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

ABSTRACT

It is known that mechanical systems and civil 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 improving current nondestructive evaluation/Testing (NDE/T) technologies or building advanced monitoring strategies. NDE/T methods based on acoustic waves in particular guided ultrasonic waves (GUWs) and nonlinear ultrasound 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 damage detection 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.

BIO SKETCH

Dr. Dehghan-Niri is currently an assistant professor in the New Mexico State University (NMSU). 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, 29 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 NDE/T, he also received the Young NDT Professional Award from the American Society for Nondestructive Testing. His current research is supported by NSF, DOE, DOD, NASA, DOT, and several industrial companies.

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