AEROSPACE & MECHANICAL ENGINEERING

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UNIVERSITY OF NOTRE DAME, NOTRE DAME, INDIANA 46556

SPEAKER: **Prof. Jerome P. Lynch**
Department of Civil and Environmental Engineering
University of Michigan
Ann Arbor, Michigan

TOPIC: **NANOENGINEERED THIN FILMS FOR STRUCTURAL HEALTH MONITORING**

DATE: Tuesday, November 06, 2012

TIME: 3:30 p.m.

PLACE: Lower Level Auditorium, Geddes Hall

RECEPTION: 3:00 – 3:30 p.m. – Coffee House, Geddes Hall

ABSTRACT

The field of structural health monitoring (SHM) has been pursuing new sensing technologies for monitoring performance and for assessing the health condition of complex structural systems such as bridges, aircrafts, ships, and machinery. Unfortunately, the current set of sensing technologies available has proven inadequate for the detection of structural distress for two reasons. First, most sensors are "point" sensors that measure responses to loads at highly localized regions (usually not collocated with damage). Second, physics-based models or pattern recognition algorithms are necessary for inferring damage states based on indirect structural response measurements. These existing technology bottlenecks could be resolved by engineering a new generation of multifunctional materials that can serve as the basis for distributed and direct damage sensing. Specifically, nanomaterials such as single-walled carbon nanotubes (SWNT) and polyelectrolytes (PE) can be molecularly assembled at nanometer length-scales to form homogeneous nanocomposites with superior mechanical and electrical properties. These materials can also be tailored to exhibit sensing capabilities including the ability to sense structural responses (*e.g.*, strain) and damage (*e.g.*, plastic deformations). This presentation focuses on the creation of SWNT-based thin films designed as a sensing applique for structural health monitoring. Fundamental modeling of the mechanical and electrical properties of SWNT-PE thin films is presented. Next, the use of SWNT-PE films for spatial mapping of structural behavior is achieved through the use of electrical impedance tomography (EIT) techniques. Unlike traditional structural health monitoring systems, the proposed sensing skins can directly determine structural damage location and severity (i.e., due to strain, impact, pH, and corrosion) since it is inherently a distributed sensor sensing the damage directly. The ability to accurately detect damage location and severity facilitates efforts to prevent future catastrophic failures from occurring in complex structural systems.

NOTE: ***If you are interested in meeting individually with Prof. Lynch, please contact Linda at 631-5431***