

JOINT BIOENGINEERING SEMINAR SERIES



BIO-INSPIRED SENSING IN ENGINEERED SMART MATERIALS

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Abstract

Bio-inspired smart materials represent the next generation of engineered material systems capable of reporting and reacting to their state. This technology has the potential to revolutionize the entire life cycle of mechanical structures from design through manufacturing, service, maintenance, and end of life. Multiple techniques have been developed with the goals of achieving automated real-time state detection.

High spatial resolution heterogeneous sensing systems and self-healing capabilities are core to this technology. Initial development has focused on damage detection, location, characterization, and quantification capabilities and self-healing properties independently. While many techniques to accomplish each of these tasks have been developed, ultrasonic sensing systems and shape memory alloy reinforced self-healing materials have been found to be among the most promising. Ultrasonic systems are capable of detecting multiple stimuli with broad structural coverage using a sparse sensor network. Shape Memory Alloy based self-healing materials have an inherent capability to restore their geometry after damage occurs.

This presentation will highlight current issues and research into ultrasonic damage detection and characterization systems. In addition, application to self-healing materials will be addressed. Topics include the interrelated fields of sensor design, sensor deployment, signal analysis, and communication. In addition, initial integration of damage detection systems into self-healing materials will be presented.

Biosketch:

Nathan P. Salowitz received the B.S. degree in engineering mechanics from the University of Wisconsin – Madison in 2001 and the M.S. and Ph.D. degrees in aeronautics and astronautics from Stanford University in 2006 and 2013, respectively. From 2003 to 2005 he was a Structural Analysis Engineer with The Boeing Company. From 2013 to 2014 he was a postdoctoral Engineering Research Associate at Stanford University. Since 2014 he has been an Assistant Professor with the Mechanical Engineering Department with Adjunct Professor appointments in the Electrical Engineering and Civil and Environmental Engineering departments at the University of Wisconsin – Milwaukee. He has more than 16 publications and is currently pursuing research in Intelligent Materials and Structural Health Monitoring with particular interests in sensor design, mass sensor deployment, wireless communication, and the interaction of sensors and structures. Prof. Salowitz is a member of ASME and IEEE with significant involvement in the Structural Health Monitoring community.