Seminar

"What is next in acoustic-based sensing and testing: localization, diagnosis, and prognosis challenges"

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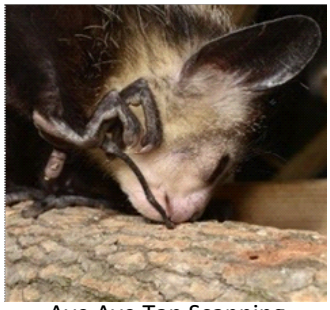
abstract



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It is known that mechanical systems and infrastructures are subjected to deterioration due to aging, increased load, and natural multi-hazard. Additionally, lack of reliable quality control methods in recently-developed advanced manufacturing processes has reduced the expected reliability of critical components manufactured using these processes. To minimize the maintenance cycle/ costs and to increase the operation lifetime of mechanical systems, researchers and practitioners are increasingly interested in pioneering advanced nondestructive evaluation/Testing (NDE/T) technologies by building novel sensing and monitoring strategies. Sensing methods based on acoustic waves have received significant interest in the past few years, which has led to the development of a variety of systems and signal processing techniques for material evaluation in complex structures. Although systems have been developed, unanswered questions have been posed regarding their reliability and accuracy. The inherent uncertainty in sensor measurements, caused not only by the sensor impreciseness and noise, but also from the ambiguities and inconsistencies present within the environment, and from an inability to distinguish between them, may hamper their reliability in terms of automatic damage detection and characterization. This presentation will highlight new sensing systems and data processing techniques to enhance accuracy and capabilities of acoustic-based sensing methods for robotic inspections, in-situ quality monitoring of additive manufacturing, and real-time monitoring of infrastructures. Specifically, recent advances and challenges in localization, diagnosis, and prognosis capabilities of acoustic-based sensing and testing systems will be discussed. Finally, it will be shown that near-field auditory systems of a fascinating group of animals that have evolved over the past million years to use self-generated acoustical cues when foraging can help us to pioneer bio-inspired acoustic-sensing and NDE/T methods to revolutionize robotic inspection and manufacturing quality control.

biosketch

Dr. Dehghan-Niri is currently an assistant professor at New Mexico State University (NMSU). He is the lead PI and director of consortium "enabling in- and ex-situ quality control of additive manufacturing (QCAM)". Before joining NMSU he was a Non-destructive evaluation/Testing (NDE/T) scientist at Materials and Processes Engineering in General Electric (GE Power). He obtained his Ph.D. in structural Engineering at University of Buffalo, in 2014. He is the author of over 28 scientific journal publications, 31 conference publications/ presentations, and 14 US and European pending and approved patents. Dr. Dehghan-Niri's main research interests include bio-inspired acoustic sensing, acoustic-based testing and monitoring methods for inspection of infrastructures and mechanical systems, robotic inspection, and in-situ quality control of advanced manufacturing. In 2021, Dr. Dehghan-Niri received the National Science Foundation CAREER Award. For his contributions to field of NDE/T, he also received a national award "Young NDT Professional Award" from the American Society for Nondestructive Testing. His current research is supported by NSF, DOE, DOD, NASA, NIH, DOT, and several industrial companies.

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