# Modeling and Simulation of Liquid Composite Molding using LIMS

M. Deleglise, C. Binetruy and P. Krawczak
Ecole des Mines de Douai, Technology of Polymers and Composites Department

## ABSTRACT

Liquid Compression Molding is a fast Liquid Composite Molding (LCM) process, in which the mold is kept slightly open during the resin injection stage. A gap is created between the fiber perform and the mold allowing the resin to flow mainly in the plane direction to fill up the open region. Once the desired amount of resin is injected, the mold is slowly closed and the resin is forced to impregnate the remaining dry fibrous medium in the thickness direction. During the compression phase, the fiber perform is deformed and the excess of resin is squeezed out of the saturated perform under high pressure. The main advantages of this process as compared to RTM are the reduction of the mold filling time and the elimination of trapped air due to high compression pressure.

Simulation of this process implies to be able to simulate the compression stage, which includes the flow of resin through the preform while the preform is being deformed. Injection-compression is simulated using LIMS, an open code for LCM simulation initially developed at the Center for Composite Materials (Delaware, USA) for the simulation of flow through immobile and non-deformable porous media. It is a finite element based injection code that uses a control volume approach. Since the code allows one to change simulation input parameters at any time, a dedicated compression subroutine is inserted between each calculation step.
This subroutine changes the geometry of the part between each calculation step and tracks the fluid pressure and flow during the injection. In addition, the load applied on the preform can be calculated, knowing the compressive stress/strain behavior of the dry and wetted preform under compression. Those data are implemented from experimental results based on compression tests on dry and wetted fiber preform.

This numerical tool thus allows one to simulate compression of a wetted preform, compression driven flow, deformation of a material under fluid pressure or a combination of those. Comparison between simulation results and experimental injections are presented and discussed.