The University of Cincinnati

aerospace engineering
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GRADUATE SEMINAR

Embedded Ultrasonics NDE with Piezoelectric Wafer Active Sensors

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University of South Carolina

Date: January 31, 2003
Time: 3:00 - 4:00 p.m.
Place: 755 Baldwin Hall

ABSTRACT

Embedded ultrasonics NDE with piezoelectric wafer active sensors (PWAS) is a new technology that enables in-situ structural health monitoring (SHM) of aircraft and other structural systems. Unlike conventional ultrasonic transducers and surface acoustic wave (SAW) devices, PWAS are small, inexpensive, non-invasive, and unobtrusive. They can be affordably deployed on a variety of structures as permanently attached sensor arrays. PWAS are non-resonant broadband devices. Their principle of operation, stemming from their intimate electromechanical coupling with the Lamb wave modeshapes at selectable frequencies, will be briefly reviewed. PWAS applications will be illustrated through simulations and experiments, as for example:

- Traveling wave methods (pitch-catch and pulse-echo)
- Standing-wave methods (high-frequency electromechanical impedance)
- Passive sensing (acoustic emission and low-velocity impact detection)
- Phase-array scanning beam methods

These new type of active sensors have still many challenging issues to be clarified. These challenges are good opportunities for high quality theoretical and experimental research.

BIOGRAPHICAL SKETCH

Education: Imperial College, London, UK: PhD (1977) *Aeronautical Structures*; BS (1972) *Aeronautics*.
Research Interests: Building on a background in vibrations, dynamics and controls, aeroservoelasticity, helicopter aeromechanics, and composite materials, his present interest is in the multidisciplinary fields of Adaptive Materials and Smart Structures, Structural Health Monitoring, and Mechatronics. Currently developing a new area: Embedded Ultrasonic Nondestructive Evaluation (NDE) with Piezoelectric Wafer Active Sensors (PWAS). Concurrently, he is expanding into Active Bio Sensors, and Integrated Nano Sensors.
Professional Career: 1996-current: Associate Professor of Mechanical Engineering and Director of the Laboratory for Adaptive Materials and Smart Structures at the University of South Carolina http://www.me.sc.edu/research/lamss/; 1992-1996: Visiting Professor and Associate Director in the Center for Intelligent Materials Systems and Structures at Virginia Tech. 1977-1992: Aviation Research Institute, Bucharest, Romania.
Service: Associate Editor of *Structural Health Monitoring – An International Journal* (Sage Pub.); organizer, chair and co-chair of numerous conferences in the area of smart structures, adaptive materials, structural health monitoring, etc.

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