College of Engineering
Department of Mechanical & Industrial Engineering

The Sidney E. Fuchs Seminar Series

3:30-4:30pm, Friday, September 14, 2012

Frank H. Walk Design Presentation Room

Embedded Piezoelectric Fiber Composite Sensors for Structural Health Monitoring

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Health monitoring of composite structures is an important issue that must be addressed carefully. Embedded sensors could be an effective way to monitor the health of composite structures continuously, especially at critical locations, which could help avoiding eventual unexpected or catastrophic failures of the structures. Piezoelectric-fiber-composite-sensors (PFCS) made from micro-sized Lead-Zirconate-Titanate (PZT) fibers have great advantages over the traditional bulk PZT sensors for embedded sensor applications. The work presented in this seminar is a critical study on using some aspects of the PFCS as an effective embedded sensor within the composite structures.

A series of carefully planned experiments are conducted to study the sensor performance based on several important characteristics such as transfer function, sensitivity, nonlinearity, resolution, etc. In-plane tensile loading, in plane tension fatigue, flexural and short beam strength tests are performed to evaluate the strengths/behavior of the composite laminates and composite sandwich structures containing embedded PFC sensors. Overall, PFCS seem to have high compatibility with composites and the reduction in strength values, are within the permissible limits. By continuously monitoring the output response of the embedded PFCS, one could effectively monitor the magnitude of stress/strain acting on the structure. Experiments are also performed to explore the ability of the embedded PFCS to detect damages within the structures using modal analysis and impact techniques. It is found that embedded PFCS could be an effective method to monitor the health of the composite structures' in-service conditions.

* Dr. M.A. Wahab completed PhD in Mechanical Engineering from the University of Alberta in Edmonton, Canada and has a Master degree in Mechanical Engineering from the University of New Brunswick, Canada. After graduation he went to Australia and worked there as a Faculty in Mechanical Engineering from 1985 to 2001 at four different universities (Universities of RMIT-Melbourne, Tasmania, Central Queensland, and Adelaide). Subsequently he moved to LSU in January 2002. Dr. Wahab's main research interests are in the general areas of Welding, Composites, and Materials Characterization and Processing. Dr. Wahab was a founding member for the Australian "Cooperative Research Centers for Materials Welding in Joining" CRC-MW&J, 1992-1997 and "Cooperative Research Center for Welded Structures" (CRC-WS, 1999-2006). Dr. Wahab contributed extensively in strategic research initiatives of these two CRCs from 1992 to 2001, and joined LSU in 2002 as an Associate Professor in Mechanical Engineering.