Department of Structural Engineering
University of California, San Diego
SE 290 Seminar

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University of Arizona

"Electric Field Effects in Fiber Reinforced Polymer Matrix Composite Structures: from Low-field Damage Sensing to High-field Lightning Protection Applications"
Wednesday, October 10, 2018
12:00 pm - 12:50 pm, Pepper Canyon Hall, Room 122

https://structures.ucsd.edu/seminars

Abstract

This talk discusses on the behavior of fiber reinforced polymer matrix composites subjected to electric fields ranging from the low-magnitude fields encountered in damage sensing applications to the extremely high-magnitude fields occurring during lightning strikes. First, electrical characterization methods for carbon fiber reinforced polymer (CFRP) composites subjected to a variety of electric fields will be presented. Extensive experimental studies of the electrical response and damage sensing capabilities of continuous carbon fiber reinforced and textile composites subjected to low-velocity impact will be discussed. The effective conducting thickness concept and a methodology for building finite element (FE) models of electrically anisotropic CFRP materials will be discussed along with its integration with quasi-static FE models for predicting and sensing impact-induced delamination in laminated composites. The second part of the talk will focus on the behavior of composites under extreme electromagnetic fields that arise during lightning strikes. Physics-based models that describe electric and thermal fields and include surface interaction between a lightning channel and a composite structure will be introduced. The models include: (i) spatial and temporal evolution of the lightning channel as a function of the electric current waveform; (ii) temporary and spatially non-uniform heat flux generated at the composite structure; (iii) nonlinear transient heat transfer problem formulation for layered anisotropic composites that accounts for temperature-dependent material properties, a moving boundary of the expanding lightning channel, and phase transition moving boundary associated with instantaneous material removal due to sublimation. Computational algorithms for the multi-layer composite laminates will be discussed.

Biography

Dr. Zhupanska is a Professor in the Department of Aerospace and Mechanical Engineering at the University of Arizona. She received her Ph.D. in Mechanics of Solids and Applied Mathematics from Kiev University (Kiev, Ukraine) in 2000. Dr. Zhupanska's research interests are in the general area of mechanics of solids with a particular emphasis on mechanics of composites, multiphysics problems related to composites, and contact mechanics. Her work has been recognized by a number of awards including the DARPA Young Faculty Award, ASME/Boeing Award, and National Research Council (NRC) Senior Research Associateship Award. She is Fellow of ASME and Associate Fellow of AIAA.

Sponsored by Professor Hyonny Kim
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