INCORPORATION OF DIRECTIONALLY DEPENDANT DIFFUSION WITH POLYMER COMPOSITE FLOW THEORY

David Abram Jack
Dr. Stephen Montgomery-Smith, Thesis Supervisor

ABSTRACT

The extensive industrial use of short-fiber reinforced polymer composites demands an accurate understanding of fiber orientation kinematics. There is a growing concern in recent literature with the popular Folgar and Tucker (1984) model for the transient fiber orientation analysis. As the reliability and repeatability of the material behavior from the fabrication procedure advances, the demand for accurate models for use in design processes beyond the current methods has become increasingly important.

A model to incorporate the directional nature of fiber interactions through the introduction of directional diffusion is presented, and the fiber orientation tensor flow equations are developed based upon the directional diffusion model. The model satisfies the desired characteristics, both to decrease fiber alignment rates and steady state orientation results at the cost of requiring orientation tensors up to the tenth-order. Future work will incorporate experimental results with the proposed model to produce acceptable results for industrial applications.