Biologically Inspired Multifunctional Adaptive Structural Systems

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Abstract

During the past couple of decades, due to the advances in materials, electronics, and system integration technologies, structural dynamics and control researchers in various disciplines have been investigating the feasibility of creating adaptive structures (also named as smart structures or intelligent structures). The ultimate vision is to develop a structure that has built-in actuation, sensing, decision making, self-powered, self-diagnostic, and self-healing abilities. It has been recognized that in order to achieve significant advances in this field, the adaptive structure researchers have to conduct more cross talks with researchers in various other scientific disciplines, such as biology, chemistry, molecular and nano science. Various biologically-inspired adaptive structure concepts have been investigated, emulating the physiological behaviors of animals. On the other hand, it has also been recognized in recent years that new bio-sensing and bio-actuation ideas can be created building upon innovations inspired by the mechanical, chemical, and electrical properties of plants. For example, plant nastic motions (e.g., rapid plant motions of venus flytrap or mimosa) can achieve actuations with large force and stroke. It is also known that plants can adapt to the direction/magnitude of external loads and damage, and reconfigure or heal themselves via cell growth. This presentation will highlight some of the interdisciplinary exploratory efforts in this new emerging technical area.

Biography

Dr. Kon-Well Wang is the Department Chair and Stephen P. Timoshenko Professor of Mechanical Engineering at the University of Michigan in Ann Arbor, MI, U.S.A. He received his B.S. degree from the National Taiwan University and his M.S. and Ph.D. degrees from the University of California at Berkeley. After completing his Ph.D.,

Dr. Wang has worked at the General Motors Research Labs for three years as a Senior Research Engineer, before starting his career in academia as an Assistant Professor 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 June 2008. Professor Wang's major technical interests are in adaptive structural systems, bio-inspired systems, and structural dynamics and controls. He has published over 200 technical articles and is the holder of several patents in these areas. Professor Wang is a Fellow of the American Society of Mechanical Engineers (ASME), and has received numerous recognitions for his accomplishments in research and education; including the ASME N.O. Myklestad Award for major innovative contribution to vibration engineering, the ASME Adaptive Structures and Materials Systems Prize for significant contributions to the advancement of the sciences associated with adaptive structures and/or material systems, the NASA Tech Brief Award, the Society of Automotive Engineers Ralph Teetor Award, the Penn State Engineering Society (PSES) Premier Research Award, and the PSES Outstanding Teaching Award. Dr. Wang has chaired the ASME Technical Committee on Vibration and Sound, and has been the General Chair to the Army Research Office Smart Structures Workshop and the SPIE Damping and Isolation Conference. He is currently the Chief Editor of the ASME Journal of Vibration and Acoustics and an Associate Editor for the Journal of Intelligent Material Systems and Structures.