ASME SMASIS 2021

The ASME 2021 Conference on Smart Materials, Adaptive Structures and Intelligent Systems

CONFERENCE
September 14–15, 2021

Virtual, Online

Program

https://event.asme.org/SMASIS

The American Society of Mechanical Engineers®
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ASME
SETTING THE STANDARD

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Dear SMASIS Community,

On behalf of the organizing committee, we welcome you to the 2021 ASME Conference on Smart Materials Adaptive Structures and Intelligent Systems. This year marks the 14th consecutive SMASIS conference, and we are glad that you are a part of it. Foremost, we hope that you, your families and friends, and your research teams and colleagues are healthy, and that you are continuing to inspire, learn from, and find gratitude in one another.

As former students who attended SMASIS and now faculty members/volunteers, we are especially grateful for the familial ethos that our founders and former organizers successfully distilled into this yearly event. We are indeed a family that hosts a technical conference, and we hope that SMASIS 2021 provides this same experience.

It's fair to say that meeting online is probably not what each of us wished 2021 would bring! We dearly miss the reunion that SMASIS provides, the opportunities to collaborate, and the chances to see firsthand the technical and professional development of our students. Therefore, our goal with this year's conference was to instill these same opportunities.

Highlights of this year's two-day meeting include keynote presentations from Dr. John Cavolowsky (NASA ARMD), Prof. Conor Walsh (Harvard), and Prof. Mary Frecker (Penn State)—the 2021 Adaptive Structures and Material Systems Award Winner! Additionally, we are pleased to showcase the exciting STEM outreach efforts of Dr. Kazuko Fuchi (UDRI) and Prof. Edwin Peraza Hernandez (UC Irvine) with Azusa High School Academy (California). With a nod to a traditional SMASIS program, we will host parallel virtual sessions organized by the following technical tracks.

- Session 1: Development & Characterization of Multi-functional Materials
- Session 2: Mechanics and Behavior of Active Materials
- Session 3: Modeling, Simulation and Control of Adaptive Systems
- Session 4: Integrated System Design and Implementation
- Session 5: Structural Health Monitoring
- Session 6: Bioinspired Smart Materials and Systems
- Session 7: Energy Harvesting
- Session 8: Emerging Technologies

A two-day format was designed such that each Session could feature more live content. Technical sessions feature live invited talks and five-minute presentations from authors of technical papers and abstracts. Like last year, pre-recorded presentations are available for viewing on-demand via the Pheedloop platform. Oh, and there are multiple student-focused events, including Best Paper and Hardware competitions and a first-ever SMASIS career fair! Both days culminate with a relaxed networking session hosted by Gather Town, and, on Wednesday, we conclude by hosting a virtual pioneer banquet (complementary cookies provided by your browser—get it? ☺) to celebrate the successes of our community.

We are indebted to many for their hard work and guidance, including and especially the ASME staff, the ASME Aerospace Division Adaptive Structures and Materials Systems Branch, the ASME Aerospace Executive Committee, the ASME SMASIS Symposia Chairs and Co-Chairs, and the Technical Committees and organizing committees. We are also sincerely grateful for financial support from our sponsors: General Motors, Fort Wayne Metals, Teledyne Scientific & Imaging, and the University of Dayton Research Institute.

We hope this jam-packed program provides a rewarding conference experience, and we look forward to reuniting safely in the near future.

		
Prof. Andy Sarles General Conference Chair University of Tennessee	Prof. Amin Karami Technical Conference Chair University at Buffalo	Prof. James Gibert Technical Program Co-Chair Purdue University

CONFERENCE INFORMATION

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.

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

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ASME Member / Author: $249
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Registration Fees: All conference participants must register and pay the advertised fee, including authors, presenters, chairs, co-chairs, topic and session organizers, sponsors, exhibitors, and general attendees**. At least one author needs to register at the full conference rate, not the student rate!**

Payment Method: Individuals with incomplete registrations will not be able to attend the conference until payment has been made and registration is completed. ASME accepts VISA, MasterCard, American Express, and Discover as well as wire transfers. Non-member fees include a one-year complimentary membership to ASME.

Registration Includes: OnDemand access to the virtual platform for 90 days after the conference, online access to all technical presentations, pre-recorded technical presentations, and live presentations (recorded and posted after the conference), and digital access to all online papers as well as the official conference proceedings

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CONFERENCE PROCEEDINGS

Each attendee receives an email with a unique code to access the papers online. Check your spam folder if you have not received an email shortly before or during the conference. The official conference archival proceedings will be published after the conference and will not include accepted papers that were not presented at the conference. The official conference proceedings are registered with the Library of Congress and are submitted for abstracting and indexing. The proceedings are published on the ASME Digital Library. You will be provided with an individual link to the online papers via email. In the event you do not receive the email, send a request to toolboxhelp@asme.org.

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According to ASME's Presenter Attendance Policy, if a paper is not presented at the conference, the paper will not be published in the official Archival Proceedings, which are registered with the Library of Congress and are abstracted and indexed. The paper also will not be published in the ASME Digital Collection and may not be cited as a published paper.

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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.

MEMBERSHIP

It is easy to apply, and the benefits include the fellowship and recognition from being associated with one of the largest engineering societies in the world. ASME members and student members, and members from select countries can receive a discount on their conference registration. You can apply for ASME membership by registering online. Alternatively, you can call 1-800-THE-ASME (800-843-2763) or outside North America 973-882-1170 and ASME will mail you an application, or you can follow this link: https://www.asme.org/membership/membership-benefits to obtain an application. First-time conference attendees will receive a complimentary four-month trial membership after the conference.

PUBLICATION SALES

All SMASIS Technical Papers are available electronically to registered attendees only. Attendees will receive electronic access via their email on record. Additional copies of the proceedings can be ordered from: **ASME Order Department, 150 Clove Road, 6th Fl, Little Falls, NJ 07424-2139**

HAVE QUESTIONS ABOUT THE MEETING?

If you have any questions or need assistance, please contact Mary Jakubowski, Manager, Conferences & Events at jakubowskim@asme.org

PROGRAM AT-A-GLANCE

Please Note: The Program-at-a-Glance can be found on the conference website under the Program page and on the following two pages. A complete list of all the technical presentations can be found starting on page 39.

The link to the conference website is as follows: https://event.asme.org/SMASIS

Times (EDT)		SMASIS 2021 Day 1, Tuesday, September 14, 2021			
Start	End	PLENARY SESSION			
9:00 AM	9:10 AM	**Welcome**	Welcome by Tom Constable (ASME) Introductions by Conference Chairs: Andy Sarles and Amin Karami		
9:10 AM	9:45 AM	**Keynote 1**	Advanced Material Systems in NASA Aeronautics' Innovation Portfolio		John Cavolowsky (NASA ARMD)
9:45 AM	10:20 AM	**Keynote 2**	Leveraging Soft Materials in Wearable Robots		Conor Walsh (Harvard University)
10:20 AM	10:30 AM	*Break*			
		MORNING SESSIONS			
10:30 AM	10:35 AM	**Introductions**	**Session 01-01: Development and Characterization of Multifunctional Materials** Chairs: Bjoern Kiefer, Ji Su	**Session 02-01: Mechanics & Behavior of Active Materials** Chairs: Paris Von Lockette, Darren Hartl	**Session 03-01: Modeling, Simulation and Control of Adaptive Systems** Chairs: Rocco Vertechy, Giovanni Berselli
10:35 AM	10:55 AM	**Invited Talk + Q&A**	Mohammed Elahinia (University of Toledo)	67596, 67599, 67649, 67650, 68015, 68029, 68384, 68385, 68392, 67761	Rongjie Kang (Tianjin University)
10:55 AM	11:50 AM	**Quad Chart Presentations**	66024, 67111, 67462, 67644, 67659, 67801, 67832, 67936, 68127		67531, 67601, 67752, 67804, 67991, 68073, 68102, 68198, 68200
11:50 AM	12:00 PM	*Break*			
12:00 PM	12:50 PM	**Lunch Break**		**STUDENT DEV. PANEL** Chairs: Kazuko Fuchi, Edwin Peraza-Hernandez	
12:50 PM	1:00 PM	*Break*			
		AFTERNOON SESSIONS I			
1:00 PM	1:05 PM	**Introductions**	**Session 04-01: Integrated System Design and Implementation** Chairs: Johannes Riemenschneider, Brent Utter	**Session 05-01: Structural Health Monitoring** Chairs: Benjamin Grisso, Daewon Kim	**Session 06-01: Bioinspired Smart Materials and Systems** Chairs: Joseph Calogero, Caterina Lamuta
1:05 PM	1:25 PM	**Invited Talk+Q&A**	Umesh Gandhi (Toyota)	Steven Anton (Tenn. Tech University)	Jean-Michele Mongeau (Penn State University)
1:25 PM	2:35 PM	**Quad Chart Presentations**	67261, 67452, 67467, 67487, 67590, 67655, 67806, 67857, 67859,	67457, 67524, 67538, 67739, 67779, 67781, 68397	67304, 67508, 67559, 67646, 67651, 67686, 67703, 67760, 67786, 68035, 68183, 68238
2:35 PM	2:45 PM	*Break*			
		AFTERNOON SESSIONS II			
2:45 PM	2:50 PM	**Introductions**	**Session 07-01: Energy Harvesting** Chairs: Soobum Lee, Christopher Cooley	**Session 08-01: Emerging Technologies** Chairs: Julianna Abel, Jovana Jovanova	**Session 09-01: Student Paper Competitions** Chairs: Giovanni Berselli, Amin Bibo
2:50 PM	3:10 PM	**Invited Talk+Q&A**	Lihua Tang (University of Auckland)	Sepideh Ghodrat (TU Delft)	Best Paper Finalists: 68397, 68286, 68239, 67596, 67134
3:10 PM	4:00 PM	**Quad Chart Presentations**	67175, 67338, 67680, 67736, 67928, 68087,	67607, 67724, 67934, 67961, 68142, 68231,	Hardware Finalists: 67634, 68102, 68239, 68293
4:00 PM	4:10 PM	*Break*			
		EVENING SESSION			
4:10 PM	5:10 PM	**Networking**	Virtual Networking, Career Fair @ GatherTown		

ASME SMASIS 2021

SMASIS 2021 Day 2, Wednesday, September 15, 2021

Times (EDT)					
Start	End	**PLENARY SESSION**			
9:00 AM	9:10 AM	**Welcome**	Introductions by Conference Chairs: Amin Karami and James Gibert		
9:10 AM	9:45 AM	**Keynote 1**	Adaptive Structures and Material Systems: Community, Career, and Research Highlights		Mary Frecker (Penn State University)
9:45 AM	10:20 AM	**Keynote 2**	Origami Packaging Project: Azusa High School-SMASIS Student Symposium Collaboration		Andres Del Real, et al (Azusa High School)
10:20 AM	10:30 AM	*Break*			
		MORNING SESSIONS			
10:30 AM	10:35 AM	**Introductions**	**Session 01-02: Development and Characterization of Multifunctional Materials** Chairs: Constantin Ciocanel, Bjoern Kiefer	**Session 02-02: Mechanics & Behavior of Active Materials** Chairs: Douglas Nicholson, John Gallagher	**Session 03-02: Modeling, Simulation and Control of Adaptive Systems** Chairs: Rocco Vertechy, Amin Bibo
10:35 AM	10:55 AM	**Invited Talk + Q&A**	Aaron P. Stebner (Georgia Tech)	66807, 67471, 67609, 67746, 67854, 67856, 68034, 68075, 68322, 68396, 68111	68224, 68269, 68293, 68300, 68326, 68331, 68371, 68393, 66926, 74552
10:55 AM	11:50 AM	**Quad Chart Presentations**	68171, 68206, 68288, 68344, 67658, 67834, 68389, 75848, 76267		
11:50 AM	12:00 PM	*Break*			
12:00 PM	12:50 PM	**Lunch Break**		**TRIVIA GAME** Chairs: Anil Erol; Kazuko Fuchi	
12:50 PM	1:00 PM	*Break*			
		AFTERNOON SESSIONS I			
1:00 PM	1:05 PM	**Introductions**	**Session 04-02: Integrated System Design and Implementation** Chairs: Brent Utter, Patrick Musgrave	**Session 05-02: Structural Health Monitoring** Chairs: Daewon Kim, Nathan Salowitz	**Session 06-02: Bioinspired Smart Materials and Systems** Chairs: Caterina Lamuta, Joseph Najem
1:05 PM	1:25 PM	**Invited Talk + Q&A**	Martin Pohl - *AMTIS Award* (DLR German Aero. Center)	Sourav Banerjee (University of South Carolina)	Aimée Sakes (TU Delft)
1:25 PM	2:35 PM	**Quad Chart Presentations**	68133, 68211, 68248, 68259, 68285, 68340, 68349, 68409, 66802, 67612, 76529	67797, 67802, 68159, 68292, 67885, 76183, 68466	68239, 68271, 68283, 68296, 68299, 67332, 67837, 68055, 68225, 68403, 76248, 76453
2:35 PM	2:45 PM	*Break*			
		AFTERNOON SESSIONS II			
2:45 PM	2:50 PM	**Introductions**	**Session 07-02: Energy Harvesting** Chairs: Soobum Lee, Christopher Cooley	**Session 08-02: Emerging Technologies** Chairs: Jovana Jovanova, Paul Motzki	**Session 09-02: SMASIS Career Fair Presentations** Chairs: Kazuko Fuchi, Edwin Peraza-Hernandez
2:50 PM	3:10 PM	**Invited Talk + Q&A**	Wei Hsin Liao (Chinese University of Hong Kong)	Yannik Goergen (University of Saarland)	List of Presenters: Greg Reich (AFRL) Gloria Hardy (UDRI)
3:10 PM	4:00 PM	**Quad Chart Presentations**	68286, 68310, 68360, 68377, 68408, 67134, 67638, 76387, 76419	67634, 67896, 68146, 68382, 68358, 76365, 76758, 76414	
4:00 PM	4:10 PM	*Break*			
		EVENING SESSION			
4:10 PM	4:40 PM	**Pioneer Banquet**	Presentation of Awards - Room 1 Chairs: Andy Sarles, Amin Karami, and James Gibert		
4:40 PM	5:40 PM	**Networking**	Virtual Networking and Career Fair @ GatherTown		Online game night @ Jackbox

CONFERENCE EVENTS

VIRTUAL EXHIBITS
9:00AM –5:00PM
Tuesday, September 14 and Wednesday, September 15

Take advantage of the opportunity to visit the booths of the leading industries in the field that are making it happen! Experts from will be on hand to talk with you from **Fort Wayne Metals** and the **University of Dayton Research Institute**. Please stop by the exhibitor's virtual booths as they help support the conference, so let us support them! We would also like to thank our sponsors, **General Motors** and **Teledyne Scientific and Imaging** for their continued support.

STUDENT EVENTS

STUDENT PROFESSIONAL DEVELOPMENT PANEL
12:00PM–12:50PM
Tuesday, September 14

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.

Session 9
Student Best Paper Competition
2:45PM–4:00PM
Tuesday, September 14

The ASME Adaptive Structures and Material Systems Technical Committee 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 during the Student Best Paper Session on Tuesday, September 14.

Best Paper Finalists:

Delamination Detection in Fiber-Reinforced Polymers Using Mechanoluminescence-Optoelectronic Strain Sensor
Technical Paper Publication: SMASIS 2021-68397
Donghyeon Ryu - New Mexico Tech
Alfred Mongare - New Mexico Tech

A Nonlinear Piezoelectric Energy Harvester With Auxetic Structures
Technical Paper Publication: SMASIS 2021-68286
Keyu Chen - Chinese University of Hong Kong
Qiang Gao - Chinese University of Hong Kong
Shitong Fang - Chinese University of Hong Kong
Donglin Zou - Chinese University of Hong Kong
Zhengbao Yang - City University of Hong Kong
Wei-Hsin Liao - Chinese University of Hong Kong

Traveling Waves for Flow Control in Viscoelastic Morphing Skin
Technical Paper Publication: SMASIS 2021-68239
Anthony Olivett - University at Buffalo
Amin Karami - University at Buffalo
Amit Bhayadia - University at Buffalo

Experimental Study of NMC-Si Batteries With Bimorph Actuation
Technical Paper Publication: SMASIS 2021-67596
Shuhua Shan - The Pennsylvania State University
Cody Gonzalez - The Pennsylvania State University
Christopher Rahn - The Pennsylvania State University
Mary Frecker - The Pennsylvania State University

A Study on the Performance of a Novel Hybrid Triboelectric-Dielectric Elastomer Generator Based on PDMS Composites
Technical Paper Publication: SMASIS 2021-67134
Xiaoyue Zhao - The Pennsylvania State University
Zoubeida Ounaies - The Pennsylvania State University
Samuel Rosset - The University of Auckland
Iain Anderson - The University of Auckland

Student Best Hardware Competition
2:45PM–4:00PM
Tuesday, September 14

The ASME Adaptive Structures and Material Systems Technical Committee 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 during the Student Best Paper Session on Tuesday, September 14.

A Smart Controllable SMA-Based Tourniquet
Technical Paper Publication: SMASIS 2021-67634
Alireza Golgouneh - Department of Electrical Engineering, University of Minnesota - Twin Cities
Jiaqi Li - Department of Mechanical Engineering, University of Minnesota - Twin Cities
Julianna Abel - Department of Mechanical Engineering, University of Minnesota - Twin Cities
Lucy Dunne - University of Minnesota

Performance Comparison of Capacitive Silicone-Based Curvature Sensors With Planar and Interdigitated Electrodes
Technical Paper Publication: SMASIS 2021-68102
Lorenzo Agostini - University of Bologna
Marco Caselli - University of Bologna
Giulia Avallone - University of Bologna
Marco Fontana - PERCRO Lab, TeCIP institute - Scuola Superiore Sant'Anna
Irene Fassi - STIIMA-CNR Institute, National Research Council
Lorenzo Molinari Tosatti - STIIMA-CNR Institute, National Research Council
Rocco Vertechy - Università di Bologna

Traveling Waves for Flow Control in Viscoelastic Morphing Skin
Technical Paper Publication: SMASIS 2021-68239
Anthony Olivett - University at Buffalo
Amin Karami - University at Buffalo
Amit Bhayadia - University at Buffalo

3D Printed Resonant Compliant Mechanism to Reduce Motor Torque Requirements of Machines With Cyclic Operation
Technical Paper Publication: SMASIS 2021-68293
Luca Luzi - University of Verona
Amedeo Carloni - University of Bologna
Mohamed Refat Mostafa Ramadan - University of Bologna
Lorenzo Agostini - University of Bologna
Giovanni Berselli - University of Genoa
Rocco Vertechy - University of Bologna
Riccardo Pucci - University of Bologna

TRIVIA GAME
12:00PM–12:50PM
Wednesday, September 15

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

STUDENT CAREER FAIR
2:45PM–4:00PM
Wednesday, September 15

Join us for presentations made by recruiters from industry, government labs, and academia looking to hire the next generation of engineers and scientists.

ONLINE GAME NIGHT
4:40PM–5:40PM
Wednesday, September 15

Keep the fun going at the post-Pioneer Banquet game night. Everyone is welcome!

KEYNOTE SPEAKERS

Tuesday, September 14
9:00AM–10:20AM
Room 1

Title: Advanced Material Systems in NASA Aeronautics' Innovation Portfolio

Dr. John Cavolowsky

Director, Transformative Aeronautics Concepts Program
NASA Aeronautics Research Mission Directorate (ARMD)

Dr. Cavolowsky is responsible for the overall planning, management, and evaluation of ARMD's efforts to cultivate revolutionary concepts, tools, and technologies that enable aviation transformation. The TAC program solicits and encourages ideas, creates the environment for researchers to experiment with those ideas, explores broadly critical technologies, develops new computational and experimental tools, performs ground and small-scale flight tests, allows failures and learning from them, and drives turnover into future concepts and first-of-a-kind capabilities. He also supports the ARMD associate administrator in a broad range of mission directorate activities, including strategic planning and external coordination. Previously, Cavolowsky was director of the Airspace Operations and Safety Program, where he led overall planning, management, and evaluation of ARMD's efforts in foundational air traffic management and operational safety research that enables development of revolutionary improvements to, and modernization of, the National Airspace System. Prior positions include director of the former Aviation Systems Program, deputy program director and associate program manager for the Airspace Systems Program, and project manager for the Human Measures and Performance Project. Cavolowsky began his NASA career at Ames Research Center in 1989 as a technical lead and research manager for aerothermodynamics, addressing research and development challenges in hypersonic propulsion and thermal protection systems. He also served as a technical manager for aerospace programs in the Office of the Center Director at Ames and has published more than 25 technical papers. Cavolowsky has a Bachelor of Science degree in mechanical engineering from the Massachusetts Institute of Technology, and master's and doctoral degrees in mechanical engineering from the University of California at Berkeley.

Title: Leveraging Soft Materials in Wearable Robots

Professor Conor Walsh

John A. Paulson Harvard School of Engineering and Applied Sciences
Cambridge, MA

Conor Walsh is the Paul A. Maeder Professor of Engineering and Applied Sciences at the John A. Paulson Harvard School of Engineering and Applied Sciences. He is the is the founder of the Harvard Biodesign Lab, which brings together researchers from the engineering, industrial design, apparel, biomechanics, physical therapy, and business communities to develop and translate new disruptive robotic technologies for augmenting and restoring human performance. Technology from his lab is now commercially available in clinics for gait retraining through a collaboration with ReWalk Robotics and a lab spin-out, Verve, has launched a back assist product for workers performing physically strenuous tasks in industry. He is dedicated to training the next generation of biomedical engineering innovators and lab alumni have gone on to successful careers in academia, entrepreneurship, and high-tech R&D positions in industry. Additionally, he co-founded the Soft Robotics Toolkit that serves as a platform for the lab's extensive STEM outreach activities. He is the winner of multiple awards including the Presidential Early Career Award for Scientists and Engineers and the MIT Technology Review Innovator Under 35 Award.

Abstract

This talk will give an overview of our work on developing disruptive soft wearable robot technologies for augmenting and restoring human performance and how we characterize their performance through biomechanical and physiological studies so as to further the scientific understanding of how humans interact with such machines. Our efforts are the result a multidisciplinary team of students and research staff with backgrounds in engineering, materials science, apparel design, industrial design, biomechanics, and physical therapy, in addition to valuable collaborations with colleagues from Harvard, Boston University, and beyond. Current application areas include, enhancing the mobility of healthy individuals, restoring the mobility of patients with gait deficits, assisting those with upper extremity weakness to perform activities of daily living and preventing injuries of workers performing physically strenuous tasks. Our long-term vision is for ubiquitous soft wearable robots that can be worn all day, every day, in the community, home, sporting and workplace environments.

KEYNOTE SPEAKERS

Wednesday, September 15
9:00AM–10:20AM

2021 ASMS ADAPTIVE STRUCTURES AND MATERIALS SYSTEMS MEDAL KEYNOTE

Title: Adaptive Structures and Material Systems: Community, Career, and Research Highlights

Prof. Mary Frecker

Leighton Riess Chair in Engineering and Founding Director of the Center for Biodevices at The Pennsylvania State University

Mary Frecker is a Professor of Mechanical Engineering and Biomedical Engineering, the Leighton Riess Chair in Engineering, and the founding director of the Center for Biodevices at Pennsylvania State University. She was recently appointed Head of the Department of Mechanical Engineering at Penn State and has served as Associate Department Head for Graduate Programs in Mechanical & Nuclear Engineering, as well as Director of the Bernard Gordon Learning Factory in the College of Engineering. Dr. Frecker has a B.S. from the University of Dayton, and an M.S. and Ph.D. in Mechanical Engineering from the University of Michigan. Upon joining Penn State in 1997, she was awarded the Pearce Endowed Development Professorship in Mechanical Engineering. Dr. Frecker has also been awarded the GM/Freudenstein Young Investigator Award by the American Society of Mechanical Engineers (ASME) Mechanisms Committee (2002), the Outstanding Advising Award by the Penn State Engineering Society (2002), the Outstanding Research Award by the Penn State Engineering Society (2005), and three ASME Best Paper awards (2009 and 2015). She served as an Executive Leadership in Academic Technology & Engineering (ELATE) Fellow in 2018–2019 and completed the Changing the Future for Senior Women Faculty in STEM leadership program in 2019. Dr. Frecker is a Fellow of the ASME, is currently Chair of the ASME Mechanisms & Robotics Technical Committee and has served as Associate Editor of the *ASME Journal of Mechanical Design*, Chair of the ASME Adaptive Structures and Material Systems Technical Committee, and Executive Committee member of the ASME Aerospace Division.

Abstract: The field of adaptive structures and material systems has been advancing rapidly for more than 25 years, and the ASME ASMS research community has provided a welcoming and intellectually stimulating home for so many of us as we build our research careers. This presentation will offer reflections on an academic career built with the collaboration and support of the ASMS community, in the context of key research activities along with way. Projects from early work on design of compliant mechanisms with piezoelectric actuators to subsequent efforts aimed at optimal design of self-folding origami, morphing structures, and minimally invasive surgical instruments will be presented. Current work including optimal design of Lithium-ion battery actuators and 3D printed smart devices will also be highlighted. The presentation will conclude with suggestions for future research directions to continue the positive trajectory of the ASMS field and research community.

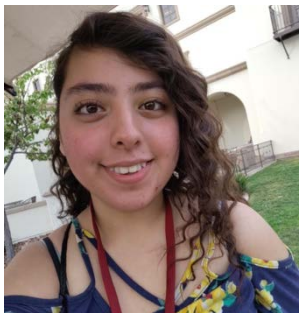
Title: Origami Packaging Project: Azusa High School–SMASIS Student Session Collaboration

Andres Del Real, students, and collaborators

Teacher, Azusa High School, Azusa, California

The SMASIS 2020 Student Session Organizers collaborated with the Azusa High School (AHS) Academy of Engineering to carry out an all-virtual educational outreach project. AHS second-year engineering academy students were asked to design origami-based packaging cushions that reduce the impact forces within shipping egg cartons, which cause the eggs to break during transportation. The students worked remotely with their teammates to come up with proposed designs and used the given material and size constraints and other evaluation metrics to make a design selection. The students then tested the designs by conducting compression and impact tests at home to mimic the laboratory tests typically conducted in packaging engineering. The presentation will showcase the origami packaging designs devised by the students and the collaborative design process adopted by one of the teams. This coming year, students from AHS will work with the SMASIS Student Session on a brand-new project on pneumatic actuators with applications in robotics.

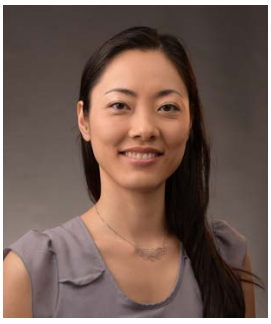
Oswaldo Cardenas



Getsemani Rodriguez

Lisa Ing

Elizabeth Ruiz



Kazuko Fuchi (UDRI)

Edwin Peraza-Hernandez (UCI)

INVITED SPEAKERS

TUESDAY, SEPTEMBER 14

MORNING SESSIONS
10:30AM–11:50AM

SESSION 1: Development and Characterization of Multifunctional Materials

Title: Controlling Microstructure and Thermomechanical Properties of NiTi Shape Memory Alloy Through Laser Powder Bed Fusion Technique

Speaker: Mohammed Elahinia | University of Toledo

Abstract: The Laser Powder Bed Fusion (LPBF) method is a free-form additive manufacturing (AM) technique showing remarkable progress in making shape memory alloy (SMA) components. The LPBF process parameters play an eminent role in tailoring the microstructure of the as-fabricated parts. In NiTi alloys, the high thermal gradient toward the building direction results in an epitaxial grain growth with the preferred crystallographic orientation of <001>, which is also the iconic microstructure for other alloys with the cubic structure. Columnar grain structure with a strong texture is the main source of the anisotropic thermomechanical behavior in the NiTi alloys processed via the LPBF technique. Such an anisotropic behavior is not favorable for many applications in which the component experiences a multi-axial loading regime. Even though, the capability of controlling the microstructure and texture of the alloy through the process opens new doors to enhancing the properties of the parts and introducing functionally graded (FG) materials. In this study, we introduce a new approach to control the texture of NiTi alloy by controlling the building parameters. We show that the building direction is a key parameter that can tailor the texture of the material toward the loading direction. This approach can be a game-changer for the application with a uniaxial loading regime. We, then, correlate the resulted texture with the thermomechanical behavior of the samples under various loading scenarios to highlight the texture dependency of NiTi alloy's properties. It is shown that the textured LPBF NiTi samples qualitatively follow the trend of the theoretical transformation strains of single crystals for various crystallographic orientations. Thus, we are able to enhance the thermomechanical performance of the parts by controlling the texture via build parameters, while other process parameters are kept constant. Having an optimized set of process parameters ensures the healthy part with minimum to no defect. On the other hand, we investigate the potential of the LPBF method to produce FG NiTi SMA thru controlling the process parameters. To this end, we employ two sets of process parameters in a single part to locally control the properties of the sample. Half of the sample shows perfect superelasticity under compression at room temperature, while the other half demonstrates the shape memory effect. A unique stress-strain response resulted from the combination of superelastic and shape memory effect behavior is achieved for the whole sample.

SESSION 3: Modeling, Simulation and Control of Adaptive Systems

Title: Design of SMA Driven Compliant Mechanisms and Their Applications in Robotics

Speaker: Rongjie Kang | Tianjin University

Abstract: Rigid mechanical components in a robotic system were used to provide body structure and mechanism to achieve physical motions following the commands from electronic controller. This kind of robotic system requires complex hardware and firmware and lacks adaptability to the change of environments. To increase flexibility and reduce computational cost for a robotic system, the combination of smart materials and compliant structures to take over control tasks fully or partially is a promising way, which is also referred to as 'mechanical intelligence' (MI).

In this talk, two examples are shared showing the implementation of Shape Memory Alloy (SMA) into compliant mechanisms to achieve crawling locomotion and stiffness regulation, respectively. In the first example, a compliant bistable mechanism is introduced to cooperate with a pair of antagonistically arranged SMA actuators to perform reciprocating motion between the two stable positions. A mechanical logic switch is utilized to determine the activation timing for the SMA actuators. The presented actuation device allows for a turtle-like robot crawling over a surface without any use of electronic controller. The second example presents a novel variable-stiffness mechanism powered by a set of embedded SMA springs in a continuum robot, which can make the compliant body structure get 'locked'. As a result, the phenomenon that the compliant body of the robot can exhibit an S-shaped curve when subject to single-directional forces is observed and analyzed. Simulations and experiments demonstrated that the presented mechanism has the stiffness variation over 287%. This is important for the continuum robot to operate and respond to different situations and environments.

AFTERNOON SESSIONS I

1:00PM–2:35PM

SESSION 4: Integrated System Design and Implementation

Title: Development of Programmable Systems at Toyota Research Institute North America

Speaker: Umesh Ghandi | Toyota R&D

Abstract: There is great interest in enhancing performance of automobile and other mobility products in the industry. Often, enhancing performance comes with increase in weight and volume. In past few years use of lighter materials, such as aluminum, magnesium, carbon fibers composites, etc., has steadily increased to help reduce the weight. We believe that the opportunity for further reduction in weight is limited. Alternative to using lighter material for weight reduction is using active or functional materials. These materials can change properties when activated. Which can be change in shape, stiffness, electrical or thermal conductivity, color, opacity, etc. Such materials can be used to design products that can adopt to the environment and achieve the optimal performance. For the past few years our team at Toyota research institute North America is exploring how to design products with such active materials. We are finding that such products, we call programmable systems, not only perform better, but also, are lighter in weight and show unique capabilities, which are not possible through conventional methods.

We recognize that these active materials are still evolving, and the programmable systems are not mature yet, there is lot more that needs to be developed and learned. At the same time, we also see high potential and significant impact of such technology in the future. In this presentation we will share our vision of using programmable system in future and experience in developing them. We will also discuss the limitation and advantage of different active materials that are available.

SESSION 5: Structural Health Monitoring

Title: Identification of Aseptic Loosening in Arthroplasty via Impedance Structural Health Monitoring

Speaker: Steven Anton | Tennessee Tech University

Abstract: Total knee arthroplasty (TKA) is one of the most common surgical interventions in the world, with over 1 million procedures performed annually in the US. While a majority of TKA procedures are successful, some total knee replacements (TKRs) still fail, and the revision burden is ~7.5%. The leading causes of revision knee replacement surgeries are aseptic (non-infectious) loosening and infection. Early detection of aseptic loosening is critical for timely intervention to ultimately improve long-term patient outcomes. As such, the potential to apply structural health monitoring (SHM) techniques to address the detection and assessment of mechanical failure in TKRs is quite appealing. This talk reviews historic and ongoing research at Tennessee Tech University focused on identifying and classifying aseptic loosening in total knee arthroplasty via impedance-based structural health monitoring (SHM). A review of our works that have investigated impedance-based SHM applied to simulated total knee replacement in various states of mechanical failure will be presented. Specific topics of discussion include the design and fabrication of simulated TKRs and associated data collection, conventional impedance SHM using traditional damage metrics (i.e., root-mean-square deviation, or RMSD), and novel SHM using classification machine learning techniques. The talk concludes with perspectives on the future of autonomous, patient-specific, data-driven healthcare via smart sensing and machine learning.

SESSION 6: Bioinspired Smart Materials and Systems

Title: Revealing Biological Principles of Adaptability and Robustness in Animal Locomotion

Speaker: Jean-Michele Mongeau | Penn State University

Abstract: Animals move with remarkable agility in a world where environmental uncertainties are often the norm rather than the exception. To meet these challenges, animals have evolved a host of adaptive control strategies and smart materials and structures that remain poorly understood. Robots must contend with similar uncertainties in real-world scenarios, thus principles from biology can inspire more agile and robust robots. Flapping flight has evolved independently four times in nature, which can provide a great source of inspiration for bioinspired engineering. For flying animals, uncertainties that cause physical injury can have severe consequences as flight is inherently an unstable mode of locomotion. For instance, flying insects, unlike birds and bats, cannot repair wing damage and therefore might require compensatory strategies to sustain performance upon damage. One possibility is that insects are robust to naturally occurring wing damage, with well-tuned control driven by sensory feedback enabling them to rapidly compensate without changes in internal gains. Alternatively, insects could compensate for damage by adaptively changing internal gains to maintain adequate performance.

We tested these two complementary but distinct hypotheses by implementing quantitative analysis of flight behavior in tethered fruit flies, *Drosophila melanogaster*. By combining experiments and theory, we quantified how sensory feedback influences compensation to wing damage. Following unilateral wing area loss of up to 40%, flies exhibited modest changes in flight performance during gaze stabilization.

By combining flight data with control theoretic and robophysical models, we discovered that compensatory changes in wing movements are driven by both active and passive control mechanisms. Using control theory, we show that compensation to wing damage is achieved by adaptive changes in internal gains that trade off stability and performance. Principles of compensatory control in insect flight can inform the development of bio-inspired flapping robots that fly in uncertain environments.

AFTERNOON SESSIONS II

2:45PM-4:00PM

SESSION 7: Energy Harvesting

Title: A Whirligig-Inspired Design for Human Motion Energy Harvesting

Speaker: Lihua Tang | University of Auckland

Abstract: Kinetic energy of human motions in different activities could be potentially harvested to charge batteries for wearable electronics, or power these devices with batteries eliminated completely. However, the main challenge remains due to the low frequencies of the human motions. A conventional vibration energy harvester design needs to adopt certain frequency up-conversion method to boost up the efficiency, which, however, complicates the structural design of the energy harvester. A traditional toy, whirligig, inspires us to design an energy harvester with a very simple structure that could convert the low-frequency linear reciprocating motions to high-speed rotations for efficient power generation. The new mechanism is demonstrated in the two designs. The initial design requires two strings to drive the rotor and meanwhile the harvester should align with the gravitational direction to work properly. The improved design requires only a single string after the introduction of a spring as energy buffer and it is insensitive to the excitation directions. In this talk, the working principle will be introduced followed by experimental characterization. Simple finger tapping could generate 20.2 mW on a matched resistive load. As a demonstration, a few electronic devices could be powered to maintain simultaneous operations by the prototyped energy harvester.

SESSION 8: Emerging Technologies

Title: Designing Shape Morphing Objects with Shape Memory Materials

Speaker: Sepideh Ghodrat | Technische Universität Delft

Abstract: Imagine we can design objects that can be altered in a variety of shapes by an external trigger and that this shape can be designed in a programmed and controlled way, not by using sensors or actuators but by the very constitution of the material itself so that it autonomously responds to changing conditions. Shape Memory Materials (SMMs), of the most paramount members of the smart materials family, are as yet not well-known and established in the world of designers.

Hence by stimulating the design of innovative products, which adapt their shapes to specific user needs, the potential of these materials is demonstrated to designers in an inspiring and meaningful way. In this research, we describe the design process of developing several SMM-based composites, including shape morphing objects consisting of SMA wires embedded in various types of substrates. By making such composites which integrate both active and passive elements, we were able to create a two-way memory effect, which is of crucial importance for obtaining a closed loop cyclic actuation. A number of examples of designed objects are presented, such as a locomotive device inspired by the caterpillar movement, a self-regulating wearable garment, wearable tactile garments, self-fastening shoes, and haptic devices for visually impaired.

INVITED SPEAKERS

Wednesday, September 15

MORNING SESSIONS
10:30AM-11:50AM

SESSION 1: Development and Characterization of Multifunctional Materials

Title: Multifunctional Additive Manufacturing Using Shape Memory Alloys

Speaker: Aaron Stebner | Georgia Institute of Technology

Abstract: Shape memory alloys are a unique class of multifunctional materials enabled by diffusionless, first-order, solid-state transformations. Still, the complexity of their process-structure-property relationships has led to slow commercial uptake – today, the largest commercial market is an ~ $2B/yr. material, $10B/yr. global medical device market. Conservative estimates project that when aerospace qualification of critical components is achieved, global markets will expand to more than $100B/yr. within a 10-year period. This growth is because shape memory alloys enable incredibly high energy density actuators, thermal switches, structural components with high damping, thermomechanical energy harvesters including heat engines, solid-state refrigerators, impact-resistant bearings, and blades, and more, all of which are capable of passive operation – that is, achieving their function through first principles mechanisms, free of electronic control systems. Furthermore, because the functional performance of shape memory alloys can be tailored through small, precise changes of their process-structure relationships, and additive manufacturing provides opportunity for such “on the fly” local variations across single parts, it is plausible that entire multifunctional systems could be printed as single components made from a single feedstock. Such technology would altogether circumvent multi-material and multi-component joining, corrosion, and thermal compatibility issues, to name a few. This seminar will review the current state of the art of shape memory alloys and their additive manufacturing, including recent advancements in using machine learning of their composition-process-property relationships to discovery new materials more. It will conclude with an outlook on new research activities and new

additive manufacturing capabilities for shape memory alloys, and more generally any alloy and metal matrix composite materials at the Advanced Manufacturing Pilot Facility of Georgia Tech.

AFTERNOON SESSIONS I

1:00PM-2:35PM

***SESSION 4: Integrated System Design and Implementation* – AMTIS TC Best Paper Award**

Title: Designing and Testing a Flexible Trailing Edge for Active Load Reduction on Wind Energy Rotor Blades

Speaker: Martin Pohl | DLR German Aerospace Center

Abstract: Facing limited resources of fossil energy, an enduring supply of energy to sustain human civilization becomes challenging. Therefore, regenerative sources of energy are increasingly important. Especially for providing electrical power, wind energy is a promising choice. To allow the best use of the limited installation locations, wind energy turbines have grown to very large sizes utilizing the stronger wind in greater altitudes.

Due to the square cube law, enlarging technical structures increases the rigidity by the power of two, whereas the mass increases by the power of three. As a consequence, any structure will reach a limit, where further growth becomes impossible due to its own structural weight. For wind energy turbine blades, this limit is to be reached in the near future.

A reduction of loads occurring at the rotor blade roots is a possibility to overcome this limitation and to allow a further growth of wind energy turbines and their blades. Since fatigue loads are the main design factor for long blades, reducing these loads is necessary. One solution therefore is the installation of a moving trailing edge to the outer part of the rotor blades comparable to a control surface on aircraft. By adjusting the trailing edge according to the inflow, wind gradients, tower shock, and even gusts can be alleviated. Due to the necessity of wind energy turbines to work in harsh environments over long times without maintenance, only a completely sealed solution is feasible keeping water, dirt, and insects out of the mechanism. Based on this, a flexible trailing edge has been designed, developed, and tested at DLR within the SmartBlades projects.

The presentation will provide an overview of the basic concept of the trailing edge, some design considerations, and the modeling to derive the final design. The trailing edge itself consists of a glass fiber prepreg structure with elastomer covers to provide the sufficient strain for the movement and environmental sealing at the same time. For the experimental investigation, a demonstrator airfoil section is built. It has been tested in the DLR lab to compare the simulated structural behavior with the measurements. Furthermore, a rotating test has been undertaken at the Danish Technical University to obtain the aerodynamic polars in the relevant environment as well as to demonstrate the load reduction. Finally, a wind tunnel test was done at the University in Oldenburg to investigate the lift polars for seven positions of the flexible trailing edge in detail in a more controlled airflow. In the presentation, some representative results of all measurement campaigns will be provided.

SESSION 5: Structural Health Monitoring

Title: Benefit of Machine Learning and Computational NDE/SHM for Digital Twin Application

Speaker: Sourav Banerjee | University of South Carolina

Abstract: In this presentation the fundamental understanding and the necessary concepts of Digital twin for Nondestructive evaluation (NDE) and Structural Health Monitoring (SHM) will be introduced. Digital twin for Nondestructive testing (NDT), is named DigiNDTwin. The primary objective of DigiNDTwin is to make one aware of the material and/or structural states using real time sensor data for the naval structures. Sensor data are multiscale in nature, designated by their frequency of operation. Low frequency data (<20 kHz) are used for understanding the global structural health, whereas higher frequencies (>100 kHz) are used probing guided waves for local defect detection, e.g., cracks, corrosion, delamination, material loss, etc. For automated defect recognition from ultrasonic NDE, guided wave sensor data is the bottle neck for the implementation of DigiNDTwin. Autonomous diagnosis of global and local health of the structures in real time will require an artificial brain or an intelligence around the never-ending multi-scale incoming data sets. However, such intelligence must be created off-line, through training a Machine Learning (ML) model to eventually build an Artificial Intelligence (AI). Training an ML model will require abundant data set with various damage scenarios. Next bottle neck is, it's neither feasible nor cost effective to perform all possible experiments with multiple possible damage scenarios to generate such data set for the ML model. Further to recognize local defects, the model must understand the physics-based ultrasonic wave interaction with various types of possible defects and material degradation in order to accurately detect the defects and effects of defects. It was identified that computational NDE and SHM could alleviate some load. The models must be verified and validated through experiments. From the verified model, it is necessary to generate datasets and employ advanced big-data analytics and deep learning models. In this presentation the past 5 years of research activities at the integrated material assessment and predictive simulation laboratory (iMPAS) towards the above goal will be presented in a concise form. The presentation will introduce few key environments and will explain how to generate a library of multiple possible defect scenarios for big data training using computational NDE/SHM methods. All available computational models and their possible mode of applications will be discussed. Please note that no single modeling technique works for all NDE/SHM problem. Hence, workability with different modeling approaches and their respective know-how will be discussed. Further, objective and process with the AI driven automated defect recognition from ultrasonic signal and digitized information propagation for progressive failure models housed in DigiNDTwin will be explained. Output from such models will help recognize safety of an imminent mission through material/structural certification.

SESSION 6: Bioinspired Smart Materials and Systems

Title: How a Small Wasp Inspired New Developments in Medical Instrument Design

Speaker: Aimée Sakes | Technische Universität Delft

Abstract: Nature has evolved for millions of years and came up with a wide variety of non-conventional solutions to overcome different challenges faced by animals, fungi, and plants. Knowledge on these non-conventional mechanical approaches in nature can lead to more creativity in mechanical design and to better (simpler, smaller, more robust) solutions than with conventional technology. Especially if we look at relatively small animals, we see that they have come up with ingenious solutions to overcome constraints put on them by their small size or size of their body parts. A very interesting small animal is the parasitic wasp.

The parasitic wasp has a long and slender ovipositor (egg-laying tube) which it uses to deposit eggs in wood, fruit, or other animals. Based on the length and diameter of this ovipositor, it should be technically impossible to penetrate wood. In order to achieve this incredible feat, the parasitic wasp makes smart use of a variety of mechanisms to prevent buckling and initiate egg transport through its ovipositor. The most prominent mechanism is a reciprocating motion of the valves of the ovipositor. This reciprocating motion results in a friction differential between the valves and their direct environment, allowing for egg transport and low push force penetration.

In this talk I will discuss how this small wasp inspired us to design new types of ultrathin (0.4 mm) self-propelling needles (designed by Marta Scali) and transport mechanisms and how we translated the wasp's mechanism into different mechanical solutions. These mechanical solutions allow for smaller, more flexible, and longer instrument designs that fill the growing demand of minimally invasive surgeries in the near future.

AFTERNOON SESSIONS II

2:45PM-4:00PM

SESSION 7: Energy Harvesting

Title: Self-Powered Smart Watch and Wristband Enabled by Embedded Generator

Speaker: Wei Hsin Liao | Chinese University of Hong Kong

Abstract: Smart watches and wristbands are demonstrating great potential in industries such as health monitoring, sports training, and entertainment. However, the limited battery life of these devices remains a key issue. We reported an electromagnetic generator with coaxial topology that efficiently captures the motion of arm swing to produce electricity for smart watches and wristbands. This electromagnetic generator integrates a coaxially installed motion capture mechanism, a magnetic frequency-up converter, and a power generation unit in a highly compact and flat space, allowing it to be embedded in smart watches and wristbands. We used the finite element method to analyze the magnetic frequency-up conversion effect, generated voltage, and transmission torque. We constructed a prototype to test the characteristics of the proposed embedded generator and its performance under simulated walking conditions. The average power generation and normalized power density were 1.74 mW and 820.38 $\mu W/cm^3\ Hz^2$, which are, respectively, more than 4 and 10 times that of previous works. An inertial energy

harvester without additional proof mass was also proposed to efficiently scavenge the kinetic energy of human limb swing.

A miniature prototype was fabricated to experimentally characterize the energy harvester under pseudo-walking excitation and evaluate its performance in real walking. This embedded generator enables smart watches and wristbands to be self-powered.

SESSION 8: Emerging Technologies

Title: Smart Materials as Artificial Muscles in Soft Continuum Robot Applications

Speaker: Yannik Goergen | University of Saarland

Abstract: Inspired by nature, the development of intrinsically soft continuum robots has become a popular field of research with a wide range of potential applications. Bionic structures similar to elephant trunks, snakes or tentacles omit rigid structures and joints of traditional robots and use more complex multidimensional bending motion. To generate these unconventional movements, smart material actuators like shape memory alloy (SMA) wires or dielectric elastomer actuators (DEA), which are both often referred to as artificial muscles, represent an attractive approach because of their unique actuator properties. In this presentation, a variety of prototypical continuum robotic structures using SMAs and DEAs are presented. These prototypes cover medical applications like steerable guide-wires, catheters and endoscopes as well as industrial maintenance and inspection systems. Also, larger structures for the growing field of human-machine-interaction are introduced. The presentation covers the design of the actuator systems, as well as their integration into robotic bending structures and an introduction into different simulation tools, which assist the systematic design processes.

AWARDS

Wednesday, September 15
Virtual Pioneer Banquet
4:10PM–4:40 PM

ASME 2021 ADAPTIVE STRUCTURES & MATERIALS SYSTEMS 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.

Mary Frecker | Penn State University

Dr. Mary Frecker is a Professor of Mechanical Engineering and Biomedical Engineering, the Leighton Riess Chair in Engineering, and the founding director of the Center for Biodevices at Pennsylvania State University. She was recently appointed Head of the Department of Mechanical Engineering at Penn State and has served as Associate Department Head for Graduate Programs in Mechanical & Nuclear Engineering, as well as Director of the Bernard Gordon Learning Factory in the College of Engineering. Dr. Frecker has a B.S. from the University of Dayton, and an M.S. and Ph.D. in Mechanical Engineering from the University of Michigan. Upon joining Penn State in 1997, she was awarded the Pearce Endowed Development Professorship in Mechanical Engineering. Dr. Frecker has also been awarded the GM/Freudenstein Young Investigator Award by the American Society of Mechanical Engineers (ASME) Mechanisms Committee (2002), the Outstanding Advising Award by the Penn State Engineering Society (2002), the Outstanding Research Award by the Penn State Engineering Society (2005), and three ASME Best Paper awards (2009 and 2015). She served as an Executive Leadership in Academic Technology & Engineering (ELATE) Fellow in 2018–2019 and completed the Changing the Future for Senior Women Faculty in STEM leadership program in 2019. Dr. Frecker is a Fellow of the ASME, is currently Chair of the ASME Mechanisms & Robotics Technical Committee and has served as Associate Editor of the *ASME Journal of Mechanical Design*, Chair of the ASME Adaptive Structures and Material Systems Technical Committee, and Executive Committee member of the ASME Aerospace Division.

ASME ASMS TC GARY ANDERSON AWARD

The Gary Anderson Award recognizes 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 award includes $1000 and a certificate.

Suyi Li | Clemson University

Dr. Suyi Li is currently an assistant professor of mechanical engineering at Clemson University. He received his Ph.D. from 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 program on the dynamic matter. His research interests are in origami-inspired adaptive structures, multi-functional mechanical metamaterials, and compliant robotics. Since joining Clemson, Dr. Li secured close to two million dollars of research funding, including the prestigious NSF CAREER award. He is also the recipient of the Freudenstein Young Investigator Award from the ASME Mechanism and Robotics committee and CECAS Junior Researcher of the Year Award from Clemson. His research has generated 34 journal manuscripts and 31 conference proceedings.

ASME ASMS TC 2021 BEST PAPER AWARDS

There are three Best Paper Awards established by the ASME Adaptive Structures and Materials Systems Technical Committee (ASMS TC): 1) Structures and Structural Dynamics Best Paper Award, 2) Materials and Systems Best Paper Award, and 3) Energy Harvesting Best Paper Award. Papers 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.

I. Structures and Structural Dynamics Best Paper

Authors: Sansit Patnaik (Purdue University), Fabio Semperlotti (Purdue University)

Patnaik, S.; Semperlotti, F., A Generalized Fractional Order Elastodynamic Theory for Non-Local Attenuating Media. *Proceedings of the Royal Society A: Mathematical, Physical and Engineering Sciences* **2020,** *476* (2238), 20200200.

II. Mechanics and Materials Systems Best Paper

Authors: M.A. Attarzaheh (University of Buffalo), J. Callanan (University of Buffalo), M. Nouh (University of Buffalo)

Attarzadeh, M.A.; Callanan, J.; Nouh, M., Experimental Observation of Nonreciprocal Waves in a Resonant Metamaterial Beam. *Physical Review Applied* **2020,** *13* (2), 021001

2020 STRUCTURAL HEALTH MONITORING TC 2021 BEST PAPER AWARDS

Winner:

Authors: S. Gupta, G. Vella, I.-N. Yu, C.-H. Loh, W.-H. Chiang, K. Loh (University of California, San Diego)

Gupta, S.; Vella, G.; Yu, I.N.; Loh, C.-H.; Chiang, W.-H.; Loh, K.J., Graphene Sensing Meshes for Densely Distributed Strain Field Monitoring. *Structural Health Monitoring* **2019,** *19* (5), 1323-1339.

Runner-Up:

Authors: J. Liu, S. Chen, M. Bergés, J. Bielak, J.H. Garrett, J. Kovacevic, H. Noh (Stanford University)

Liu, J.; Chen, S.; Bergés, M.; Bielak, J.; Garrett, J.H.; Kovačević, J.; Noh, H.Y., Diagnosis Algorithms for Indirect Structural Health Monitoring of a Bridge Model via Dimensionality Reduction. *Mechanical Systems and Signal Processing* **2020,** *136*, 106454.

2021 AMTIS Outstanding Contribution Award

Authors: Martin Pohl, Johannes Riemenschneider, Hans Peter Monner (DLR German Aerospace Center)

Pohl, M.; Riemenschneider, J.; Monner, H.P., Design and Experimental Investigation of a Flexible Trailing Edge for Wind Energy Turbine Blades. 2020.

2020 ENERGY HARVESTING BEST PAPER AWARD

Authors: M. Cai, J. Wang, W.-H. Liao (The Chinese University of Hong Kong)

Cai, M.; Wang, J.; Liao, W.-H., Self-Powered Smart Watch, and Wristband Enabled by Embedded Generator. *Applied Energy* **2020,** *263*, 114682.

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TECHNICAL PRESENTATIONS

Please note the videos for all the technical presentations will be OnDemand and not shown during the two-day conference. They will be available for viewing the day before the conference and for three months after on the virtual platform.

Access to the virtual platform is sent to all registered attendees prior to the start of the conference.

On the following pages you will find the list of all technical presentations.

TECHNICAL PRESENTATIONS

TUESDAY, SEPTEMBER 14, 2021

01-01: Development and Characterization of Multifunctional Materials
9/14/2021
10:30 AM–11:50 AM - Room 1

Chair: ***Constantin Ciocanel - Northern Arizona University***
Co-Chair: ***Bjoern Kiefer - TU Bergakademie Freiberg***

Development and Characterization of Shape Memory Polymers for Non-Invasive Biomedical Applications
Technical Paper Publication: SMASIS 2021-66024
Janitha Jeewantha - University of Southern Queensland
Chris Emmanuel - University of Southern Queensland
Madhubhashitha Herath - Uva Wellassa University
Mainul Islam - University of Southern Queensland
Jayantha Epaarachchi - University of Southern Queensland

Effect of Thickness on the Shape Memory Properties of Bisphenol an Epoxy Based Shape Memory Polymer Composites
Technical Paper Publication: SMASIS 2021-67111
Kotikawattege Don Chris Emmanuel - University of Southern Queensland
Janitha Jeewantha - University of Southern Queensland
Madhubhashitha Herath - Uva Wellassa University
Jayantha Epaarachchi - University of Southern Queensland
Thiru Aravinthan - University of Southern Queensland

Characterization of Nanoporous Polyvinylidene Fluoride (PVDF) Sensors Under Tensile Loading of Nanoporous Polyvinylidene Fluoride (PVDF) Sensors Under Tensile Loading
Technical Paper Publication: SMASIS 2021-67462
Zhaolin Gao - University of Minnesota Duluth
Matthew Danley - University of Minnesota Duluth
Jack Kloster - University of Minnesota Duluth
Victor Lai - University of Minnesota Duluth
Ping Zhao - University of Minnesota Duluth

Flexoelectric Polarization of Piezoelectric PVDF-Films Above the Curie Temperature
Technical Paper Publication: SMASIS 2021-67644
Lars Seyfert - Technical University of Munich
Norbert Schwesinger - Technical University of Munich
Hassen Ben Ammar - Technical University of Munich

Investigation of Highly Sensitive 3D-Printed Liquid Sensors Using Response Surface Methodology
Technical Paper Publication: SMASIS 2021-67659
Amir Ameli - University of Massachusetts Lowell
Nahal Aliheidari - University of Massachusetts Lowell

The Transient Response of Piezoresistive CNF-Modified Epoxy Rods to One-Dimensional Wave Packet Excitation
Technical Paper Publication: SMASIS 2021-67801
Julio Hernandez - Purdue University
Hongfei Zhu - Purdue University
Fabio Semperlotti - Purdue University
Tyler Tallman - Purdue University

Contact-Poling Enhanced, Fully 3D Printed PVDF Pressure Sensors: Towards 3D Printed Functional Materials
Technical Paper Publication: SMASIS 2021-67832
Jinsheng Fan - Purdue University
Jose Garcia - Purdue University
Brittany Newell - Purdue University
Richard Voyles - Purdue University
Robert Nawrocki - Purdue University

Modulation of Zirconia Ferroelectricity via Crystal Orientation of Pt Electrode
Technical Paper Publication: SMASIS 2021-67936
Yong-Xiang Zhuang - National Taiwan University
Jay Shieh - National Taiwan University
Miin-Jang Chen - National Taiwan University
Hsin-Chih Lin - National Taiwan University

Characterization and Quantification of Hierarchical Particle Microstructures in External Field-Processed Composites
Technical Paper Publication: SMASIS 2021-68127
Dashiell Papula - Penn State University
Zoubeida Ounaies - Penn State University
Paris Von Lockette - Penn State University
Dennise Widdowson - Penn State University
Anil Erol - Penn State University
Abdulla Masud - Penn State University

02-01: Mechanics & Behavior of Active Materials
9/14/2021
10:30AM–11:50AM - Room 2

Chair: ***Paris Von Lockette - Penn State University***
Co-Chair: ***Darren Hartl - Texas A&M University***

Experimental Study of NMC-Si Batteries With Bimorph Actuation
Technical Paper Publication: SMASIS 2021-67596
Shuhua Shan - The Pennsylvania State University
Cody Gonzalez - The Pennsylvania State University
Christopher Rahn - The Pennsylvania State University
Mary Frecker - The Pennsylvania State University

SMA Actuator Usage in Upper Limb Rehabilitation Technology
Technical Paper Publication: SMASIS 2021-67599
Michael Miro - Ruhr-University
Benedict Theren - Ruhr-University
Tobias Schmelter - Ruhr-University
Bernd Kuhlenkötter - Ruhr-University

Investigations Regarding the Longterm Behaviour of Electrically Heated SMA Wires Using Alternating Current
Technical Paper Publication: SMASIS 2021-67649
Benedict Theren - Ruhr-University Bochum
Tobias Schmelter - Ruhr-University Bochum
Philipp Chromik - Ruhr-University Bochum
Bernd Kuhlenkötter - Ruhr-University Bochum

Integration of SMA Wires Into the Additive Manufacturing Process Using PBF-LB/M and Long-Term Tests of the Specimens to Validate the Functional Properties

Technical Paper Publication: SMASIS 2021-67650

Tobias Schmelter - Ruhr-University Bochum
Magnus Thiele - Ruhr-University Bochum
Benedict Theren - Ruhr-University Bochum
Marvin Schuleit - Ruhr-University Bochum
Cemal Esen - Ruhr-University Bochum
Bernd Kuhlenkötter - Ruhr-University Bochum

Influences of Various Parameters on the Microstructure and Their Effects on the Structural Fatigue of Shape Memory Systems

Technical Paper Publication: SMASIS 2021-68015

Peter Dültgen - Forschungsgemeinschaft Werkzeuge und Werkstoffe e.V.
Ralf Theiß - Forschungsgemeinschaft Werkzeuge und Werkstoffe e.V.
Romina Krieg - Forschungsgemeinschaft Werkzeuge und Werkstoffe e.V.
Yannic Zwinscher - Forschungsgemeinschaft Werkzeuge und Werkstoffe e.V.
Fabian Hoffmann - Forschungsgemeinschaft Werkzeuge und Werkstoffe e.V.

An Attempt to Topology Optimize 3D Printed Piezoelectric Composite Sensors for Highest D31 Output

Technical Paper Publication: SMASIS 2021-68029

Rytis Mitkus - TU Braunschweig
Ayat Taleb Alashkar - TU Braunschweig
Michael Sinapius - TU Braunschweig

Work Capacity of Self-Folding Polymer Origami

Technical Paper Publication: SMASIS 2021-68384

Ryan Long - Auburn University
Kanak Parmar - Auburn University
Manuel Indaco - Auburn University
Will Taylor - Auburn University
Nathan Adkins - Auburn University
Deepika Singla - Auburn University
Davide Guzzetti - Auburn University
Russell Mailen - Auburn University

Development of Torque Sensors Using Additive Manufacturing

Technical Paper Publication: SMASIS 2021-68385

Narciso Soto - Purdue University
Jose Garcia - Purdue University
Brittany Newell - Purdue University

Resilience and Performance of Deployable Space Structures Based on a Shape Memory Polymer Bus
Technical Paper Publication: SMASIS 2021-68392
Deepika Singla - Auburn University
Ryan Long - Auburn University
Kanak Parmar - Auburn University
Manuel Indaco - Auburn University
Nathan Adkins - Auburn University
Will Taylor - Auburn University
Davide Guzzetti - Auburn University
Russell Mailen - Auburn University

Bending Properties of 3D Printed Continuous Fiber-Reinforced Composite Sandwich Structures with Shape Memory Effects
Technical Presentation Only: SMASIS 2021-67761
Chengjun Zeng - Harbin Institute of Technology
Liwu Liu - Harbin Institute of Technology
Wenfeng Bian - Harbin Institute of Technology
Yanju Liu - Harbin Institute of Technology
Jinsong Leng - Harbin Institute of Technology

03-01: Modeling, Simulation and Control of Adaptive Systems
9/14/2021
10:30AM–11:50AM - Room 3

Chair: ***Rocco Vertechy - University of Bologna***
Co-Chair: ***Giovanni Berselli - UniGe***

Design of SMA Driven Compliant Mechanisms and Their Applications in Robotics
Invited Speaker Presentation: SMASIS 2021-77829
Rongjie Kang - Tianjin University

Topology Morphing Lattice Structures
Technical Paper Publication: SMASIS 2021-67531
Venkatesh Sundararaman - University of Limerick
Matt O'Donnell - University of the West of England
Isaac Chenchiah - University of Bristol
Paul Weaver - University of Limerick

Feasibility Study on Piezoelectric Actuated Automotive Morphing Wing
Technical Paper Publication: SMASIS 2021-67601
Alessandro Messana - Politecnico di Torino
Lorenzo Sisca - Politecnico di Torino
Henrique De Carvalho Pinheiro - Politecnico di Torino
Alessandro Ferraris - BeonD srl
Andrea Giancarlo Airale - BeonD srl
Massimiliana Carello - Politecnico di Torino
Davide Berti Polato - BeonD srl

Finite Element Modeling and Simulation of a Soft Array of Dielectric Elastomer Actuators
Technical Paper Publication: SMASIS 2021-67752
Sipontina Croce - Saarland University
Julian Neu - Saarland University
Jonas Hubertus - University of Applied Sciences of Saarland
Stefan Seelecke - Center for Mechatronics and Automation Technologies (ZeMA)
Günter Schultes - University of Applied Sciences of Saarland
Giacomo Moretti - Saarland University
Gianluca Rizzello - Saarland University

Tailoring Structure-Borne Traveling Waves in Targeted Areas of a Two-Dimensional Plate for Particle Motion Applications
Technical Paper Publication: SMASIS 2021-67804
William Rogers - Tennessee Tech University
Mohammad Albakri - Tennessee Tech University

Understanding the Influence of Resonators on Frequency Band Gaps in Sonic Crystal Metamaterials
Technical Paper Publication: SMASIS 2021-67991
Riaz Ahmed - University of Wisconsin-Green Bay
Hossain Ahmed - University of South Carolina

Numerical Studies on the Dynamic Characteristics of Series-Connected Multistable Laminates
Technical Paper Publication: SMASIS 2021-68073
P.M. Anilkumar - Indian Institute of Technology Madras
S. Scheffler - Leibniz Universität Hannover
A. Haldar - Cardiff University
E.L. Jansen - Rotterdam University of Applied Science
B.N. Rao - Indian Institute of Technology Madras
R. Rolfes - Leibniz Universität Hannover

Performance Comparison of Capacitive Silicone-Based Curvature Sensors With Planar and Interdigitated Electrodes
Technical Paper Publication: SMASIS 2021-68102
Lorenzo Agostini - University of Bologna
Marco Caselli - University of Bologna
Giulia Avallone - University of Bologna
Marco Fontana - PERCRO Lab, TeCIP institute - Scuola Superiore Sant'Anna
Irene Fassi - STIIMA-CNR Institute, National Research Council
Lorenzo Molinari Tosatti - STIIMA-CNR Institute, National Research Council
Rocco Vertechy - Università di Bologna

4D Printed Bilayer Helical Structures Mechanical Behaviors and Shape Memory Effects
Technical Paper Publication: SMASIS 2021-68198
Siyuan Zeng - Zhejiang University
Yixiong Feng - Zhejiang University
Zhe Wei - Shenyang University of Technology
Yicong Gao - Zhejiang University
Jianrong Tan - Zhejiang University

Transverse Wave Propagation Bandgap in a Buckled Kirigami Sheet
Technical Paper Publication: *SMASIS 2021-68200*
Hesameddin Khosravi - Clemson University
Suyi Li - Clemson University

04-01: Integrated System Design and Implementation
9/14/2021
1:00PM–2:35PM - Room 1

Chair: ***Johannes Riemenschneider - DLR***
Co-Chair: ***Brent Utter - Lafayette College***

An SMA-Based Multifunctional Implant for Improved Bone Fracture Healing
Technical Paper Publication: SMASIS 2021-67261
Lukas Zimmer - ZeMA gGmbH
Rouven Britz - Saarland University
Yannik Goergen - ZeMA gGmbH
Gianluca Rizzello - Saarland University
Tim Pohlemann - Saarland University
Marcel Orth - Saarland University
Bergita Ganse - Saarland University
Stefan Seelecke - Saarland University
Paul Motzki - ZeMA gGmbH

A Smart Wing Based on Vacuum-Packed Particles
Technical Paper Publication: SMASIS 2021-67452
Juan David Brigido - University of Bristol
Benajmin Woods - University of Bristol
Piotr Bartkowski - Warsaw University of Technology
Steve Burrow - University of Bristol

Reliability Study on Spring Interconnections for Piezo-Jet Printed Electronics Under Environmental Stress
Technical Paper Publication: SMASIS 2021-68028
Andreas Erben - Fraunhofer Institute for Machine Tools and Forming Technology
Nataliia Matvieieva - Fraunhofer Institute for Machine Tools and Forming Technology
Moritz Frauendorf - Fraunhofer Institute for Machine Tools and Forming Technology
André Bucht - Fraunhofer Institute for Machine Tools and Forming Technology
Welf-Guntram Drossel - Fraunhofer Institute for Machine Tools and Forming Technology

Development of Programmable Systems at Toyota Research Institute North America
Invited Speaker Presentation: SMASIS 2021-77644
Umesh Gandhi - Toyota

An Experimental and Numerical Study of a Solid-State Ornithopter Wing Performance
Technical Paper Publication: SMASIS 2021-67806
Mohammad Katibeh - Rutgers University
Onur Bilgen - Rutgers University

Investigation of Transformation Behaviour of Pseudoelastic NiTi Shape Memory Alloys Under Compressive Loading to Assess the Potential Use in Vibration Damping in Milling Operations
Technical Paper Publication: SMASIS 2021-67467
Christian Brecher - RWTH Aachen University
Stephan Neus - RWTH Aachen University
Niclas Klumpen - RWTH Aachen University
Peter Dültgen - Forschungsgemeinschaft Werkzeuge und Werkstoffe e.V.
Ralf Theiß - Forschungsgemeinschaft Werkzeuge und Werkstoffe e.V.
Romina Krieg - Forschungsgemeinschaft Werkzeuge und Werkstoffe e.V.
Fabian Hoffmann - FGW Forschungsgemeinschaft Werkzeuge und Werkstoffe e.V.

Generative Design of a Quad-Copter Frame
Technical Paper Publication: SMASIS 2021-67487
Gavireddi Abhinava bharat - V R Siddhartha Engineering College
Alluri Nandini - Velagapudi Ramakrishna Siddhartha Engineering College
Jogendra Prasad Malladi - V.R. Siddhartha Engineering College

Development and Testing of an Active Trailing Edge Morphing Demonstrator for a Rotary Wing
Technical Paper Publication: SMASIS 2021-67590
Yasir Zahoor - Delft University of Technology
Roeland De Breuker - Delft University of Technology

Mark Voskuijl - Netherlands Defence Academy
Jurij Sodja - Delft University of Technology

Rotational Modular Metastructures for Cobot Impact Energy Absorption
Technical Paper Publication: SMASIS 2021-67655
Vipin Agarwal - University of Michigan
Narayanan Kidambi - University of Michigan
Kon-Well Wang - University of Michigan

A Lumped Parameter Electro-Mechanical-Fluid Coupling Model for an Oscillating Beam in Fluids
Technical Paper Publication: SMASIS 2021-67857
Xin Shan - Rutgers University
Onur Bilgen - Rutgers University

Collocated Actuation and Feedback Control of a Piezoelectric Bandage for Producing Low-Intensity Vibrations
Technical Paper Publication: SMASIS 2021-67859
Xin Shan - Rutgers University
Timothy Koh - University of Illinois at Chicago, and Jesse Brown Veterans Affairs Medical Center
Rhonda Kineman - University of Illinois at Chicago, and Jesse Brown Veterans Affairs Medical Center
Onur Bilgen - Rutgers University

Controlling of Piezo Actuators in High Frequency Machine Hammer Peening Processes
Technical Paper Publication: SMASIS 2021-67935
Alexander Hiekel - Fraunhofer Institute for Machine Tools and Forming Technology
Maik Fiedler - Fraunhofer Institute for Machine Tools and Forming Technology
Martin Kolouch - Fraunhofer Institute for Machine Tools and Forming Technology

Additively Manufactured Force Sensors Based on Shape Memory Alloys
Technical Paper Publication: SMASIS 2021-68013
Peter Dültgen - Forschungsgemeinschaft Werkzeuge und Werkstoffe e.V.
Ralf Theiß - Forschungsgemeinschaft Werkzeuge und Werkstoffe e.V.
Romina Krieg - Forschungsgemeinschaft Werkzeuge und Werkstoffe e.V.
Robin Roj - Forschungsgemeinschaft Werkzeuge und Werkstoffe e.V.
Alina Heynen - Forschungsgemeinschaft Werkzeuge und Werkstoffe e.V.
Fabian Hoffmann - Forschungsgemeinschaft Werkzeuge und Werkstoffe e.V.

05-01: Structural Health and Performance Monitoring
9/14/2021
1:00PM–2:35PM - Room 2

Chair: ***Benjamin Grisso - NSWC Carderock***
Co-Chair: ***Daewon Kim - Embry-Riddle Aeronautical University***

Excitation of Ultrasonic Natural Vibrations by Multi-Excitation Using Decentralized Control for Failure Monitoring
Technical Paper Publication: SMASIS 2021-67457
Takashi Tanaka - The University of Shiga Prefecture
Takato Tamura - The University of Shiga Prefecture
Yasunori Oura - The University of Shiga Prefecture

Surface Mounted Distributed Fiber Optic Sensor Measurements and Concrete Damaged Plasticity Modeling for Damage Analysis of Reinforced Concrete Beams
Technical Paper Publication: SMASIS 2021-67524
Minol Jayawickrema - Uva Wellassa University
Arjun Kumar - University of Southern Queensland
Madhubhashitha Herath - Uva Wellassa University
Nandita Hettiarachchi - University of Ruhuna
Harsha Sooriyaarachchi - University of Ruhuna
Jayantha Epaarachchi - University of Southern Queensland

Feature Generation and Selection for Identification of Damage in Thin-Walled Structures Based on a Statistical Approach
Technical Paper Publication: SMASIS 2021-67538
Afshin Sattarifar - Ruhr-Universität Bochum
Tamara Nestorović - Ruhr-Universität Bochum

Localization of Multiple Contact-Type Failures Using Structural Intensity of Low-Frequency Vibration Caused by Frequency Down-Conversion
Technical Paper Publication: SMASIS 2021-67739
Takashi Tanaka - The University of Shiga Prefecture
Junnosuke Asano - The University of Shiga Prefecture
Yasunori Oura - The University of Shiga Prefecture

Electrical Self-Sensing of Pulsed Laser Ablation in Nanofiller-Modified Composites
Technical Paper Publication: SMASIS 2021-67779
Rajan Jain - Purdue University
Nesrdin Kedir - Purdue University
Hashim Hassan - Purdue University
Weinong Chen - Purdue University
Tyler Tallman - Purdue University

The Effect of Sensitivity Matrix Formulation on Damage Detection in Carbon Fiber Composites With Surface-Mounted Electrodes via Electrical Impedance Tomography
Technical Paper Publication: SMASIS 2021-67781
Monica Sannamani - Purdue University
Tyler Tallman - Purdue University

Delamination Detection in Fiber-Reinforced Polymers Using Mechanoluminescence-Optoelectronic Strain Sensor
Technical Paper Publication: SMASIS 2021-68397
Donghyeon Ryu - New Mexico Tech
Alfred Mongare - New Mexico Tech

06-01: Bioinspired Smart Materials and Systems
9/14/2021
1:00PM–2:35PM - Room 3

Chair: ***Joseph Calogero - Pratt & Whitney***
Co-Chair: ***Caterina Lamuta - University of Iowa***

Voltage-Dependent Medium-Term Synaptic Plasticity in Biomolecular Synapses
Technical Paper Publication: SMASIS 2021-67304
Joshua Maraj - University of Tennessee
Jessie Ringley - University of Tennessee
Andy Sarles - University of Tennessee

1D Shape Matching of a Lithium-Ion Battery Actuator
Technical Paper Publication: SMASIS 2021-67508
Cody Gonzalez – The Pennsylvania State University
Shuhua Shan - The Pennsylvania State University
Mary Frecker - The Pennsylvania State University
Chris Rahn - The Pennsylvania State University

Design of Pennate Topology Fluidic Artificial Muscle Bundles Under Spatial Constraints
Technical Paper Publication: SMASIS 2021-68183
Emily Duan - North Carolina State University
Matthew Bryant - North Carolina State University

Design and Characterization of a Multilayered Multifield-Actuated Polymer Unimorph
Technical Paper Publication: SMASIS 2021-68238
Rui Leng - The Pennsylvania State University
Oliver Uitz - The University of Texas at Austin
Zoubeida Ounaies - The Pennsylvania State University
Carolyn Seepersad - The University of Texas at Austin

Generation of Travelling Using Tracking Control Method
Technical Paper Publication: SMASIS 2021-67559
Amit Bhayadia - University at Buffalo
Anthony Olivett - University at Buffalo
Amin Karami - University at Buffalo
Tarunraj Singh - University at Buffalo

Design of a Bio-Inspired Soft Robot for Handling Large Objects in Transport Engineering
Technical Paper Publication: SMASIS 2021-67646
Trung Tin Bui Duc - Delft University of Technology
Jovana Jovanova - Delft University of Technology

Shape Memory Modeling of a Nonlinear and Superelastic Compliant Mechanism
Technical Paper Publication: SMASIS 2021-67651
Brianne Hargrove - Penn State
Angela Nastevska - Kentaur Impex
Jovana Jovanova - Delft University of Technology
Mary Frecker - Penn State

Design of a Pneumatic Growing Robot Inspired to Plants' Roots
Technical Paper Publication: SMASIS 2021-67686
Giovanni Bianchi - Politecnico di Milano
Aldo Agoni - Politecnico di Milano
Simone Cinquemani - Politecnico di Milano

Analytical Modeling of a Segmented Magneto-Active Elastomer Unimorph Actuator
Technical Paper Publication: SMASIS 2021-67703
Tan Pan - The Pennsylvania State University
Rui Leng - The Pennsylvania State University
Zoubeida Ounaies - The Pennsylvania State University
Mary Frecker - The Pennsylvania State University

A Suction Cup With Tunable Stiffness Based on Shape Memory Alloy
Technical Paper Publication: SMASIS 2021-67760
Weimian Zhou - Hefei Institutes of Physical Science, Chinese Academy of Sciences
Xuan Wu - Hefei Institutes of Physical Science, Chinese Academy of Sciences
Xiaojie Wang - Hefei Institutes of Physical Science, Chinese Academy of Sciences

Investigation of Fluid-Dynamic Forces on an Artificial Cownose Ray Fin
Technical Paper Publication: SMASIS 2021-67786
Giovanni Bianchi - Politecnico di Milano
Ivan Claudio - Politecnico di Milano
Simone Cinquemani - Politecnico di Milano

Finite Element Modeling of Bio Compatible Piezoelectric Actuator for Orthodontic Treatment
Technical Paper Publication: SMASIS 2021-68035
Nikta Amiri - University at Buffalo
Amin Karami - University at Buffalo

07-01: Energy Harvesting
9/14/2021
2:45PM–4:00PM - Room 1

Chair: ***Soobum Lee - University of Maryland, Baltimore County***
Co-Chair: ***Christopher Cooley, Oakland University***

Piezoelectret Based Energy Harvesting From Human Body Motions With Respect to Implementation of Self-Powering Wearable Devices
Technical Paper Publication: SMASIS 2021-67338
Ye Ji Park - Fraunhofer LBF
Björn Seipel - Fraunhofer LBF
Hendrik Holzmann - TU Darmstadt

A Translation-to-Rotation Converter for Scavenging Energy From Human Walking
Technical Paper Publication: SMASIS 2021-67680
Qiqi Pan - City University of Hong Kong
Biao Wang - City University of Hong Kong
Lingling Zhang - City University of Hong Kong
Zhengbao Yang - City University of Hong Kong

Realization of Uniform Bending Strain in Piezoelectric Energy Harvesters by Gamma-Shaped Structures
Technical Paper Publication: SMASIS 2021-67736
Sinwoo Jeong - Hanyang University
Soobum Lee - University of Maryland, Baltimore County
Hong Hee Yoo - Hanyang University

A Novel Design of Broadband Piezoelectric Vibration Energy Harvester With Cross-Coupled L-Shaped Structure
Technical Paper Publication: SMASIS 2021-67928
Shilong Sun - Harbin Institute of Technology
Yulong Zheng - Harbin Institute of Technology
Xiao Zhang - South-Central University for Nationalities

Design and Experimental Studies of a Heel-Embedded Energy Harvester for Self-Powered Wearable Electronics
Technical Paper Publication: SMASIS 2021-68087
Zhongjie Li - Shanghai University

Xiaomeng Jiang - Shanghai University
Yan Peng - Shanghai University
Jun Luo - Shanghai University
Shaorong Xie - Shanghai University
Huayan Pu - Shanghai University

Computational and Experimental Efficiency Investigation of Nonlinear Energy Harvesting Systems Based on Monostable and Bistable Piezoelectric Beams
Technical Paper Publication: SMASIS 2021-68209
Gregory Kardarakos - University of Patras
Nikolaos Chrysochoidis - University of Patras
Dimitris Varelis - Hellenic Air Force Academy
Nikolaos Leventakis - National Technical University of Athens
Nikolaos Margelis - National Technical University of Athens
Theofanis Plagianakos - National Technical University of Athens
Georgios Bolanakis - National Technical University of Athens
Dimitrios Saravanos - University of Patras
Evaggelos Papadopoulos - National Technical University of Athens

Simulation-Based Design and Experimental Validation of a Ferroelectret Strain Energy Harvester for Lightweight Structures
Technical Paper Publication: SMASIS 2021-68305
Hendrik Holzmann - Technical University Darmstadt
Ye Ji Park - Fraunhofer Institute for Structural Durability and System Reliability LBF
Heiko Atzrodt - Fraunhofer Institute for Structural Durability and System Reliability LBF

Multifunctional Electromechanical Metastructures for Energy Harvesting and Vibration Mitigation
Technical Presentation Only: SMASIS 2021-67175
Zhenkun Lin - University of Michigan
Nadya Barghouty - University of Michigan
Serife Tol - University of Michigan

08-01: Emerging Technologies
9/14/2021
2:45PM–4:00PM - Room 2

Chair: ***Julianna Abel - University of Minnesota***
Co-Chair: ***Jovana Jovanova - Delft University of Technology***

Mechxels: A Preliminary Exploration of Leveraging Bistability for Text and Image Display
Technical Paper Publication: SMASIS 2021-67607
Wan Kyn Chan - Purdue University
Katherine S. Riley - Purdue University
Andres F. Arrieta - Purdue University

Finding Optimal Material Layout for Heat Transfer Through Physics-Informed Neural Networks
Technical Presentation Only: SMASIS 2021-67724
Kazuko Fuchi - University of Dayton Research Institute
Eric Wolf - Ohio Aerospace Institute
David Makhija - Lateral Unbounded Software, LLC
Nathan Wukie - Air Force Research Laboratory
Christopher Schrock - Air Force Research Laboratory
Philip Beran - Air Force Research Laboratory

Optimization and Experimental Validation of a Vacuum Suction Cup Operated by Shape Memory Actuators
Technical Paper Publication: SMASIS 2021-67934
Claudia Daut - iSML, UdS
Susanne-Marie Kirsch - iMSL, UdS
Felix Welsch - iMSL, UdS
Stefan Seelecke - iMSL, UdS
Paul Motzki - iMSL, UdS

AI Supported Noise Analysis for Structure Design Requirements Definition
Technical Paper Publication: *SMASIS 2021-67961*
Simona Domazetovska - Ss. Cyril, and Methodius University
Jovana Jovanova - Delft University of Technology
Viktor Gavriloski - Ss. Cyril, and Methodius University

Towards Dynamic Characterization of Fully 3D Printed Capacitive Sensors for Footbed Pressure Sensing Applications
Technical Paper Publication: SMASIS 2021-68142
Andrew Gothard - Tennessee Technological University
Steven Anton - Tennessee Technological University

Virtual Reality Supported Design of Smart Grasper
Technical Paper Publication: SMASIS 2021-68231
Jelena Djokikj - Ss. Cyril and Methodius University
Tashko Rizov - Ss. Cyril and Methodius University
Jovana Jovanova - TU Delft

Human Acceptance as Part of the Soft Robot Design
Technical Paper Publication: SMASIS 2021-68268
Romeo Van Adrichem - TU Delft
Jovana Jovanova - Delft University of Technology

Time-Series Forecasting for Structures Subjected to Nonstationary Inputs

Technical Paper Publication: SMASIS 2021-68338

Puja Chowdhury - University of South Carolina
Philip Conrad - University of South Carolina
Jason Bakos - University of South Carolina
Austin Downey - University of South Carolina

WEDNESDAY, SEPTEMBER 15, 2021

01-02: Development and Characterization of Multifunctional Materials
9/15/2021
10:30AM–11:50AM - Room 1

Chair: ***Bjoern Kiefer - TU Bergakademie Freiberg***
Co-Chair: ***Ji Su - NASA Langley Research Center***

Integrated Thin-Film Supercapacitor as Multifunctional Sensor System
Technical Paper Publication: SMASIS 2021-68171
Jan Petersen - German Aerospace Center
Sebastian Geier - DLR e.V.
Peter Wierach - DLR e.V.

Study on Effective Estimation of Parameters of the Herschel-Bulkley Fluid Model for Magnetorheological Fluid
Technical Paper Publication: SMASIS 2021-68206
Manjeet Keshav - Pandit Deendayal Energy University
Sujatha Chandramohan - Indian Institute of Technology Madras

Unit Cell Optimization of Polymer Filled Honeycomb Composites
Technical Paper Publication: SMASIS 2021-68288
Carson Squibb - Virginia Tech
Michael Philen - Virginia Tech

Fractional Drift-Diffusion Model of Organic Field Effect Transistors Including Effects of Bending Stress for Smart Materials
Technical Paper Publication: SMASIS 2021-68344
Yi Yang - Purdue University
Huiwen Bai - Purdue University
Robert Nawrocki - Purdue University
Richard Voyles - Purdue University
Haiyan Zhang - Purdue University

Multiple Programmable Resistance States and Unpowered Memory Retention in PEDOT: PSS Based Memristors
Technical Presentation Only: SMASIS 2021-67658
Yongchao Yu - University of Tennessee
Subhadeep Koner - University of Tennessee
Andy Sarles - University of Tennessee

Piezoelectric Performance of Graphene Reinforced Metakaolin Based Geopolymer Mortars
Technical Presentation Only: SMASIS 2021-67834
Mahmudul Alam Shakib - University of Iowa
Utku Uzun - University of Iowa, Zonguldak Bulent Ecevit University
Sebastiano Candamano - University of Calabria
Caterina Lamuta - University of Iowa

Reduced-Order Structure-Property Linkage for Multifunctional CNT-Polymer Nanocomposites via Principal Component Regression
Technical Presentation Only: SMASIS 2021-68389
Gary Seidel - Virginia Tech
Kavan Shah - Virginia Tech

High Strength and Fatigue Resistant Welds in NiTi and Brass by Impact Welding
Technical Presentation Only: SMASIS 2021-75848
Jianxiong Li - The Ohio State University
Boyd Panton - The Ohio State University
Anupam Vivek - The Ohio State University
Glenn Daehn - The Ohio State University

Coupled Flexural and Torsional Vibration Attenuation With Acoustic Black Hole Metamaterial
Technical Presentation Only: SMASIS 2021-76267
Sayan Dutta - Indian Institute of Technology Madras
Senthil Murugan - Indian Institute of Technology Madras

02-02: Mechanics & Behavior of Active Materials
9/15/2021
10:30AM–11:50AM - Room 2

Chair: ***Douglas Nicholson - The Boeing Company***
Co-Chair: ***John Gallagher – Merrimack College***

Feasibility Study of Quick SMA Actuation
Technical Presentation Only: SMASIS 2021-66807
Ryohei Tsuruta - Toyota Motor North America
Brian Stasey - Miga Motor Company
Mark Gummin - Miga Motor Company
Shinnosuke Shimokawa - Toyota Motor Corporation
Eiji Itakura - Toyota Motor Corporation
Umesh Gandhi - Toyota Motor North America
Shardul Panwar - Toyota Motor North America
Shiki Iwase - Toyota Motor Corporation

A Simplified One-Dimensional Constitutive Model for Magnetostrictive Materials
Technical Presentation Only: SMASIS 2021-67471
Alecsander Imhof - Virginia Tech
John Domann - Virginia Tech

Feasibility Study of Twisted Coiled Polymer Actuator
Technical Presentation Only: SMASIS 2021-67609
Ryohei Tsuruta - Toyota Motor North America
Eric Smith - Toyota Motor North America
Mark Smith - Toyota Motor North America
Eiji Itakura - Toyota Motor Corporation
Shinnosuke Shimokawa - Toyota Motor Corporation
Umesh Gandhi - Toyota Motor North America

Phenomenological Assessment of Post Constrained Recovery Residual Stress of Shape Memory Alloys
Technical Paper Publication: SMASIS 2021-68111
Muhammad Istiaque Haider - University of Wisconsin-Milwaukee
Nathan Salowitz - University of Wisconsin-Milwaukee

4D Printing Chiral Auxetic Metamaterials
Technical Presentation Only: SMASIS 2021-67746
Xiaozhou Xin - Harbin Institute of Technology
Liwu Liu - Harbin Institute of Technology
Yanju Liu - Harbin Institute of Technology
Jinsong Leng - Harbin Institute of Technology

Hybrid Piezo-Magnetic Responsive Self-Sensing Actuator Through Crystallinity Promotion of Piezoelectric Polyvinylidene Fluoride Embedded With Functionalized Single Walled Carbon Nanotubes With Iron (III) Oxide Nanoparticles
Technical Presentation Only: SMASIS 2021-67854
Ji Eun Lee - University of Toronto
Hani E. Naguib - University of Toronto

Inkjet Printing to Produce PEDOT Circuits onto Nafion Membrane for Origami Based Actuators
Technical Presentation Only: SMASIS 2021-67856
Andrew Jo - University of Toronto
Hani Naguib - University of Toronto

Self-Healable TPU-Based Vitrimer Blend via Controlled Bond Exchange Reaction
Technical Presentation Only: SMASIS 2021-68034
Zhiqiang Chen - University of Toronto
Yu-Chen Sun - Universtiy of Toronto
Jintian Wang - University of Toronto
Jerry Qi - Georgia Institute of Technology
Tiejun Wang - Xi'an Jiaotong University
Hani Naguib - Univeristy of Torotno

Mechanical and Thermal Properties of Multi Walled Carbon Nanotube W/ PHBV
Technical Presentation Only: SMASIS 2021-68075
Azizi Turner - Tuskegee University

Cavatappi Artificial Muscles
Technical Presentation Only: SMASIS 2021-68322
Diego Ricardo Higueras-Ruiz - Northern Arizona University
Michael Shafer - Northern Arizona University
Heidi Feigenbaum - Northern Arizona University

Processing and Application of Recycled Shape Memory Polymers
Technical Presentation Only: SMASIS 2021-68396
Maggie Nelson - Auburn University
Rylee Cardon - Auburn University
Eldon Triggs - Auburn University
Asha-Dee Celestine - Auburn University
Russell Mailen - Auburn University

03-02: Modeling, Simulation and Control of Adaptive Systems
9/15/2021
10:30AM–11:50AM - Room 3

Chair: ***Rocco Vertechy - University of Bologna***
Co-Chair: ***Amin Bibo, Clemson University***

New Analytical Approach for Bistable Composites
Technical Paper Publication: SMASIS 2021-68224
Vishrut Deshpande - Clemson
Oliver Myers - Clemson University
Georges Fadel - Clemson University
Suyi Li - Clemson University

Effective Initial and Subsequent Loading Surfaces for Phase Transformation in Triply Periodic Minimal Surface Shape Memory Alloys
Technical Paper Publication: SMASIS 2021-68269
Ali Alagha - Khalifa University
Nguyen Viet - Khalifa University
Wael Zaki - Khalifa University

3D Printed Resonant Compliant Mechanism to Reduce Motor Torque Requirements of Machines With Cyclic Operation
Technical Paper Publication: SMASIS 2021-68293
Luca Luzi - University of Verona
Amedeo Carloni - University of Bologna
Mohamed Refat Mostafa Ramadan - University of Bologna
Lorenzo Agostini - University of Bologna
Giovanni Berselli - University of Genoa
Rocco Vertechy - University of Bologna
Riccardo Pucci - University of Bologna

Combined Finite Element and Network Model of Embedded Shape Memory Alloy Actuators for Endoscopic Tools with an Efficient Dynamic Thermo-Electro-Mechanical Design Process

Technical Paper Publication: SMASIS 2021-68300

Philipp J. Mehner - Technische Universitaet Dresden
Ronny Huettner - Technische Universitaet Dresden
Konrad Henkel - Technische Universitaet Dresden
Rene Koerbitz - Technische Universitaet Dresden
Franz Brinkmann - University Hospital Dresden
Matthieu Fischer - Leibniz-Institut für Polymerforschung Dresden e.V.
Kai Uhlig - Leibniz-Institut für Polymerforschung Dresden e.V.
Jan Mehner - Technische Universität Chemnitz
Jochen Hampe - University Hospital Dresden
Uwe Marschner - Technische Universitaet Dresden
Andreas Richter - Technische Universitaet Dresden

The Effectiveness of 2D Unit Cells in Creating χ-Spring Based Metamaterials

Technical Paper Publication: SMASIS 2021-68326

Jared Kastner - Purdue University
Amin Joodaky - Michigan State University
James Gibert - Purdue University

Fused Filament Fabrication of Continuous Fiber-Reinforced Thermoplastics for Compliant Mechanisms

Technical Paper Publication: SMASIS 2021-68331

Mohamed Refat Mostafa Ramadan - University of Bologna
Luca Luzi - University of Verona
Lorenzo Agostini - University of Bologna
Giovanni Berselli - University of Genoa
Rocco Vertechy - University of Bologna
Riccardo Pucci - University of Bologna

Dynamic Stiffness of Dielectric Elastomer Isolators

Technical Paper Publication: SMASIS 2021-68371

Christopher Cooley - Oakland University
Robert Lowe - University of Dayton

Fully 3D Printed Soft Actuator With Embedded Sensing

Technical Paper Publication: SMASIS 2021-68393

David Gonzalez - Purdue University
Brittany Newell - Purdue University
Jose Garcia - Purdue University

Exploring the Ideal Bias Conditions for a Magnetoelectric Antennas Considering the Impact of Nonuniform Material Properties
Technical Presentation Only: SMASIS 2021-66926
Michael Goforth - Virginia Polytechnic Institute and State University
John Domann - Virginia Polytechnic Institute and State University
Alec Imhof - Virginia Polytechnic Institute and State University

An Adaptive Winglet Structure Based on Active Inflatable Honeycomb and Shape Memory Polymer Composite Skin
Technical Presentation Only: SMASIS 2021-74552
Jian Sun - Harbin Institute of Technology
Linzhe Du - Harbin Institute of Technology
Fabrizio Scarpa - University of Bristol
Yanju Liu - Harbin Institute of Technology
Jinsong Leng - Harbin Institute of Technology

04-02: Integrated System Design and Implementation
9/15/2021
1:00PM–2:35PM - Room 1

Chair: ***Brent Utter - Lafayette College***
Co-Chair: ***Patrick Musgrave - U.S. Naval Research Laboratory***

Development of a Wearable Piezoelectric Bandage for Wound Healing
Technical Paper Publication: SMASIS 2021-68133
Natalie Shultis - Rutgers University
Rita Roberts - University of Illinois at Chicago
Timothy Koh - University of Illinois at Chicago
Rhonda Kineman - University of Illinois at Chicago
Onur Bilgen - Rutgers University

Design and Structural Integration of a Semi-Active Tuned Mass Damper for Improved Vibration Control on Airframe Structures
Technical Paper Publication: SMASIS 2021-68211
Grigoris Chatziathanasiou - University of Patras
Dimitris Dimitriou - University of Patras
Nikolaos Chrysochoidis - University of Patras
Dimitrios Saravanos - University of Patras

Design and Testing of a Chord Morphing Rotor Blade for Helicopter Performance Improvement
Technical Presentation Only: SMASIS 2021-76529
Johannes Riemenschneider - DLR
Christoph Balzarek - DLR
Rohin Kumar Majeti - DLR
Wall Van Der Wall - DLR
Steffen Kalow - DLR
Jannis Lübker - DLR
Franziska Becker - DLR
Andrés Riverobracho - University of Bristol
Stephane Fournier - University of Bristol
Ben Woods - University of Bristol

Design of a Lightweight Shape Memory Alloy Stroke-Amplification and Locking System in a Transradial Prosthetic Arm
Technical Paper Publication: SMASIS 2021-68248
Peter Bishay - California State University, Northridge
Christian Aguilar - California State University, Northridge
Arshak Amirbekyan - California State University, Northridge
Kevin Vartanian - California State University, Northridge
Martin Arjon-Ramirez - California State University, Northridge
David Pucio - California State University, Northridge

Development of a Releasable Snap-Fit Connector Based on Shape Memory Alloy Actuators
Technical Paper Publication: SMASIS 2021-68259
Kenny Pagel - Fraunhofer Institute for Machine Tools and Forming
Arne Wiechmann - Fraunhofer Institute for Machine Tools and Forming Technology
Welf-Guntram Drossel - Fraunhofer Institute for Machine Tools and Forming Technology
Lutz Lachmann - Fraunhofer Institute for Machine Tools and Forming Technology

Design of Bistable Laminates With Low Aspect Ratio
Technical Paper Publication: SMASIS 2021-68285
Karthik Boddapati - Purdue University
Andres F. Arrieta - Purdue University

Machine Learning-Assisted Modeling and Design of Hybrid Shape Memory Alloy Axial Actuators
Technical Paper Publication: SMASIS 2021-68340
Weilin Guan - University of California, Irvine
Hasitha Hewakuruppu - University of California, Irvine
Edwin Peraza Hernandez - University of California, Irvine

Robust and Powerful Structural Integrated Thin Film Supercapacitors for Lightweight Space Structures

Technical Paper Publication: SMASIS 2021-68349

Sebastian Geier - German Aerospace Center
Jan Petersen - German Aerospace Center
Marius Eilenberger - German Aerospace Center
Peter Wierach - German Aerospace Center

Towards Clinically Relevant Shape Memory Alloy Actuated Active Steerable Needle

Technical Paper Publication: SMASIS 2021-68409

Sharad Acharya - Temple University
Parsaoran Hutapea - Temple University

On Active Seat Bolsters Using Shape Memory Wires

Technical Presentation Only: SMASIS 2021-66802

Shardul Panwar - Toyota Research Institute of North America
Ryohei Tsuruta - Toyota Research Institute of North America
Eric Smith - Toyota Research Institute of North America
Mark Smith - Toyota Research Institute of North America
Brian Pinkelman - Toyota Research Institute of North America
Mark Gummin - Miga Motor Company
Umesh Gandhi - Toyota Research Institute of North America

Progress on Fluid Actuated Morphing Unit Structures

Technical Presentation Only: SMASIS 2021-67612

Srinivas Vasista - German Aerospace Center
Maik Titze - German Aerospace Center
Johannes Riemenschneider - German Aerospace Center
Hans Peter Monner - German Aerospace Center
Carmine Contaldi - German Aerospace Center
Melin Sahin - German Aerospace Center and Middle East Technical University
Kilian Jacobi - German Aerospace Center
Michael Schäfer - German Aerospace Center
Oliver Bertram - German Aerospace Center
Muhammad Yasser Meddaikar - German Aerospace Center
Felix Nolte - Technische Universität Braunschweig
Peter Horst - Technische Universität Braunschweig
Aditya Wankhade - PhotonFirst
Rolf Evenblij - PhotonFirst

05-02: Structural Health and Performance Monitoring
9/15/2021
1:00PM–2:35PM - Room 2

Chair: ***Daewon Kim - Embry-Riddle Aeronautical University***
Chair: ***Nathan Salowitz - University of Wisconsin-Milwaukee***

Indirect Impedance-Based NDE Through Instrumented Fixtures: Effects of Fixture Material on Defect-Detection Capabilities
Technical Paper Publication: SMASIS 2021-67797
Peter Oyekola - Tennessee Technological University
Al-Barkat Mehedi - Tennessee Technological University
Morgan Ivey - Tennessee Technological University
Mohammad Albakri - Tennessee Technological University

Functionalized Thermoplastic Polyurethane for FDM Printing of Piezoresistive Sensors
Technical Paper Publication: SMASIS 2021-67802
Cole Maynard - Purdue University
Julio Hernandez - Purdue University
David Gonzalez - Purdue University
Monica Viz - Purdue University
Corey O'Brien - Purdue University
Tyler N. Tallman - Purdue University
Jose Garcia - Purdue University
Brittany Newell - Purdue University

Validation of a Numerical-Experimental Methodology for Structural Health Monitoring on Automotive Components
Technical Paper Publication: SMASIS 2021-68159
Lorenzo Sisca - Politecnico di Torino
Alessandro Messana - Politecnico di Torino
Henrique De Carvalho Pinheiro - Politecnico di Torino
Alessandro Ferraris - BeonD srl
Andrea Giancarlo Airale - BeonD srl
Massimiliana Carello - Politecnico di Torino

Comparison of Classification Machine Learning Algorithms for Damage Detection in Simulated Total Knee Replacements
Technical Paper Publication: SMASIS 2021-68292
Brandon Miller - Tennessee Technological University
Steven Anton - Tennessee Technological University

A Magnetostrictive Particle Delamination Detection Method in a Composite Material Using Artificial Neural Networks
Technical Presentation Only: SMASIS 2021-67885
Christopher Nelon - Clemson University

Oliver Myers - Clemson University
Asha Hall - Army Research Laboratory

Experimental Demonstration of the Structurally Embedded Gradient Index Lens for Guided Wave Amplification in Polymer Plates
Technical Presentation Only: SMASIS 2021-76183
Hrishikesh Danawe - University of Michigan
Ziqi Wang - University of Michigan
Gorkem Okudan - University of Illinois at Chicago
Didem Ozevin - University of Illinois at Chicago
Serife Tol - University of Michigan

An Intelligent System for Crack Growth Monitoring
Technical Presentation Only: SMASIS 2021-68466
Sarah Malik - Drexel University
Emine Tekerek - Drexel University
Abrar Zawad - Drexel University
Antonios Kontsos - Drexel University

06-02: Bioinspired Smart Materials and Systems
9/15/2021
1:00PM–2:35PM - Room 3

Chair: ***Caterina Lamuta - University of Iowa***
Chair: ***Joseph Najem - The Pennsylvania State University***

Traveling Waves for Flow Control in Viscoelastic Morphing Skin
Technical Paper Publication: SMASIS 2021-68239
Anthony Olivett - University at Buffalo
Amin Karami - University at Buffalo
Amit Bhayadia - University at Buffalo

Experimental Verification of Stiffness-Variability of an Active Tensegrity With Nylon Actuators
Technical Paper Publication: SMASIS 2021-68271
Tomoya Yoshizumi - Kyoto Institute of Technology
Arata Masuda - Kyoto Institute of Technology
Nanako Miura - Kyoto Institute of Technology

Morphing of a Rotor Blade
Technical Presentation Only: SMASIS 2021-76248
Zaffir Chaudhry - Raytheon Technologies

Computational Modeling and Design Characterization of 3D-Printed Origami-Inspired Springs
Technical Presentation Only: SMASIS 2021-76453
Ahmed Dalaq - New York University Abu Dhabi
Ravindra Masana - New York University Abu Dhabi
Mohammed Daqaq - New York University Abu Dhabi

Single Phased Elastic Metamaterials for Wave Filtering
Technical Paper Publication: SMASIS 2021-68283
Ana Vasconcelos - Delft University of Technology
Jovana Jovanova - Delft University of Technology
Alejandro Aragón - Delft University of Technology
Dingena Schott - Delft University of Technology

A Novel Flexible Bio-Inspired Pneumatic Valve Adapter for Soft Robotic Vasculature
Technical Paper Publication: SMASIS 2021-68296
Benjamin Saunders - Washington State University
John Swensen - Washington State University

Bird-Inspired Morphing Wings: Design and Experimental Evaluation of a Wing Folding Mechanism for Pitch Stability Control
Technical Paper Publication: SMASIS 2021-68299
Anna Alvarez - University of Illinois at Urbana-Champaign
Aimy Wissa - University of Illinois at Urbana-Champaign

Buckling Prevention Strategies in Nature: Applications in Medical Device Design
Technical Presentation Only: SMASIS 2021-67332
Aimee Sakes - Delft University of Technology

Stretchable and Waterproof Self-Morphing Skin via Embedded 3D Printing and Twisted Spiral Artificial Muscles Inspired by Cephalopods
Technical Presentation Only: SMASIS 2021-67837
Parth Kotak - University of Iowa
Fan Fei - University of Iowa
Li He - University of Iowa
Xiaofeng Li - Wuhan University
Cyan Vanderhoef - University of Iowa
Xuan Song - University of Iowa
Caterina Lamuta - University of Iowa

Composite Droplet Interface Bilayers Formed From Lipids and Amphiphilic Copolymers: Toward Improved Biomimetic Membranes
Technical Presentation Only: SMASIS 2021-68055
Subhadeep Koner - University of Tennessee
Joseph Tawfik - University of Tennessee
Andy Sarles - University of Tennessee

Squid-Inspired Muscular Hydrostats From Twisted and Coiled Artificial Muscles (TCAMs)
Technical Presentation Only: SMASIS 2021-68225
Thilina Weerakkody - University of Iowa
Parth Kotak - University of Iowa
Mahmudul Alam Shakib - University of Iowa
Caterina Lamuta - University of Iowa

Dual-Ionophore Enabled Synapse-Like Adaptability in Biomimetic Membranes
Technical Presentation Only: SMASIS 2021-68403
Jessie Ringley - University of Tennessee
Andy Sarles - University of Tennessee

07-02: Energy Harvesting
9/15/2021
2:45PM–4:00PM - Room 1

Chair: ***Christopher G. Cooley - Oakland University***
Co-Chair: ***Soobum Lee - University of Maryland, Baltimore County***

Stochastic Signal Analysis and Processing of Non-Harmonic, Periodic Vibrational Energy Harvesters
Technical Paper Publication: SMASIS 2021-68310
Maxim Germer - Technische Universität Dresden
Uwe Marschner - Technische Universität Dresden
Andreas Richter - Technische Universität Dresden

Modeling of Piezoelectric Vibration Energy Harvesting From Low-Frequency Using Frequency Up-Conversion
Technical Paper Publication: SMASIS 2021-68360
Mohammad Atmeh - University of Texas at Tyler
Alwathiqbellah Ibrahim - University of Texas at Tyler

Modeling of Triboelectric Vibration Energy Harvester Under Rotational Magnetic Excitation
Technical Paper Publication: SMASIS 2021-68377
Mostafa Hassan - University of Texas at Tyler
Katy Baker - University of Texas at Tyler
Alwathiqbellah Ibrahim - University of Texas at Tyler

Effect of Supporting Boundary Conditions on the Generation Characteristics of the Piezoelectric Cylindrical Shell Wind Energy Harvesting Flag
Technical Paper Publication: SMASIS 2021-68408
Chisuzu Oda - Kindai University
Tsutomu Nishigaki - Kindai University

A Low Frequency Tunable Pendulum Energy Harvester
Technical Presentation Only: SMASIS 2021-67638
Davide Castagnetti - Università di Modena e Reggio Emilia
Leonardo Ferrari - Università di Modena e Reggio Emilia
Andrea Sorrentino - Università di Modena e Reggio Emilia

Parametric Study of a 2D of Concurrent Galloping and Base Vibration Energy Harvester With Internal Resonance
Technical Presentation Only: SMASIS 2021-76387
Che Xu - University of Technology Sydney
Liya Zhao - University of Technology Sydney

Improving the Performance of Galloping Energy Harvesters via the Addition of Forked Tail Fins: A Computational Study
Technical Presentation Only: SMASIS 2021-76419
Praveen Laws - New York University
Mohammed Farid Daqaq - New York University

A Nonlinear Piezoelectric Energy Harvester With Auxetic Structures
Technical Paper Publication: *SMASIS 2021-68286*
Keyu Chen - The Chinese University of Hong Kong
Qiang Gao - The Chinese University of Hong Kong
Shitong Fang - The Chinese University of Hong Kong
Donglin Zou - The Chinese University of Hong Kong
Zhengbao Yang - City University of Hong Kong
Wei-Hsin Liao - The Chinese Univ of Hong Kong

A Study on the Performance of a Novel Hybrid Triboelectric-Dielectric Elastomer Generator Based on PDMS Composites
Technical Paper Publication: SMASIS 2021-67134
Xiaoyue Zhao - The Pennsylvania State University
Zoubeida Ounaies - The Pennsylvania State University
Samuel Rosset - The University of Auckland
Iain Anderson - The University of Auckland

08-02: Emerging Technologies
9/15/2021
2:45PM–4:00PM - Room 2

Chair: ***Jovana Jovanova - Delft University of Technology***
Chair: ***Paul Motzki – ZeMA***

A Smart Controllable SMA-Based Tourniquet
Technical Paper Publication: SMASIS 2021-67634
Alireza Golgouneh - University of Minnesota Twin Cities
Jiaqi Li - University of Minnesota Twin Cities
Julianna Abel - University of Minnesota Twin Cities
Lucy Dunne - University of Minnesota

Altering the Acoustic Responses of Architectural Kerf Structures
Technical Presentation Only: SMASIS 2021-67896
Zaryab Shahid - Texas A&M University
Ed Green - HBK
Rabah Hadjit - HBK
James Hubbard - Texas A&M University
Negar Kalantar - California College of Arts
Anastasia Muliana - Texas A&M University

Conception Through Inception: Creating a Shape Memory Alloy Clamp
Technical Presentation Only: SMASIS 2021-68146
Steve Adcock - Vector Ring, LLCA

Hybrid Materials With Autonomous Information Processing: Part I — Filtering, Thresholding, and Nonlinear Signal Amplification
Technical Presentation Only: SMASIS 2021-68382
Katherine S. Riley - Purdue University
Janav P. Udani - Purdue University
Harith Morgan - Purdue University
Subhadeep Koner - University of Tennessee, Knoxville
Yongchao Yu - University of Tennessee, Knoxville
Andy Sarles - University of Tennessee, Knoxville
Andres F. Arrieta - Purdue University

Hybrid Materials with Autonomous Information Processing: Part II — Integration of Sensing and Memory

Technical Presentation Only: SMASIS 2021-68358

Subhadeep Koner - University of Tennessee
Yongchao Yu - University of Tennessee
Janav P. Udani - Purdue University
Katherine S. Riley - Purdue University
Harith Morgan - Purdue University
Andres F. Arrieta - Purdue University
Andy Sarles - University of Tennessee

Hybrid Artificial Muscle Actuator

Technical Presentation Only: SMASIS 2021-76365

Maduran Palaniswamy - Toyota
Max Herzog - Toyota
Shardul Panwar - Toyota
Ryohei Tsuruta - Toyota
Michael Rowe - Toyota

Multistable Self-Folding Structures Based on Stimuli Responsive Bio-Inspired Spring Origami

Technical Presentation Only: SMASIS 2021-76758

Salvador Rojas - Purdue University
Katherine S. Riley - Purdue University
Andres F. Arrieta - Purdue University

On the Escape From a Potential Well via Vortex-Induced Vibrations

Technical Presentation Only: SMASIS 2021-76414

Hussam Alhussein - New York University Abu Dhabi
Mohammed Daqaq - New York University Abu Dhabi

2021 CONFERENCE SESSION CHAIRS

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1	Development and Characterization of Multifunctional Materials	Chair	Constantin Ciocanel	Northern Arizona University
		Co-Chair	Bjoern Kiefer	TU Bergakademie Freiburg
		Co-Chair	Ji Su	NASA
2	Mechanics & Behavior of Active Materials	Chair	Paris Von Lockette	Penn State University
		Co-Chair	Darren Hartl	Texas A&M University
		Co-Chair	Douglas Nicholson	Boeing
		Co-Chair	John Gallagher	Merrimack College
3	Modeling, Simulation and Control of Adaptive Systems	Chair	Rocco Vertechy	University of Bologna
		Co-Chair	Giovanni Berselli	University of Genoa
		Co-Chair	Amin Bibo	Clemson University
4	Integrated System Design and Implementation	Chair	Johannes Riemenschneider	German Aerospace Center (DLR)
		Co-Chair	Brent Utter	Lafayette College
		Co-Chair	Patrick Musgrave	University of Florida
5	Structural Health Monitoring	Chair	Benjamin Grisso	U.S. Naval Research Laboratory
		Co-Chair	Daewon Kim	Embry Riddle Aeronautical University
		Co-Chair	Nathan Salowitz	University of Wisconsin Milwaukee
6	Bioinspired Smart Materials and Systems	Chair	Joe Calogero	Pratt & Whitney
		Co-Chair	Caterina Lamuta	University of Iowa
		Co-Chair	Joseph Najem	Penn State University
7	Energy Harvesting	Chair	Sherry Towfighian	Binghamton Univ.
		Co-Chair	Soobum Lee	University of Maryland, Baltimore County
		Co-Chair	Christopher Cooley	Oakland University
8	Emerging Technologies	Chair	Julianna Abel	University of Georgia
		Co-Chair	Paul Motzki	Saarland University
		Co-Chair	Jovana Jovanova	TU Delft
9	Student Development and Competitions	Chair	Kazuko Fuchi	University of Dayton Research Inst.
		Co-Chair	Edwin Peraza Hernandez	University of California Irvine
		Co-Chair	Giovanni Berselli	University of Genoa
		Co-Chair	Amin Bibo	Clemson University

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Eugenio Dragoni, UNIMO

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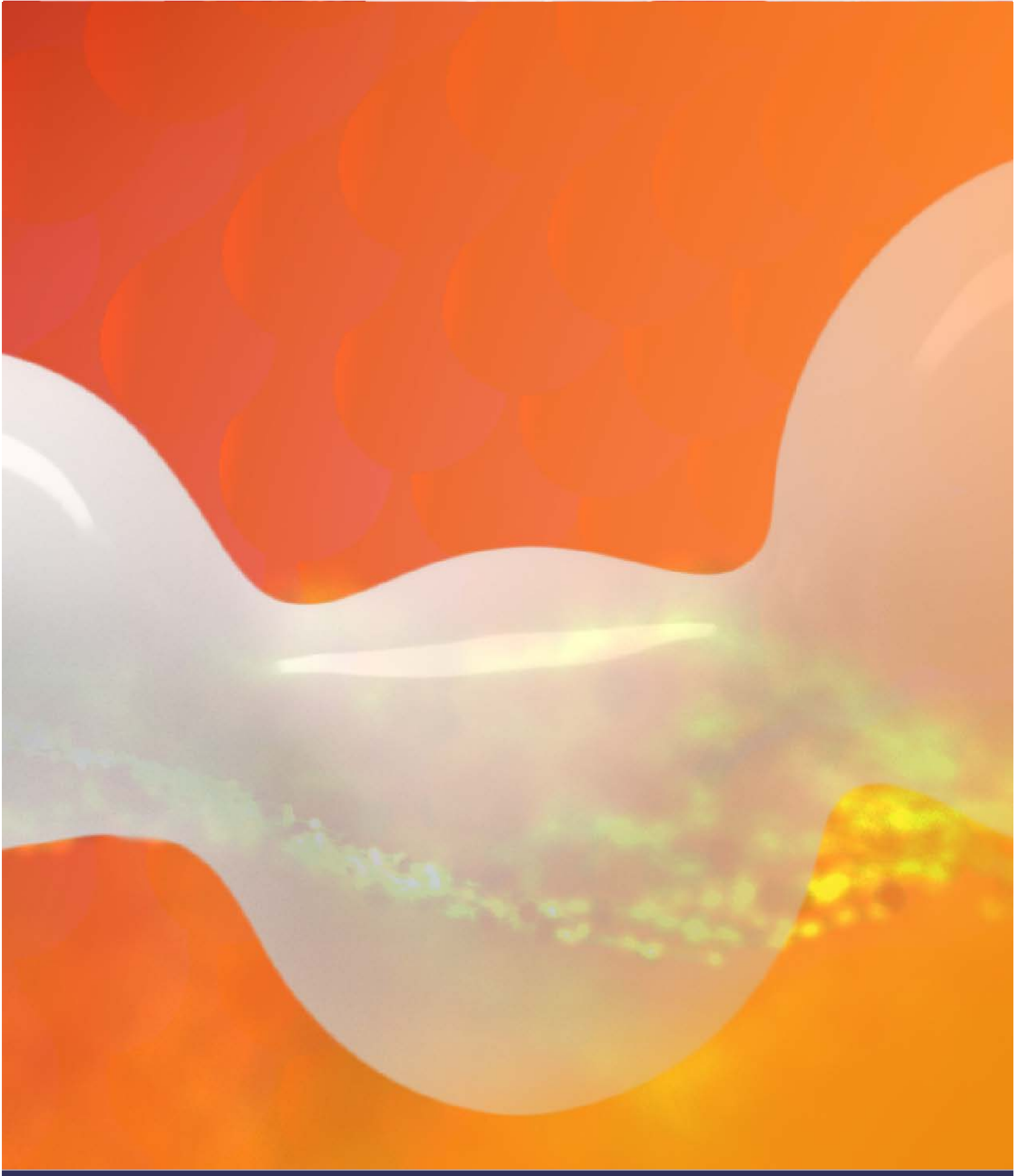
Copyright & Proceedings Coordinator

Thank you for your participation this year. We hope you enjoyed the conference.

The 2022 Call for Papers is coming soon. Please join us again in 2022!



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