ASME

Adaptive Structures & Material Systems

AIAA

ASME & AIAA Adaptive Structures & Material Systems Newsletter — Spring 2014

MESSAGE FROM THE CHAIR

Greg Reich, Air Force Research Laboratory ■ Welcome to another edition of the newsletter! It seems like yesterday that I took over as the Chair of the AIAA Adaptive Structures Technical Committee. However, it has actually been two years, so as my time at the helm comes to an end, I'd like to share with you my observations on some of the successes and ongoing challenges that face our community.

Of the many successes enjoyed by this community, none is as important as the current health of the community itself. The existence and strength of multiple conferences (SMASIS, SPIE, ICAST, ASC), this newsletter, and other avenues for information sharing and networking, building and maintaining professional and personal relationships, are what makes a strong community. This vitality and vibrancy does not come free, however. It takes the time and effort of a large number of people, and they are to be congratulated, supported, and assisted whenever possible.

Speaking directly of the technology itself, another success is the integration of adaptive materials into mainstream usage in a number of industries. Devices in medicine, space, the automotive industry, and even some consumer electronics all point to wider acceptance and understanding of the benefits that adaptive materials can offer to specific problems.

While we are currently in a healthy state, there are a number of significant issues that continue to challenge the community. The largest of these is R&D funding. The last five years of government budgets have resulted in significant cut-backs across the board, from the DoD to the DoE to NSF. This has direct impact on everything we do, from funding of research and education and support of graduate students, to conference participation and travel, to industry R&D activities, to facility upkeep and development of new research capabilities. While the new FY2014 budget has removed the immediate threat of sequestration, shrinking R&D budgets will most likely continue for the foreseeable future.

Another significant challenge is related to our success. As the field transitions from "bold new technology" to "mature technology", it is imperative that we develop ways for non-experts to easily integrate design using adaptive materials into existing applications. As my predecessor Greg Agnes of JPL has said, the challenge is "to bring together the 'Rules and Tools' of adaptive structures component technologies to mainstream design. The ability to analyze and simulate not only the performance of multi-physics, often non- linear mechanics, must be available for the design engineers in industry."

While there are significant challenges to be faced now and moving forward, I am confident in the current and future leadership of this community. This remains a young (or at least young at heart!), vibrant group of people, dedicated to their field, and willing to be active in roles beyond that of their day-to-day jobs. This reflects well on the future, and I remain personally dedicated to working to ensure the long-term adaptation of adaptive structures and materials technologies into the mainstream. ■

Diann Brei ■ EDITOR
dibrei@umich.edu

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THANK YOU!

To all those that contributed and helped in the preparation of this newsletter!

Diann Brei — *University of Michigan*
Tizoc Cruz-Gonzalez — *University of Michigan*
Alper Erturk — *Georgia Tech*
Marco Fontana — *Scuola Superiore Sant'Anna*
Sergio L. dos Santos e Lucato — *Teledyne Scientific*
Greg Reich — *Air Force Research Laboratory*
Eric Ruggiero — *GE*
Cheryl Sampson — *Boeing*
Janet Sater — *IDA*
Vishnu Baba Sundaresan — *Ohio State*
Travis Turner — *NASA Langley*
Rocco Vertechy — *Scuola Superiore Sant'Anna*

BOEING X-51A WAVERIDER SETS RECORD WITH SUCCESSFUL 4TH FLIGHT - SUPERSONIC COMBUSTION SCRAMJET-POWERED VEHICLE MAKES LONGEST HYPERSONIC FLIGHT TO DATE

Cheryl Sampson, Boeing ■ A Boeing X-51A WaveRider unmanned hypersonic vehicle achieved the longest air-breathing, scramjet-powered hypersonic flight in history on May 1, 2013, flying for three and a half minutes on scramjet power at a top speed of Mach 5.1. The vehicle flew for a total time of over six minutes.

"This demonstration of a practical hypersonic scramjet engine is a historic achievement that has been years in the making," said Darryl Davis, president, Boeing Phantom Works. "This test proves the technology has matured to the point that it opens the door to practical applications, such as advanced defense systems and more cost-effective access to space."

With the X-51A firmly tucked under its wing on a warm, clear day, a U.S. Air Force B-52H Stratofortress swung into position and roared down Runway 4 at Edwards Air Force Base and took off toward the Pacific Ocean.

"It was a tremendous event, well worth the wait, hard work and perseverance paid off," said Joseph Vogel, director, Boeing X-51A and Airborne Space Access.

Vogel and the team had two main objectives for the flight – fly the X-51A at the hypersonic speed of Mach 5 until the fuel runs out and study the transition from ethylene to liquid jet fuel, both were successfully accomplished.

At nearly 60,000 feet, the B-52 released the X-51A over the sea range at Point Mugu Naval Air Warfare Center. Once released, the solid rocket booster from a U.S. Army tactical missile accelerated the X-51A to about Mach 4.8 before the booster and a connecting interstage were jettisoned. From that point, the X-51A supersonic combustion scramjet engine took over and pushed the vehicle to hypersonic speeds of Mach 5.1, traveling more than a mile a second and burning all of its JP-7 jet fuel.

"The vehicle was just going. Fuel gauges showed the fuel being sucked up rapidly, and the acceleration was quickly climbing all the way to the end," said Vogel.

After more than three and a half minutes of powered flight with the scramjet engine as planned, the X-51A made a controlled dive into the Pacific Ocean, ending the six-minute test but providing Boeing and the Air Force with plenty of information to study regarding hypersonic flight.

Vogel added "There is a lot of learning that can be leveraged by the U.S. government, industry and academia for years to come from this mission and previous missions. It's just the beginning of a new era of air travel."

The flight was the fourth X-51A test flight completed for the U.S. Air Force Research Laboratory. It exceeded the previous record set by the program in 2010.

The X-51A program was a collaborative effort of the Air Force Research Laboratory and the Defense Advanced Research Projects Agency, with industry partners Boeing and Aerojet Rocketdyne. Boeing performed program management, design and integration in Huntington Beach, Calif. ■

Wave Energy Converters based on Dielectric Elastomers

Rocco Vertechy and Marco Fontana, Scuola Superiore Sant'Anna

■ Ocean-wave power is one of the most persistent, spatially-concentrated and predictable forms of intermittent renewable energy. Since the worldwide estimated resource amounts to nearly 3TW of yearly average power, wave-energy is expected to cover a significant portion of the intermittent renewable energy mix in the next future.

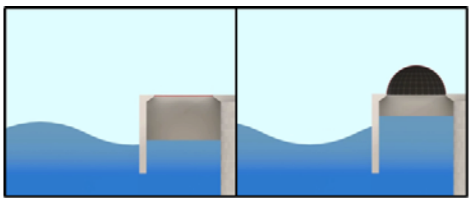

Figure 1. Poly-OWC wave energy converter

Harvesting energy from waves is very challenging and the sector is still immature, with only a few pre-commercial systems currently being in operation around the world nowadays. Based on traditional technologies, current Wave Energy Converters (WECs) are showing excessive complexity and costs for construction, installation and maintenance; scarce resistance to the marine environment; limited energy conversion efficiency.

In this context, Dielectric Elastomers could provide the technological breakthrough that is required to make wave energy exploitable. Dielectric Elastomers (DE) are incompressible polymeric solids that undergo finite elastic deformations and are electrically non-conductive. Stacking multiple DE films separated by compliant electrodes makes a deformable capacitor transducer, namely a DE Transducer (DET), that can be used to convert mechanical energy into direct electricity and vice versa. DETs can be used as actuators, sensors and generators. In generator mode, DETs operate via the variable capacitance electrostatic generation principle.

Recently, the use of DETs for WECs has attracted significant interest from both Academia and the Industry. Their potential advantages over conventional technologies are: large energy densities, direct-drive and cyclic operation, good and rate-independent efficiencies, good shock and corrosion resistance, silent operation and moderate/low cost.

In the framework of the European project PolyWEC (*www.polywec.org*), we are studying different concepts of DE-based WECs. The project goes through the following activities: device conception, fluido-electro-elastic modeling and optimization; improvement and electromechanical characterization of DE materials as well as of compliant electrodes; wave-tank testing of small-scale prototypes; economic and environmental assessment of DE-based WEC technology.

Two promising concepts we are currently investigating are the Poly-OWC (see Figure 1) and the Poly-Surge (see Figure 2) devices. The Poly-OWC features a semi-submerged hollow structure, open at the sea bottom to the incoming wave field and closed at the top by a circular diaphragm DET. The Poly-OWC is partially filled with water (namely, the water column) and air. As the waves break on the structure, the water column is put into reciprocating motion, which causes compression-expansion of the air and the resulting inflation-deflation of the DET. The Poly-Surge features an oscillating flap, hinged at the sea bottom and connected in direct-drive to a parallelogram-shaped DETs. In the Poly-Surge, movement of water wave particles puts into reciprocating motion the flap, which then cyclically deforms and transmits the captured power to the DET. In both systems, wave energy can be extracted by properly charging and discharging the DET during its cyclical deformation.

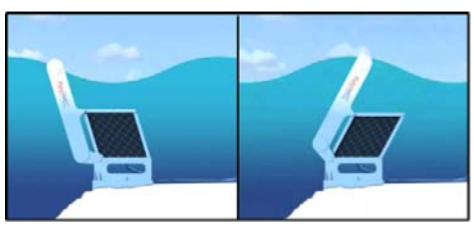

Figure 2. Poly-Surge wave energy converter

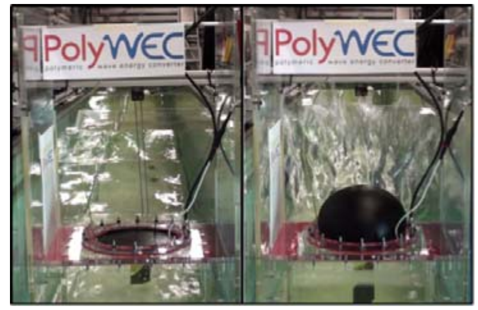

Figure 3. Wave-tank test of a small-scale Poly-OWC prototype

Preliminary simulation results and small-scale experiments (see Figure 3 and 4) highlight that real-scale Poly-OWC and Poly-Surge systems could feature energy harvesting performances that are comparable to those of existing WECs, but with significant simplifications in system architecture and operation. Improvement in materials as well as in design and control could lead to

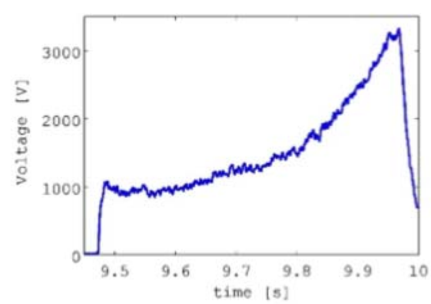

Figure 4. Voltage generation from water waves of a small-scale Poly-OWC prototype

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ASMS Technical Committees

NASA-Langley / TiiMS Team Developing New Adaptive Structure for Aeroacoustic Noise Reduction in Commercial Aircraft

Travis Turner, NASA Langley ■ Researchers from the ASME Active and Multifunctional Materials Technical Committee have begun collaborations on the development of a new implementation of shape memory alloys (SMAs) for the purpose of reducing airframe noise. The leading-edge-slat device of high-lift systems for typical transport aircraft is a prominent source of localized unsteady flow with aeroacoustic consequences that contributes significantly to environmental noise in the vicinity of airports. One solution first proposed a decade ago is the concept of a slat-cove filler (SCF), which greatly reduces these aeroacoustic effects by eliminating a key structural cavity and many of the accompanying unsteady flow mechanisms. Practical implementation of this concept has proven difficult, however, due to the substantial geometric change that is required during the transition from cruise to/from takeoff and landing. Researchers at NASA LaRC, led by Travis Turner, have developed a highly deformable SCF concept enabled by pseudoelastic SMAs. Bench-top models have been developed to demonstrate concept feasibility and explore the parametric design space. To expand and improve these efforts, a team at the Texas Institute for Intelligent Materials and Structures (TiiMS) at Texas A&M University, led by Darren Hartl, has developed a high-fidelity and fully-parameterized computational representation of this novel device. The TiiMS team has begun the process of analysis-driven design exploration using a combination of commercial, open source, and custom-created tools. This has resulted in both an optimized design for the bench-top prototype being further developed at NASA LaRC as well as comprehensive understanding of design trends that may facilitate implementation of a pseudoelastic SMA, slat-cove filler on future transport aircraft. ■

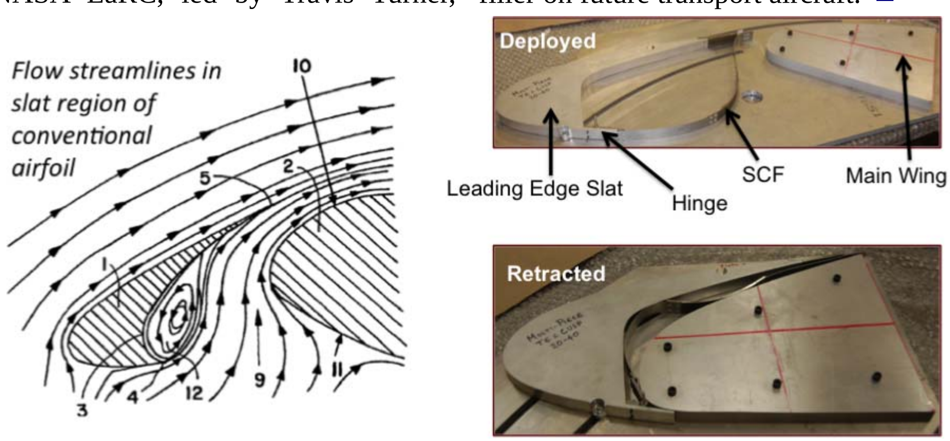

Figure 1: Schematic illustration of the noise-inducing flow between a deployed slat and the fixed leading edge of a commercial transport wing with circulating flow in the "slat cove" (left) and an experimental prototype of a pseudoelastic SMA-based slat cove filler (SCF) being developed by NASA-LaRC and Texas A&M/TiiMS researchers (right).

RAMS Laboratory at RPI

Eric Ruggiero, GE ■ In August 2012 Farhan Gandhi, a new member of the Active Material Technologies and Integrated Systems Technical Committee, moved from Penn State to assume the Rosalind and John J. Redfern Jr. '33 Endowed Chair in Aerospace Engineering at the Rensselaer Polytechnic Institute. Prof. Gandhi, who has spent over 20 years working in the areas of rotary-wing aircraft and adaptive aerospace structures, established the Rotorcraft, Adaptive, and Morphing Structures (RAMS) Lab at RPI. In the area of rotary-wing aircraft, Gandhi's interests and expertise cover dynamics and aeroelasticity of helicopter rotors, rotor active control, advanced configurations, and reconfigurable or morphing rotors. In the adaptive structures area, Gandhi's interests cover Shape Memory Alloys, Pneumatic Artificial Muscles, Electro- and Magneto-rheological fluid dampers and devices, bi-stable, cellular, and variable stiffness structures, and innovative damping treatments.

Prof. Gandhi has eight PhD students working with him in the RAMS Lab on various projects in the areas of high-speed rotorcraft, and adaptive and morphing structures. A couple of projects focus on slowed-rotor compound helicopters and coaxial rotor helicopters for very high-speed flight. A couple of other projects focus on rotor blade cross-section morphing and rotor-blade span extension morphing (applicable to both helicopters as well as wind-turbines). Another project focuses on the use of Shape Memory Alloys for unmanned undersea gliders, and yet another examines the use of Pneumatic Artificial Muscles for impedance control and morphing of aero-structures.

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ASMS Technical Committees

Metamaterial-Inspired Concepts for Elastoacoustic Wave Energy Harvesting

Alper Erturk, Georgia Tech ■ Georgia Tech researchers (a team led by Michael Leamy, Massimo Ruzzene, and Alper Erturk) have developed novel concepts for the enhanced harvesting of structure-borne propagating waves by exploiting unique characteristics of metamaterial-inspired structures in piezoelectric power generation. Wave focusing by elastoacoustic mirrors (Figure 1a, b), wave guiding using an elastoacoustic funnel (Figure 1c), and energy localization by an imperfection (Figure 1d) constitute the class of electromechanical MEH (Metamaterial-inspired Energy Harvesting) concepts developed by the team for energy harvesting applications.

The transformation of vibration into electricity has been heavily researched for powering small electronic components employed in wireless applications (e.g., structural health monitoring) ranging from civil infrastructure to aircraft / rotorcraft systems. The existing literature in the field of vibration-based energy harvesting has been mainly focused on standing wave patterns (i.e., modal response), such as the case of well-known resonant energy harvesting. However, numerous engineering systems exhibit more complex vibration and propagating wave patterns than simple standing wave motions. Therefore, the efficient harvesting of propagating waves in structures requires new methods and solutions. To this end, the Georgia Tech team has developed elliptical (Figure 1a) and parabolic (Figure 1b) elastoacoustic mirrors for the spatial focusing of incident wave energy originating from a point source and a plane-wave source, respectively, and demonstrated more than an order of magnitude increase in the harvested power over a broad range of frequencies. The funnel concept (Figure 1c) exploits specific frequency bandgaps (in which waves do not propagate) and enables capturing of the guided wave energy by the harvester. The last concept (Figure 1d) is based on the energy localization characteristic of an imperfection (or defect) deliberately introduced to break the periodicity of a 2-D lattice system. The localized wave energy is then extracted by the piezoelectric energy harvesting interface. While the mirror and funnel concepts are suggested for broadband energy harvesting, the imperfection case is well suited for tuned energy harvesting. High frequencies involved in MEH systems are expected to open new avenues for MEMS energy harvesting as well. ■

Bioinspired Systems and Structures

Vishnu Baba Sundaresan, Ohio State ■ The Bioinspired Systems and Structures Technical Committee fosters the creation of societally significant biologically inspired research areas by bringing leading researchers from government, academia, and industry together. The committee aims to advance the state of the art of bioinspired systems and structures by strengthening ties with the engineering and scientific disciplines including mechanical, aerospace and biomedical engineering, evolutionary biology, cell and molecular biology, organic chemistry, and STEM education. The committee fulfills this purpose by (a) encouraging the presentation and publication of substantive papers in the area of bio-inspired research, (b) serving as a focal point for bio-inspired research by interacting with other related groups within and outside the area of bio-inspired research, (c) highlighting and promoting technical innovations in the field of bio-inspired research, and (d) promoting interdisciplinary and industrial collaborations.

Chair: Vishnu Baba Sundaresan (sundaresan.19@osu.edu)

Vice Chair: Stephen Andrew Sarles (ssarles@utk.edu) ■

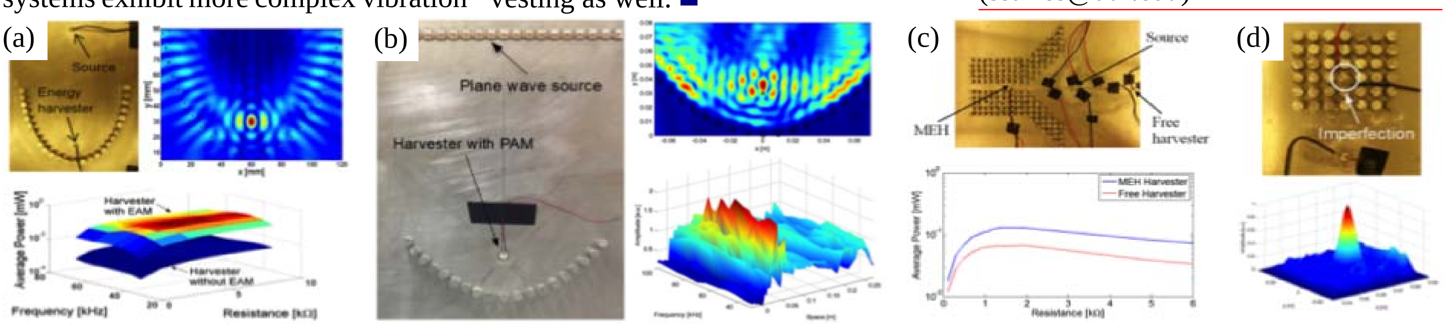

Figure 1. MEH concepts developed at Georgia Tech: (a) Elliptical acoustic mirror (EAM) for focusing wave energy originating from a point source; (b) Parabolic acoustic mirror (PAM) for focusing incident plane wave energy; (c) wave guiding by using an elastoacoustic funnel; and (d) energy localization by introducing an imperfection to a 2-D lattice structure.

ASMS TCs

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Prof. Gandhi's group has also set up an instrumented rotor test facility for testing small (up to 2 ft diameter) rotors. This facility will be used to advance research in highly-efficient, hover-capable micro-aerial vehicles (MAVs).

Prof. Gandhi and his group regularly present their work at the ASME Smart Materials, Adaptive Structures and Intelligent Systems (SMASIS) Conference, the AIAA Adaptive Structures Forum, and the American Helicopter Society (AHS) Forum. The photograph below shows some recent work by Prof. Gandhi's group on camber variation over a section of a Boeing CH-46 helicopter blade. ■

Figure 1. Spanwise variation of camber demonstrated on a 4 ft section of a CH-46 rotor blade

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performance enhancements by up to one order of magnitude.

Next to Poly-OWC and Poly-Surge, different DE-based WEC concepts, including those with submerged DETs directly interacting with water wave particles, will be considered in the course of the PolyWEC project. ■

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Honors and Awards

2013 ASME Adaptive Structures and Materials Systems Prize

Alison Flatau, University of Maryland ■ Dr. Flatau's teaching and research interests are in the areas of the dynamics of smart materials and structures, with emphasis on bio-inspired actuator and sensor technologies. Her research focuses on application of these materials and structures for noise, vibration and flow control in both aerospace and civil-infrastructure systems. Throughout her career, she has been an active mentor and educator of Aerospace Engineering students, serving as AIAA student branch advisor for over twelve years and as Director of the UMD Aerospace Undergraduate Program for five years (2004-2009). She served as Program Director for the National Science Foundation (1998-2002). Dr. Flatau has published over 75 journal articles and over 150 conference articles. Dr. Flatau is an inventor on four patents with over a half dozen patents pending. Dr. Flatau is a past Associate Editor for the *Journal of Intelligent Material Systems and Structures and Smart Materials and Structures*. She served as Chair of the ASME Adaptive Structures Technical Committee

(2004-2006) and co-Chair (2006 & 07) and Chair (2008 & 09) of the SPIE Symposium on Smart Structures/NDE. Dr. Flatau is the recipient of several awards including the Clark School of Engineering's 2009 Faculty Service award, the WIA Aerospace Engineering Educator of the Year (2010) and the SPIE Smart Structures and Materials Lifetime Achievement Award (2010). Dr. Flatau is a Fellow of the ASME, an Associate Fellow of the AIAA, and a University of Maryland ADVANCE Professor (2011-2013).

The ASME Aerospace Division and the ASME ASMS Branch present the Adaptive Structures and Materials Systems Prize to an individual who has "made significant lifetime contributions to the sciences and technologies associated with adaptive structures and/or materials systems." Nominations for the 2014 award, consisting of a one page biosketch, may be received at large from any source and should be sent to Billy Oates, *woates@fsu.edu* by June 2014. ■

2013 Gary Anderson Early Achievement Award

Maurizio Porfiri, Polytechnic Institute of New York University ■ Maurizio Porfiri was born in Rome, Italy in 1976. He received M.Sc. and Ph.D. Degrees in Engineering Mechanics from Virginia Tech, in 2000 and 2006; a "Laurea" in Electrical Engineering (with honours) and a Ph.D. in Theoretical and Applied Mechanics from the University of Rome "La Sapienza" and the University of Toulon (dual degree program), in 2001 and 2005, respectively. From 2005 to 2006 he held a Post-doctoral position with the Electrical and Computer Engineering Department at Virginia Tech. He has been a member of the Faculty of the Mechanical and Aerospace Engineering Department of the Polytechnic Institute of New York University since 2006, where he is currently an Associate Professor. He is engaged in conducting and supervising research on dynamical systems theory,

multiphysics modeling, and underwater robotics. Maurizio Porfiri is the author of more than 100 journal publications and the recipient of the NSF CAREER award (Dynamical Systems program) in 2008. He has been included in the "Brilliant 10" list of Popular Science in 2010. Other significant recognitions include an invitation to the Frontiers of Engineering Symposium organized by National Academy of Engineering in 2011, the Outstanding Young Alumnus award by the college of Engineering of Virginia Tech in 2012, and the ASME Gary Anderson Early Achievement Award in 2013.

The Gary Anderson Early Achievement Award is presented by the ASME ASMS Branch for notable contributions to the field of Adaptive Structures and Material Systems. The winner of the award must be within 7 years of terminal degree at the time of nomination. Nominations for the 2013 award may be received at large from any source and should be sent to Billy Oates, *woates@fsu.edu* by December 2014. ■

Calendar of Events

SPIE Smart Structures & Materials Symposium
San Diego, CA
Dates: March 9-13, 2014
http://spie.org/smart-structures-nde.xml

IWPMA 2014
Suzhou, China
Dates: September 22-25, 2014
http://www.iwpma2014.net

2014 International Workshop on Acoustics Transduction Materials and Devices
Location: Newport, RI
Dates: May 12-16, 2014
http://www.mri.psu.edu/conferences/2014IEEE-ISAF-IWATMD-PFM

2014 NASA/ESA Conference on Adaptive Hardware and Systems (AHS-2014)
Location: Leicester, UK
Dates: July 14-17, 2014
http://www2.le.ac.uk/conference/ahs2014

ASME Conference on Smart Materials, Adaptive Structures and Intelligent Systems
Location: Newport, RI
Dates: September 8-10, 2014
Abstracts Due: March 21, 2014
http://www.asmeconferences.org/SMASIS2014

International Conference on Adaptive Structures and Technologies
Location: The Hague, The Netherlands
Dates: October 6-8, 2014
Abstracts Due: March 8, 2014
http://www.icast2014.nl

AIAA/ASME/AHS Adaptive Structures Conference
Location: Kissimmee, FL
Dates: January 5-9, 2015
http://www.aiaa.org/EventDetail.aspx?id=20990

Honors and Awards

ASMS Best Paper Awards

There are two best-paper awards established by the ASME Adaptive Structures and Materials Systems Technical Committee (ASMS TC): 1) Materials and Systems Best Paper Award and 2) Structural Dynamics and Control 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.

2013 Best Paper in Structural Dynamics and Control

J. Abel, J. Luntz, and D. Brei, "A Two-dimensional Analytical Model and Experimental Validation of Garter Stitch Knitted Shape Memory Alloy Actuator Architecture", *Journal of Smart Materials and Structures*, vol. 21 no. 8, July, 2012.



From left: Julianna Abel, Jonathan Lutz, Diann Brei

2013 Best Paper in Materials and Material Systems

Donghyeon Ryu and Kenneth J. Loh, "Strain Sensing using Photocurrent Generated by Photoactive P3HT-based Nanocomposites", *Journal of Smart Materials and Structures*, vol. 21 no. 6, May, 2012.


From Left: Donghyeon Ryu, Kenneth J. Loh

Nominations for the 2014 Best Paper Awards (appearing during calendar year 2012) should be sent to: Zoubeida Ounaies *zxo100@psu.edu* or Mohammad Elahinia *melahin@utnet.utoledo.edu* by December 2014. ■

Education Corner

Student Spotlight

Amin Bibo is a unique individual, driven to deeply understand theory and inspired to work on many different interdisciplinary problems. As a highly inquisitive student, he exhibits excellent insight and understanding. Amin works in the field of flow energy harvesting. Using a unique combination of analytical, numerical, and experimental research skills Amin developed, modeled and characterized several devices for flow energy harvesting including a scalable device inspired by the harmonica in which piezoelectric beams (reeds) installed at the end of a cavity are used to harvest energy from wind. Amin is also the first to study the performance of energy harvesters under a combination of flow and vibratory excitations. His work has been published in eight Journal papers, three in *Applied Physics Letters*, two in the *Journal of Intelligent Materials Systems and Structures*, and one each in the *Journal of Sound and Vibration*, *Physics Letters A*, and *ASME Journal of Computational and Nonlinear Dynamics*. Amin has also presented six papers in leading ASME conferences. Amin's work has been recognized at the University and National levels. He received the Top-five Posters award at the Clemson University Engineering Graduate Conference, 2013, and received the Best Student Paper Award at the ASME Smart Materials, Adaptive Structures, and Intelligent Systems Conference held in Sept. 2013 in Snowbird, Utah.

Amin exemplifies the qualities of the dedicated and extremely successful graduate student. He is making a difference in the world by directly addressing some of the critical concerns of our time, namely energy use, energy losses, and energy harvesting for reuse. He is a role model for all students, and is highly respected by his colleagues, senior and junior, and by everyone in the Department. ■

Yashwanth Tummala is a recent PhD graduate in Mechanical Engineering from The Pennsylvania State University, University Park. His dissertation research focused on design optimization of contact-aided compliant mechanisms for passive morphing of ornithopters. These mechanisms include compliant spine, bend-and-sweep compliant mechanism, and twist compliant mechanism. He has presented his work on design optimization of these mechanisms at SMASIS (2010 - 2013) conferences and also at IDETC 2013. His 2010 SMASIS paper received the best student paper award in the Bio-inspired smart materials and structures symposium. He also presented a poster titled 'Design and Optimization of a Compliant Spine with Tailorable Non-linear Stiffness' at the Center for Acoustics and Vibration workshop in 2012. This poster received third place in the poster competition. Prior to attending Penn State, Yash obtained his bachelor's in mechanical engineering with a minor in bio-medical engineering from Indian Institute of Technology Madras. He is currently working as a mechanical engineer in Vibrations Lab at GE Global Research Center in Niskayuna, NY.

Yash worked on designing contact-aided compliant mechanisms for passive morphing in collaboration with University of Maryland, College Park. His work was funded by Air Force Office of Scientific Research. The team included his adviser, Dr. Mary Frecker, and his collaborators, Dr. James E. Hubbard Jr. and Aimy Wissa. Passive morphing of ornithopters is important because they require no additional power, add very little extra weight and do not need any closed loop control or feedback. Contact-aided compliant mechanisms designed for passive morphing have tailorable non-linear stiffness properties. A compliant spine induces passive bending, bend-and-sweep compliant mechanism induces passive bending and sweep while a twist compliant mechanism induces passive twist of ornithopters wings when inserted in the leading edge wing spar. These mechanisms, when integrated into the wings, help the ornithopter imitate a continuous vortex gait. Yash and his team have published their work in the *Smart Materials and Structures* (SMS) journal in the past couple of years. They also have journal papers that have been submitted to the *Journal of Aircraft* and *Journal of Mechanisms and Robotics*. Yash likes to train for and run marathons in his free time. ■

Education Corner

Student Spotlight

Brent Utter is set to graduate with a PhD in Mechanical Engineering from the University of Michigan in May, 2014. His dissertation has focused on the development of technologies to research a novel treatment approach for Short Bowel Syndrome, a devastating condition in which insufficient bowel length leads to malnutrition and high rates of mortality. The novel treatment method is based on inducing longitudinal bowel growth by the application of tensile loading. Collaborating with a team of pediatric surgeons from the University of Michigan and the CS Mott's Children's Hospital, Brent has demonstrated the feasibility of this approach with clinically relevant large animals by doubling the length of bowel segments in less than two weeks. In addition, Brent has developed a wirelessly controlled SMA driven ratcheting device with force and displacement instrumentation. The versatility of this device was used to explore different approaches for exploiting the tension-induced tissue growth process by applying a range of tension and/or displacement profiles on *in vivo* porcine small bowel tissue. This series of experiments demonstrated that applying a low and constant tension on the tissue results in faster tissue growth compared to the rates of growth used in prior experiments with large animals. This result has important clinical implications, because reducing the length of the tensioning period results in shorter hospital stays, reduces the cost of care, and improves the quality of patient care. Brent has presented his research on the development of these technologies at SPIE (2009), SMASIS (2009, 2010), ICAST (2011) and ECCOMAS (2013). Brent's research achievements have also been published several times in *Pediatric Surgery International* and in the *Journal of Pediatric Surgery*. The efforts of Brent and his collaborative team of pediatric surgeons and mechanical engineers have led to several awards including an Honorary Paper at SMASIS in 2009, first place in the SMASIS 2010 Student Hardware Competition, and being a finalist for the Pediatric Inventor Award at the University of Michigan Medical Innovation Summit in 2012. In addition, his research has been recognized by the Ted Kennedy Family Team Excellence Award from the University of Michigan College of Engineering award series in 2011. Outside of his dissertation research, Brent has been an inspired mentor for undergraduate and graduate students in many independent research studies and group designs projects. ■

Julianna Abel will be completing her Ph.D. in Mechanical Engineering from the University of Michigan in May, 2014. Her dissertation research has focused on establishing the fundamental scientific understanding of the Active Knit actuation architecture to enable design, analysis, and synthesis of simultaneous large strain and moderate force actuators that produce complex three-dimensionally distributed actuation motions in a compact package. Active Knits are a novel cellular actuation architecture that enables a variety of complex actuation motions including contraction, scrolling, coiling, arching, and accordioning that are difficult or impossible with current actuation technologies.

Julianna has published her research in *Smart Materials and Structures* and she has presented her results at ASME SMASIS, SPIE Smart Structures/NDE, ICAST, and ASME IMECE, in addition to numerous symposia at the University of Michigan. She has been awarded the 2013 ASME ASMS Best Paper Award in Structural Dynamics and Control, Honorable Mention in the ASME SMASIS Student Paper Competition, 2nd Place in the Materials Session of the University of Michigan Engineering Graduate Symposium (UM EGS), and 3rd Place in the Design Session of the UM EGS. Julianna has received support for her graduate research from the Air Force Office of Scientific Research, a NSF Graduate Research Fellowship, a NASA Jenkins Pre-doctoral Fellowship Program, and a Rackham Merit Fellow Program.

In addition to her research, Julianna has been active in a variety of service initiatives. She was the Student Chair of the Student and Young Professional Development Symposium of ASME SMASIS in 2010, 2011, and 2013 where she established a high school student outreach event and arranged networking and community building events. Julianna has participated in numerous outreach activities and has mentored one high school, four undergraduate, and one graduate student on the fundamentals of smart materials and structures research. Julianna enjoys combining research and teaching to inspire students to pursue or continue engineering careers. ■

SMASIS Conference Synopsis

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

Schedule

March 21, 2014:	400 word abstract due
April 22, 2014:	Authors informed of abstract acceptance
May 19, 2014:	Final full-length paper due
June 2, 2014:	Copyright form due

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

Participation

Authors should submit a 400 word abstract to the conference web site **www.asmeconferences.org/SMASIS2014.** Questions can be directed to:

Andrei Zagrai, General Chair
azagrai@nmt.edu

Ralph Smith, Technical Chair
rsmith@eos.ncsu.edu

Michael Philen, Technical Co-Chair
mphilen@vt.edu

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Call for Papers

ASME Conference on

SMART MATERIALS, ADAPTIVE STRUCTURES AND INTELLIGENT SYSTEMS

September 8 - 10, 2014
Newport, RI, USA

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

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

Development and Characterization of Multifunctional Materials

Chair: Hani E. Naguib, *Univ. of Toronto*
Co-Chairs: Billy Oates, *Florida State*
Henry Sodano, *Univ. of Florida*

Topical areas: Material formulations, evaluation, synthesis, and processing; multifunctional composites and hybrid materials; bio-inspired and nano-composites; self-healing materials; novel triggering approaches, including optical, chemical, electrical, and mechanical; material property enhancement; interface and interaction science.

Mechanics & Behavior of Active Materials

Chair: Iain Anderson, *Univ. of Auckland*
Co-Chair: Nazanin Bassiri-Gharb*, Georgia Tech*

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

Modeling, Simulation and Control of Adaptive Systems

Chair: Jeong-Hoi Koo*, Miami Univ., Ohio*
Co-Chairs: Bjoern Kiefer, *TU Dortmund*
Uwe Marschner, *TU Dresden*

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

Integrated System Design and Implementation

Chair: Eric Ruggiero, *GE*
Co-Chair: Onur Bilgen, *Old Dominion Univ.*
Rich Beblo*, Dayton Research Inst.*

Topical areas: Sensors and actuators, power and control electronics, smart devices and technologies, compliant mechanism design, adaptive / intelligent / integrated systems design, smart structures design processes and tools, Industrial and Government smart products and system applications, smart electronics and devices, MEMS.

Structural Health Monitoring

Chair: Kenneth Loh, *UC Davis*
Co-Chairs: Andrew Swartz, *Michigan Tech*
Lingyu Yu, *Univ. South Carolina*

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

Bioinspired Smart Materials and Systems

Chair: Richard Trask, *Univ. of Bristol*
Co-Chair: Andy Sarles, *Univ. of Tennessee*
Pablo Tarazaga, *Virginia Tech*

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

Energy Harvesting

Chair: Adam Wickenheiser, *George Washingon Univ.*
Co-Chairs: Kazuhiko Adachi, *Kobe University* ***Michael Shafer,*** *Northern Arizona University*

Topical areas: Modeling and experiments of energy harvesting using piezoelectric and magnetostrictive materials; dielectric, ferroelectric, and ionic electroactive polymers; inductive and capacitive devices; deterministic and stochastic excitations; broadband and nonlinear systems; aeroelastic, hydroelastic, and acoustic energy harvesting; MEMS and NEMS configurations; novel circuits and storage devices.

ASME
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Rev. 6 – 02/19/14 - S.Lucato