"Fostering Real World Educational Environments – A Case for Ultrasonic Acoustics Research in Promoting Student Learning"

David Torello

Summary:
Research experiences play a vital role in student development by providing opportunities to scaffold new and old knowledge in the context of the study, and to transfer that knowledge to a wide range of complex and dynamic problems. In this talk, I will discuss my research in ultrasonic acoustics in the field of Nondestructive Evaluation (NDE) of structural metals and will highlight the connections between components of the research and learning opportunities for undergraduate students. NDE is a crucial monitoring tool to predict catastrophic failure of critical infrastructure and devices before serious harm results. The nonlinear stress-strain relationship of structural materials is directly related to microstructural deformation or damage due to effects like fatigue, stress-corrosion cracking, thermal aging, and nuclear embrittlement. As materials deform or degrade with life, propagating acoustic waves become more or less nonlinear, signified by changes in the acoustic nonlinearity parameter, β, which can be further related to damage prediction and end-of-life metrics. I will discuss the experimental and modeling frameworks required to measure β and discuss how to apply ultrasonic NDE to the rapidly growing field of Additive Manufacturing (AM), which sorely needs these monitoring capabilities as the industry approaches production of certified engineering components. Within this discussion will be the identification of possible areas of undergraduate research involvement and how to mold the research experience into a succession of learning opportunities.

Bio:
David E. Torello is a doctoral candidate in Mechanical Engineering at the Georgia Institute of Technology in Atlanta. He received his Bachelor of Science degree at the University of California, Berkeley in Mechanical Engineering and his Master of Science in the field of Microelectromechanical Systems (MEMS) acoustics at Georgia Tech. His current research is on nonlinear ultrasonics as a tool in the field of Nondestructive Evaluation (NDE) to characterize the nonlinear stress-strain relationship in structural engineering materials through measurement of the acoustic nonlinearity parameter, β. His work on nonlinear acoustics has been published in journals such as *Ultrasonics* and *Review of Scientific Instruments* and has won best student poster and paper competitions at conferences such as QNDE, ASA Meetings, and PRCI Research Exchanges. David is passionate about engineering education and has taught courses in Dynamics, helped establish the Grand Challenge Scholars Program at Georgia Tech, consulted in problem based learning environments, and mentored and published with multiple undergraduate research colleagues in his doctoral studies.

After the seminar there will be an informal dinner and conversation with the speaker in the Rose Hills PDR at Hoch-Shanahan Dining Hall. If you are not on the meal plan, we will have a signup sheet. If you are interested in attending, please RSVP with Sydney Torrey at storrey@hmc.edu.