2019 Tennessee Tech College of Engineering
New Faculty
Research Seminar Series

Part Authentication and Quality Control for Additive Manufacturing via Smart Vibrations

Presented by Mohammad Albakri Ph.D., Assistant Professor, Mechanical Engineering

Abstract: As Additive Manufacturing (AM) technologies and materials continue to mature, there has been a significant increase in the desire to leverage AM to fabricate end-use and mission-critical products. However, the widespread adoption of AM for mission-critical components is somewhat hindered by our inability to effectively validate the quality of printed complex parts. Furthermore, there are classes of defects, unique to AM, that cannot be efficiently detected with standard quality control techniques (internal porosity for example). In this talk, I will discuss recent advancements in vibration-based quality control and nondestructive evaluation, where the potential of electromechanical impedance measurements to bridge existing gaps in current practices is investigated. The background of electromechanical impedance measurements, in the context of structural health monitoring and quality control, is first discussed. The sensitivity of electromechanical impedance measurements to build-defects typical of AM processes, including dimensional inaccuracies, positional inaccuracies, and internal porosities, is then evaluated. For this purpose, a suite of test specimens with common build-defects is designed, fabricated, and augmented with piezoelectric transducers. An impedance-based analysis is then conducted, in a supervised learning context, to identify manufacturing anomalies. The efficacy of this approach for in-situ monitoring and as a side-channel part authentication solution is also discussed in this talk. Being a functional-based technique, impedance-based quality control is well suited for inspecting parts of complex geometry and deeply embedded flaws, with the promise of significant reduction in inspection cost.

About the Speaker: Mohammad Albakri received his Ph.D. degree in Engineering Mechanics from Virginia Tech in 2016 and his Master's degree in Mechanical Engineering from Masdar Institute of Science and Technology in 2011. His research interests are in the area of structural dynamics and smart materials with applications in nondestructive evaluation and advanced manufacturing. His research has been supported by the National Science Foundation and the Federal Railroad Administration.

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Prescott Hall, Room 225

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