USE OF SLIC FOR DESIGN OF DISTRIBUTION MEDIA LAY-UP IN VARTM

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MOTIVATION

✓ Why do we need to optimize distribution media lay-up?
- ◊ To minimize filling time.
- ◊ To avoid dry spot formations.

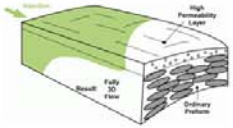
✓ Why do we need a simulation based approach to do that?
- ◊ To reduce design cost and time!!!
- ◊ To find optimized solution.

✓ What were the goals to achieve?

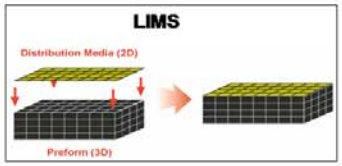
To develop and validate a simulation based software making it easy for the designer to optimize infusion gates and vents location, and distribution media lay-up with respect to the fill time and void content.

VARTM MODELING WITH LIMS

Challenge: the use of highly permeable distribution media (DM), which generates measurable 3D flow during filling although the part geometry is usually very thin.

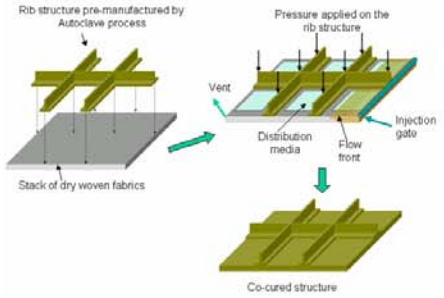


The combination of 2D and 3D elements in LIMS allows the user to model the distribution media as a 2D structure placed on top of 3D preforms.



CASE STUDY

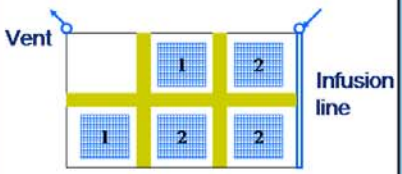
The goal was to benchmark the current way of designing the DM lay-up, which consists of a trial and error approach, with our simulation based approach for this rib assembly.



How to optimize DM lay-up using simulation and process models?

INTUITIVE APPROACH - EXPERT GUESS

After 5 trial and error approach, the following DM lay-up resulted in a void content of 0.851% and a filling time of 12min.



Unsymmetrical flow is introduced using a point vent.

SIMULATION-BASED APPROACH TO OPTIMIZE DISTRIBUTION MEDIA LAY UP

Simulation based approach

AUTOMATED DESIGN

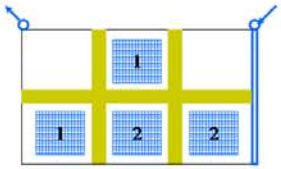
- Selection of Initial Gate and Vent Locations
- Location of Resin Detection Sensors
- Injection Location for Auxiliary Gates
- Creation of Sensing and Control Instructions
- Optimization of the Flow Distribution Network

AutoRTM (Implementation Software)

Intelligent LCM (RTM/VARTM) Automation

OPTIMUM LAY-UP FROM THE SIMULATION-BASED APPROACH

After 1 trial, the simulation based approach optimized the DM lay-up as shown below (void content: 0.051%, 13min fill)



CONCLUSIONS

	Dry spot content	Fill time	Number of experiments
Trial-and-error intuitive design	0.851%	11.87 min	5
Simulation-based design	0.052%		1

1. The flow distribution network has substantial influence on the VARTM process.
2. By using flow simulation and genetic algorithms, SLIC can optimize the flow distribution network design.
3. The design from SLIC has been experimentally validated.