SDSU College of Engineering Mechanical Engineering

Mechanical Engineering Seminar Series

April 22, 2025, 11:00AM

Dean's Conference Room, E-203E

Title: Advanced Manufacturing of High-Performance Thermoplastic Composites

Dr. Mehran Tehrani
University of California, San Diego

Abstract: Mehran Tehrani is an Associate Professor of Structural and Materials Engineering at the University of California San Diego (UCSD), where he holds the Callaway Golf Endowed Chair Position. Prof. Tehrani's research specializes in advanced multifunctional composites, bridging advanced manufacturing, materials science, and mechanics. His work aims to enhance the design and manufacturing of these composites, focusing on reducing cost and energy consumption. Dr. Tehrani's research is currently supported by the National Science Foundation (NSF), NASA, the Air Force Office of Scientific Research (AFOSR), the Office of Naval Research (ONR), and industry partners. He has published over 90 journal and conference papers, and received several awards for his research and teaching, including the NASA Early Stage Tech Innovations Award, the NSF CAREER Award, the ONR Young Investigator Program (YIP) Award, and the Air Force Research Laboratory Summer Faculty Fellowship.

Brief Bio: Thermoplastic composites (TPCs) combine weldability, outstanding toughness, and the potential for rapid out-of-autoclave (OoA) processing—attributes that make them prime candidates for next-generation aerospace, automotive, and energy applications. In rapid-cycle processes such as additive manufacturing (AM), in-situ consolidated automated fiber placement (AFP), and welding, TPCs are exposed to extreme thermal and mechanical conditions. These environments profoundly influence their microstructure, directly impacting interlaminar bond formation and, consequently, overall structural performance. In this talk, I will present the underlying physics of interlaminar bond development in fiber–reinforced TPCs, focusing on how processing parameters and microstructural changes govern mechanical properties across multiple scales. Through case studies involving AM and in-situ consolidated AFP, I will illustrate the interplay between polymer morphology, fiber architecture, and defect management, showing how engineered voids or strategically placed defects can enable post-processing consolidation to boost performance. Additionally, I will introduce novel interfacial materials designed to facilitate more effective in-situ consolidation under rapid-cycle conditions, thereby reducing cycle times while improving part quality. By highlighting both fundamental mechanisms and practical manufacturing considerations, this talk aims to provide actionable insights into the design and processing of TPCs for high-efficiency, high-performance applications in a rapidly evolving industrial landscape.