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Modeling Resin Transfer Molding (RTM) using LS-DYNA

Resin Transfer Molding (RTM) is a closed mold process for making composite materials. The manufacturing process consists of:

1. Laying a fiber (e.g., glass, carbon) mat inside a mold cavity
2. Injecting a resin to fill the voids in the fiber mat
3. Creating an environment for the resin to cure

This discussion focuses on using LS-DYNA to model step 2. The objective is to determine the progression of the resin front position and identify hard-to-fill regions. Resin flow through the fiber mat is described by Darcy's law. Darcy's law is a phenomenological derived constitutive equation that describes the flow of a fluid through a porous medium. It is analogous to Fourier's law in the field of heat conduction. There are many papers in the literature presenting methodologies on how to use FE heat transfer codes to model porous media flow. A significant drawback to this approach is the lack of a direct computational method to predict the flow front position which is the primary objective of the calculation. LS-DYNA can predict the flow front position using an ALE computational method. An ALE modeling methodology will be presented along with techniques to decrease the computation time.