ENGINEERING ASPECTS OF DESIGNING WITH PULTRUDED CARBON-FIBER COMPOSITES

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Abstract

The use of lightweight, high strength, materials is becoming more common within the automotive industry due to the effort to reduce vehicle emissions and increase fuel economy. Often times a composite component can be used to replace a metallic component, providing a significant reduction in weight while providing little or no loss in strength or stiffness. For automotive engineers to further utilize composites in new applications, it is important to understand and characterize its mechanical performance. This paper focuses on evaluating quasi-static and fatigue characteristics under tension and compression along the principal load direction of a carbon fiber/epoxy pultruded composite. Utilizing finite element modeling techniques, the quasi-static behavior of the composite, including failure, was captured. A micro-mechanics model was utilized to derive the homogenized material properties of the composite from its constituent materials. These properties were then incorporated into macro-mechanics models to capture the tensile and compression behavior of the pultruded beam. The combined experimental and micro/macro-mechanics based approach was found to be an effective tool for characterizing the constitutive behavior of the composite for application development engineering.