Public Abstract

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Graduation Term:FS 2006

Department:Mathematics

Degree:MS

Title:Incorporation of Directionally Dependant Diffusion with Polymer Composite Flow Theory

The extensive use of short-fiber reinforced polymer composites in industrial use demands an accurate understanding of the fiber orientation analysis. There is a growing concern in recent literature with the accuracy of the results from the popular Folgar and Tucker (1984) model for the history of fiber orientation. As technology within the industrial process advances, and products can be reliably manufactured with consistent material behavior, the demand for accurate models for use in design processes beyond the current methods has become increasingly important.

A directionally dependant diffusion model is investigated based upon the observation made by Folgar and Tucker in their original work that fiber collision rates are different for random orientations versus aligned orientations. This work develops the fiber orientation flow equations based upon the directionally dependant diffusion model introduced and developed within this work. Results demonstrate that the orientation behavior predicted from the developed model has a greater accuracy in representing the physical orientation state than existing theories. This increased accuracy will allow the product and process analysis in the industrial setting to be streamlined thereby decreasing the developmental costs for design.