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INTRODUCTION

Objective:

Liquid Composite Molding (LCM) simulation of structural parts with a complex and compound curvature using bidirectional woven fabrics reinforcements .

Issue:

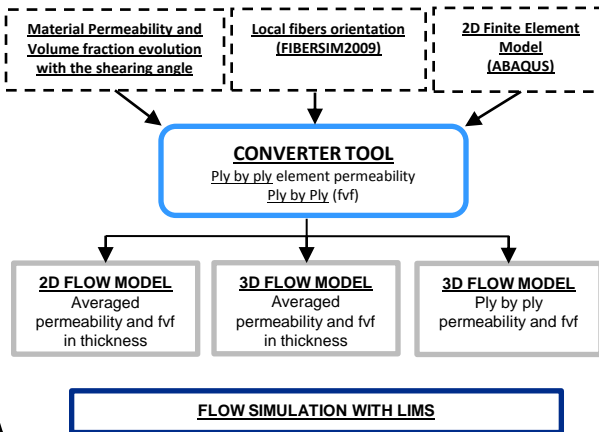
This type of reinforcements undergoes a certain amount of deformation which may significantly affect the local values of permeability and fiber volume fraction (fvf).

Approach:

Following three modeling approaches are conducted and the results are compared :

- 3D flow simulation in which each sheared layer of fabric is assigned a permeability and a fvf based on the local shear.
- 3D flow simulation in which the permeability and the fvf of all the layers through the thickness is averaged.
- 2D flow simulation in which the permeability and the fvf of the various layers is averaged.

METHOD



CASE STUDY

- One material: Bidirectional woven fabrics with high shearing effect.
- One quasi-isotropic lay-up: [0;45;-45;90;90;-45;45;0]
- Two parts: To emphasize layup and shearing effect.

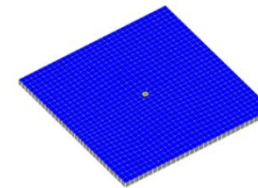
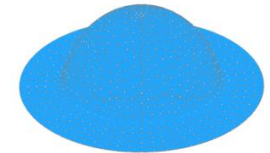
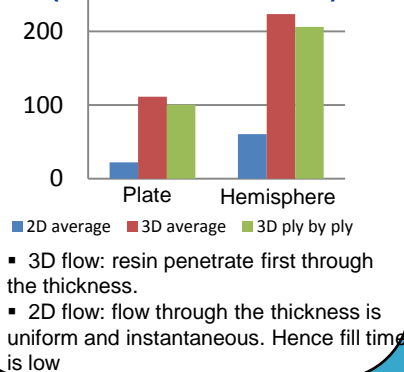


PLATE :
No shearing
Only layup effect

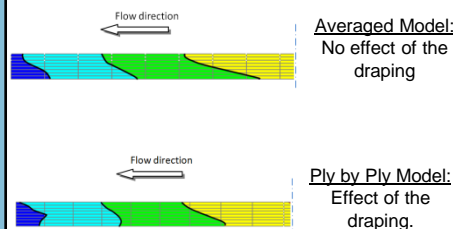


HEMISPHERE :
Layup and shearing due to draping effects

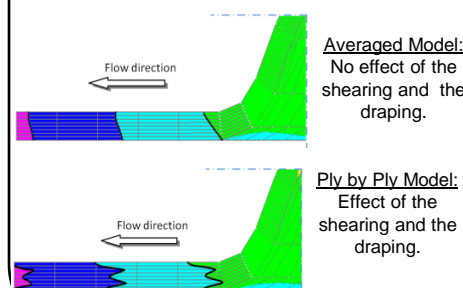
RESULTS: FILLING TIME (time to fill in seconds)



RESULTS :THROUGH THE THICKNESS FLOW PATTERN: PLATE



RESULTS: THROUGH THE THICKNESS FLOW PATTERN: HEMISPHERE



CONCLUSIONS

- With the ply by ply model, the effects of the shearing and the draping are clearly visible and potential defects can occur due to non-uniform flow through the thickness..
- Three dimensional modeling is important and necessary to predict the fill time when the injection gate is restricted to one of the surfaces.

ACKNOWLEDGEMENTS

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