Finite Element Modelling of Textile Composites’ Deformation

Xiaochuan (Ric) Sun, Adam Thompson, Bassam El Said and Stephen Hallett

Woven composites with different weave designs present complex internal fibre architecture and high manufacturing variabilities. There is a strong need for numerical models with high fidelity and accuracy, to fully represent the forming response of such materials and to ensure consistent quality and performance in their production. This poster presents the current modelling capability for textile composites deformation at the Bristol Composite Institute (ACCIS) and highlights different modelling techniques for simulating composite manufacturing processes and arising defects, which can affect the mechanical performance of 2D and 3D woven composites.

2D Plain Weave Fabric Forming Simulation with Different Techniques

- Each fibre yarn is modelled by a bundle of beam element
- Highest fidelity level for detailed analysis

Mesoscale Beam

- Macroscale model with shell and membrane elements with user defined material model
- Most computationally efficient

Mesoscale 3D Shell

3D Layer-to-Layer Weave Generation by In-House Finite Element Code SimTex

- Macroscale model with shell and membrane elements with user defined material model
- As-woven yarn cross-sections are obtained from mesoscale beam model

3D Layer-to-Layer Woven Forming on Curved Geometry

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