"A WAVE PROPAGATION APPROACH TO STRUCTURAL HEALTH MONITORING AND TO THE ANALYSIS OF PERIODIC STRUCTURES"

Tuesday, April 21, 2009

3:00 p.m.

MRDC 4211

ABSTRACT:

The presentation provides an overview of research activities in the area of wave propagation as applied to Structural Health Monitoring (SHM) and to the design and analysis of acoustic periodic structures.

The first part of the seminar illustrates the application of Guided Ultrasonic Waves (GUW) for the analysis of the health of structural components. GUW have the potentials to travel long distances thus enabling the inspection of large areas in a timely manner. The propagation and GUW, together with the application of Scanning Laser Vibrometry for full wavefield measurement, allows the introduction of novel damage detection techniques which are based on the application of filtering techniques in the frequency/wavenumber (k,ω) space. Goal of these techniques is to separate the contribution of damage from the overall response of the structure, thus highlighting its presence and location. Their application is illustrated on several laboratory specimens, and on actual aircraft measurements obtained in the field.

The second part of the presentation presents the application of periodic structural lattices as novel configurations for acoustic waveguides and filters. This class of structural assemblies features unique design flexibility which allows tailoring their mechanical behavior through the proper selection of the unit cell topology. Wave propagation characteristics of various lattice configurations are presented to show their directional and band gap properties. Such unique features are applied for acoustic wave guiding, and for the design of novel actuators with frequency dependent directivity. Such properties are also investigated in the presence of nonlinear material behavior, which may be exploited to further enhance the functionality of periodic structures and to generate novel unique properties uniquely associated with nonlinear interactions.

BIO:

Massimo Ruzzene is an Associate Professor in the School of Aerospace Engineering at Georgia Institute of Technology. He received a Ph.D in Mechanical Engineering from the Politecnico di Torino (Italy) in 1999. He is author of approximately 70 journal papers and about 90 conference papers, and has participated as a PI or co-PI in various research projects funded by the Air Force Office of Scientific Research (AFOSR), the Army Research Office (ARO), the Office of Naval Research (ONR), NASA, the US Army, TRW Corporation and the National Science Foundation (NSF). Most of his current and past research work has dealt with structural health monitoring, wave propagation analysis, high frequency vibration modeling, and vibration and noise control techniques.