PhD Dissertation Defense Announcement
Mechanical and Aerospace Engineering Department
University of Texas at Arlington

MICROSTRUCTURALLY TAILORED COMPOSITE MATERIALS
IMPROVING VERTICAL LIFT STRUCTURAL PERFORMANCE

By

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Abstract

Carbon fiber-reinforced composites are increasingly used in aerospace application thanks to their excellent specific stiffness and strength. However, incomplete understanding of their failure behaviors leads to composite components often being designed with a high Safety Factor, limiting their advantages. Using computational methods, this project seeks a better understanding and an improvement of composite material performances.

Microscale residual stress is known to affect composite strengths. This project proposes a new method for the assessment of microscale residual stress in composite matrix. The new method is based on the fiber push-out experiment that creates local matrix deformation induced by the relaxed stress and evaluation by the Finite Element Method Updating technique for the inverse characterization of residual stress field in the corresponding specimen.

Literature review and FE modeling results identified the Interfacial Shear Strength (IFSS) as a key material property affecting composite strength. Meanwhile, the IFSS measurement using the standard push-out method suffers from several unwanted effects, potentially lowering its accuracy. These effects were analyzed using FE modeling. Notably, the results suggest that the effect of microscale residual stress on the IFSS measurement is rather insignificant.