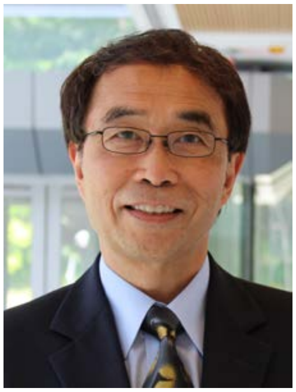
KEYNOTE SPEAKERS



Kon-Well Wang
Stephen P. Timoshenko Professor
Tim Manganello/BorgWarner Department Chair
Department of Mechanical Engineering
University of Michigan
Ann Arbor, MI

Monday, September 18, 2017
Presentation: From Muscles to Plants – Nature-Inspired Multifunctional Metastructures
8:00 am - 9:20 am
Ballroom 2&3

Abstract
During the past few decades, with the advances in materials, electronics, and system integration technologies, structural dynamics and controls researchers in various engineering disciplines have been investigating the feasibility of creating adaptive structures. The vision is to develop multifunctional structural systems that have various embedded and distributed autonomous functionalities, such as mechanical property variations, shape reconfiguration and morphing, vibration and noise controls, energy harvesting and management, and sensing and health monitoring. From a structural system's point of view, one of the major challenges is on how to best synthesize the cross-field and local-global coupling characteristics of the various adaptive materials and elements to optimize the overall structural performance. It has been recognized that to achieve significant new advances in adaptive structures, researchers should conduct even more cross talks among various disciplines. In recent years, the concept of mechanical *metastructures* developed based on *synergistic modular* architectures has been explored. Such architectures are often observed in nature, such as in biological systems. This presentation will discuss recent interdisciplinary research efforts in synthesizing nature-inspired adaptive multifunctional metastructures for structural dynamics enhancement. Inspired by biological studies on muscle crossbridges and plant cells, metastable mechanical modules and fluidic flexible matrix composite and fluidic origami modules are developed and the characteristics and functionalities of their corresponding modular metastructures are investigated.

Biography
Kon-Well Wang is the Stephen P. Timoshenko Professor and Tim Manganello/BorgWarner Department Chair of Mechanical Engineering at the University of Michigan. He received his Ph.D. degree from the University of California at Berkeley in 1985, worked at the General Motors Research Labs as a Senior Research Engineer, and started his academic career at the Pennsylvania State University in 1988. During his Penn State years, Professor Wang has served as the William E. Diefenderfer Chaired Professor in Mechanical Engineering, Director of the Structural Dynamics and Controls Lab, Associate

Director of the Vertical Lift Research Center of Excellence, and Group Leader for the Center for Acoustics and Vibration. Dr. Wang joined the University of Michigan in 2008.

Professor Wang's main technical interests are in adaptive structural systems and structural dynamics. He has received numerous recognitions for his accomplishments; such as the ASME J. P. Den Hartog Award, the SPIE Smart Structures and Materials Lifetime Achievement Award, the ASME Adaptive Structures and Materials Systems Award, the ASME N. O. Myklestad Award, the ASME Rudolf Kalman Award, the ASME Adaptive Structures and Material Systems Best Paper Awards, the NASA Tech Brief Award, and the SAE Ralph Teetor Award. He is a Fellow of the ASME, AAAS, and IOP. Professor Wang has been the Chief Editor for the ASME *Journal of Vibration and Acoustics*. He is currently an Associate Editor for the *Journal of Intelligent Material Systems and Structures* and an Editorial Advisory Board Member for the *Journal of Sound and Vibration*.

Christopher M. Spadaccini
Director, Additive Manufacturing Initiative
Director, Center for Engineered Materials and Manufacturing
Lawrence Livermore National Laboratory
Livermore, CA

Tuesday, September 19, 2017
Presentation: Additive Manufacturing and Architected Materials
8:00 am - 9:20 am
Ballroom 2&3

Abstract

Material properties are governed by the chemical composition and spatial arrangement of constituent elements at multiple length-scales. This fundamentally limits material properties with respect to each other creating trade-offs when selecting materials for specific applications. For example, strength and density are inherently linked so that, in general, the more dense the material, the stronger it is in bulk form. We are combining advanced microstructural design, using flexure and screw theory as well as inverse methods, such as topology optimization, with advanced additive micro- and nanomanufacturing techniques to create new material systems with previously unachievable property combinations – mechanical metamaterials. The performance of these materials is fundamentally controlled by geometry at multiple length-scales rather than chemical composition alone. We have demonstrated designer properties of these mechanical metamaterials in polymers, metals, ceramics and combinations thereof. Properties include ultra-stiff lightweight materials, negative stiffness, and negative thermal expansion as well as functional properties such electrical, optical, and chemical responses. We have primarily utilized our custom developed additive micro-manufacturing techniques to create these structures and materials. These include Projection Microstereolithography (P ng (DIW), and Electrophoretic Deposition (EPD) as well as some new advanced concepts such as volumetric additive manufacturing. These tools are capable of generating the designed structures which are highly three-dimensional micro- and nano-scale architectures often with multiple constituent materials in the same structure.

Biography

Christopher M. Spadaccini, Ph.D., is currently the Director of the Additive Manufacturing Initiative at the Lawrence Livermore National Laboratory (LLNL) as well as the leader of the Center for Engineered Materials and Manufacturing. He has been working in advanced additive manufacturing process development and architected materials for the last decade and has over 35 journal publications, three book chapters, and several dozen patents awarded and pending. Dr. Spadaccini founded several new fabrication laboratories at LLNL for process development focused on micro and nano-scale features and mixed material printing. He received his B.S., M.S., and Ph.D. degrees from the Department of Aeronautics and Astronautics at the Massachusetts Institute of Technology (MIT) in 1997, 1999, and 2004 respectively and has been a member of the LLNL technical staff for over 13 years. He has also been a lecturer in the Chemical, Materials, and Biomedical Engineering Department at San Jose State University where he taught graduate courses in heat, mass, and momentum transfer.

Marcelo Dapino
The Honda R&D Americas Designated Chair in Engineering
Director, NSF I/UCRC on Smart Vehicle Concepts
Department of Mechanical & Aerospace Engineering
The Ohio State University
Columbus, OH

Wednesday, September 20, 2017
Presentation: Are we there yet? The long road to achieving the widespread adoption of smart materials in automobile design
8:00 am - 9:20 am
Ballroom 2&3

Abstract
Although advanced materials and multi-material technologies are seen as essential for the future of the automotive industry, smart materials are not sufficiently represented in current automotive material selection strategies. Research done by the presenter's group within the NSF I/UCRC on Smart Vehicle Concepts seeks to develop understanding of how smart materials can drive the development of innovative vehicle components, systems, and structures. The multi-functional nature of smart materials can be effectively utilized to reduce part count and enable vehicle components capable of achieving high power density while being compatible with emerging vehicle electrification demands. Design concepts that incorporate shape memory materials, piezoelectric ceramics and polymers, or magnetostrictive alloys are being developed for applications such as vibration energy harvesters, tire electronics, vehicle morphing panels, and advanced impact detection systems. An integral part of these efforts is the incorporation of smart materials into dynamically-responsive structures that combine the sensing and actuation properties of smart materials with the high strength and low cost of conventional structural materials. This facet of the research motivates the investigation of new joining and manufacturing methods for smart structures, such as ultrasonic additive manufacturing (UAM), a 3D printing process driven by piezoelectric transducers that is based on the principles of ultrasonic metal welding. Unlike other additive processes, UAM process temperatures are well below the fusion temperature of the participating metals, which avoids the formation of brittle intermetallics and makes it possible to embed into metals high-value or thermally-sensitive materials such as carbon fiber, aramid, fiber optics, shape memory alloys, active polymers, and ceramic fibers. In this keynote presentation, research challenges, approaches, and opportunities associated with smart materials and ultrasonic additive manufacturing are discussed.

Biography
Marcelo Dapino is the Honda R&D Americas Designated Chair in Engineering at the Ohio State University, where he is a Professor in the Department of Mechanical and Aerospace Engineering. Prof. Dapino serves as Director of the Smart Vehicle Concepts Center, a National Science Foundation Industry/University Cooperative Research Center. Professor Dapino joined Ohio State University as a faculty member in 2001 where he has served as a mechanical engineering educator and primary advisor

for close to 60 MS and Ph.D. students, 15 undergraduate theses, and 10 post-doctoral associates. Along with his advisees and collaborators, he has published over 102 archival journal articles, 8 book chapters, 106 conference papers, and has generated 11 patents and intellectual property disclosures. Professor Dapino has an extensive record of service to the ASME Adaptive Structures and Materials Systems community and the ASME Aerospace Division. Among several recognitions, he is a recipient of the ASME Gary Anderson Early Achievement Award, the Honda Initiation Grant Award, and The Ohio State University Harrison Award for Excellence in Engineering Education. Professor Dapino is a Fellow of ASME and a Senior Member of SPIE.