Introduction

The use of new polymers for thermoplastic composites potentially offers an increase in performance combined with a decrease in cost. A thorough understanding of the production process is required to develop an optimal processing route for these novel thermoplastic composites.

Process description

Thermoplastic resin needs to infiltrate into a dry fabric during the consolidation process of flat fabric reinforced composite plates. This is a complex process with various interrelated phenomena, as shown in figure 1.

The applied pressure not only forces the matrix material to infiltrate into the fabric, but also alters the infiltration kinetics by deforming the compliant fabric. The process temperature significantly affects the viscosity of the plastic. Impregnation will improve at higher temperature, and conversely, heat transfer will improve as impregnation proceeds.

Objectives

The first objective is an improved understanding of the phenomena involved and how they are related to each other. The second objective is the development of a simplified impregnation model. This design tool will shorten the time to market for new thermoplastic composite materials.

Future work

Michaud and Månson [1] divide the consolidation process in three steps, shown in figure 2: (i) infiltration of the preform by the liquid polymer, (ii) preform relaxation and (iii) preform equilibration. The simplifying assumption of a homogeneous permeability will be replaced by an analysis at meso level, considering the flow around the fibre tows. A Darcy flow solver with fabric architecture as input will be developed.

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References