Announcing the Final Examination of Jayden Beyrooti for the degree of Master of Science

Time & Location: November 4, 2019 at 4:00 PM in Harris Engineering Center 450
Title: Piezoresistive Behavior of Carbon Nanopaper Polymer Composites for Strain Sensing

Carbon nanopapers made of carbon nanotubes (CNTs) or carbon nanofibers (CNFs), possess unique electrical, thermal and mechanical properties and when integrated with a polymer matrix, can become a multifunctional composite capable of strain sensing and heat actuation. Smart structures such as these can be used in many applications including deployable space structures, human motion detection, and structural health monitoring as a flexible, sensitive and stable strain sensor in addition to providing electrical heat actuation for the shape memory effect in polymers. This study focuses on strain sensing capabilities by developing a numerical model to predict piezoresistive behavior. The piezoresistive effect is a change in resistivity of a conductive network when a deformation is applied. This allows strain to be determined by simply measuring the electrical resistance. An equivalent resistor network can be formed to represent the fiber network. The proposed 2D model generates randomly oriented fibers inside a control area, determines their intersection points, and creates a mesh of the network for finite element analysis. Electrical conductivity is found for the initial and deformed fiber states by determining the current through the network for a known voltage. A piezoresistivity experimental study is conducted to investigate the strain sensing abilities of this material and validate model results. This simple model provides an initial framework that can be developed in future work. Despite its 2D nature, the model captures the governing mechanisms of piezoresistivity to a certain extent.

Major: Mechanical Engineering

Educational Career:
Bachelor's of Mechanical Engineering, BS, 2017, University of Central Florida

Committee in Charge:
Kawai Kwok, Chair, Mechanical & Aerospace Engineering
Jihua Gou, Mechanical & Aerospace Engineering
Jeffrey Kauffman, Mechanical & Aerospace Engineering

Approved for distribution by Kawai Kwok, Committee Chair, on January 17, 2021.

The public is welcome to attend.