

# MAE Seminar SERIES

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## ZOOM INFORMATION

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**Dr. Rudraprasad  
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## MULTISCALE MODELING FOR PROGRESSIVE DAMAGE ANALYSIS OF COMPOSITE LAMINATES

### ABSTRACT

Carbon Fiber Reinforced Polymer (CFRP) composites are gaining momentum in various engineering disciplines, especially in the aerospace industry. The conventional design and certification of aerospace composite structures require the extensive use of experimental data for a range of specimens, from coupons to full-scale prototypes. Apart from experimental testing being expensive and time-consuming, this approach is prone to over-conservative design. Due to lack of understanding of damage initiation and growth, conventional composite airframe designs cannot fully capitalize on the weight and performance gains that are possible with composites. The potential benefits of incorporating predictive failure modeling and simulation methodologies in aircraft design, certification, and maintenance processes are recently being recognized due to progressive damage analysis. Progressive damage analysis is a broad term applied to modeling methodologies that allow for the prediction of the initiation and evolution of damage. In this talk, progressive damage analysis of composite laminates will be discussed with a focus on a concurrent multiscale modeling technique. In addition to the deterministic approach of composite laminate analysis the stochastic approach will also be presented. The highlights of this presentation are: (i) constitutive model development for constituent materials, (ii) computational and numerical aspects of modeling framework, and (iii) uncertainty quantification.

### BIO SKETCH

Dr. Rudraprasad Bhattacharyya has over fifteen years of experience in research, analysis, design, and teaching of structural systems. He has expertise in damage mechanics, multiscale modeling, nonlinear dynamic analysis of structures under blast loading and uncertainty quantification. Dr. Bhattacharyya has worked on multiple research projects sponsored by Air Force Research Laboratory. Currently, he is working on a research project sponsored by the Department of Transportation Pipeline and Hazardous Materials Safety Administration (PHMSA) regarding development of guidance on the potential cascading effects from flammable Vapor Cloud Explosions (VCE) at Liquefied Natural Gas (LNG) facilities. Rudraprasad got his PhD from Vanderbilt University, MS from IIT Kharagpur and BE from BESU Shibpur (Currently, IEST Shibpur). Dr. Bhattacharyya is a registered professional engineer (PE) in the states of Tennessee and Texas. He is a member of American Society of Civil Engineers (ASCE) and American Society of Mechanical Engineers (ASME). Currently he is a member of the Executive Committee of Structural Engineering Institute's (SEI) Global Activity Division and Computational Mechanics committee of Engineering Mechanics Institute (EMI). He is a Fellow member of ASCE SEI. Dr. Bhattacharyya was a recipient of ASCE's '2017 Edmund Friedman Young Engineer Award' and Institution of Engineers India's 'Young Engineers Award for 2014-2015'.



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