



RESEARCH SEMINAR

COLLEGE OF SCIENCE AND TECHNOLOGY

TEXAS SOUTHERN UNIVERSITY



Thursday, December 3rd, 2009

3:45 pm-4:45 pm

154 New Science Building

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Piezoceramic Based Smart Aggregates: a Distributed Intelligent Multi-purpose Sensor Network (DIMSN) for Civil Structures

This talk summarizes the authors' recent pioneer research work in piezoceramic-based smart aggregates and their innovative applications in concrete civil structures. The smart aggregate is formed by embedding a water-proof piezoelectric patch with lead wires into a small concrete block. The smart aggregates are multi-functional and can perform three major tasks: early-age concrete strength monitoring, impact detection, and structural health monitoring. The smart aggregates are embedded into the desired location before the casting of the concrete structure. The concrete strength development is monitored by observing the high frequency harmonic wave response of the smart aggregate. Impact on the concrete structure is detected by observing the open circuit voltage of the piezoceramic patch in the smart aggregate. For structural health monitoring purposes, the embedded smart aggregates form a Distributed Intelligent Multi-purpose Sensor Network (DIMSN) and the active sensing approach is used for damage detection. Wavelet packet analysis is used as a signal-processing tool to analyze the sensor signal. A damage index based on the wavelet packet analysis is used to determine the structural health status. To better describe the damage time-history and location information, two types of damage index matrices are proposed: a time-history damage index matrix and an actuator-sensor damage index matrix. To demonstrate the multi-functionality of the proposed smart aggregates, different types of concrete structures have been used as test objects, including concrete bridge bent caps, concrete cylinders, and a concrete frame. Experimental results have verified the effectiveness and the multi-functionality of the proposed smart aggregates. The multi-functional smart aggregates have the potential to be applied in the comprehensive monitoring of concrete structures from their early stages throughout their lifetime.

Refreshments will be served

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