Nature-Inspired Adaptive Modular Metastructures

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Abstract

During the past few decades, due to the advances in materials, electronics, and system integration technologies, structural dynamics and controls researchers in various engineering disciplines (e.g., aerospace, civil, mechanical) 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 shape reconfiguration and morphing, materials and mechanical property variations, energy harvesting, vibration and stability controls, and health monitoring and healing. From a structural system 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 structure performance. It has been recognized that to achieve significant new advances in adaptive structures, researchers have to conduct even more cross talks among various fields and disciplines. In recent years, interesting approaches have been explored to develop mechanical metamaterials or metastructures based on synergistic modular architectures, often observed in nature, such as in biological systems. This presentation will discuss some of the recent interdisciplinary research efforts in synthesizing nature-inspired adaptive modular metastructures for structural dynamics enhancement and applications.

About the Speaker

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

Professor Wang's main technical interests are in adaptive structural systems and structural dynamics & control. He has received numerous recognitions for his accomplishments; such as 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 Best Paper 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*.