



Mechanical Engineering Seminar Series

Additively Manufactured Polymer Composites: Mechanics, Materials Science, and Manufacturing

MEHRAN TEHRANI

Assistant Professor

The University of Texas at Austin



Tuesday, March 30, 2021

4:00 p.m.

[ME Seminar Zoom link](#) (QR Code below)

Password 121814



Abstract

Polymer additive manufacturing (AM) is mostly relegated to the space of rapid prototyping. New approaches for transitioning polymer AM to the production of end-use parts will be discussed. Moreover, processing-structure-failure relationships in AM polymer parts will be elucidated. Carbon fiber has been identified as a potential solution to overcome several shortcomings of polymer AM, where it improves polymer properties, reduces the time required to manufacture functional parts, and lowers warping to lead to a larger build envelop. The effects of carbon fiber reinforcement on the processability, structure, and properties of AM parts will be discussed. In particular the effects of fiber length, orientation distribution, polymer type, and AM technology for various applications will be discussed. Despite several advantages, AM composites suffer low interlaminar mechanical properties due to poor layer-to-layer adhesion and voids. Failure mechanics of AM composites will be explained and new post-processing methods to alleviate their poor interlaminar performance will be introduced. From a structural standpoint, AM allows for the implementation of specially designed fiber placement within the parts. With a knowledge of the loading profile, parts with unprecedented performance and weight can be designed and manufactured. In this regard, a framework for the design optimization of AM composite parts will be introduced and demonstrated for a few benchmark problems.

Bio

Dr. Tehrani obtained his Ph.D. in Engineering Mechanics from Virginia Tech in 2012. He was an Assistant Professor of Mechanical Engineering at the University of New Mexico from 2014-2019. In 2019, he joined the Walker Department of Mechanical Engineering at the University of Texas at Austin as an Assistant Professor. Tehrani's research focuses on advanced multifunctional composites and lies at the intersection of additive manufacturing, materials science, and mechanics. He has published his research in some of the highest ranked journals in the field including Additive Manufacturing, Composites Science and Technology, Composites Part A, and Composites Part B. Tehrani is in the organizing committee of the Solid Freeform Fabrication (SFF) symposium, Technical Division Chair for Design & Manufacturing at the American Society for Composites (ASC), Organizer of the Congress-Wide Additive Manufacturing Topic at ASME-IMECE. Tehrani's research and teaching awards include the National Science Foundation CAREER award (2019), Office of Naval Research YIP award (2018), Air Force Research Laboratory Summer Faculty Fellowship (2016), Perkin-Elmer Award from the Composite Division @Society of Plastic Engineers (2012), and The College of Engineering Outstanding Doctoral Student at Virginia Tech (2012).

Karen Brown karenar@umich.edu

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