. Topics include droplet-based materials and bioinspired devices, an overview of droplet elasticity, and ongoing research on droplet manipulation and reconfiguration towards the development of a magnetically responsive bioinspired material.

Biography

Eric Freeman is an assistant professor in the College of Engineering at the University of Georgia. He received his B.S. in Mechanical Engineering from Geneva College in 2006, M.S. and Ph.D. in Mechanical Engineering and Material Science from the University of Pittsburgh in 2009 and 2012. He then worked as a postdoctoral associate in the Biomolecular Materials

and Systems Laboratory at Virginia Tech before joining the faculty at the University of Georgia in 2014. His research includes experimental and computational studies on the mechanics of soft emulsive systems, and ongoing research projects include the manufacture of synthetic bioinspired tissues, reconfigurable droplet-based materials through magnetic forces, and exploration of interfacial phenomena through tensiometry and electrophysiology.

SYMPOSIUM 7

PASSIVE ADAPTIVE VIBRATION ENERGY HARVESTING

Lei Zuo
Professor
Department of Mechanical Engineering
Virginia Tech

Abstract

Vibration energy harvesters are typically designed to have the natural frequency match the excitation frequency. Such energy harvesters work effectively at the resonance. Unfortunately, in the real world, the excitation frequency is mostly time varying. When the frequency is mistuned a little bit, the power output can be reduced significantly. Hence, an adaptive tuning is desired. Several researchers have been developed adaptive tuning method to solve this challenge. However, most of them were active tuning and required external energy to achieve adaptive tuning. In this talk, we would like to introduce two passive self-tuning energy harvesting strategies: Adaptive tuning stochastic resonance via centrifugal effect and self-resonance with a sliding mass. Our new energy harvesting strategies can achieve passive, adaptive and broad tuning capability. The first strategy is to passively tune the stochastic resonance frequency to track the time varying rotating speeds of the rotation systems like the tires, via a centrifugal stiffening effect. It is an electromagnetic energy harvester consisting of an inward oriented rotating beam subjected to buckling induced by centrifugal force. As rotating frequency changes, the stiffness of rotating beam also changes due to centrifugal stiffening effect. Therefore, stochastic resonance frequency can track the time varying rotating speeds. Its performance was verified in the smart tire application with the maximum power of 30mW in the driving speed 30–70mph, in comparison with sub milli-watt power of traditional energy harvesters. The second strategy is adding a sliding mass to the beam. The freely sliding mass changes the beam's resonance frequency, allowing the beam to "self-tune" and resonate at the time-varying input excitation frequency. The bandwidth of system increased about 150% compared to without sliding mass cases. Such technique can be used to develop self-powered sensors for the infrastructural Internet-of-Things (i-IoT) such as intelligently structure monitoring.

Biography

Lei Zuo is a professor in both Mechanical Engineering and Electrical and Computer Engineering at Virginia Tech. He serves as the Director of NSF Industry-University Collaborative Research Center (I/UCRC) for Energy Harvesting Materials and Systems. He completed his Ph.D. from MIT and returned to academia in 2008 after working in industry for four years. Lei Zuo's research interests include energy harvesting, mechatronics design, vibration control, ocean renewable energy, thermoelectricity, and advanced manufacturing. He has secured over 12 million U.S. dollars of research funding ($10M as the PI). Lei Zuo has published over 260 papers in journals and conferences, including a few with best paper awards. He mentored 10 Ph.D. and 43 Master's, and is currently advising 11 Ph.D. and 6 M.S. students. The ASME recognized him as "a pioneering researcher in energy harvesting, especially at larger energy scale" with its 2015 Thar Energy Design Award. Zuo is also the sole recipient of the 2017 ASME Leonardo Da Vinci Award. He won R&D Awards twice (2015 and 2011) from R&D Magazine. He was named as ASME Fellow in 2016. He currently serves as a technical editor for *IEEE/ASME Transactions on Mechatronics* and associate editor for *ASME Journal of Vibration and Acoustics* and IFAC journal *Mechatronics*. He is a general co-chair of the 2019 ASME IDETC/CIE conference.

SYMPOSIUM 8

COLD-BLOODED CIRCUITS: TRANSIENT ELECTRICAL SYSTEMS THAT REQUIRE CONSTANT HEAT INPUT TO PREVENT DISSOLUTION

Leon M. Bellan
Assistant Professor
Department of Mechanical Engineering
Vanderbilt University

Abstract

Most circuits are used for applications that rely on the invariance of the materials used to form them. Recently, however, there has been a push to expand the range of materials used to include those that can be easily induced to disintegrate and vanish. Current efforts in the field of transient circuitry have demonstrated silicon-based microelectronic circuits that dissolve in aqueous solutions with predetermined timeframes. These systems are promising for many applications, including as monitoring or therapeutic implantable devices, secure "self-destructing" electronics that may contain classified or other high value information, or zero-waste vanishing environmental sensors. There are applications, however, that may require more sophisticated mechanisms and triggers for transience, and several stimuli-responsive platforms have been recently developed that disintegrate upon input of some form of energy (i.e., UV, heat, etc.) To

produce novel circuitry that requires constant energy input (in the form of heat) to prevent irreversible dissolution and loss of function, we have combined thermoresponsive polymers that exhibit a lower critical solution temperature (LCST) behavior with patterned conductive nanowire networks. When the resulting thermoresponsive transient circuit is placed in a warm water bath above the LCST, the polymer remains hydrophobic and holds the nanowire networks together, enabling an electrically conductive path. Upon cooling below the LCST, the polymer quickly becomes hydrophilic and dissolves, releasing the nanowires into solution and destroying the conductive path. We have shown that it is possible to pattern passive components such as resistors, capacitors, and inductors with this approach, and demonstrated a thermoresponsive transient antenna that supports wireless interaction when in a warm water bath but vanishes and loses functionality as soon as the bath cools below the LCST. Thus, by forming a composite of conductive nanowires and thermoresponsive polymer binder, we are able to achieve a unique platform that requires constant heat input to prevent irreversible circuit disintegration and loss of function. Such systems have potential for use in applications such implantable circuitry that dissolves upon cooling (e.g., due to application of ice to the skin, loss of life, or removal from host tissue).

Biography

Dr. Leon M. Bellan received his B.S. degree in Physics from Caltech and his Ph.D. in Applied and Engineering Physics from Cornell University. Dr. Bellan did his postdoctoral training at MIT, focusing on developing techniques to pattern 3D capillary-like channel networks within hydrogels. He joined the Department of Mechanical Engineering at Vanderbilt University in 2013 and has a secondary appointment in the Department of Biomedical Engineering. His lab focuses on the development of scalable micro-/nanofabrication techniques for the production of smart materials with novel functionality and biomimetic fluidic systems within cell-laden hydrogels.

SYMPOSIUM 8

NOVEL MATERIAL EXTRUSION ADDITIVE MANUFACTURING METHODS TO CONTROL MICROSTRUCTURE AND MESOSTRUCTURE IN PRINTED COMPOSITES

Brett G. Compton
Assistant Professor
Mechanical, Aerospace, and Biomedical Engineering Department
University of Tennessee, Knoxville

Abstract

This talk will provide an overview of some recent advances in material extrusion additive manufacturing (AM) that enable the creation of new materials with novel microstructures and mesostructures that may find application in smart or adaptive systems. Specifically, the talk will begin with an introduction of AM of thermoset polymer materials (e.g., epoxy and silicone resins) that are amenable to formulation with a wide range of structural and functional filler materials. Next, new direct-write print head designs will be described and explored that impart unprecedented control over the spatial arrangement and orientation of anisotropic fillers in printed components and hybrid structures. Finally, new design approaches for graded cellular structures will be described that allow spatial tailoring of the stiffness, directionality, and strain response of printed structures. Throughout the talk opportunities for applications of these materials and methods in SMASIS will be highlighted.

Biography

Brett G. Compton is currently an assistant professor of mechanical engineering at the University of Tennessee, Knoxville. Brett moved to UTK from Oak Ridge National Laboratory where he was a staff scientist in additive manufacturing (AM) at the Manufacturing Demonstration Facility (MDF). The MDF is the Department of Energy's flagship additive manufacturing center, and his research there included thermo-mechanical modeling of large-scale polymer composite AM and in situ thermal monitoring of metal powder bed systems. Prior to moving to Tennessee, Brett was a Postdoctoral Research Fellow in the Lewis Group in the School of Engineering and Applied Sciences and the Wyss Institute for Biologically Inspired Engineering at Harvard University, where he developed materials and techniques to 3D print short fiber-reinforced thermoset polymer resins to enable bio-inspired, lightweight polymer composites with controlled fiber orientation. Brett received his Ph.D. in Materials from the University of California, Santa Barbara, and his B.S. in Mechanical Engineering from the University of Kentucky.

Current research activities include the development and study of thermoset feedstock materials for AM of lightweight composites, foams, and cellular structures; study of the effects the 3D printing process on properties of composites with anisotropic filler materials; and novel printing techniques to control microstructure and mesostructure in printed composites and cellular materials.

ASME 2019 ADAPTIVE STRUCTURES & MATERIALS SYSTEMS AWARD

Nancy Johnson
Lab Group Manager and Technical Fellow
General Motors Research and Development

DESCRIPTION OF THE AWARD

The ASME Adaptive Structures and Materials System Prize is presented to a member of the technical community who has made significant contributions to the advancement of the sciences and technologies associated with adaptive structures and/or material systems. The $1,000 cash award and certificate are meant to recognize scientific contributions as measured by leadership, technical publications, and advances made.

Biography

Nancy Johnson is currently a Lab Group Manager and Technical Fellow at General Motors Research and development in Warren, Michigan. When she joined the GM Research her research focus was on composite material structures and energy management. She established design and analysis methods for an all carbon composite body structure and led projects of the Automotive Composites Consortium. She is a founding member and Fellow of the American Society for Composites and was invited to give keynote addresses on the use of composites in the automotive industry.

In the late 1990s, she became interested in how smart materials and adaptive structures could be utilized in the automotive industry. She recognized their potential and formed a new team at GM by hiring additional researchers in India and Michigan to bring smart materials into product and manufacturing processes. She established GM's strategy for smart materials and led the research necessary to enable the transition into real products while working to develop the necessary supply base. She conducted fundamental research necessary to advance smart materials in the automotive industry with a focus on shape memory alloys and shape memory polymers. Nancy has over 275 patents, many of which are in the area of smart materials and adaptive structures with many more in progress. Many of her patents are enablers for specific applications utilizing smart materials in the automotive industry. Example applications are in the areas of vehicle aerodynamics, vehicle crashworthiness, occupant safety, and interiors. Her team developed design tools and established test procedures for smart materials-based devices and was responsible for getting shape memory based applications into production including the active hatch vent in Corvette. Nancy has over 80 publications on smart materials and their uses and applications.

Nancy continues to lead multifunctional systems research work spanning multiple groups at General Motors and at HRL Laboratories, suppliers, and universities including the University of Michigan. She is co-director of the General Motors/University of Michigan Collaborative Research Laboratory, which has broadened its focus from smart materials and design tool development to multifunctional active systems. For over 20 years, Nancy has actively participated in ASME's Adaptive Structures and Materials Systems community. She is a Fellow of ASME and has served as chair of the Aerospace Division, was General Chair of the 2013 SMASIS conference, and currently serves on the conference executive committee.

ASME ASMS TC GARY ANDERSON AWARD

Ryan L. Harne
Assistant Professor
The Ohio State University

DESCRIPTION OF THE AWARD

The Gary Anderson Early Achievement Award is given for notable contribution(s) to the field of Adaptive Structures and Material Systems. The prize is awarded to a young researcher in his or her ascendancy whose work has already had an impact in his/her field within Adaptive Structures and Material Systems. The winner of the award must be within seven years of terminal degree at the time of nomination.

Biography

Ryan L. Harne is an Assistant Professor in the Department of Mechanical and Aerospace Engineering at The Ohio State University where he directs the Laboratory of Sound and Vibration Research. Dr. Harne received the Ph.D. degree in Mechanical Engineering at Virginia Tech in 2012. From 2012 to 2015, Dr. Harne was a Research Fellow at the University of Michigan. His research expertise falls in the areas of vibration, acoustics, mechanics, manufacturing, and smart materials. He is passionate for training students in these disciplines and mentoring them towards bright professional futures. The outcomes of Dr. Harne's research efforts have included one patent, multiple patents pending, one book, over 50 journal publications, over 50 conference proceedings, and numerous students mentored and guided through their academic programs. Dr. Harne is active in the ASME, ASA, and SPIE, where he serves in elected and appointed roles. Dr. Harne has been recognized for significant scientific contributions, including by the 2019 ASME Gary Anderson Early Achievement Award, the 2018 National Science Foundation CAREER Award, the 2017 and 2019 Air Force Research Lab Summer Faculty Fellowship, the 2017 ASME Best Paper Award in Structures and Structural Dynamics, the 2016 Haythornthwaite Young Investigator Award from ASME, and the 2011 ASA Royster Award. He currently serves as an Associate Editor for the *Journal of the Acoustical Society of America, Proceedings of Meetings on Acoustics*.

ASME ASMS TC 2019 BEST PAPER AWARDS

There are four best-paper awards established by the ASME Adaptive Structures and Materials Systems Technical Committee (ASMS TC): 1) Structural Dynamics and Control Best Paper Award, 2) Materials and Systems Best Paper Award, and 4) Best Paper Award in Bioinspired Smart Materials and Systems published in journal publications relevant to smart materials and structures and conference proceedings sponsored by the ASMS committee are eligible for the best-paper competition. Nominated papers are sent out for review. The winners of this year's awards are listed below.

2019 BEST PAPER IN STRUCTURAL DYNAMICS AND CONTROL AWARDS

A Comprehensive Study of 2:1 Internal-Resonance-Based Piezoelectric Vibration Energy Harvesting

Nonlinear Dynamics, Vol. 91, No. 3, pp. 1817–1834

Abstract

This work exploits a 2:1 internal resonance mechanism to enhance broadband vibration energy harvesting. It is achieved by adding a properly tuned auxiliary oscillator to the primary energy harvesting oscillator coupled by a nonlinear magnetic force. A theoretical study is conducted on the nonlinear dynamic and energy harvesting performance of the proposed harvester by various analytical approximations, and the accuracy of these analytical models is investigated. Given harmonic base excitation, the output voltage frequency response is derived by the multi-scale method and harmonic balance method (HBM), which are then verified by equivalent circuit simulations and experiments. The necessity of taking into account the zeroth-order harmonic component in the HBM is verified and discussed. The HBM result without this component and the multi-scale method fail to accurately predict the nonlinear dynamic behaviour. With the validated HBM model and the equivalent circuit model, key features of internal resonance are revealed by investigating modal interaction and saturation phenomena under varying excitation. By and large, the operational bandwidth of the vibration energy harvester is enlarged due to the 2:1 internal resonance.

Liuyang Xiong

Biography

Liuyang Xiong is currently a doctoral candidate in the Department of Mechanical Engineering, University of Auckland, New Zealand. He received his MEng degree from Shanghai Institute of Applied Mathematics and Mechanics, Shanghai University, China, in 2015, and BEng degree from School of Civil Engineering, Hefei University of Technology, China, in 2012, respectively. His main research interests include energy harvesting, passive and active vibration control, and structural dynamics.

Dr. Lihua Tang

Biography

Lihua Tang is currently a senior lecturer in the Department of Mechanical Engineering, University of Auckland, New Zealand. He received the B.Eng. degree in engineering mechanics and the MEng degree in solid mechanics from Shanghai Jiao Tong University, China, in 2005 and 2008, respectively, and the Ph.D. degree in structures and mechanics from Nanyang Technological University, Singapore, in 2012. His main research interests include smart materials and structures, energy harvesting, vibration control, acoustic/elastic metamaterials and thermoacoustic engines. He has authored and co-authored more than 100 technical papers including 63 journal articles. Dr. Tang is a Member of ASME, SPIE and ENZ. He is a member of Energy Harvesting Technical Committee of ASME and a member of Adaptive Structures and Material Systems (ASMS) Technical Branch of ASME.

Brian R. Mace

Biography

Brian R. Mace is Professor of Mechatronics in the Department of Mechanical Engineering, University of Auckland, which he re-joined in 2011. Prior to that he was Professor of Structural Dynamics at the Institute of Sound and Vibration Research (ISVR), University of Southampton. He graduated MA (Hons) and DPhil (1977) in Engineering Science from the University of Oxford. Following that he was Research Fellow at the ISVR (1977–1980), Lecturer in the Department of Civil and Structural Engineering, University College, Cardiff, Wales (1980–1983) and then moved to the University of Auckland, returning in 2000 to the ISVR. His research interests concern structural dynamics, vibrations, acoustics, smart structures and dynamics. including uncertainty modelling and wave-based approaches. Interests outside work include fishing, bridge, golf and walking.

2019 MATERIALS AND SYSTEMS BEST PAPER AWARDS

Investigation of Multimodal Electret-Based MEMS Energy Harvester With Impact Induced Nonlinearity

Journal of Microelectromechanical Systems, Vol. 27, No. 2, April, 2018

Abstract

This paper presents an electret-based MEMS energy harvester synergizing the advantages of multi-modal structure and impact mechanism for broad operating bandwidth. The device with a volume of 295 mm^3 comprises an electret-based primary subsystem for power generation and an electrode-free auxiliary subsystem for frequency tuning. The tiny auxiliary subsystem helps to induce close resonances with comparable outputs at low excitations, as well as introduces impact-based nonlinearity to drive the first resonant peak upward and further approach the second one at elevated excitations. The experimental results demonstrate that at an excitation of 12.8 m/s^2, the 3-dB bandwidth of the first peak is increased from 20.4 to 60.4 Hz and a low frequency ratio of 1.15 between the two peaks is achieved. The two degree-of-freedom resonant structure with impact-based nonlinearity is systematically investigated through an equivalent circuit representation. An electrical equivalent circuit model of the proposed device with impact mechanism is derived. The circuit simulation confirms the nonlinear behavior of the system, and reveals the mechanism of peak shifting and bandwidth enhancing dynamics.

Kai Tao

Biography

Kai Tao (M'16) received the B.Eng. degree in microelectronics from Central South University in 2009, the M.Eng. degree in microelectronics from Shanghai Jiao Tong University in 2012, and the Ph.D. degree from Nanyang Technological University in 2016. He was a Post-Doctoral Research Associate/Fellow for the Singapore-MIT Alliance for Research and Technology Project from 2015 to 2017. He is currently an Associate Professor with the Department of Mechanical Engineering, Northwestern Polytechnical University. His research interest includes NEMS/MEMS fabrication, micro energy harvesting, and self-powered MEMS devices.

Lihua Tang

Biography

Lihua Tang received the B.Eng. degree in engineering mechanics and the M.Eng. degree in solid mechanics from Shanghai Jiao Tong University, China, in 2005 and 2008, respectively, and the Ph.D. degree in structures and mechanics from Nanyang Technological University, Singapore, in 2012. He is currently a Senior Lecturer with the Department of Mechanical Engineering, University of Auckland, New Zealand. He has published over 70 peer-reviewed journal and conference papers. His research interests include energy harvesting, smart materials and structures, vibration and noise control, nonlinear dynamics, acoustic metamaterials, and MEMS. He currently serves on the ASME Energy Harvesting Technical Committee and the ASME Adaptive Structures and Material Systems Technical Branch.

Awards

Jin Wu

Biography

Jin Wu received the B.S. degree from the Wuhan University of Technology in 2008, the M.S. degree from the Huazhong University of Science and Technology in 2011, and the Ph.D. degree from Nanyang Technological University in 2014. He was at Nanyang Technological University as a Post-Doctoral Research Fellow to develop advanced gas sensors based on graphene material. He is undertaking the projects at the Singapore-MIT Alliance for Research and Technology. His research interest includes graphene sensors, NEMS/MEMS fabrication, surface patterning, and sub-diffraction imaging.

Sun-Woh Lye

Biography

Sun-Woh Lye received the B.Sc. and Ph.D. degrees from the University of Bath, U.K., in 1983 and 1987, respectively. He is currently a Professor and the Deputy Director of the School of Mechanical and Aerospace Engineering, Air Traffic Management Research Institute, Nanyang Technological University, Singapore. His research interests are in design decision support and optimization, computer-aided design, and manufacturing smart tools and technology. During his professorial career, he has served as a consultant and expert member to several engineering and governmental related companies in the training, problem solving, and evaluation of engineering projects; product design, and development issues. He has also served as chairman, and on the organizing and judging panel for both national and international conferences, technological competitions, and research funding applications. He is also the recipient of several international awards for his academic contributions.

Honglong Chang

Biography

Honglong Chang (M'04–SM'14) received the B.S., M.S., and Ph.D. degrees in mechanical engineering from Northwestern Polytechnical University (NPU), Xi'an, China, in 1999, 2002, and 2005, respectively. From 2011 to 2012, he was a Visiting Associate (Faculty) in the Micromachining Laboratory, California Institute of Technology, Pasadena, CA, USA. He is currently a Professor with the Ministry of Education Key Laboratory of Micro and Nano Systems for Aerospace, NPU, where he is also the Head of the Department of Microsystems Engineering. He has authored over 49 international journal papers and over 34 international conference papers in the microelectromechanical systems field. His research interests include MEMS physical sensors and MEMS design tools. He was a recipient of the Transducer 2015 Outstanding Paper Finalist Award and the MEMS 2016 Outstanding Paper Award.

Jianmin Miao

Biography

Jianmin Miao received the Dipl.-Ing. degree and Dr. Ing. degree (Hons.) in microelectromechanical systems (MEMS) from the Darmstadt University of Technology, Darmstadt, Germany. He spent several years in the industry for sensor/MEMS development. In 1998, he joined the Nanyang Technological University, Singapore, to establish the Micromachines Centre as the Founding Director, where he is currently a Tenured Faculty Member with the School of Mechanical and Aerospace. He has collaborated with MIT faculty at the Singapore-MIT Alliance for Research and Technology, Singapore, since 2008. He has authored or co-authored over 400 papers in journals and conferences, several books, and book chapters, and holds numerous patents. He is an Editorial Board Member of the *Journal of MEMS* and *Sensors,* and was the Chair and the Co-Chair of the MEMS/nanotechnology international conferences, and a Technical Committee Member of international conferences, including the IEEE International Conference on Micro Electro Mechanical Systems and the International Conference on Solid-State Sensors, Actuators, and Microsystems. He was invited by several international MEMS/nanotechnology conferences as a Plenary Speaker, a Keynote Lecturer, and an Invited Talker.

2019 BEST PAPER AWARD IN BIOINSPIRED SMART MATERIALS AND SYSTEMS FOR BIOINSPIRED SPRING ORIGAMI

Bioinspired Spring Origami

Abstract

Origami enables folding of objects into a variety of shapes in arts, engineering, and biological systems. In contrast to well-known paper-folded objects, the wing of the earwig has an exquisite natural folding system that cannot be sufficiently described by current origami models. Such an unusual biological system displays incompatible folding patterns, remains open by a bistable locking mechanism during flight, and self-folds rapidly without muscular actuation. We show that these notable functionalities arise from the protein-rich joints of the earwig wing, which work as extensional and rotational springs between facets. Inspired by this biological wing, we establish a spring origami model that broadens the folding design space of traditional origami and allows for the fabrication of precisely tunable, four-dimensional–printed objects with programmable bioinspired morphing functionalities.

Jakob Faber

Biography

Jakob Faber was a Postdoctoral Scientist with the complex materials group at ETH Zürich until 2018. He completed his Ph.D. in Mechanical Engineering at Technische Universität Darmstadt, graduating Summa Cum Laude in 2016. His research emphasizes bioinspired flexible architectures, origami, and self-healing materials, and has been published in *Science, Nature Communications,* and *Matter*. Currently, he works at RUAG Space AG in Zürich, Switzerland.

Andres Arrieta

Biography

Andres F. Arrieta is an Assistant Professor of Mechanical Engineering and Aeronautics and Astronautics Engineering (by courtesy) at Purdue University, where he leads the Programmable Structures Laboratory (PS Lab). Previously, he worked as a Group Leader at ETH Zürich's CMASLab and as a Research Associate at the Dynamics and Oscillations Group of TU Darmstadt. He received his Ph.D. in Mechanical Engineering from the University of Bristol in 2010. Prof. Arrieta investigates the interrelation between shape-property-function of material systems and structures, with a focus on embracing nonlinearity. His work lies at the interface between structures and vibrations and aims to discover and apply nonlinear phenomena, such as buckling and multi-stability, to engineering applications. PS Lab's work has been highlighted by several media outlets including National Geographic, Nature's News and Views and Switzerland's Neue Zurcher Zeitung. Prof. Arrieta's research is currently focused on programmable structures, morphing structures, nonlinear metamaterials and energy harvesting systems. He has co-authored 44 journal papers and received a number of prestigious awards, including the ASME Gary Anderson Award (2018) for outstanding contributions to the field of Adaptive Structures; the ETH Postdoctoral Fellowship (2012); and the UK's Oversees Research Scholarship (ORS) for doctoral studies (2007).

André R. Studart

Biography

André R. Studart received his Bachelor's degree in Materials Science and Engineering from the Federal University of São Carlos, Brazil. He carried out his Ph.D. under the supervision of Prof. Victor C. Pandolfelli in the same university, investigating novel methods for processing of refractory castables and near-net-shape advanced ceramics. From 2002 until mid-2007 he worked and gave lectures at ETH Zürich as a member of Prof. Ludwig J. Gauckler's group. During this first period in Zürich, he studied the mechanical properties of dental materials and ceramics processed through colloidal routes. In 2007–2008 he was researcher at Harvard University in the group of Prof. David A. Weitz in the area of inorganic materials obtained using microfluidic techniques. Since February 2009 he heads the Complex Materials group in the Department of Materials at ETH Zürich. He was awarded by Alcoa Co., Thermo Haake Co., Brookfield Co, Magnesita and the Brazilian Ceramic Society. He is co-author of an undergraduate textbook on ceramic processing, holds three patents, and has published about 50 scientific papers in international peer-reviewed journals. His main research interests are in bio-inspired complex materials with potential applications as medical implants, energy conversion systems, and smart structures.

Awards

2019 ENERGY HARVESTING BEST PAPER AWARDS

Acoustic Holograms in Contactless Ultrasonic Power Transfer Systems: Modeling and Experiment

Journal of Applied Physics, Vol. 124, 244901

Marjan Bakhtiari-Nejad

Biography

Marjan Bakhtiari-Nejad is a Ph.D. candidate in the Department of Biomedical Engineering and Mechanics at Virginia Tech. She received the B.S. and M.S. degrees in Mechanical Engineering from Tehran Polytechnic and Universiti Teknologi Malaysia, respectively. Her research interests include acoustic holography and contactless ultrasound acoustic energy transfer systems.

Ahmed Elnahhas

Biography

Ahmed Elnahhas is a Ph.D. student in the Department of Mechanical Engineering at Stanford University. He received the B.S. degree in Mechanical Engineering from Virginia Tech. Ahmed was MInDS undergraduate researcher between 2016 and 2018, and was named top graduating senior in the College of Engineering.

Muhammad R. Hajj

Biography

Muhammad R. Hajj is the George Meade Bond Professor, Chair of the Department of Civil, Environmental and Ocean Engineering and Director of the Davidson Laboratory at Stevens Institute of Technology. Before joining Stevens Institute of Technology in July 2018, Dr. Hajj was the J. Byron Maupin Professor of Engineering and Director of the NSF funded I/UCRC Center for Energy Harvesting Materials and Systems at Virginia Tech, where he oversaw the development of industry-directed energy-related science and technology research programs. At Virginia Tech, he also served as the Associate Dean of Graduate School between 2014 and 2018 where he was involved in the implementation of the Transformative Graduate Education initiative. Dr. Hajj is a Fellow of the Engineering Mechanics Institute and has served as an elected member of its Board of Governors. Dr. Hajj received a B.Eng. degree (with distinction) from the American University of Beirut. He received a M.Sc. and Ph.D. degrees from the University of Texas at Austin. To date, he has advised and directed research programs of 26 Ph.D. students who hold prestigious academic and industry positions. He is the author/co-author of over 150 journal publications.

Shima Shahab

Biography

Shima Shahab is an Assistant Professor in the Department of Mechanical Engineering at Virginia Tech. She completed her Ph.D. and M.S. in Mechanical Engineering at Georgia Institute of Technology. Dr. Shahab is the Director of the Multiphysics Intelligent and Dynamical Systems (MInDS) Laboratory and Associate Director of the NSF I/UCRC Center for Energy Harvesting Materials and Systems (CEHMS). Her theoretical and experimental research program focuses on the intersection of smart materials and dynamical systems for various interdisciplinary applications such as contactless acoustic energy transfer, microfluidics driven via ultrasonic, ultrasound responsive drug delivery systems, and piezoelectric actuation. Dr. Shahab has served as Principal Investigator on research grants from National Science Foundation, Alpha Foundation and Oakridge National Laboratory.

Exhibitors

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جامعة نيويورك أبوظبي
NYU ABU DHABI

Considered by many as the Ivy League University of the middle east, New York University Abu Dhabi (NYUAD; http://nyuad.nyu.edu/) first opened in 2008 and is currently located in a 15-acre campus in the Marina District of Saadiyat Island, Abu Dhabi. As a liberal arts college and research university, NYUAD offers twenty two majors in the area of Arts and Humanities, Social Sciences, Science, and Engineering that culminate into a B.A. or B.S. degrees. The university has a small and diverse student body from 120 nationalities, with a total student enrollment of around 1350 (56% female, 44% male) in 2018. NYUAD students are drawn from around the globe, surpassing all traditional academic benchmarks. According to Inside Higher Ed, NYUAD is among the most diverse and selective undergraduate universities, with an acceptance rate of around 4%. In the past five years, NYUAD undergraduate student body has garnered an impressive record of scholarships, graduate-school appointments, and many other honors, including twelve Rhodes Scholarships since 2014. NYU Abu Dhabi's highly selective liberal arts college is complemented by faculty-led advanced research, sponsoring cutting-edge projects across the Arts, Humanities, Social Sciences, Sciences, and Engineering. The global Ph.D. Fellowship program attracts the best talent from across the world for pursuing doctoral research on campus. The Engineering Division of NYUAD also takes pride in a thriving doctoral program, as well as in the postdoctoral researchers who have chosen to make NYUAD their research home.

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MECHANICAL ENGINEERING

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MONDAY, SEPTEMBER 9 • 9:30AM–10:40AM

9:30AM	9:50AM	10:10AM

Symposium 1 Development and Characterization of Multifunctional Materials

1-1 Shape Memory Alloys – Applications **9:30AM–10:40AM** **Level 3, Charred**

Session Organizer: **Cory R. Knick**, *U.S. Army Research Laboratory, Adelphi, MD, United States*

Session Co-Organizer: **Kenny Pagel**, *Fraunhofer Institute for Machine Tools and Forming, Dresden, Germany*

9:30AM High Frequency, Low Power, Electrically Actuated Shape Memory Alloy (SMA) MEMS Bimorph Thermal Actuators

Technical Presentation. SMASIS2019-5502

Cory R. Knick, *U.S. Army Research Laboratory, Adelphi, MD, United States*

9:50AM Development of an Active Cushion Based on Shape-Memory-Alloy Actuators

Technical Presentation. SMASIS2019-5596

Kenny Pagel, Christoph Eppler, Lukas Boxberger, *Fraunhofer Institute for Machine Tools and Forming, Dresden, Germany*, **Andre Bucht**, *Fraunhofer IWU, Dresden, Germany*, **Holger Kunze**, *Fraunhofer Institute for Machine Tools and Forming, Dresden, Germany*

10:10AM An Efficient Methodology to Characterize SMA Behavior Under Cyclic Bi-Axial Loading Conditions Based on the Small Punch Test

Technical Presentation. SMASIS2019-5613

Bjoern Kiefer, Jarno Hein, Martin Abendroth, Horst Biermann, Sebastian Henkel, Anja Weidner, *TU Bergakademie Freiberg, Freiberg, Germany*, **Thomas Niendorf, Philipp Krooss**, *University of Kassel, Kassel, Germany*

Symposium 2 Mechanics & Behavior of Active Materials

2-1 Advanced Materials, Mechanics, and Devices **9:30AM–10:30AM** **Level 3, Malt**

9:30AM Phase Inversion Drilling Fluids

Technical Paper Publication. SMASIS2019-5715

Gilles Numkam, Babak Akbari, *Louisiana State University, Baton Rouge, LA, United States*

9:50AM Application of Enhanced Higher Order Layer-by-Layer Theory to Composite and Orthotropic Face Sandwich Beam Structure With Consideration of Interfacial Strain Energy Continuity

Technical Presentation. SMASIS2019-5752

Temesgen Takele Kasa, *Pukyong National University/Addis Ababa Science and Technology University, Busan, Busan, Korea (Republic)*

MONDAY, SEPTEMBER 9 • 9:30AM–10:30AM

9:30AM	9:50AM	10:10AM

Symposium 3 Modeling, Simulation and Control of Adaptive Systems

3-1 Design of Smart and Adaptive Systems 1 **9:30AM–10:30AM** **Level 3, Oak**

Session Organizer: **Giovanni Berselli**, *University of Genoa, Savignano sul Panaro, Italy*

Session Co-Organizer: **Salvatore Ameduri**, *Italian Aerospace Research Centre, Capua, Italy*

9:30AM On the Design of a Long-Stroke Beam-Based Compliant Mechanism Providing Quasi-Constant Force

Technical Paper Publication. SMASIS2019-5519

Pietro Bilancia, **Alessandro Geraci**, *University of Genoa, Genoa, Italy*, **Giovanni Berselli**, *University of Genoa, Savignano sul Panaro, Italy*

9:50AM Traveling Waves on Two-Dimensional Surfaces: Generating and Tailoring the Waveform

Technical Presentation. SMASIS2019-5523

Patrick F. Musgrave, *U.S. Naval Research Laboratory, Washington, DC, United States*, **Mohammad I. Albakri, Pablo A. Tarazaga**, *Virginia Tech, Blacksburg, VA, United States*

10:10AM Geometrically Nonlinear Vibration Attenuation of Functionally Graded Magneto-Electro-Elastic Shells

Technical Paper Publication. SMASIS2019-5533

Subhaschandra Kattimani, Sharnappa Joladarashi, *National Institute of Technology Karnataka, Mangalore, Karnataka, India*, **Vinyas Mahesh**, *Nitte Meenakshi Institute of Technology, Bangalore, Karnataka, India*

Symposium 4 Integrated System Design and Implementation

4-1 Morphing Wing 1 **9:30AM–10:30AM** **Level 3, Rye**

Session Organizer: **Paolo Ermanni**, *ETH Zürich, Zürich, Switzerland*

Session Co-Organizer: **Matthew P. Snyder**, *United States Air Force Academy, USAFA, CO, United States*

9:30AM Application of Multifunctional Structural Materials and Morphing Wing Concepts to the Development of Low-Cost ISR UAVs

Technical Presentation. SMASIS2019-5738

Scott Bland, *NextGen Aeronautics, Hillsborough, NC, United States*, **Darold Cummings**, **Jayanth Kudva**, *NextGen Aeronautics, Inc., Torrance, CA, United States*, **Jeff Baur**, *Air Force Research Laboratory, Liberty Township, OH, United States*, **Gregory Reich**, *Air Force Research Laboratory, Bellbrook, OH, United States*

9:50AM Aerostructural Optimization of a Morphing Airfoil Using Graph Based L-System Topologies

Technical Paper Publication. SMASIS2019-5695

Madalyn Mikkelsen, *Texas A&M University, Bryan, TX, United States*, **Patrick Philip Walgren, Michayal Matthew, Brent R. Bielefeldt, Pedro Leal**, *Texas A&M University, College Station, OH, United States*, **Andres Arrieta**, *Purdue University, West Lafayette, IN, United States*, **Darren Hartl**, *Texas A&M University, College Station, TX, United States*

10:10AM Transient Fluid-Structure Interaction Analysis of a Solid State Ornithopter Wing

Technical Paper Publication. SMASIS2019-5557

Mohammad Katibeh, **Onur Bilgen**, *Rutgers University, Piscataway, NJ, United States*

MONDAY, SEPTEMBER 9 • 9:30AM–10:40AM

9:30AM	9:50AM	10:10AM

Symposium 7 Energy Harvesting

7-1 Biological and Thermal Applications **9:30AM–10:40PM** **Level 3, Barley**

Session Organizer: **Shahrzad Towfighian**, *Binghamton University, Binghamton, NY, United States*

Session Co-Organizer: **Xuewei Zhang**, *Texas A&M University-Kingsville, Kingsville, TX, United States*

9:30AM Optimization of a Triboelectric Energy Harvester for Load Sensing in Total Knee Replacements

Technical Presentation. SMASIS2019-5622

Alwathiqbellah Ibrahim, **Shahrzad Towfighian**, *Binghamton University, Binghamton, NY, United States*

9:50AM A Wearable Biomedical Motion Sensor Employing a Vibration Energy Harvester

Technical Paper Publication. SMASIS2019-5634

Hesam Sharghi, *Rutgers University, Piscataway, NJ, United States*, **Jean-Francois Daneault**, *Rutgers University, Newark, NJ, United States*, **Onur Bilgen**, *Rutgers University, Piscataway, NJ, United States*

10:10AM A Theoretical Study of Ferrofluid Generator Powered by Waste Heat and Ambient Vibration

Technical Presentation. SMASIS2019-5767

Xuewei Zhang, *Texas A&M University-Kingsville, Corpus Christi, TX, United States*

Symposium 5 Structural Health Monitoring

5-1 New Approaches in SHM **9:30AM–10:40AM** **Level 3, Barrel**

Session Organizer: **Hae Young Noh**, *Carnegie Mellon University, Pittsburgh, PA, United States*

Session Co-Organizer: **Daewon Kim**, *Embry-Riddle Aeronautical University, Daytona Beach, FL, United States*

9:30AM Detection of Precursors to Damage in Aerostructures

Invited Presentation. SMASIS2019-5764

Ed Habtour, *Sandia National Laboratories, Albuquerque, NM, United States*

10:10AM Structural Monitoring of Full-Scale Composite Vessels During Hydro-Proof and Mechanical Acceptance Tests by Surface Bonded Distributed Sensing Fiber Optic

Technical Presentation. SMASIS2019-5750

Monica Ciminello, **Antonio Concilio**, **Camillo Richiello**, *Italian Aerospace Research Centre, Capua, Italy*, **Gabriele Fabbi, Andrea Mataloni, Pierluigi Perugini, Vincenzo Mancini**, *AVIO, Colleferro, Italy*

MONDAY, SEPTEMBER 9 • 10:50AM–12:10PM

10:50AM	11:10AM

Symposium 1 Development and Characterization of Multifunctional Materials

SMA - Characterization I **10:50AM–12:10PM** **Level 3, Charred**

Session Organizer: **Mohammad Elahinia,** *University of Toledo, Sylvania, OH, United States*

Session Co-Organizer: **Othmane Benafan,** *NASA Glenn Research Center, Cleveland, OH, United States*

10:50AM Experimental Investigation on the Cyclic Compression Behavior of NiTi SMA Bars

Technical Paper Publication. SMASIS2019-5654

Amedebrhan Asfaw, *University of Virginia, Charlottesville, VA, United States,* **Guohua Xing,** *Chang'an University, Xi'an, Shaanxi, China,* **Osman Ozbulut,** *University of Virginia, Charlottesville, VA, United States*

11:10AM Selective Laser Melting of NiTi and NiTiHf Shape Memory Alloys

Invited Presentation. SMASIS2019-5799

Haluk Karaca, *University of Kentucky, Louisville, KY, United States*

Symposium 2 Mechanics & Behavior of Active Materials

2-2 Multifield Response and Modeling I **10:50AM–12:10PM** **Level 3, Malt**

Session Organizer: **Paris Von Lockette**, *Penn State University, University Park, PA, United States*

Session Co-Organizer: **Gary Seidel**, *Virginia Tech, Blacksburg, VA, United States*

10:50AM Thermo-Mechanical Modeling of Mechanical Metamaterials

Technical Presentation. SMASIS2019-5681

Russell W. Mailen, *Auburn University, Auburn, AL, United States*

11:10AM Coupled Electro-Thermo-Mechanical Modeling of Shape Memory Polymers

Technical Paper Publication. SMASIS2019-5693

Midhan Siwakoti, Russell W. Mailen, *Auburn University, Auburn, AL, United States*

11:30AM Visualization of Ni2MnGa Alloy's Magnetic Microstructure Under Magneto-Mechanical Loading to Inform Constitutive Modeling Refinements

Technical Presentation. SMASIS2019-5719

Glen D'Silva, Heidi Feigenbaum, Constantin Ciocanel, *Northern Arizona University, Flagstaff, AZ, United States*

11:50AM Influence of Heating Rate in the Detection of Prescribed Hotspots Within Nanocomposite Bonded Explosives (NCBXs) Using Thermo-Electro-Mechanical Peridynamic Modeling

Technical Presentation. SMASIS2019-5733

Krishna Talamadupula, Stefan Povolny, *Virginia Tech, Blacksburg, VA, United States*, **Naveen Prakash**, *Los Alamos National Laboratory, Los Alamos, NM, United States*, **Gary Seidel**, *Virginia Tech, Blacksburg, VA, United States*

MONDAY, SEPTEMBER 9 • 10:50AM–12:10PM

10:50AM	11:10AM	11:30AM	11:50AM

Symposium 3 Modeling, Simulation and Control of Adaptive Systems

3-2 Vibration and Control **10:50AM–12:10PM** **Level 3, Oak**

Session Organizer: **James Gibert**, *Purdue University, West Lafayette, IN, United States*

Session Co-Organizer: **Yaqoub Abdullah**, *The Public Authority for Applied Education and Training, Kuwait, Kuwait*

10:50AM Study on Vibration Characteristics of Cantilever Plate With Annular Mass Frame

Technical Paper Publication. SMASIS2019-5543

Lihua Chen, Shoujie Cui, Hao Jing, Chaoran Hou, *Beijing University of Technology, Beijing, China*, **Fenghong Yang**, *Central University of Finance and Economics, Beijing, China*

11:10AM Control of Brake Squeal Using Shunted Piezoelectric Pads

Technical Paper Publication. SMASIS2019-5548

Yaqoub Abdullah, *The Public Authority for Applied Education and Training, Kuwait, Kuwait*, **Amr Baz**, *University of Maryland, College Park, MD, United States*

11:30AM Numerical Analysis and Experimental Verification of Synchronized Switching Damping Systems

Technical Paper Publication. SMASIS2019-5570

Fengling Zhang, Lin Li, Yu Fan, *Beihang University, Beijing, China*, **Jiuzhou Liu**, *China Academy of Launch Vehicle Technology, Beijing, China*

11:50AM Experimental Studies of Semi-Active Dry Friction Dampers for Steady-State Vibration

Technical Presentation. SMASIS2019-5571

Yaguang Wu, Lin Li, Yu Fan, *Beihang University, Beijing, China*

Symposium 4 Integrated System Design and Implementation

4-2 Lattice & Deployable Structures **10:50AM–12:10PM** **Level 3, Rye**

Session Organizer: **Johannes Riemenschneider**, *German Aerospace Center, Braunschweig, Lower Saxony, Germany*
Session Co-Organizer: **Kazuko Fuchi**, *University of Dayton Research Institute, Dayton, OH, United States*

10:50AM Selective Stiffness Approaches for Shape Adaptation, Expandable Structures, and Deployable Systems

Invited Presentation. SMASIS2019-5787

Paolo Ermanni, *ETH Zürich, Zürich, Switzerland*

11:30AM Compact Telescopic Morphing Lattice Boom

Technical Paper Publication. SMASIS2019-5620

Ciarán McHale, Robert Telford, Paul M. Weaver, *University of Limerick, Limerick, Ireland*

11:50AM Discovering Optimal Origami Fold Patterns Using Graph-Based L-System Topology Optimization

Technical Presentation. SMASIS2019-5739

Madalyn Mikkelsen, *Texas A&M University, Bryan, TX, United States*, **Andrew Gillman**, *UES, Dayton, OH, United States*, **Kazuko Fuchi**, *University of Dayton Research Institute, Dayton, OH, United States*, **Brent R. Bielefeldt**, *Texas A&M University, College Station, TX, United States*, **Philip Buskohl**, *AFRL/RXAS, WPAFB, OH, United States*, **Darren Hartl**, *Texas A&M University, College Station, TX, United States*

MONDAY, SEPTEMBER 9 • 10:50AM–12:10PM

10:50AM	11:10AM	11:50AM

Symposium 5 Structural Health Monitoring

5-2 Understanding DynAMics and Waves for SHM **10:50AM–12:10PM** **Level 3, Barrel**

Session Organizer: **Daniel Cole**, *U.S. Army Research Laboratory, Aberdeen Proving Ground, MD, United States*

Session Co-Organizer: **Soobum Lee**, *University of Maryland Baltimore County, Baltimore, MD, United States*

10:50AM Evaluation of SHM With the Electromechanical Impedance Method Using a High Voltage Excitation Signal in High Frequencies

Technical Paper Publication. SMASIS2019-5556

Eric Nolan, *Tennessee Technological University, Kingston, TN, United States*, **Mohsen Safaei**, *Tennessee Technological University, Cookeville, TN, United States*, **Steven Anton**, *Tennessee Tech, Cookeville, TN, United States*

11:10AM Bondline Inspection With Shear-Mode Piezoelectric Transducers

Technical Presentation. SMASIS2019-5641

Hussain Altammar, Nathan Salowitz, *University of Wisconsin-Milwaukee, Milwaukee, WI, United States*

11:30AM Structural Dynamic Performance of Additive and Conventional Manufactured Aerospace Metallic Alloys

Technical Presentation. SMASIS2019-5763

Ed Habtour, *Sandia National Laboratories, Albuquerque, NM, United States*, **Laura Cordova Gonzalez, Dario Di Maio**, *University of Twente, Enschede*, **Daniel Cole**, *U.S. Army Research Laboratory, Aberdeen Proving Ground, MD, United States*, **Tiedo Tinga**, *University of Twente, Ensched,, Netherlands*

Symposium 7 Energy Harvesting

7-2 Modeling and Characterization **10:50AM–12:10PM** **Level 3, Barley**

Session Organizer: **Christopher Cooley**, *Oakland University, Rochester, MI, United States*

Session Co-Organizer: **M. Amin Karami**, *University at Buffalo, Buffalo, NY, United States*

10:50AM Modeling and Analysis of Micro-Cantilever Plate Piezoelectric Energy Harvester With a Tip Mass

Technical Paper Publication. SMASIS2019-5539

Lihua Chen, Chaoran Hou, *Beijing University of Technology, Beijing, China*, **Fenghong Yang**, *Central University of Finance and Economics, Beijing, China*

11:10AM Passive Adaptive Vibration Energy Harvesting

Technical Presentation. SMASIS2019-5794

Lei Zuo, *Virginia Tech, Blacksburg, VA, United States*

11:50AM Vibrations From Phase Transformations in PCXM Cellular Materials for Energy Harvesting

Technical Presentation. SMASIS2019-5577

Aman Thakkar, Kristiaan Hector, *Purdue University, West Lafayette, IN, United States*, **Nilesh Mankame**, *General Motors Global Research & Development, Warren, MI, United States*, **Pablo Zavattieri, Andres Arrieta**, *Purdue University, West Lafayette, IN, United States*

MONDAY, SEPTEMBER 9 • 1:40PM–3:20PM

1:40PM	2:00PM	2:20PM	2:40PM	3:00PM

Symposium 1 Development and Characterization of Multifunctional Materials

1-3 Polymers **1:40PM–3:20PM** **Level 3, Charred**

Session Organizer: **Ji Su**, *NASA Langley Research Center, Hampton, VA, United States*

Session Co-Organizer: **Allison Arnold**, *NASA Langley Research Center, Langley, OH, United States*

1:40PM Surface Bonding Graphene-Based Elastomeric Sensor Preliminary Characterization

Technical Paper Publication. SMASIS2019-5578

Salvatore Ameduri, Monica Ciminello, *Italian Aerospace Research Centre, Capua, Italy*

2:00PM Amplifying Photoresponsive Actuation in Liquid Crystal Polymeric Shells Using Instabilities

Technical Presentation. SMASIS2019-5712

Mahnoush Babaei, *Carnegie Mellon University, Pittsburgh, PA, United States,* **Arul J. Clement, Junfeng Gao,** *University of Pittsburgh, Pittsburgh, PA, United States,* **M. Ravi Shankar,** *University of Pittsburgh, Aspinwall, PA, United States,* **Kaushik Dayal,** *Carnegie Mellon University, Pittsburgh, PA, United States*

2:20PM Direct Printing of a Flexible Strain Sensor for Distributed Monitoring of Deformation in Inflatable Structures

Technical Paper Publication. SMASIS2019-5713

Mohammed Al-Rubaiai, *Michigan State University, Lansing, MI, United States,* **Ryohei Tsuruta, Taewoo Nam, Umesh Gandhi,** *Toyota, Ann Arbor, MI, United States,* **Xiaobo Tan,** *Michigan State University, East Lansing, MI, United States*

2:40PM Hybrid Conductive and Semi-conductive Fillers Towards High Relative Permittivity and Low Dielectric Loss in Thermoplastic Polyurethane

Technical Presentation. SMASIS2019-5758

Gayaneh Petrossian, Amir Ameli, *Washington State University, Richland, WA, United States*

3:00PM Characterization and Synthesis of Photostrictive Azobenzene-Nylon Polymer Threads

Technical Presentation. SMASIS2019-5775

John Gallagher, Jimmy Franco, Constantina Stavrou, Brendan Lavallee, Noah Nunes, Erika Torkildsen, *Merrimack College, North Andover, MA, United States*

Symposium 2 Mechanics & Behavior of Active Materials

2-3 Advanced Materials and Transduction Level 3, Malt **1:40PM–3:20PM** **Level 3, Charre**

Session Organizer: **Paris Von Lockette**, *Penn State University, University Park, PA, United States*

Session Co-Organizer: **Othmane Benafan**, *NASA Glenn Research Center, Cleveland, OH, United States*

1:40PM Transduction Using Functional Materials: Basic Science and Understanding at the U.S. Naval Research Laboratory

Technical Paper Publication. SMASIS2019-5501

Virginia DeGiorgi, **Peter Finkel**, *Naval Research Laboratory, Washington, DC, United States*, **Lauren Garten**, *National Research Council, Washington, DC, United States*, **Margo Staruch**, *Naval Research Laboratory, Washington, DC, United States*

2:20PM Silicone Material With Enhanced Permittivity Used for Dielectric Elastomer Transducers

Technical Paper Publication. SMASIS2019-5730

Ozan Çabuk, Juergen Maas, *TU Berlin, Berlin, Germany*

2:40PM Acoustical Behaviour of Buckling Dielectric Elastomer Transducers

Technical Paper Publication. SMASIS2019-5747

Michael Gareis, Juergen Maas, *TU Berlin, Berlin, Germany*

MONDAY, SEPTEMBER 9 • 1:40PM–3:20PM

1:40PM	2:00PM	2:30PM	2:55PM	3:00PM
Symposium 3 Modeling, Simulation and Control of Adaptive Systems				
3-3 Design of Smart and Adaptive Systems 2 1:40PM–3:20PM Level 3, Oak Session Organizer: **Bjoern Kiefer**, *TU Bergakademie Freiberg, Freiberg, Germany* Session Co-Organizer: **Leandro Maio**, *University of Naples, Naples, Italy*				
1:40PM Multifunctional Structures for Attitude Control Technical Paper Publication. SMASIS2019-5565 **F.N.U. Vedant**, **James Allison**, *University of Illinois at Urbana-Champaign, Urbana, IL, United States*	**2:05PM Ultrasonic De-Icing System for Leading Edge in Composite Material** Technical Paper Publication. SMASIS2019-5627 **Leandro Maio**, *University of Naples, Naples, Italy*, **Salvatore Ameduri**, *Italian Aerospace Research Centre, Capua, Italy*, **Vittorio Memmolo, Fabrizio Ricci**, *University of Naples, Naples, Italy*, **Antonio Concilio**, *Italian Aerospace Research Centre, Capua, Italy*	**2:30PM Developing a Smart Façade System Controller for Wind-Induced Vibration Mitigation in Tall Buildings** Technical Paper Publication. SMASIS2019-5674 **Khalid M. Abdelaziz, Jared D. Hobeck**, *Kansas State University, Manhattan, KS, United States*	**2:55PM Nonlinear Dynamics of Shape Memory Alloy Systems and Structures** Invited Presentation. SMASIS2019-5797 **Marcelo Savi**, *Universidade Federal do Rio de Janeiro, Rio De Janeiro - RJ, Brazil*	

MONDAY, SEPTEMBER 9 • 1:40PM–3:20PM

1:40PM	2:00PM	2:20PM	2:40PM	3:00PM

Symposium 4 Integrated System Design and Implementation

4-3 Morphing Missile **1:40PM–3:20PM** **Level 3, Rye**

Session Organizer: **Andres Arrieta**, *Purdue University, West Lafayette, IN, United States*

Session Co-Organizer: **Richard Beblo**, *Air Force Research Laboratory, Oakwood, OH, United States*

1:40PM Optimization of a Morphing Missile Head

Technical Presentation.
SMASIS2019-5522

Richard Beblo, *Air Force Research Laboratory, Oakwood, OH, United States*, **Mackenzie Tidball**, **Tizoc Cruz-Gonzalez**, *University of Dayton Research Institute, Dayton, OH, United States*, **Gregory Reich**, *Air Force Research Laboratory, Bellbrook, OH, United States*

2:00PM Design of a Morphing Missile Head

Technical Presentation.
SMASIS2019-5770

Tizoc Cruz-Gonzalez, *University of Dayton Research Institute, Dayton, OH, United States*, **Richard Beblo**, *Air Force Research Laboratory, Oakwood, OH, United States*, **Mackenzie Tidball**, *University of Dayton Research Institute, Dayton, OH, United States*, **Gregory Reich**, *Air Force Research Laboratory, Bellbrook, OH, United States*

2:20PM Design of a High Torque Mechanism for a Morphing Missile Nosecone

Technical Presentation.
SMASIS2019-5524

Christopher Hoppe, **John Ferguson**, **Matthew Hopkins, Charles Leano, Caleigh McLean, Chaise Poland, Matthew Deutsch**, **Matthew P. Snyder**, *United States Air Force Academy, USAFA, CO, United States*

2:40PM Morphing Skins for Aerospace Cylinders in Bending

Technical Presentation.
SMASIS2019-5611

Jeff Baur, *Air Force Research Laboratory, Liberty Township, OH, United States*, **Wesley A. Chapkin**, *Universal Technology Corporation, Wright-Patterson Air Force Base, OH, United States*, **Patrick Philip Walgren**, *Texas A&M University, College Station, OH, United States*, **Geoffrey J. Frank**, *University of Dayton Research Institute, Dayton, OH, United States*, **David Ryan Seifert**, *Universal Technology Corporation, Wright-Patterson Air Force Base, OH, United States*, **Maria Ward Rashidi**, *University of Michigan, Ann Arbor, MI, United States*, **Darren Hartl**, *Texas A&M University, College Station, TX, United States*

3:00PM Design, Fabrication, and Testing of Topology Optimized Flexible Cylinders

Technical Paper Publication.
SMASIS2019-5601

David Ryan Seifert, Wesley A. Chapkin, *Universal Technology Corporation, Wright-Patterson Air Force Base, OH, United States*, **Geoffrey J. Frank**, *University of Dayton Research Institute, Dayton, OH, United States*, **Jeff Baur**, *Air Force Research Laboratory, Liberty Township, OH, United States*

MONDAY, SEPTEMBER 9 • 1:40PM–3:20PM

1:40PM	2:00PM	2:20PM	2:40PM	3:00PM

Symposium 5 Structural Health Monitoring

5-3 Machine Learning and Probabilistic Approaches in SHM **1:40PM–3:20PM** **Level 3, Barrel**

Session Organizer: **Benjamin Grisso**, *Naval Surface Warfare Center Carderock, West Bethesda, MD, United States*

Session Co-Organizer: **Ed Habtour**, *Sandia National Laboratories, Albuquerque, NM, United States*

1:40PM	2:00PM	2:20PM	2:40PM	3:00PM
Design and Validation of a Probabilistic Health Monitoring System Using Embedded Piezoelectric Patch Sensors Technical Paper Publication. SMASIS2019-5506 **Amin Toghi Eshghi**, *University of Maryland Baltimore County, Ellicott City, MD, United States*, **Soobum Lee, Hyunjun Jung**, *University of Maryland Baltimore County, Baltimore, MD, United States*, **Pingfeng Wang**, *University of Illinois at Urbana-Champaign, Urbana, IL, United States*	**Development of a Structural Health Monitoring Methodology in Reinforcement Concrete Structures Using FBGs and Pattern Recognition Techniques** Technical Paper Publication. SMASIS2019-5517 **Alejandra Amaya, Joham Alvarez-Montoya, Julián Sierra-Pérez**, *Universidad Pontificia Bolivariana, Medellin, Antioquia, Colombia*	**Multiclass Welding Defect Detection and Classification Using Convolution Neural Network in Radiographic Image** Technical Presentation. SMASIS2019-5585 **Ji-Hyung An**, **Yong-Ho Kim, Jung-Ryul Lee**, *Korea Advanced Institute of Science and Technology, Daejeon, Korea (Republic)*	**Structural Health Monitoring of Composite Structures via Multivariate Linear Regression Analysis of Mechanoluminescence** Technical Paper Publication. SMASIS2019-5697 **Sujasha Gupta, Srivatsava Krishnan, Vishnu Baba Sundaresan**, *Ohio State University, Columbus, OH, United States*	**Automated Evaluation Method for Phased Array Ultrasonic Testing Using Recurrent Neural Networks and K-means Clustering** Technical Presentation. SMASIS2019-5721 **Yong-Ho Kim, Jung-Ryul Lee**, *Korea Advanced Institute of Science and Technology, Daejeon, Korea (Republic)*

MONDAY, SEPTEMBER 9 • 1:40PM–3:20PM

1:40PM	2:00PM	2:20PM	2:40PM	3:00PM

Symposium 7 Energy Harvesting

7-3 Nonlinear and Broadband Harvesting — 1:40PM–3:20PM — Level 3, Barley

Session Organizer: **Shahrzad Towfighian**, *Binghamton University, Binghamton, NY, United States*

Session Co-Organizer: **Matthew Bryant**, *North Carolina State University, Chapel Hill, NC, United States*

1:40PM	2:00PM	2:20PM	2:40PM	3:00PM
Experimental and Theoretical Study of the Self-Tuning Bistable Piezoelectric Cantilever Beam Technical Paper Publication. SMASIS2019-5542 **Jianyu Jiao, Wei Zhang, Chaoran Hou**, *Beijing University of Technology, Beijing, China*	**A Miniaturized Broadband Vibration Energy Harvester With Piecewise-Linear Asymmetric Restoring Force** Technical Paper Publication. SMASIS2019-5616 **Arata Masuda, Feng Zhao**, *Kyoto Institute of Technology, Kyoto, Japan*	**Dynamics and Output Voltage Analysis of a PVDF-Based Broadband Bistable Energy Harvester** Technical Presentation. SMASIS2019-5701 **Masoud Derakhshani, Niknam Momenzadeh, Thomas Berfield**, *University of Louisville, Louisville, KY, United States*	**Geometrically Nonlinear Flexoelectric and Piezoelectric-Flexoelectric Cantilever Modeling and Analysis for Energy Harvesting** Technical Presentation. SMASIS2019-5768 **Adriane Moura, Alper Erturk**, *Georgia Institute of Technology, Atlanta, GA, United States*	

MONDAY, SEPTEMBER 9 • 3:40PM–5:40PM

3:40PM	4:00PM	4:20PM	4:40PM	5:00PM	5:20PM

Symposium 1 Development and Characterization of Multifunctional Materials

1-4 Composites I **3:40PM–5:40PM** **Level 3, Charred**

Session Organizer: **Osman Ozbulut**, *University of Virginia, Charlottesville, VA, United States*

Session Co-Organizer: **Ian Bond**, *University of Bristol, Bristol, United Kingdom*

3:40PM Active Thermal Management of FRP Composites via Embedded Vascular Networks

Technical Paper Publication. SMASIS2019-5555

Jim Cole, Ian Bond, Andrew Lawrie, *University of Bristol, Bristol, United Kingdom*

4:00PM 4D Printed Shape Memory Polymer Composite Structures for Deployable Small Spacecrafts

Technical Paper Publication. SMASIS2019-5583

Madhubhashitha Herath, *University of Southern Queensland, Toowoomba, Queensland, Australia*, **Fenghua Zhang**, *Harbin Institute of Technology, Harbin, China*, **Mainul Islam**, *University of Southern Queensland, Toowoomba, Australia*, **Jinsong Leng**, *Harbin Institute of Technology, Harbin*, **Jayantha Epaarachchi**, *University of Southern Queensland, Toowoomba, Australia*

4:20PM Full-Field Deformation and Thermal Characterization of GNP/Epoxy and GNP/SMA Fiber/Epoxy Composites

Technical Paper Publication. SMASIS2019-5640

Ugur Kilic, Muhammad Sherif, Sherif Daghash, Osman Ozbulut, *University of Virginia, Charlottesville, VA, United States*

4:40PM Self-Sensing Characterization of GNP and Carbon Black Filled Cementitious Composites

Technical Paper Publication. SMASIS2019-5653

Zhangfan Jiang, Osman Ozbulut, *University of Virginia, Charlottesville, VA, United States*, **Guohua Xing**, *Chang'an University, Xi'an, Shaanxi, China*

4:40PM Self-Sensing Characterization of GNP and Carbon Black Filled Cementitious Composites

Technical Paper Publication. SMASIS2019-5653

Zhangfan Jiang, Osman Ozbulut, *University of Virginia, Charlottesville, VA, United States*, **Guohua Xing**, *Chang'an University, Xi'an, Shaanxi, China*

MONDAY, SEPTEMBER 9 • 3:40PM–5:40PM

3:40PM	4:00PM	4:20PM	4:40PM	5:00PM	5:20PM

Symposium 2 Mechanics & Behavior of Active Materials

2-4 Multifield Response and Modeling II **3:40PM–5:40PM** **Level 3, Malt**

Session Organizer: **Ryan L. Harne**, *Ohio State University, Columbus, OH, United States*

3:40PM Modeling Strain-Mediated Magnetoelectric Near-Field Communication Devices Technical Presentation. SMASIS2019-5638 **John Domann**, *Virginia Tech, Blacksburg, VA, United States*, **Joseph Schneider**, **Greg Carman**, *University of California, Los Angeles, Los Angeles, CA, United States*	**4:00PM Electro-Mechanical Response of a Nanocomposite Electrospun Piezoelectric Microfiber** Technical Paper Publication. SMASIS2019-5686 **Krishna Chytanya Chinnam, Arnaldo Casalotti**, **Giulia Lanzara**, *University of Roma Tre, Rome, Italy*	**4:20PM Mechanical and Electrical Characterization of PVDF and PVDF-TrFE Additively Manufactured Structures** Technical Presentation. SMASIS2019-5711 **Niknam Momenzadeh, Masoud Derakhshani, Thomas Berfield**, *University of Louisville, Louisville, KY, United States*	**4:40PM Experimental Findings of Structural Noise Reduction in High Lift Devices Using Shape Memory Alloy Inserts** Technical Presentation. SMASIS2019-5529 **Andrew Leaton, William Scholten**, *Texas A&M University, College Station, TX, United States*, **Kevin Lieb**, *MAESTRO Laboratory, College Station, TX, United States*, **Travis Turner**, *NASA Langley Research Center, Hampton, VA, United States*, **Darren Hartl**, *Texas A&M, College Station, TX, United States*	**5:00PM Mechanical and Electrical Characterization of PVDF and PVDF-TrFE Additively Manufactured Structures** Technical Presentation. SMASIS2019-5773 **Niknam Momenzadeh, Masoud Derakhshani, Thomas Berfield**, *University of Louisville, Louisville, KY, United States*	

MONDAY, SEPTEMBER 9 • 3:40PM–5:40PM					
3:40PM	4:00PM	4:20PM	4:40PM	5:00PM	5:20PM

Symposium 3 Modeling, Simulation and Control of Adaptive Systems

3-4 Modeling Complex Materials and Systems 1 **3:40PM–5:40PM** **Level 3, Oak**

Session Organizer: **Rocco Vertechy**, *University of Bologna, Bologna, Italy*

Session Co-Organizer: **Christopher Sugino**, *Georgia Institute of Technology, Atlanta, GA, United States*

3:40PM Parameter Estimation of Fractional-Order Viscoelastic Models

Technical Presentation.
SMASIS2019-5530

Paul Miles, **Graham Pash**, *North Carolina State University, Raleigh, NC, United States*, **William Oates**, *Florida A&M/ Florida State University, Tallahassee, FL, United States*, **Ralph Smith**, *North Carolina State University, Raleigh, NC, United States*

4:00PM A High-Fidelity Dynamic Model for Origami Based on Iso-Parametric Absolute Nod-Al Coordinate Formulation (iso-ANCF)

Technical Paper Publication.
SMASIS2019-5534

Jiayue Tao, *Clemson University, Central, SC, United States*, **Suyi Li**, *Clemson University, Clemson, SC, United States*

4:20PM Nonreciprocal Wave Transmission in Metastable Modular Metastructures Utilizing Asymmetric Dual-Threshold Snap-Through

Technical Paper Publication.
SMASIS2019-5572

Xiang Liu, *University of Michigan, Ann Arbor, MI, United States*, **Guoping Cai**, *Shanghai Jiao Tong University, Shanghai, China*, **Kon-Well Wang**, *University of Michigan, Ann Arbor, MI, United States*

4:40PM An Electromechanical Framework for Non-Reciprocal Wave Propagation in Piezoelectric Metamaterials With Synthetic Impedance Shunts

Technical Presentation.
SMASIS2019-5774

Christopher Sugino, **Massimo Ruzzene**, **Alper Erturk**, *Georgia Institute of Technology, Atlanta, GA, United States*

MONDAY, SEPTEMBER 9 • 3:40PM–5:40PM

3:40PM	4:00PM	4:20PM	4:40PM	5:00PM	5:20PM

Symposium 4 Integrated System Design and Implementation

SYMP 4-4: Aerospace Applications 3 **3:40PM–5:40PM** **Level 3, Rye**

4-4 Morphing Wing 2

Session Organizer: **Srinivas Vasista**, *German Aerospace Center, Braunschweig, Germany*

Session Co-Organizer: **Andres Arrieta**, *Purdue University, West Lafayette, IN, United States*

3:40PM Passive and Active Material Selection for Morphing Skins

Technical Presentation.
SMASIS2019-5612

Wesley A. Chapkin, *Universal Technology Corporation, Wright-Patterson Air Force Base, OH, United States*, **Geoffrey J. Frank**, *University of Dayton Research Institute, Dayton, OH, United States*, **David Ryan Seifert**, *Universal Technology Corporation, Wright-Patterson Air Force Base, OH, United States*, **Patrick Philip Walgren**, **Darren Hartl**, *Texas A&M University, College Station, TX, United States*, **Jeff Baur**, *Air Force Research Laboratory, Liberty Township, OH, United States*

4:00PM Aerostructure Design of a 2D Morphing Airfoil in Unsteady Supersonic Flow Using Bio-Inspired Evolutionary Design Processes and Low-Fidelity Physics Models

Technical Presentation.
SMASIS2019-5598

Joshua Hodson, *Hodson Aerospace LLC, Beavercreek, OH, United States*, **Gregory Reich**, *Air Force Research Laboratory, Bellbrook, OH, United States*, **Joshua D. Deaton, Alexander M. Pankonien, Philip Beran**, *U.S. Air Force Research Laboratory, WPAFB, OH, United States*

4:20PM A Variable Camber Piezocomposite Trailing-Edge for Subsonic Aircraft: Multidisciplinary Design Optimization

Technical Paper Publication.
SMASIS2019-5604

Cody Wright, Onur Bilgen, *Rutgers University, Piscataway, NJ, United States*

4:40PM Graph-Based Interpretation of L-System Encodings Toward Topology Optimization of a Morphing Airfoil in Supersonic Flow

Technical Paper Publication.
SMASIS2019-5609

Brent R. Bielefeldt, *Texas A&M University, College Station, TX, United States*, **Joshua Hodson**, *Hodson Aerospace LLC, Beavercreek, OH, United States*, **Gregory Reich**, *Air Force Research Laboratory, Bellbrook, OH, United States*, **Philip Beran, Alexander M. Pankonien, Joshua D. Deaton**, *U.S. Air Force Research Laboratory, WPAFB, OH, United States*, **Darren Hartl**, *Texas A&M University, College Station, TX, United States*

5:00PM Design and Manufacture of a Multistable Selectively Stiff Morphing Section Demonstrator

Technical Paper Publication.
SMASIS2019-5706

David Boston, Jose Rivas-Padilla, Andres Arrieta, *Purdue University, West Lafayette, IN, United States*

MONDAY, SEPTEMBER 9 • 3:40PM–5:40PM

3:40PM	4:00PM	4:20PM	4:40PM	5:00PM	5:20PM

Symposium 7 Energy Harvesting

7-4 Energy Harvesting and Storage Applications **3:40PM–5:40PM** **Level 3, Barley**

Session Organizer: **Steven Anton**, *Tennessee Tech, Cookeville, TN, United States*

Session Co-Organizer: **Soobum Lee**, *University of Maryland Baltimore County, Baltimore, MD, United States*

3:40PM Energy Harvesting From the Vibration and Rotation of Host Systems Using Piezoelectric Devices

Technical Paper Publication. SMASIS2019-5629

Christopher Cooley, *Oakland University, Rochester, MI, United States*

4:00PM Controlled Operation of Lithium Ion Batteries Using Reversible Shutdown Membrane Separators

Technical Paper Publication. SMASIS2019-5650

Travis Hery, *Ohio State University, Hilliard, OH, United States*, **Vishnu Baba Sundaresan**, *Ohio State University, Columbus, OH, United States*

4:20PM Structure Integrated Supercapacitors for Space Applications

Technical Paper Publication. SMASIS2019-5687

Sebastian Geier, **Jan Petersen, Peter Wierach**, *German Aerospace Center, Braunschweig, Germany*

4:40PM Modified Kelvin Water Dropper for Energy Harvesting

Technical Presentation. SMASIS2019-5765

Xuewei Zhang, *Texas A&M University-Kingsville, Corpus Christi, TX, United States*

TUESDAY, SEPTEMBER 10 • 9:30AM–10:30AM

9:30AM	9:50AM	10:10AM

Symposium 1 Development and Characterization of Multifunctional Materials

1-5 Composites II **9:30AM–10:30AM** **Level 3, Charred**

Session Organizer: **Constantin Ciocanel**, *Northern Arizona University, Flagstaff, AZ, United States*

Session Co-Organizer: **Giulia Lanzara**, *University of Roma Tre, Rome, Italy*

9:30AM Self-Sensing Composite Materials With Intelligent Fabrics

Technical Paper Publication. SMASIS2019-5684

Federico Fabriani, **Giulia Lanzara**, *University of Roma Tre, Rome, Italy*

9:50AM Evaluation of the Form Factor Impact on Performance Metrics of Multifunctional Composites

Technical Presentation. SMASIS2019-5717

Samarjith Biswas, Behrooz Shirani, Cindy Browder, Constantin Ciocanel, *Northern Arizona University, Flagstaff, AZ, United States*

TUESDAY, SEPTEMBER 10 • 9:30AM–10:30AM

9:30AM	9:50AM	10:10AM

Symposium 2 Mechanics & Behavior of Active Materials

2-5 Advanced Materials, Mechanics, and Devices II **9:30AM–10:30AM** **Level 3, Charred**

Session Organizer: **John Gallagher**, *Merrimack College, North Andover, MA, United States*

Session Co-Organizer: **Frederick Calkins**, *Boeing, Renton, WA, United States*

9:30AM From Atoms to Bulk: High Fidelity Atomistic and Coarse-Grained Model Development of Light-Matter Interactions in Azobenzene Polyimide Glassy Polymers

Technical Presentation. SMASIS2019-5655

Chenxi Zhai, Huanhuan Zhou, *Florida State University, Tallahassee, FL, United States*, **Shangchao Lin**, *Shanghai Jiao Tong University, Shanghai, China*, **William Oates**, *Florida State University, Tallahassee, FL, United States*

Symposium 3 Modeling, Simulation and Control of Adaptive Systems

3-5 Modeling Complex Materials and Systems 2 **9:30AM–10:30AM** **Level 3, Barrel**

Session Organizer: **Julianna Abel**, *University of Minnesota, Minneapolis, MN, United States*

Session Co-Organizer: **Uwe Marschner**, *Technische Universität Dresden, Dresden, Germany*

9:30AM An FE Based Surrogate Model for Predicting the Impact of a SMA Twist System on the Helicopter Performance

Technical Paper Publication. SMASIS2019-5574

Salvatore Ameduri, Antonio Concilio, *Italian Aerospace Research Centre, Capua, Italy*, **Rohin Kumar Majeti**, *Deutschen Zentrums für Luft- und Raumfahrt, Braunschweig, Germany*

9:50AM Description of a Hydrogel-Based Micro-Valve as a Library Element for MATLAB Simulink

Technical Paper Publication. SMASIS2019-5614

Philipp J. Mehner, Anthony Beck, Mathias Busek, Andreas Voigt, Uwe Marschner, Andreas Richter, *Technische Universität Dresden, Dresden, Germany*

10:10AM Implementation of a Modular Multifunctional Fabric Modeling and Optimization Architecture

Technical Presentation. SMASIS2019-5628

Kevin Eschen, Julianna Abel, *University of Minnesota, Minneapolis, MN, United States*

TUESDAY, SEPTEMBER 10 • 9:30AM–10:30AM

9:30AM	9:50AM	10:10AM

Symposium 4 Integrated System Design and Implementation

4-5 SMA Applications **9:30AM–10:30AM** **Level 3, Barley**

Session Organizer: **Jonathan Luntz**, *University of Michigan, Ann Arbor, MI, United States*

Session Co-Organizer: **Brent Utter**, *Lafayette College, Easton, PA, United States*

9:30AM Demonstrations of Geared Shape Memory Alloy Elements for High Torque Actuation

Technical Presentation. SMASIS2019-5779

Micheal Bass, James Mabe, *The Boeing Company, Berkeley, MO, United States*, **Myrielle Allen-Prince**, *Boeing, Saint Louis, MO, United States*, **Alexander Lafranchi**, *The Boeing Company, Tukwila, WA, United States*, **Othmane Benafan**, *NASA Glenn Research Center, Cleveland, OH, United States*

9:50AM Shape Memory Alloys in Continuum and Soft Robotic Applications

Technical Paper Publication. SMASIS2019-5610

Yannik Goergen, *Saarland University, Saarbrücken, Deutschland, Germany*, **Romol Chadda**, *Technische Universität Darmstadt, Darmstadt, Germany*, **Rouven Britz**, *Saarland University, Saarbrücken, Germany*, **Dominik Scholtes**, *ZEMA GmbH, Saarbruecken, Germany*, **Nataliya Koev**, *Technische Universität Darmstadt, Darmstadt, Germany*, **Paul Motzki**, *ZEMA, Saarbruecken, Germany*, **Roland Werthschützky, Mario Kupnik**, *Technische Universität Darmstadt, Darmstadt, Germany*, **Stefan Seelecke**, *Saarland University, Saarbrücken, Germany*

10:10AM Soft Morphing Buttons Based on Actuator and Sensor Properties of Shape Memory Alloy Wires

Technical Paper Publication. SMASIS2019-5504

Dominik Scholtes, *ZEMA GmbH, Saarbruecken, Germany*, **Yannik Goergen**, *Saarland University, Saarbrücken, Deutschland, Germany*, **Philipp Scheiner**, *Robert Bosch GmbH, Stuttgart, Germany*, **Paul Motzki**, *ZEMA, Saarbruecken, Germany*, **Stefan Seelecke**, *Saarland University, Saarbrücken, Germany*

Symposium 6 Bioinspired Smart Materials and Systems

6-1 Bioinspired Aviation **9:30AM–10:30AM** **Level 3, Oak**

Session Organizer: **Eric Freeman**, *University of Georgia, Athens, GA, United States*

Session Co-Organizer: **Joseph Calogero**, *Pratt & Whitney, Glastonbury, CT, United States*

9:30AM Initial Analysis of a Novel Biomimetic Span-Wise Morphing Wing Concept

Technical Paper Publication. SMASIS2019-5567

Ben Stacey, Peter Thomas, *University of Hertfordshire, Hatfield, Hertfordshire, United Kingdom*

9:50AM Design Optimization of a Nonlinear Hinge for an Adaptive Feather-Inspired Flap

Technical Presentation. SMASIS2019-5667

Chengfang Duan, *University of Illinois at Urbana-Champaign, Champaign, IL, United States*, **Aimy Wissa**, *University of Illinois, Urbana, IL, United States*

10:10AM Towards Mission Adaptability of Small UAVs: A Deployment Mechanism for an Adaptive Leading-Edge Alula-Inspired Device (LEAD)

Technical Presentation. SMASIS2019-5656

Mihary Ito, *University of Illinois at Urbana-Champaign, Urbana, IL, United States*, **Aimy Wissa**, *University of Illinois, Urbana, IL, United States*

TUESDAY, SEPTEMBER 10 • 10:50AM–12:10PM

10:50AM	11:10AM	11:30AM

Symposium 6 Bioinspired Smart Materials and Systems

6-6 Biomolecular Materials II **9:30AM–10:30AM** **Level 3, Oak**

Session Organizer: **Aimy Wissa**, *University of Illinois, Urbana, IL, United States*

Session Co-Organizer: **Michelle Makhoul-Mansour**, *University of Georgia, Athens, GA, United States*

10:50AM Totipotent Cellularly-Inspired Materials

Technical Paper Publication. SMASIS2019-5745

Samuel Mattern-Schain, MaryAnne Nguyen, Tayler Schimel, *University of Tennessee, Knoxville, TN, United States*, **James Manuel**, *University of Georgia, Athens, GA, United States*, **Josh Maraj**, *University of Tennessee, Knoxville, TN, United States*, **Donald Leo**, *University of Georgia, Bogart, GA, United States*, **Eric Freeman**, *University of Georgia, Athens, GA, United States*, **Scott Lenaghan**, **Stephen Sarles**, *University of Tennessee, Knoxville, TN, United States*

11:10AM Memcapacitive Devices in Neuromorphic Circuits via Polymeric Biomimetic Membranes

Technical Paper Publication. SMASIS2019-5648

Colin Basham, Megan Pitz, Joseph Najem, Md. Sakib Hasan, **Stephen Sarles**, *University of Tennessee, Knoxville, TN, United States*

11:30AM Soft Reconfigurable Materials Inspired by Cellular Mechanics

Invited Presentation. SMASIS2019-5801

Eric Freeman, *University of Georgia, Athens, GA, United States*

TUESDAY, SEPTEMBER 10 • 10:50AM–12:10PM

10:50AM	11:10AM	11:30AM	11:50AM

Symposium 1 Development and Characterization of Multifunctional Materials

1-6 Shape Memory Alloys – Applications and Characterization **10:50AM–12:10PM** **Level 3, Charred**

Session Organizer: **Bjoern Kiefer**, *TU Bergakademie Freiberg, Freiberg, Germany*

Session Co-Organizer: **Darren Hartl**, *Texas A&M, College Station, TX, United States*

10:50AM Determination of Shape-Set Parameters for a NiTiHf20 High-Temperature Shape Memory Alloy

Technical Presentation. SMASIS2019-5746

Glen Bigelow, *NASA Glenn Research Center, Cleveland, OH, United States*, **Anita Garg**, *NASA/University of Toledo, Cleveland, OH, United States*, **Othmane Benafan**, *NASA Glenn Research Center, Cleveland, OH, United States*

11:10AM Towards High Power Density Additively Manufactured SMA Actuators With Internal Liquid Metal-Enabled Heating/Cooling Integration: Design and Performance

Technical Presentation. SMASIS2019-5776

Jacob Mingear, Jessica Zamarripa, Brent R. Bielefeldt, *Texas A&M University, College Station, TX, United States*, **Darren Hartl**, *Texas A&M, College Station, TX, United States*

11:30AM Predicting Functional Properties in Shape Memory Alloys Using Statistical Machine Learning Techniques

Technical Presentation. SMASIS2019-5778

William Trehern, **Sharon Pearlnath, Ben D. Rudzinski**, *Texas A&M University, College Station, TX, United States*, **Othmane Benafan**, *NASA Glenn Research Center, Cleveland, OH, United States*, **Ibrahim Karaman**, *Texas A&M University, College Station, TX, United States*

11:50AM Utilizing the Statistical Machine Learning Approaches to Design New NiTiHf High Temperature Shape Memory Alloys

Technical Presentation. SMASIS2019-5781

Tejas Umale, *Texas A&M University, Bryan, TX, United States*, **Shahin Boluki, Xiaoning Qian, Raymundo Arroyave, Ibrahim Karaman**, *Texas A&M University, College Station, TX, United States*

Symposium 2 Mechanics & Behavior of Active Materials

2-6 Lifetime and Fatigue of SMA Materials **10:50AM–12:10PM** **Level 3, Rye**

Session Organizer: **Theocharis Baxevanis**, *University of Houston, Houston, TX, United States*

Session Co-Organizer: **Dimitris Lagoudas**, *Texas A&M University, College Station, TX, United States*

10:50AM On the Fatigue-Testing of Shape Memory Actuators in Cyclic Operation

Technical Presentation. SMASIS2019-5757

Ciera Balkenbusch, *Fort Wayne Metals, Fort Wayne, IN, United States*, **Alexander Czechowicz**, *Kunststoffverarbeitung Hoffmann GmbH, Heiligenhaus, NRW, Germany*

11:10AM Investigation of the Lifetime of Antagonistic Shape Memory Wires With Focus on Accelerated Resetting

Technical Paper Publication. SMASIS2019-5511

Antonia Weirich, Benedict Theren, Dennis Otibar, *Ruhr-University Bochum, Bochum, Germany*, **Bernd Kuhlenkötter**, *Ruhr-Universität Bochum, Bochum, Germany*

11:30AM Investigation of the Fatigue Strength of Shape Memory Alloy Wires With Different Diameters

Technical Paper Publication. SMASIS2019-5512

Dennis Otibar, Benedict Theren, Antonia Weirich, *Ruhr-University Bochum, Bochum, Germany*, **Bernd Kuhlenkötter, Haang Wai Tung**, *Ruhr-Universität Bochum, Bochum, Germany*

11:50AM Methodology for Minimizing Operational Influences of the Test Rig During Long-Term Investigations of SMA Wires

Technical Paper Publication. SMASIS2019-5513

Benedict Theren, Dennis Otibar, Antonia Weirich, *Ruhr-University Bochum, Bochum, Germany*, **Julius Brandenburg, Bernd Kuhlenkötter**, *Ruhr-Universität Bochum, Bochum, North Rhine-Westphalia, Germany*

TUESDAY, SEPTEMBER 10 • 10:50AM–12:10PM

10:50AM	11:10AM	11:30AM	11:50AM

Symposium 3 Modeling, Simulation and Control of Adaptive Systems

3-6 Modeling Complex Materials and Systems 3 **10:50AM–12:10PM** **Level 3, Barrel**

Session Organizer: **James Gibert**, *Purdue University, West Lafayette, IN, United States*

Session Co-Organizer: **Francesco Danzi**, *Purdue University, West Lafayette, IN, United States*

10:50AM	11:10AM	11:30AM	11:50AM
Modal Characteristics of String Networks **Invited Presentation.** SMASIS2019-5586 **Vishvesh Koranne, James Gibert**, *Purdue University, West Lafayette, IN, United States*		**Nonlinear Dynamics Study of Tapered Resonators: Response to Primary and Secondary Resonance Excitation** **Technical Presentation.** SMASIS2019-5594 **Francesco Danzi**, **James M. Gibert**, *Purdue University, West Lafayette, IN, United States*	**Continuous Operating Elastocaloric Heating and Cooling Device: Air Flow Investigation and Experimental Parameter Study** **Technical Paper Publication.** SMASIS2019-5633 **Susanne-Marie Kirsch**, **Felix Welsch**, **Lukas Ehl**, *Intelligent Material Systems Lab /Saarland University, Saarbrücken, Germany*, **Nicolas Michaelis**, *Saarland University, Saarbrücken, Germany*, **Paul Motzki**, *ZEMA, Saarbruecken, Germany*, **Andreas Schütze**, **Stefan Seelecke**, *Saarland University, Saarbrücken, Germany*

Symposium 4 Integrated System Design and Implementation

4-6 Heat Transfer by Means of SMA **10:50AM–12:10PM** **Level 3, Barley**

Session Organizer: **Onur Bilgen**, *Rutgers University, Piscataway, NJ, United States*

Session Co-Organizer: **Alexander Czechowicz**, *Kunststoffverarbeitung Hoffmann GmbH, Heiligenhaus, NRW, Germany*

10:50AM	11:10AM	11:30AM	11:50AM
Addressing Aviation and Education Challenges With NASA University Leadership Initiative **Invited Presentation.** SMASIS2019-5762 **Koushik Datta**, *NASA, Moffett Field, CA, United States*		**Continuous Operating Elastocaloric Heating and Cooling Device: Model-Based Parameter Study With Air Flow Losses** **Technical Paper Publication.** SMASIS2019-5636 **Felix Welsch**, **Susanne-Marie Kirsch**, **Nicolas Michaelis**, *Saarland University, Saarbrücken, Germany*, **Paul Motzki**, *ZEMA, Saarbruecken, Germany*, **Andreas Schütze**, **Stefan Seelecke**, *Saarland University, Saarbrücken, Germany*	**Continuous Operating Elastocaloric Heating and Cooling Device: Air Flow Investigation and Experimental Parameter Study** **Technical Paper Publication.** SMASIS2019-5633 **Susanne-Marie Kirsch**, **Felix Welsch**, **Lukas Ehl**, *Intelligent Material Systems Lab /Saarland University, Saarbrücken, Germany*, **Nicolas Michaelis**, *Saarland University, Saarbrücken, Germany*, **Paul Motzki**, *ZEMA, Saarbruecken, Germany*, **Andreas Schütze**, **Stefan Seelecke**, *Saarland University, Saarbrücken, Germany*

TUESDAY, SEPTEMBER 10 • 10:50AM–12:10PM

10:50AM	11:10AM	11:30AM	11:50AM

Symposium 6 Bioinspired Smart Materials and Systems

6-2 Bioinspired Structures **10:50AM–12:10PM** **Level 3, Oak**

Session Organizer: **Joseph Calogero**, *Pratt & Whitney, Glastonbury, CT, United States*

Session Co-Organizer: **Aimy Wissa**, *University of Illinois, Urbana, IL, United States*

10:50AM Towards Highly Reconfigurable Carbon Fiber Composites

Technical Paper Publication. SMASIS2019-5677

Arnaldo Casalotti, *University of Roma Tre, Rome, Italy*, **Matthew P. Snyder**, *United States Air Force Academy, USAFA, CO, United States*, **Giulia Lanzara**, *University of Roma Tre, Rome, Italy*

11:10AM Analytical Modeling and Simulation of the Blocked Force and Large Deformation of Multifunctional Segmented Lithium Ion Battery Unimorph Actuator

Technical Paper Publication. SMASIS2019-5560

Cody Gonzalez, *Penn State University, State College, PA, United States*, **Jun Ma**, **Mary Frecker**, **Christopher Rahn**, *Penn State University, University Park, PA, United States*

11:30AM Target Shape Optimization of 3D Compliant Mechanism With Superelastic Joints and Shape Memory Actuation

Technical Paper Publication. SMASIS2019-5639

Jovana Jovanova, Angela Nastevska, *Ss. Cyril and Methodius University, Skopje, Macedonia (Yugoslav Rep)*, **Mary Frecker**, *Pennsylvania State University, University Park, PA, United States*

11:50AM DfAM of Nonlinear Cellular Flexible Structure

Technical Paper Publication. SMASIS2019-5673

Jelena Djokikj, **Jovana Jovanova**, *Ss. Cyril and Methodius University, Skopje, Macedonia (Yugoslav Rep)*

TUESDAY, SEPTEMBER 10 • 1:40PM–3:20PM

1:40PM	2:00PM	2:20PM	2:40PM	3:00PM

6-3 Biolocomotion I **1:40PM–3:20PM** **Level 3, Oak**

Session Organizer: **Jovana Jovanova,** *Ss. Cyril and Methodius University, Skopje, Macedonia (Yugoslav Rep)*

Session Co-Organizer: **Mary Frecker,** *Pennsylvania State University, University Park, PA, United States*

1:40PM Autonomous Path Following for a Soft Compliant Origami Crawling Robot

Technical Presentation. SMASIS2019-5668

Oyuna Angatkina, Sumanyu Singh, *University of Illinois at Urbana-Champaign, Urbana, IL, United States,* **Aimy Wissa, Andrew Alleyne,** *University of Illinois, Urbana, IL, United States*

2:00PM Kinematics and Dynamics of the Energy Release Stage of Click Beetles: Power Amplified Mechanism

Technical Presentation. SMASIS2019-5670

Ophelia Bolmin, Marianne Alleyne, *Alison C. Dunn, University of Illinois at Urbana-Champaign, Urbana, IL, United States,* **Aimy Wissa,** *University of Illinois, Urbana, IL, United States*

2:20PM Modeling and Prototyping of Self-Folding Origami Structure

Technical Paper Publication. SMASIS2019-5676

Jovana Jovanova, Simona Domazetovska, Vasko Changoski, *Ss. Cyril and Methodius University, Skopje, Macedonia (Yugoslav Rep)*

2:40PM Bioinspired Aerial and Terrestrial Locomotion Strategies

Invited Presentation. SMASIS2019-5796

Aimy Wissa, *University of Illinois, Urbana, IL, United States*

TUESDAY, SEPTEMBER 10 • 1:40PM–3:20PM

1:40PM	2:00PM	2:20PM	2:40PM	3:00PM

Symposium 1 Development and Characterization of Multifunctional Materials

1-7 Multifunctional Materials I **1:40PM–3:20PM** **Level 3, Charred**

Session Organizer: **Zoubeida Ounaies**, *Penn State University, University Park, PA, United States*

Session Co-Organizer: **James Gibert**, *Purdue University, West Lafayette, IN, United States*

1:40PM Electrochemical Healing of Cellular Metals at Room Temperature

Technical Presentation.
SMASIS2019-5518

James Pikul, Zakaria Hsain, *University of Pennsylvania, Philadelphia, PA, United States*

2:00PM Mechanics and Functionalities of 3D Printed Architected Materials

Technical Presentation.
SMASIS2019-5520

Yanyu Chen, *University of Louisville, Louisville, KY, United States*

2:20PM On the Development of Adaptive Triboelectric Metamaterials

Technical Presentation.
SMASIS2019-5582

Hongcheng Tao, James Gibert, *Purdue University, West Lafayette, IN, United States*

2:40PM A Two-Stage Optimization Framework for Design of Multifield Responsive Structures

Technical Presentation.
SMASIS2019-5608

Wei Zhang, *Pennsylvania State University, State College, PA, United States*, **Zoubeida Ounaies**, **Mary Frecker**, *Pennsylvania State University, University Park, PA, United States*

3:00PM Acoustically Driven Magnetic Oscillations at High Frequency

Technical Presentation.
SMASIS2019-5618

Joseph Schneider, *University of California, Los Angeles, Los Angeles, CA, United States*, **Katie Nygren**, *Colorado State University, Fort Collins, CO, United States*, **Qianchang Wang**, *University of California, Los Angeles, Los Angeles, CA, United States*, **Dominic Labanowski**, *Sonera Magnetics, Berkeley, CA, United States*, **Sayeef Salahuddin**, *University of California Berkeley, Berkeley, CA, United States*, **Kristen Buchanan**, *University of Colorado State, Fort Collins, CO, United States*, **Greg Carman**, *University of California, Los Angeles, Los Angeles, CA, United States*

TUESDAY, SEPTEMBER 10 • 1:40PM–3:20PM

1:40PM	2:00PM	2:20PM	2:40PM	3:00PM

Symposium 2 Mechanics & Behavior of Active Materials

2-7 SMAs - Additive Manufacturing and Combined Responses **1:40PM–3:20PM** **Level 3, Rye**

Session Organizer: **Darren Hartl**, *Texas A&M University, College Station, TX, United States*

Session Co-Organizer: **Mohammad Elahinia**, *University of Toledo, Sylvania, OH, United States*

1:40PM Effect of Annealing on the Thermomechanical Behavior of the Additively Manufactured NiTi Technical Presentation. SMASIS2019-5727 **Ahmadreza Jahadakbar**, **Parisa Bayati, Mohammadreza Nematollahi**, *University of Toledo, Toledo, OH, United States*, **Mohammad Elahinia**, *University of Toledo, Sylvania, OH, United States*	**2:00PM Finite Element-Based Numerical Investigations of a Beamlike Actuator Combining Shape Memory and Superelastic Effects** Technical Paper Publication. SMASIS2019-5546 **Danillo C. Reis**, *Instituto Tecnologico de Aeronautica, Sao Jose dos Campos, SP, Brazil*, **Osmar S. Santos**, *Universidade Federal de Lavras, Lavras, MG, Brazil*, **Domingos A. Rade**, *Instituto Tecnologico de Aeronautica, Sao Jose dos Campos, SP, Brazil*		**2:40PM Fatigue Life Analysis of the SLM Fabricated NiTi Samples With Different Build Directions** Technical Presentation. SMASIS2019-5729 **Parisa Bayati, Ahmadreza Jahadakbar**, **Mohammadreza Nematollahi**, *University of Toledo, Toledo, OH, United States*, **Mohmmad J. Mahtabi**, *University of Tennessee at Chattanooga, Chattanooga, TN, United States*, **Mohammad Elahinia**, *University of Toledo, Sylvania, OH, United States*	**3:00PM Shape Memory Alloy Nested Rotary Actuator: When Shape Memory Meets Superelasticity** Technical Presentation. SMASIS2019-5734 **Othmane Benafan**, *NASA Glenn Research Center, Cleveland, OH, United States*, **Darrell Gaydosh**, *Ohio Aerospace Institute, Cleveland, OH, United States*, **Paul A. Solano**, *NASA Glenn Research Center, Cleveland, OH, United States*

TUESDAY, SEPTEMBER 10 • 1:40PM–3:20PM

1:40PM	2:00PM	2:20PM	2:40PM	3:00PM

Symposium 4 Integrated System Design and Implementation

4-7 Rotormorphing **1:40PM–3:20PM** **Level 3, Barley**

Session Organizer: **Andres Arrieta**, *Purdue University, West Lafayette, IN, United States*

Session Co-Organizer: **Johannes Riemenschneider**, *German Aerospace Center, Braunschweig, Lower Saxony, Germany*

1:40PM Modeling and Design of an Experimental Demonstrator of Blade Twist Through the SMA Technology Technical Paper Publication. SMASIS2019-5573 **Salvatore Ameduri, Antonio Concilio, Bernardino Galasso**, *Italian Aerospace Research Centre, Capua, Italy*	**2:00PM Chord Morphing for Helicopter Rotor Blades** Technical Paper Publication. SMASIS2019-5625 **Johannes Riemenschneider, Christoph Balzarek, Berend van der Wall, Rohin Kumar Majeti**, *German Aerospace Center, Braunschweig, Germany*	**2:20PM Integrated Rotor Performance Improvement and Vibration Reduction Using Active Camber Morphing** Technical Paper Publication. SMASIS2019-5588 **Sumeet Kumar, Domink Komp, Manfred Hajek, Juergen Rauleder**, *Technical University of Munich, Munich, Germany*	**2:40PM A Piezocomposite Solid-State Rotor: Theoretical Analysis of Thrust and Efficiency Metrics** Technical Paper Publication. SMASIS2019-5558 **Tais Carneiro Ferreira De Castro**, *Federal University of Rio de Janeiro, Rio de Janeiro, Brazil*, **Onur Bilgen**, *Rutgers University, Piscataway, NJ, United States*	

TUESDAY, SEPTEMBER 10 • 1:40PM–3:20PM				
1:40PM	2:00PM	2:20PM	2:40PM	3:00PM

Symposium 8 Emerging Technologies

8-1 Emerging Research **1:40PM–3:20PM** **Level 3, Barrel**

Session Organizer: **Onur Bilgen**, *Rutgers University, Piscataway, NJ, United States*

Session Co-Organizer: **Ryan L. Harne**, *Ohio State University, Columbus, OH, United States*

1:40PM Cold-Blooded Circuits: Transient Electrical Systems That Require Constant Heat Input to Prevent Dissolution

Invited Presentation.
SMASIS2019-5786

Leon Bellan, *Vanderbilt University, Nashville, TN, United States*

2:20PM An Electrical Impedance Tomography Drive Pattern for Fast and Accurate Gesture Recognition With Less Electrodes

Technical Paper Publication.
SMASIS2019-5550

Gang Ma, *University of Science and Technology of China, Hefei, Anhui, China*, **Zhiliang Hao, Xuan Wu**, **Xiaojie Wang**, *Hefei Institutes of Physical Science, Chinese Academy of Sciences, Changzhou, Jiangsu, China*

2:40PM Controlling Mechanical Function and Electrical Behavior With Flexible Hybrid Electronic Material Systems

Technical Presentation.
SMASIS2019-5743

Nicholas C. Sears, *Ohio State University, Columbus, OH, United States*, **Dan Berrigan**, *Air Force Research Laboratory, Wright Pat, OH, United States*, **Philip Buskohl**, *AFRL/RXAS, WPAFB, OH, United States*, **Ryan L. Harne**, *Ohio State University, Columbus, OH, United States*

TUESDAY, SEPTEMBER 10 • 3:40PM–5:40PM

3:40PM	4:00PM	4:20PM

Symposium 1 Development and Characterization of Multifunctional Materials

1-8 Multifunctional Materials II **3:40PM–5:40PM** **Level 3, Charred**

Session Organizer: **Dimitris Lagoudas**, *Texas A&M University, College Station, TX, United States*

Session Co-Organizer: **Arnaldo Casalotti**, *University of Roma Tre, Rome, Italy*

3:40PM Micromechanics Modeling on the Electrical Conductivity of Aramid Nanofiber-Functionalized Graphene Electrodes

Technical Presentation. SMASIS2019-5651

Tianyang Zhou, James Boyd, Dimitrios Loufakis, Jodie Lutkenhaus, *Texas A&M University, College Station, TX, United States*, **Dimitris Lagoudas**, *Texas A&M University, College Station, TX, United States*

4:00PM Nanocomposite Coating for Strain Monitoring

Technical Paper Publication. SMASIS2019-5682

Erika Magnafico, *University of Rome, Rome, Italy*, **Francesco Poli**, **Arnaldo Casalotti**, **Giulia Lanzara**, *University of Roma Tre, Rome, Italy*

4:20PM Piezoresistive Nanocomposites for Strain and Damage Sensing: Experimental and Computational Observations

Invited Presentation. SMASIS2019-5798

Gary Seidel, *Virginia Tech, Blacksburg, VA, United States*

TUESDAY, SEPTEMBER 10 • 3:40PM–5:40PM

3:40PM	4:00PM	4:40PM

Symposium 2 Mechanics & Behavior of Active Materials

2-8 Multifield Response and Modeling III **3:40PM–4:40PM** **Level 3, Rye**

Session Organizer: **John Gallagher**, *Merrimack College, North Andover, MA, United States*

Session Co-Organizer: **Darren Hartl**, *Texas A&M University, College Station, TX, United States*

3:40PM A Nonlinear Frequency-Dependent Model for Polarization Hysteresis Loops of Ferroelectric Materials

Technical Presentation. SMASIS2019-5527

Zhiming Hu, **Jacqueline Li**, *City College of New York, New York, NY, United States*

4:00PM Experimental Technique to Estimate Interfacial Properties of Mechanoluminescent Particles in an Elastomer Matrix

Technical Paper Publication. SMASIS2019-5691

Srivatsava Krishnan, *T***Noriko Katsube**, **Vishnu Baba Sundaresan**, *Ohio State University, Columbus, OH, United States*

TUESDAY, SEPTEMBER 10 • 3:40PM–5:40PM					
3:40PM	4:00PM	4:20PM	4:40PM	5:00PM	5:20PM

Symposium 4 Integrated System Design and Implementation

4-8 Fluidic Actuators 1 **3:40PM–5:40PM** **Level 3, Barley**

Session Organizer: **Johannes Riemenschneider**, *German Aerospace Center, Braunschweig, Lower Saxony, Germany*

Session Co-Organizer: **Jonathan Luntz**, *University of Michigan, Ann Arbor, PA, United States*

TUESDAY, SEPTEMBER 10 • 3:40PM–5:40PM			
3:40PM	4:00PM	4:20PM	4:40PM

Symposium 6 Bioinspired Smart Materials and Systems

6-4 Biomolecular Materials I **3:40PM–5:40PM** **Level 3, Oak**

Session Organizer: **Joseph Calogero**, *Pratt & Whitney, Glastonbury, CT, United States*

Session Co-Organizer: **Jovana Jovanova**, *Ss. Cyril and Methodius University, Skopje, Macedonia (Yugoslav Rep)*

3:40PM Photo-Triggered Soft Materials With Differentiated Diffusive Pathways

Technical Paper Publication. SMASIS2019-5525

Michelle Makhoul-Mansour, Eric Freeman, *University of Georgia, Athens, GA, United States*

4:00PM Cephalopod-Inspired Self-Morphing Skin

Technical Presentation. SMASIS2019-5735

Caterina Lamuta, *University of Iowa, Iowa City, IA, United States*, **Honglu He**, *University of Illinois, Urbana, IL, United States*, **Kaihao Zhang**, **Michael Rogalski, Nancy Sottos, Sameh Tawfick**, *University of Illinois at Urbana-Champaign, Urbana, IL, United States*

4:20PM Dynamic Model for the Tensile Actuation of Carbon Fibers/Silicone Rubber Twisted and Coiled Artificial Muscles

Technical Presentation. SMASIS2019-5751

Valentina Giovinco, *University of Calabria, Arcavacata di Rende (CS), Italy*, **Venanzio Cichella**, *University of Iowa, Iowa City, IA, United States*, **Carmine Maletta**, *Unical, Rende, Italy*, **Caterina Lamuta**, *University of Iowa, Iowa City, IA, United States*

TUESDAY, SEPTEMBER 10 • 3:40PM–5:40PM

3:40PM	4:00PM	4:20PM	4:40PM	5:00PM	5:20PM

Symposium 8 Emerging Technologies

8-2 Multi-functional Design **3:40PM–5:40PM** **Level 3, Barrel**

Session Organizer: **Ryan L. Harne**, *Ohio State University, Columbus, OH, United States*

Session Co-Organizer: **Stephen Sarles**, *University of Tennessee, Knoxville, TN, United States*

3:40PM Perceived Value Change via 3D Printed Bistable Structures Technical Paper Publication. SMASIS2019-5694 **Wan Kyn Chan, Katherine Riley, Andres Arrieta**, *Purdue University, West Lafayette, IN, United States*	**4:00PM Multifunctional Designs With Switchable Bistability** Technical Presentation. SMASIS2019-5703 **Katherine Riley, Andres Arrieta**, *Purdue University, West Lafayette, IN, United States*	**4:20PM Influence of the Bluff Body Shape on the Escape Speed of a Bi-Stable Galloping Oscillator** Technical Presentation. SMASIS2019-5742 **Hussam Alhussein, Mohammed Daqaq**, *New York University Abu Dhabi, Abu Dhabi, United Arab Emir.*	**4:40PM Origami Inspired Mechanical Switches** Technical Presentation. SMASIS2019-5725 **Ravindra Masana, Rafael Sanchez Crespo, Hussam Alhussein, Shadi Khazaaleh, and Mohammed Daqaq**, *New York University Abu Dhabi, Abu Dhabi, United Arab Emir.*	**5:00PM Reversible Actuation for Origami Inspired Self-Folding Sarrus Mechanism Using Liquid Crystal Elastomer** Technical Presentation. SMASIS2019-5777 **Adriane Fernandes Minori, Iman Adibnazari, Qiguang He, Adrianna Stopol, Shengqiang Cai, Michael Tolley**, *University of California, San Diego, La Jolla, CA, United States*	

WEDNESDAY, SEPTEMBER 11 • 9:30AM–10:30AM

9:30AM	9:50AM	10:10AM

Symposium 2 Mechanics & Behavior of Active Materials

2-9 SMA Developments for Morphing Supersonic Aircraft **9:30AM–10:30AM** **Level 3, Charred**

Session Organizer: **Travis Turner**, *NASA Langley Research Center, Hampton, VA, United States*

Session Co-Organizer: **James Mabe**, *The Boeing Company, Berkeley, MO, United States*

9:30AM On the Mechanics of Overload and Fatigue Failure in Shape Memory Alloys **Invited Presentation.** SMASIS2019-5800 **Theocharis Baxevanis**, *University of Houston, Houston, TX, United States*		**10:10AM Micromechanical Modeling of Precipitated NiTiHf SMAs** **Technical Presentation.** SMASIS2019-5716 **Jobin Joy, Alexandros Solomou**, **Dimitris Lagoudas**, *Texas A&M University, College Station, TX, United States*

Symposium 3 Modeling, Simulation and Control of Adaptive Systems

3-7 Design of Smart and Adaptive Systems 3 **9:30AM–10:30AM** **Level 3, Barrel**

Session Organizer: **Rocco Vertechy**, *University of Bologna, Bologna, Italy*

Session Co-Organizer: **Uwe Marschner**, *Technische Universität Dresden, Dresden, Germany*

9:30AM Smart Coupled Actuation System for Dynamic Surface Adaption **Technical Presentation.** SMASIS2019-5680 **René Körbitz, Georgi Paschew, Konrad Henkel, Tim Fleck, Uwe Marschner, Andreas Richter**, *Technische Universität Dresden, Dresden, Germany*	**9:50AM Investigation of Variable Stiffness Effects on Radial Pulse Measurements Using Magneto-Rheological Elastomers** **Technical Paper Publication.** SMASIS2019-5708 **Kyle Weaver**, *Miami University, Plymouth, MI, United States*, **Dylan Shumway**, *Miami University, Oxford, OH, United States*, **Tae-Heon Yang**, *Korea National University of Transportation, Chungju-si, Chungbuk, Korea (Republic)*, **Young-Min Kim**, *Korea Institute of Oriental Medicine, Daejeon, Korea (Republic)*, **Jeong-Hoi Koo**, *Miami University, Montgomery, OH, United States*	

WEDNESDAY, SEPTEMBER 11 • 9:30AM–10:30AM

9:30AM	9:50AM	10:10AM

Symposium 4 Integrated System Design and Implementation

4-9 Fluidic Actuators 2 — **9:30AM–10:30AM** — **Level 3, Barley**

Session Organizer: **Srinivas Vasista**, *German Aerospace Center, Braunschweig, Germany*

Session Co-Organizer: **Brent Utter**, *Lafayette College, Easton, PA, United States*

9:30AM Tensegrity-Constrained Inflatables: A New Approach

Invited Presentation. SMASIS2019-5785

Jonathan Luntz, Ellen Kim, Kunj Patel, Zining Zhang, Noah Luntzlara, Koray Benli, Laura Giner Munoz, Diann Brei, *University of Michigan, Ann Arbor, PA, United States*, **Wonhee Kim, Paul Alexander**, *General Motors, Warren, MI, United States*

10:10AM Fiber-Reinforced Inflatable Torsional Actuator Design With Performance-Enhancing Axial Tension

Technical Presentation. SMASIS2019-5784

Jonathan Luntz, Ellen Kim, Lejun Jiang, Laura Giner Munoz, Diann Brei, *University of Michigan, Ann Arbor, MI, United States*, **Wonhee Kim, Paul Alexander**, *General Motors, Warren, MI, United States*

Symposium 6 Bioinspired Smart Materials and Systems

6-5 Bioinspired Actuation and Sensing I — **9:30AM–10:30AM** — **Level 3, Oak**

Session Organizer: **Joseph Calogero**, *Pratt & Whitney, Glastonbury, CT, United States*

Session Co-Organizer: **Jovana Jovanova**, *Ss. Cyril and Methodius University, Skopje, Macedonia (Yugoslav Rep)*

9:30AM Development of Multi-Chambered Variable Recruitment Artificial Muscle Tissue Actuators

Technical Presentation. SMASIS2019-5689

Nicholas Mazzoleni, **Tyler Jenkins**, **Hannah Stokes**, **Bassam Bikdash**, *North Carolina State University, Raleigh, NC, United States*, **Matthew Bryant**, *North Carolina State University, Chapel Hill, NC, United States*

9:50AM Smart Material Actuation of Multi-Locomotion Robot

Technical Paper Publication. SMASIS2019-5675

Jovana Jovanova, **Simona Domazetovska, Vasko Changoski**, *Ss. Cyril and Methodius University, Skopje, Macedonia (Yugoslav Rep)*

WEDNESDAY, SEPTEMBER 11 • 10:50AM–12:10PM

10:50AM	11:10AM	11:30AM	11:50AM

Symposium 2 Mechanics & Behavior of Active Materials

2-10 SMAs for Actuator Applications **10:50AM–12:10PM** **Level 3, Charred**

Session Organizer: **Alexander Czechowicz**, *Kunststoffverarbeitung Hoffmann GmbH, Heiligenhaus, NRW, Germany*

Session Co-Organizer: **Dennis Otibar**, *Ruhr-University Bochum, Bochum, Germany*

10:50AM Mechanics of Post Constrained Recovery Residual Stress Produced by NiTi

Technical Paper Publication. SMASIS2019-5619

Muhammad Istiaque Haider, **Maysam Rezaee, Li-Chih Tsai**, **Nathan Salowitz**, *University of Wisconsin-Milwaukee, Milwaukee, WI, United States*

11:10AM Woven Nitinol Fabric Strips Characterized in Tension via Finite Element Analysis and Geometric Modeling

Technical Paper Publication. SMASIS2019-5669

Amanda Skalitzky, Caleb Petersen, *Auburn University, Auburn, AL, United States*, **Austin Gurley**, *Deft Dynamics, Birmingham, AL, United States*, **David Beale**, *Auburn University, Auburn, AL, United States*

11:30AM Feedback Control of SMA-Wires for Position Determination: A Comparison of the Behavior Under Vacuum and Standard Conditions

Technical Paper Publication. SMASIS2019-5503

Robin Roj, *FGW Forschungsgemeinschaft Werkzeuge und Werkstoffe e.V., Remscheid, NRW, Germany*, **Florian Schummer**, *Technical University Munich, Garching, Bavaria, Germany*, **Sven Langbein**, *Feindrahtwerk Adolf Edelhoff GmbH & Co. KG, Iserlohn, Germany*, **Peter Dültgen**, *FGW Forschungsgemeinschaft Werkzeuge und Werkstoffe e.V., Remscheid, NRW, Germany*

WEDNESDAY, SEPTEMBER 11 • 10:50AM–12:10PM

10:50AM	11:10AM	11:30AM	11:50AM

Symposium 4 Integrated System Design and Implementation

4-10 Morphing Wing 3 **10:50AM–12:10PM** **Level 3, Barley**

Session Organizer: **Johannes Riemenschneider**, *German Aerospace Center, Braunschweig, Lower Saxony, Germany*
Session Co-Organizer: **Andres Arrieta**, *Purdue University, West Lafayette, IN, United States*

10:50AM Large-Displacement Morphing Wing "Droop Nose" for High-Lift: Lessons Learned in Design, Manufacture, and Testing

Technical Presentation. SMASIS2019-5771

Srinivas Vasista, Johannes Riemenschneider, Ralf Keimer, Hans Peter Monner, *German Aerospace Center, Braunschweig, Germany*, **Felix Nolte, Peter Horst**, *Technische Universität Braunschweig, Braunschweig, Lower Saxony, Germany*

11:30AM Experimental investigation of a Hybrid Skin Design Between de Morphing Leading Edge and a Fixed Wing on a Full Scale Demonstrator

Technical Presentation. SMASIS2019-5749

Martin Radestock, **Johannes Riemenschneider**, *German Aerospace Center, Braunschweig, Germany*, **Alexander Falken**, *Invent GmbH, Braunschweig, Germany*

WEDNESDAY, SEPTEMBER 11 • 10:50AM–2:10PM

10:50AM	11:10AM	11:30AM	11:50AM

Symposium 6 Bioinspired Smart Materials and Systems

6-6 Biomolecular Materials II **10:50AM–12:10PM** **Level 3, Oak**

Session Organizer: **Aimy Wissa**, *University of Illinois, Urbana, IL, United States*

Session Co-Organizer: **Michelle Makhoul-Mansour**, *University of Georgia, Athens, GA, United States*

10:50AM Totipotent Cellularly-Inspired Materials

Technical Paper Publication. SMASIS2019-5745

Samuel Mattern-Schain, MaryAnne Nguyen, Tayler Schimel, *University of Tennessee, Knoxville, TN, United States*, **James Manuel**, *University of Georgia, Athens, GA, United States*, **Josh Maraj**, *University of Tennessee, Knoxville, TN, United States*, **Donald Leo**, *University of Georgia, Bogart, GA, United States*, **Eric Freeman**, *University of Georgia, Athens, GA, United States*, **Scott Lenaghan**, **Stephen Sarles**, *University of Tennessee, Knoxville, TN, United States*

11:10AM Memcapacitive Devices in Neuromorphic Circuits via Polymeric Biomimetic Membranes

Technical Paper Publication. SMASIS2019-5648

Colin Basham, Megan Pitz, Joseph Najem, Md. Sakib Hasan, **Stephen Sarles**, *University of Tennessee, Knoxville, TN, United States*

11:30AM Soft Reconfigurable Materials Inspired by Cellular Mechanics

Invited Presentation. SMASIS2019-5801

Eric Freeman, *University of Georgia, Athens, GA, United States*

Symposium 8 Emerging Technologies

8-3 3D Printing and Advanced Manufacturing I **10:50AM–12:10PM** **Level 3, Barrel**

Session Organizer: **Julianna Abel**, *University of Minnesota, Minneapolis, MN, United States*

Session Co-Organizer: **Onur Bilgen**, *Rutgers University, Piscataway, NJ, United States*

10:50AM Novel Material Extrusion Additive Manufacturing Methods to Control Microstructure and Mesostructure in Printed Composites

Invited Presentation. SMASIS2019-5788

Brett Compton, *University of Tennessee, Knoxville, TN, United States*

11:30AM Evaluating Fretting Wear on 3D-Printed Alpha-, Beta-, Gamma- Additives Hybridized NiTi Shape Memory Alloy

Technical Paper Publication. SMASIS2019-5597

O.P. Bodunde, Shiming Gao, Mian Qin, **Wei-hsin Liao**, *Chinese University of Hong Kong, Shatin NT, Hong Kong*

WEDNESDAY, SEPTEMBER 11 • 1:40PM–3:20PM

1:40PM	2:00PM	2:20PM

Symposium 1 Development and Characterization of Multifunctional Materials

1-9 SMA - Characterization II **1:40PM–3:20PM** **Level 3, Charred**

Session Organizer: **M.J. Mills**, *Ohio State University, Columbus, OH, United States*

Session Co-Organizer: **Darren Hartl**, *Texas A&M, College Station, TX, United States*

1:40PM Effects of Aging on the Ni-Rich NiTi Fabricated by Additive Manufacturing

Technical Presentation. SMASIS2019-5705

Sayed E. Saghaian, *University of Kentucky, Lexington, KY, United States*, **Mohammadreza Nematollahi**, *University of Toledo, Toledo, OH, United States*, **Guher Pelin Toker**, *University of Kentucky, Lexington, KY, United States*, **N.S. Moghadam**, *University of Texas at Arlington, Arlington, TX, United States*, **A. Hinojos, M.J. Mills**, *Ohio State University, Columbus, OH, United States*, **Mohammad Elahinia**, *University of Toledo, Sylvania, OH, United States*, **Haluk Karaca**, *University of Kentucky, Louisville, KY, United States*

2:00PM Effect of Additive Manufacturing Process Parameters on the Mechanical Behavior of Ni-Rich NiTiHf

Technical Presentation. SMASIS2019-5709

Mohammadreza Nematollahi, *University of Toledo, Toledo, OH, United States*, **Guher Pelin Toker**, **Sayed E. Saghaian**, *University of Kentucky, Lexington, KY, United States*, **Keyvan Safaei Baghbaderani**, *University of Toledo, Toledo, OH, United States*, **Haluk Karaca**, *University of Kentucky, Louisville, KY, United States*, **Mohammad Elahinia**, *University of Toledo, Sylvania, OH, United States*

2:20PM Characterization of Ni50.3TiHf20 High Temperature Shape Memory Alloys With Uniaxial and Non-Uniaxial Thermomechanical Actuation Loading Paths

Technical Presentation. SMASIS2019-5714

Daniel Martin, **Dimitris Lagoudas**, *Texas A&M University, College Station, TX, United States*

WEDNESDAY, SEPTEMBER 11 • 1:40PM–3:20PM

1:40PM	2:00PM	2:20PM	2:40PM	3:00PM

Symposium 4 Integrated System Design and Implementation

4-11 Smart Material Application **1:40PM–3:20PM** **Level 3, Barley**

Session Organizer: **Umesh Gandhi**, *Toyota, Ann Arbor, MI, United States*

Session Co-Organizer: **Cody Wright**, *Rutgers University, Piscataway, NJ, United States*

1:40PM	2:00PM	2:20PM	2:40PM	3:00PM
A Bioinspired Piezocomposite Peristaltic Pump: An Electromechanical Euler-Bernoulli Beam Model and Parametric Analysis Technical Paper Publication. SMASIS2019-5559 **Xin Shan, Onur Bilgen**, *Rutgers University, Piscataway, NJ, United States*	**Preliminary Experimental Investigation of Control Parameters for the Electroresistive Heating of SMA Knitted Textiles** Technical Paper Publication. SMASIS2019-5666 **Rachel Marbaker, Brent Utter**, *Lafayette College, Easton, PA, United States*, **Kevin Eschen, Julianna Abel**, *University of Minnesota, Minneapolis, MN, United States*	**Design and Experimental Investigation of a Two Speed Transmission Based on Energy-Efficient MRF-Coupling Elements and Power Split Mechanism** Technical Presentation. SMASIS2019-5740 **Christian Hegger, Juergen Maas**, *TU Berlin, Berlin, Germany*	**Development of a Superelastic Damping Saddle for Bicycles** Technical Presentation. SMASIS2019-5760 **Sven Langbein**, *Feindrahtwerk Adolf Edelhoff GmbH & Co. KG, Iserlohn, Germany*, **Alexander Czechowicz**, *Kunststoffverarbeitung Hoffmann GmbH, Heiligenhaus, NRW, Germany*	**Design of a Haptic Blind Spot Warner for Bicycles Based on Shape Memory Actuators** Technical Presentation. SMASIS2019-5761 **Alexander Czechowicz**, *Kunststoffverarbeitung Hoffmann GmbH, Heiligenhaus, NRW, Germany*

Symposium 6 Bioinspired Smart Materials and Systems

6-7 Bioinspired Actuation and Sensing II **1:40PM–3:20PM** **Level 3, Oak**

Session Organizer: **Eric Freeman**, *University of Georgia, Athens, GA, United States*

Session Co-Organizer: **Larry Peel**, *Texas A&M University-Kingsville, Kingsville, TX, United States*

1:40PM	2:00PM	2:20PM	2:40PM	3:00PM
Exfoliated-Graphite/Latex Piezoresistive System for Mapping Plantar Pressure Technical Paper Publication. SMASIS2019-5696 **Allison Riegel, Gray Jonathan, Ephraim Zegeye**, *Liberty University, Lynchburg, VA, United States*	**Strain Mapping and Large Strain Measurement Using Biaxial Skin Sensors** Technical Paper Publication. SMASIS2019-5698 **Thomas Donica, Gray Jonathan, Ephraim Zegeye**, *Liberty University, Lynchburg, VA, United States*	**Versatile Layering Approach to Pneumatic Soft Actuator Fabrication** Technical Paper Publication. SMASIS2019-5561 **Emily A. Allen, John P. Swensen**, *Washington State University, Pullman, WA, United States*	**DNA Nanotechnologies for the Design of Bio-Inspired Soft Nanocomposites With Reversible Rigidity** Technical Paper Publication. SMASIS2019-5568 **Theo Calais, Thileepan Stalin, Vincent Sebastian Joseph, Pablo Valdivia y Alvarado**, *Singapore University of Technology and Design, Singapore, Singapore*	

WEDNESDAY, SEPTEMBER 11 • 1:40PM–3:20PM

1:40PM	2:00PM	2:20PM	2:40PM	3:00PM
Symposium 8 Emerging Technologies				
8-4 3D Printing and Advanced Manufacturing II 1:40PM–3:20PM Level 3, Barrel Session Organizer: **Stephen Sarles**, *University of Tennessee, Knoxville, TN, United States* Session Co-Organizer: **Giovanni Berselli**, *University of Genoa, Savignano sul Panaro, Italy*				
1:40PM Ultrasound Assisted Fused Filament Fabrication 3D Printing of PVDF-Based Smart Materials Technical Presentation. SMASIS2019-5642 **Keng Hsu, Alireza Tofangchi**, *University of Louisville, Louisville, KY, United States*	**2:00PM Characterization of a Fully 3D Printed Bellows Actuator** Technical Paper Publication. SMASIS2019-5644 **Alfonso Costas, Brittany Newell, Jose Garcia**, *Purdue University, West Lafayette, IN, United States*	**2:20PM 3D Printed Segmented Flexible Pneumatic Actuator** Technical Paper Publication. SMASIS2019-5645 **David Gonzalez, Jose Garcia, Brittany Newell**, *Purdue University, West Lafayette, IN, United States*	**2:40PM Modeling of 3D-Printed Auxetic Re-Entrant Structures With Different Angles** Technical Paper Publication. SMASIS2019-5671 **Florian Baertsch**, *Washington State University, Richland, WA, United States*, **Thomas Mayer**, *University of Applied Sciences Zürich, Winterthur, Switzerland*, **Amir Ameli**, *Washington State University, Richland, WA, United States*	

WEDNESDAY, SEPTEMBER 11 • 3:40PM–6:00PM			
3:40PM	4:00PM	4:20PM	4:40PM

Symposium 1 Development and Characterization of Multifunctional Materials

1-10 Multifunctional Materials III **3:40PM–6:00PM** **Level 3, Charred**

Session Organizer: **Allison Arnold**, *NASA Langley Research Center, Langley, OH, United States*

Session Co-Organizer: **Gary Seidel**, *Virginia Tech, Blacksburg, VA, United States*

3:40PM Effect of Environmental Conditions, Electromechanical Cycling, and Aging on the Performance Stability of Nafion -Pt and -Ag IPMCs

Technical Presentation. SMASIS2019-5624

Allison Arnold, Kavin Sivaneri Varadharajan Idhaiam, Kevin Tennant, Edward Sabolsky, *West Virginia University, Morgantown, WV, United States*, **Ji Su**, *NASA Langley Research Center, Hampton, VA, United States*

4:00PM Experimental Studies of the Actuation of Carbon Nanotube-Based Material

Technical Paper Publication. SMASIS2019-5685

Sebastian Geier, **Thorsten Mahrholz, Peter Wierach**, *German Aerospace Center, Braunschweig, Germany*, **Michael Sinapius**, *Technical University Braunschweig, Braunschweig*

4:20PM Ultra-Long Nanocomposite Ropes

Technical Paper Publication. SMASIS2019-5688

Marco Marini, Michela Talo, *University of Rome La Sapienza, Rome, Italy*, **Giulia Lanzara**, *University of Roma Tre, Rome, Italy*, **Walter Lacarbonara**, *University of Rome La Sapienza, Rome, Italy*

4:40PM Structural Health Monitoring of Polymer Bonded Energetics via Piezoresistive Response of Multi-Walled Carbon Nanotube Sensing Networks

Technical Presentation. SMASIS2019-5732

Nishant Shirodkar, Gary Seidel, *Virginia Tech, Blacksburg, VA, United States*

WEDNESDAY, SEPTEMBER 11 • 3:40PM–:00PM

3:40PM	4:00PM	4:20PM	4:40PM	5:00PM	5:20PM

Symposium 4 Integrated System Design and Implementation

4-12 Sensors and Self Sensing **3:40PM–6:00PM** **Level 3, Barley**

Session Organizer: **Andres Arrieta**, *Purdue University, West Lafayette, IN, United States*

Session Co-Organizer: **Kazuko Fuchi**, *University of Dayton Research Institute, Dayton, OH, United States*

3:40PM Design-Oriented Multifidelity Fluid Simulation Using Machine Learned Fidelity Mapping

Technical Paper Publication.
SMASIS2019-5515

Kazuko Fuchi, *University of Dayton Research Institute, Dayton, OH, United States*, **Eric M. Wolf**, *Ohio Aerospace Institute, Wright-Patterson AFB, OH, United States*, **David S. Makhija**, *Lateral Unbounded Software, LLC, Wright-Patterson AFB, OH, United States*, **Nathan A. Wukie, Christopher R. Schrock**, **Philip Beran**, *U.S. Air Force Research Laboratory, WPAFB, OH, United States*

4:00PM Implementation and Investigation of a Compact, Powerful System for Diagnosis and Control of Shape Memory Alloys in Technical Applications

Technical Paper Publication.
SMASIS2019-5551

Max Kaiser, Nils Neblung, Martin Gurka, *Institut Für Verbundwerkstoffe GmbH, Kaiserslautern, Germany*

4:20PM Self-Sensing for Twisted String Actuators Using Conductive Super-Coiled Polymers

Technical Paper Publication.
SMASIS2019-5587

David Bombara, *University of Nevada, Reno, North Las Vegas, NV, United States*, **Vasiliy Mansurov, Revanth Konda, Steven Fowzer**, **Jun Zhang**, *University of Nevada, Reno, Reno, NV, United States*

4:40PM Feasibility of 3D Printed Force Sensing Insoles for Use in Plantar Pressure Detection

Technical Presentation.
SMASIS2019-5736

Samuel Worley, *Tennessee Technological University, Cookeville, TN, United States*, **Robert Ponder**, *Tennessee Technological University, Knoxville, TN, United States*, **Steven Anton**, *Tennessee Tech, Cookeville, TN, United States*

5:00PM Design and Realization of Temperature-Driven Smart Structure Based on Shape Memory Polymer in 4D Printing

Technical Paper Publication.
SMASIS2019-5509

Yixiong Feng, Siyuan Zeng, Yicong Gao, Hao Zheng, Hao Qiu, Jianrong Tan, *Zhejiang University, Hangzhou, Zhejiang Province, China*

WEDNESDAY, SEPTEMBER 11 • 3:40PM–5:20PM

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Symposium 6 Bioinspired Smart Materials and Systems

6-8 Biolocomotion II **3:40PM–6:00PM** **Level 3, Oak**

Session Organizer: **Jovana Jovanova**, *Ss. Cyril and Methodius University, Skopje, Macedonia (Yugoslav Rep)*

Session Co-Organizer: **Eric Freeman**, *University of Georgia, Athens, GA, United States*

3:40PM	4:00PM	4:20PM	4:40PM
A Three-Row Opposed Gripping Mechanism With Radial Configuration for Wall-Climbing Robots **Technical Paper Publication.** SMASIS2019-5549 **Chao Xie, Xuan Wu**, **Xiaojie Wang**, *Hefei Institutes of Physical Science, Chinese Academy of Sciences, Changzhou, Jiangsu, China*	**Design and Testing of a Wall-Climbing Robot With Under-Actuated Force Adjusting Mechanism** **Technical Paper Publication.** SMASIS2019-5553 **Xuan Wu, Hong Liu**, **Xiaojie Wang**, *Hefei Institutes of Physical Science, Chinese Academy of Sciences, Changzhou, Jiangsu, China*		

Symposium 6 Bioinspired Smart Materials and Systems

8-5 Material Characterization and Metamaterials **3:40PM–6:00PM** **Level 3, Barrel**

Session Organizer: **Giovanni Berselli**, *University of Genoa, Savignano sul Panaro, Italy*

Session Co-Organizer: **Julianna Abel**, *University of Minnesota, Minneapolis, MN, United States*

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Quantitative Measurement of Thin Film Adhesion Force **Technical Paper Publication.** SMASIS2019-5615 **Li-Chih Tsai, Maysam Rezaee**, **Muhammad Istiaque Haider**, **Armin Yazdi**, **Nathan Salowitz**, *University of Wisconsin-Milwaukee, Milwaukee, WI, United States*	**Memristive Plasticity in Electrical Synaptic Mimics via Geometrically Reconfigurable Gramicidin-Doped Bio-Membranes** **Technical Presentation.** SMASIS2019-5646 **subhadeep koner, Joseph Najem**, **Stephen Sarles**, *University of Tennessee-Knoxville, Knoxville, TN, United States*	**Preliminary Experimental Investigation of the Mechanisms and Performance of Active Auxetic and Shearing Textiles** **Technical Paper Publication.** SMASIS2019-5661 **Rachael Granberry, Brad Holschuh**, *University of Minnesota, Saint Paul, MN, United States*, **Julianna Abel**, *University of Minnesota, Minneapolis, MN, United States*	**Experimental Investigation of Nickel-Rich, NiTi-Based SMA Knitted Actuators for Reduced-Power Wearable Actuator Systems** **Technical Presentation,** SMASIS2019-5769 **Rachel Granberry, Kevin Eschen, Brad Holschuh, Juliana Abel,** *University of Minnesota, St. Paul, MN,* **Santo Padula**, *II, NASA Glenn Research Center, Cleveland, OH*

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1-2	Mohammad	Elahinia	University of Toledo	Session Organizer
1-2	Othmane	Benafan	NASA Glenn Research Center	Session Co-Organizer
1-3	Ji	Su	NASA Langley Research Center	Session Organizer
1-3	Allison	Arnold	NASA Langley	Session Co-Organizer
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1-10	Allison	Arnold	NASA Langley	Session Organizer
1-10	Gary	Seidel	Virginia Tech	Session Co-Organizer
2-1	Virginia	DeGiorgi	Naval Research Lab	Session Organizer
2-1	Constantin	Ciocanel	Northern Arizona University	Session Co-Organizer
2-2	Paris	Von Lockette	Penn State University	Session Organizer
2-2	Gary	Seidel	Virginia Tech	Session Co-Organizer
2-3	Paris	Von Lockette	Penn State University	Session Organizer
2-3	Othmane	Benafan	NASA Glenn Research Center	Session Co-Organizer
2-4	Ryan L.	Harne	Ohio State University	Session Organizer
2-5	John	Gallagher	Merrimack College	Session Organizer
2-5	Frederick	Calkins	Boeing	Session Co-Organizer
2-6	Theocharis	Baxevanis	University of Houston	Session Organizer
2-6	Dimitris	Lagoudas	Texas A&M University	Session Co-Organizer
2-7	Darren	Hartl	Texas A&M University	Session Organizer
2-7	Mohammad	Elahinia	University of Toledo	Session Co-Organizer
2-8	John	Gallagher	Merrimack College	Session Organizer
2-8	Darren	Hartl	Texas A&M University	Session Co-Organizer
2-9	Travis	Turner	NASA Langley Research Center	Session Organizer
2-9	James	Mabe	The Boeing Company	Session Co-Organizer
2-10	Alexander	Czechowicz	Kunststoffverarbeitung Hoffmann GmbH	Session Organizer
2-10	Dennis	Otibar	Ruhr-University Bochum	Session Co-Organizer
3-1	Giovanni	Berselli	University of Genoa	Session Organizer
3-1	Salvatore	Ameduri	Italian Aerospace Research Centre	Session Co-Organizer

Session Chairs

SESSION NUMBER	FIRST NAME	LAST NAME	COMPANY	ROLE
3-2	James	Gibert	Purdue University	Session Organizer
3-2	Yaqoub	Abdullah	The Public Authority for Applied Education and Training	Session Co-Organizer
3-3	Bjoern	Kiefer	TU Bergakademie Freiberg	Session Organizer
3-3	Leandro	Maio	University of Naples	Session Co-Organizer
3-4	Rocco	Vertechy	University of Bologna	Session Organizer
3-4	Christopher	Sugino	Georgia Institute of Technology	Session Co-Organizer
3-5	Julianna	Abel	University of Minnesota	Session Organizer
3-5	Uwe	Marschner	Technische Universität Dresden	Session Co-Organizer
3-6	James	Gibert	Purdue University	Session Organizer
3-6	Francesco	Danzi	Purdue University	Session Co-Organizer
3-7	Rocco	Vertechy	University of Bologna	Session Organizer
3-7	Uwe	Marschner	Technische Universität Dresden	Session Co-Organizer
4-1	Paolo	Ermanni	ETH Zürich	Session Organizer
4-1	Matthew P.	Snyder	United States Air Force Academy	Session Co-Organizer
4-2	Johannes	Riemenschneider	German Aerospace Center	Session Organizer
4-2	Kazuko	Fuchi	University of Dayton Research Institute	Session Co-Organizer
4-3	Andres	Arrieta	Purdue University	Session Organizer
4-3	Richard	Beblo	Air Force Research Laboratory	Session Co-Organizer
4-4	Srinivas	Vasista	German Aerospace Center	Session Organizer
4-4	Andres	Arrieta	Purdue University	Session Co-Organizer
4-5	Jonathan	Luntz	University of Michigan	Session Organizer
4-5	Brent	Utter	Lafayette College	Session Co-Organizer
4-6	Onur	Bilgen	Rutgers University	Session Organizer
4-6	Alexander	Czechowicz	Kunststoffverarbeitung Hoffmann GmbH	Session Co-Organizer
4-7	Andres	Arrieta	Purdue University	Session Organizer
4-7	Johannes	Riemenschneider	German Aerospace Center	Session Co-Organizer
4-8	Johannes	Riemenschneider	German Aerospace Center	Session Organizer
4-8	Jonathan	Luntz	University of Michigan	Session Co-Organizer
4-9	Srinivas	Vasista	German Aerospace Center	Session Organizer
4-9	Brent	Utter	Lafayette College	Session Co-Organizer
4-10	Johannes	Riemenschneider	German Aerospace Center	Session Organizer
4-10	Andres	Arrieta	Purdue University	Session Co-Organizer
4-11	Umesh	Gandhi	Toyota	Session Organizer
4-11	Cody	Wright	Rutgers University	Session Co-Organizer
4-12	Andres	Arrieta	Purdue University	Session Organizer
4-12	Kazuko	Fuchi	University of Dayton Research Institute	Session Co-Organizer
5-1	Hae Young	Noh	Carnegie Mellon University	Session Organizer
5-1	Daewon	Kim	Embry-Riddle Aeronautical University	Session Co-Organizer
5-2	Daniel	Cole	U.S. Army Research Labratory	Session Organizer
5-2	Soobum	Lee	University of Maryland, Baltimore County	Session Co-Organizer
5-3	Benjamin	Grisso	Naval Surface Warfare Center Carderock	Session Organizer

Session Chairs

SESSION NUMBER	FIRST NAME	LAST NAME	COMPANY	ROLE
5-3	Ed	Habtour	Sandia National Laboratories	Session Co-Organizer
6-1	Eric	Freeman	University of Georgia	Session Organizer
6-1	Joseph	Calogero	Pratt & Whitney	Session Co-Organizer
6-2	Joseph	Calogero	Pratt & Whitney	Session Organizer
6-2	Aimy	Wissa	University of Illinois	Session Co-Organizer
6-3	Jovana	Jovanova	Ss. Cyril and Methodius University	Session Organizer
6-3	Mary	Frecker, Ph.D.	Pennsylvania State University	Session Co-Organizer
6-4	Joseph	Calogero	Pratt & Whitney	Session Organizer
6-4	Jovana	Jovanova	Ss. Cyril and Methodius University	Session Co-Organizer
6-5	Joseph	Calogero	Pratt & Whitney	Session Organizer
6-5	Jovana	Jovanova	Ss. Cyril and Methodius University	Session Co-Organizer
6-6	Aimy	Wissa	University of Illinois	Session Organizer
6-6	Michelle	Makhoul-Mansour	University of Georgia	Session Co-Organizer
6-7	Eric	Freeman	University of Georgia	Session Organizer
6-7	Larry	Peel	Texas A&M University - Kingsville	Session Co-Organizer
6-8	Jovana	Jovanova	Ss. Cyril and Methodius University	Session Organizer
6-8	Eric	Freeman	University of Georgia	Session Co-Organizer
7-1	Shahrzad	Towfighian	Binghamton University	Session Organizer
7-1	Xuewei	Zhang	Texas A&M University - Kingsville	Session Co-Organizer
7-2	Christopher	Cooley	Oakland University	Session Organizer

Session Chairs

SESSION NUMBER	FIRST NAME	LAST NAME	COMPANY	ROLE
7-2	M. Amin	Karami	University at Buffalo	Session Co-Organizer
7-3	Shahrzad	Towfighian	Binghamton University	Session Organizer
7-3	Matthew	Bryant	North Carolina State University	Session Co-Organizer
7-4	Steven	Anton	Tennessee Tech	Session Organizer
7-4	Soobum	Lee	University of Maryland, Baltimore County	Session Co-Organizer
8-1	Onur	Bilgen	Rutgers University	Session Organizer
8-1	Ryan L.	Harne	Ohio State University	Session Co-Organizer
8-2	Ryan L.	Harne	Ohio State University	Session Organizer
8-2	Stephen	Sarles	University of Tennessee	Session Co-Organizer
8-3	Julianna	Abel	University of Minnesota	Session Organizer
8-3	Onur	Bilgen	Rutgers University	Session Co-Organizer
8-4	Stephen	Sarles	University of Tennessee	Session Organizer
8-4	Giovanni	Berselli	University of Genoa	Session Co-Organizer
8-5	Giovanni	Berselli	University of Genoa	Session Organizer
8-5	Julianna	Abel	University of Minnesota	Session Co-Organizer

Sunday, September 8
Set up for exhibits and hardware competition

	Time	Room
Shape Memory Alloys (SMAs) (Darren Hartl)	1:00PM–4:30PM	Rye
Mechanics Under the Fold (Suyi Li)	1:00PM–4:30PM	Barley
Leadership Summit	4:00PM–7:00PM	Butchertown
SMASIS Symposia Chair Planning Dinner and Meeting	7:00PM–9:00PM	Hikes Point

Leadership

SYMPOSIUM 1: DEVELOPMENT AND CHARACTERIZATION OF MULTIFUNCTIONAL MATERIALS

Chair: Constantin Ciocanel
Northern
Arizona University

Co-Chair: Bjoern Kiefer
Technical University
Bergakademie Freiberg

Co-Chair: Ji Su
NASA Langley

SYMPOSIUM 2: MECHANICS & BEHAVIOR OF ACTIVE MATERIALS

Chair: Paris von Lockette
Penn State University

Co-Chair: Darren Hartl
Texas A&M University

Co-Chair: John Gallagher
Merrimack University

SYMPOSIUM 3: MODELING, SIMULATION AND CONTROL OF ADAPTIVE SYSTEMS

Chair: Wael Zaki
Khalifa University

Co-Chair: James Gibert
Purdue University

Co-Chair: Rocco Vertechy
University of Bologna

SYMPOSIUM 4: INTEGRATED SYSTEM DESIGN AND IMPLEMENTATION

Chair: Andres Arrieta
Purdue University

Co-Chair: Johannes Riemenschneider
German Aerospace Center

Co-Chair: Brent Utter
Lafayette College

SYMPOSIUM 5: STRUCTURAL HEALTH MONITORING

Chair: Hae Young Noh
Carnegie Mellon University

Co-Chair: Daniel Cole
Army Research Laboratory

Co-Chair: Benjamin Grisso
Naval Structures Warfare Center

SYMPOSIUM 6: BIOINSPIRED SMART MATERIALS AND SYSTEMS

Chair: Jovana Jovanova
Ss. Cyril and Methodius University

Co-Chair: Larry Peel
Texas A&M - Kingsville

Co-Chair: Joseph Calogero
Pratt and Whitney

SYMPOSIUM 7: ENERGY HARVESTING

Chair: Soobum Lee
University of Maryland, Baltimore County

Co-Chair: Mostafa Nouh
University at Buffalo, SUNY

Co-Chair: Sherry Tawfighian
SUNY Binghamton

SYMPOSIUM 8: EMERGING TECHNOLOGIES

Chair: Onur Bilgen
Rutgers University

Co-Chair: Julianna Abel
University of Minnesota

Co-Chair: Andy Sarles
University of Tennessee

SYMPOSIUM 9: STUDENT AND YOUNG PROFESSIONAL DEVELOPMENT

Co-Chair: Amin Bibo
Clemson University

Co-Chair: Giovanni Berselli
University of Genoa

Leadership

SMASIS 2019 LEADERSHIP

Mohammed F. Daqaq
General Chair
New York University,
Abu Dhabi

Oliver Myers
Technical Chair
Clemson University

Stephen (Andy) Sarles
Technical Co-Chair
University of Tennessee,
Knoxville

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Oliver Myers, Clemson University
Stephen (Andy) Sarles, University of Tennessee, Knoxville

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Wei-Hsin Liao, Chinese University of Hong Kong
Eugenio Dragoni, UNIMO

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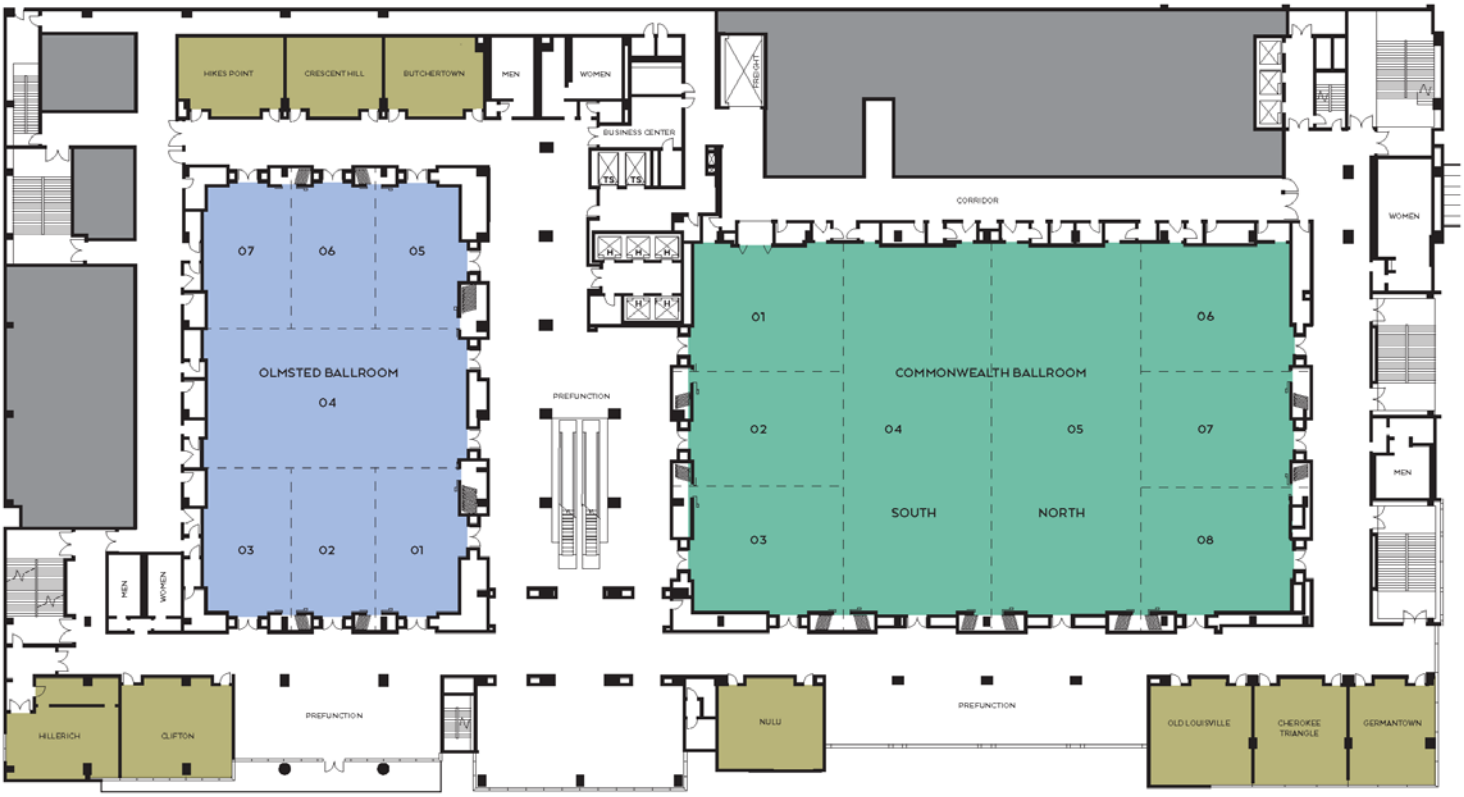
Manager, Conferences & Events

Josalind Mercado, Administrator, Unit Support

Laraine Lee
Web Tool Coordinator

OMNI LOUISVILLE HOTEL LEVEL TWO

LEVEL TWO



Hotel Floor Plan

OMNI LOUISVILLE HOTEL LEVEL THREE

LEVEL THREE

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NYU | ABU DHABI

Considered by many as the Ivy League University of the middle east, New York University Abu Dhabi (NYUAD; **http://nyuad.nyu.edu/**) first opened in 2008 and is currently located in a 15-acre campus in the Marina District of Saadiyat Island, Abu Dhabi. As a liberal arts college and research university, NYUAD offers twenty two majors in the area of Arts and Humanities, Social Sciences, Science, and Engineering that culminate into a B.A. or B.S. degrees. The university has a small and diverse student body from 120 nationalities, with a total student enrollment of around 1350 (56% female, 44% male) in 2018. NYUAD students are drawn from around the globe, surpassing all traditional academic benchmarks. According to Inside Higher Ed, NYUAD is among the most diverse and selective undergraduate universities, with an acceptance rate of around 4%. In the past five years, NYUAD undergraduate student body has garnered an impressive record of scholarships, graduate-school appointments, and many other honors, including twelve Rhodes Scholarships since 2014. NYU Abu Dhabi's highly selective liberal arts college is complemented by faculty-led advanced research, sponsoring cutting-edge projects across the Arts, Humanities, Social Sciences, Sciences, and Engineering. The global Ph.D. Fellowship program attracts the best talent from across the world for pursuing doctoral research on campus. The Engineering Division of NYUAD also takes pride in a thriving doctoral program, as well as in the postdoctoral researchers who have chosen to make NYUAD their research home.

NYUAD provides competitive start-up packages as well as salaries and relocation packages to its faculty that are on par with the best in class. Please visit our website at **http://nyuad.nyu.edu/en/about/careers/faculty-positions.html** if you are interested to be a part of the unique NYUAD family.

SMASIS Conference Synopsis

Adaptive Structures and Materials Systems by definition are intelligent systems that have sentience and responsiveness to changing environments. The field has rapidly matured due to interdisciplinary efforts across universities, government, and industry. To continue the high impact growth of this field, the purpose of this conference is to assemble world experts across engineering and scientific disciplines (mechanical, aerospace, electrical, materials, and civil engineering, biology, physics chemistry, etc.) to actively discuss the latest breakthroughs in smart materials, the cutting edge in adaptive structure applications and the recent advances in new device technologies and basic engineering research. The conference is divided into symposia broadly ranging from basic research to applied technological design and development to industrial and governmental integrated system and application demonstrations.

Schedule

March 20, 2020:	400 word abstract due
March 30, 2020:	Authors informed of abstract acceptance
April 22, 2020:	Full-length draft paper due
May 22, 2020:	Authors informed of draft paper acceptance
June 19, 2020:	Final revised paper due
June 22, 2020:	Copyright form due

Full papers will appear in an archival ASME Conference Proceedings. Selected papers will be published in archival Journals.

Participation

Authors should submit a 400 word abstract to the conference web site **https://www.asme.org/events/smasis**
Questions can be directed to:

Oliver Myers, General Chair
omyers@clemson.edu

Stephen Sarles, Technical Chair
ssarles@utk.edu du

Wei-Hsin Liao, Int'l Co-chair
whliao@cuhk.edu.hk

Eugenio Dragoni, Int'l Co-chair
eugenio.dragoni@unimore.it

Executive Committee

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Images courtesy of Azusa Tarn and Nandaro

Call for Papers

ASME Conference on

SMART MATERIALS, ADAPTIVE STRUCTURES AND INTELLIGENT SYSTEMS

September 14 – 16, 2020
Irvine, CA, USA

Sponsored by the Adaptive Structures & Material Systems Branch, Aerospace Division

The conference is divided into symposia broadly ranging from basic research to applied technological design and development to industrial and governmental integrated system and application demonstrations. The symposia and their topical areas specifically are:

Development and Characterization of Multifunctional Materials

Chair: Constantin Ciocanel, *N. Arizona*
Co-Chair: TBD

Multifunctional material formulations, evaluation, synthesis, and processing; multifunctional composites and hybrid materials; bio-inspired and nano-composites; self-healing, shape memory, piezo and magnetostrictive materials; analytics of multifunctional materials; novel triggering approaches; material property enhancement; interface and interaction science.

Integrated System Design and Implementation

Chair: Johannes Riemenschneider, *DLR*
Co-Chair: TBD

Sensors and actuators; power and control electronics; smart devices and technologies; compliant mechanism design; adaptive / intelligent / integrated systems design; smart structures design processes and tools; Industrial and government smart products and system applications; smart electronics and devices; MEMS.

Bioinspired Smart Materials and Systems

Chair: Larry Peel, *Texas A&M - Kingsville*
Co-Chair: Jovana Jovanova, *U. of Skopje*

Modeling of biological systems; understanding physical phenomena in biological systems; biomimetic and bio-inspired devices; machines and robotics; utilizing biological systems; smart prosthetic systems and intelligent implant materials and structures.

Structural Health Monitoring

Chair: Daniel Cole, *Army Research Lab.*
Co-Chair: Ben Grisso, *Navy*

Damage identification & mitigation; sensor networks; data fusion; data mining and management; damage diagnostic and prognostic modeling software; system integration, and applications.

Modeling, Simulation and Control of Adaptive Systems

Chair: James Gibert, *Purdue University*
Co-Chair: Wael Zaki, *Khalifa University*

Micro and macro level modeling; vibration and acoustic control; passive/semi-active/active damping and stiffness variation; actuation and motion control; intelligent and adaptive control; nonlinear control; hysteresis control; modeling simulation and control of micro/nano systems; nonlinear dynamics, and nonlinear vibration.

Mechanics & Behavior of Active Materials

Chair: Nakhiah Goulbourne, *U. of Michigan*
Co-Chair: Paris von Lockette, *Penn State Univ.*

Advanced constitutive measurements; micro- and nano-mechanics of actuator & sensor materials; phase field modeling; multi-scale and multi-physics material models; finite element implementations; reliability issues: aging, fatigue, and fracture; materials for energy storage; multi-ferroic materials.

Energy Harvesting

Chair: Amin Karami, *Univ. of Buffalo*
Co-Chair: Soobum Lee, *UMBC*

Modeling and experiments of energy harvesting transducers and applied systems using piezoelectric and magnetostrictive materials; electroactive polymers; inductive and capacitive devices; MEMS and NEMS configurations; novel circuits and storage devices; novel applications/analysis of traditional transduction (e.g. solar, thermoelectric); energy harvesting using metamaterials.

Emerging Technologies

Chair: Julianna Abel, *U. of Minnesota*
Co-Chair: Andy Sarles, *U. of Tennessee*

Emerging research works that are aligned with the general theme of SMASIS but may not fit in the other symposia. E.g.: advanced and additive manufacturing; nano-manufacturing; topology optimization; soft robotics; human performance sensing and augmentation; wearable technologies, uncertainty analysis in materials and structures; among others.

ASME
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SPECTRUM CENTER

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CONFERENCE ON SMART MATERIALS, ADAPTIVE STRUCTURES,
& INTELLIGENT SYSTEMS (SMASIS)

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