



AEROSPACE ENGINEERING SEMINAR SERIES



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4:00 p.m. / 202 Reed McDonald Building

**Universal Composition-Structure-Property Map for Natural and Biomimetic Platelet-Matrix Composites and Stacked Heterostructures**

**ABSTRACT**

Many natural and biomimetic platelet-matrix composites - such as nacre, silk and clay-polymer - exhibit a remarkable balance of strength, toughness, lightweight and/or lightweight, which call for a universal measure to quantify this outstanding feature given the structure and material characteristics of the constituents. Analogously, there is an urgent need to quantify the mechanics of emerging electronic and photonic systems such as stacked heterostructures, which are composed of strong in-plane bonding networks but weak interplanar bonding matrices. In this talk, I will describe the development of a unified framework to construct universal composition-structure-property diagrams that decode the interplay between various geometries and inherent material features in both platelet-matrix composites and stacked heterostructures. I will discuss the effects of elastic and elastic perfectly-plastic matrices, overlap offset ratio, stairwise staggering, and the competing mechanisms between the platelet and matrix failures. Validated by several 3D-printed specimens and a wide range of natural and synthetic materials across scales, the proposed universally valid diagrams have important implications for science-based engineering of numerous multifunctional platelet-matrix composites and stacked heterostructures while significantly broadening the spectrum of strategies for fabricating new composites through incorporating contrasting platelets.

**BIO**

Dr. Rouzbeh Shahsavari is an assistant Professor Rice University who holds a joint appointment at the Department of Civil and Environmental Engineering and Department of Materials Science and NanoEngineering. His research focuses on developing a multi-scale, multi-paradigm materials modeling approach followed by experimental characterizations to study key functional behavior of complex materials, which are critical to the infrastructure underlying the science and technology enterprises of our society. He completed his Ph.D. at MIT, his Master's at McGill University and his B.S. at Sharif University. Dr. Shahsavari is the recipient of several prestigious awards in both academia and entrepreneurship including Stephen Brunauer award for the best paper in the American Ceramic Society, MIT \$100,000 Grand Prize in Entrepreneurship Contest, Silver Medal in Material Research Society, etc.

Refreshments will be served at 3:45 p.m.

Hosted by Mohammad Naraghi