

IEEE-UT Seminar
on
Large Area Structural Health Monitoring (SHM) with
Ultrasonic Guided Waves: Vision, Issues and Progress

Jennifer E. Michaels, Ph.D.

School of Electrical and Computer Engineering
Georgia Institute of Technology
Atlanta, GA 30332-0250

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Venue : SSOE Seminar Room (NI 1027)

Abstract: Ultrasonic guided waves have the potential to interrogate large areas of critical structures for damage, and many researchers are actively considering them for structural health monitoring (SHM) applications. Unlike nondestructive evaluation (NDE), where sensors interrogating a very small region are manually or automatically moved to obtain complete spatial coverage, *in situ* sensors for SHM are fixed in space. If a spatially distributed array of guided wave sensors is permanently mounted on a structure, each individual sensor can act in turn as a transmitter and the others as receivers, thereby interrogating a large area. If such sensor data are captured over time during the structure's usage, then this time history information, which is not available for NDE data, may contain valuable information. Our vision for SHM using guided waves is that damage is first detected by monitoring changes in signals with time, then localized via sparse array imaging algorithms, and finally characterized by a combination of *in situ* measurements and follow-up inspection. This presentation shows progress made for each step of this strategy in the context of the major issues facing implementation of large area guided wave SHM. These issues include variable environmental and operational conditions, degradation of transducers and bonding, and the effect of spatial under-sampling on large area imaging methods.

Jennifer E. Michaels is an Associate Professor in the School of Electrical and Computer Engineering at Georgia Tech. She received the Bachelor's of Electrical Engineering degree from Georgia Tech in 1976, and then began working in the field of ultrasonic nondestructive evaluation at the Hanford Engineering Development Laboratory in Richland, Washington. This work led to her graduate studies in Theoretical and Applied Mechanics at Cornell University, where she earned her M.S. and Ph.D. degrees in 1982 and 1984, and spent a year as an IBM Postdoctoral Fellow. From 1985 until joining Georgia Tech in 2002, she worked in industry, first as co-founder of a startup company, and later as Manager of Systems Development at Panametrics, Inc., a world leader in the development, fabrication and deployment of custom automated ultrasonic inspection systems. She is co-director of the QUEST (Quantitative Ultrasonic Evaluation, Sensing and Testing) Laboratory at Georgia Tech, where her current research interests are structural health monitoring, nondestructive evaluation, materials characterization and measurement systems. Current and past sponsors of her work include AFRL, AFOSR, DARPA, HSARPA, NSF and industry.