

The Problem in the Thickness Direction for 2-D Fabric Composites

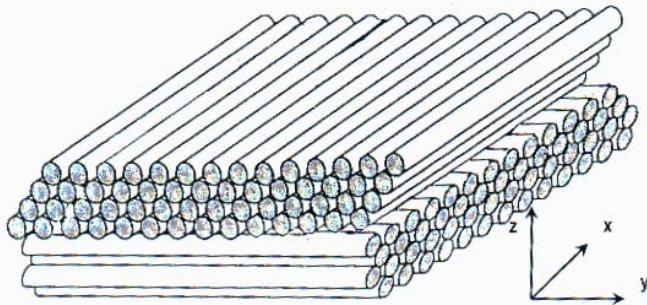
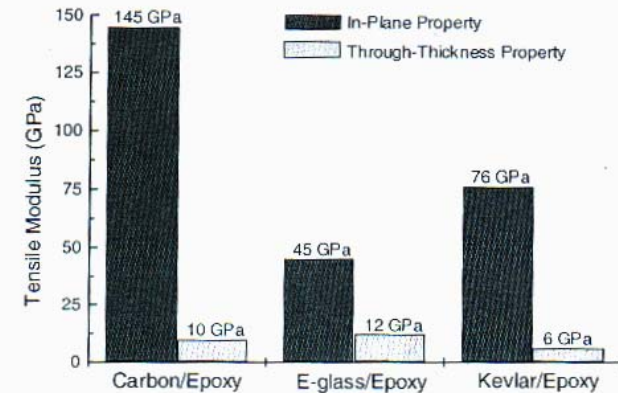


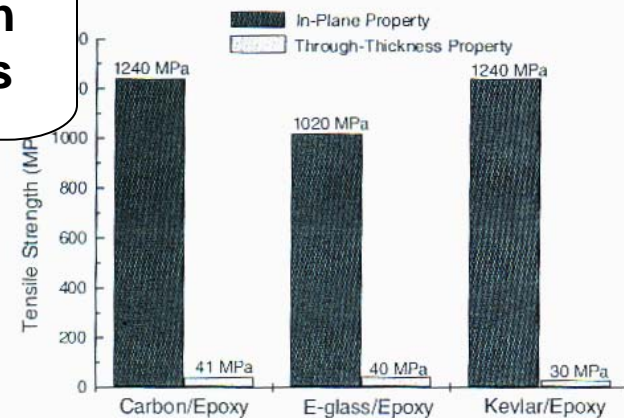
Figure 1.1 Schematic of the fibre structure to a 2D laminate



(a)

High Strength and Stiffness

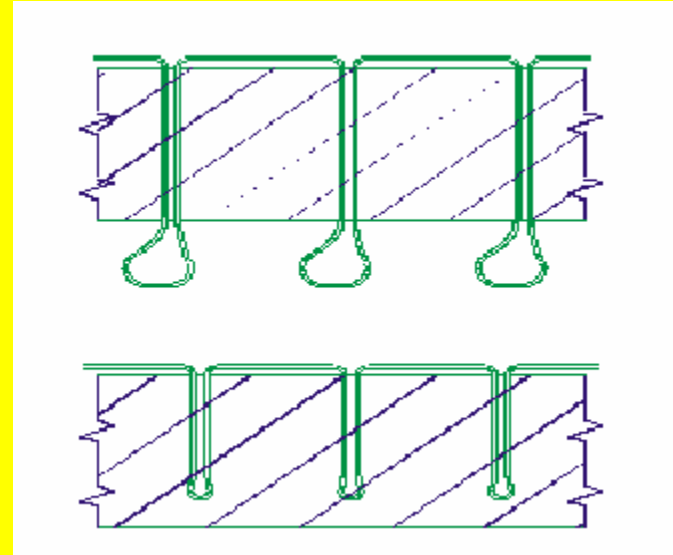
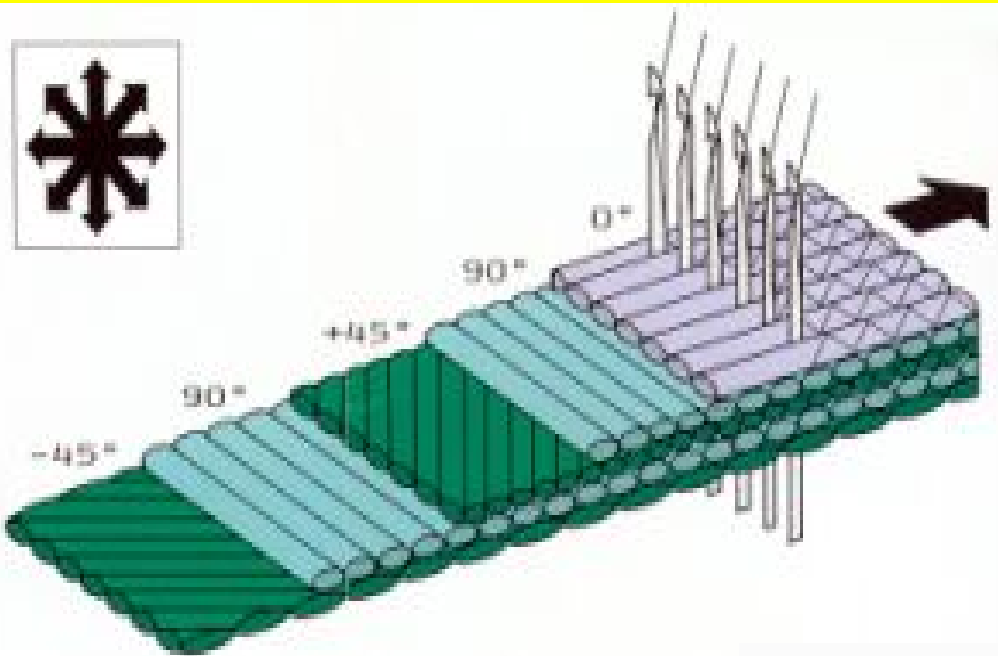
Low Strength and Stiffness



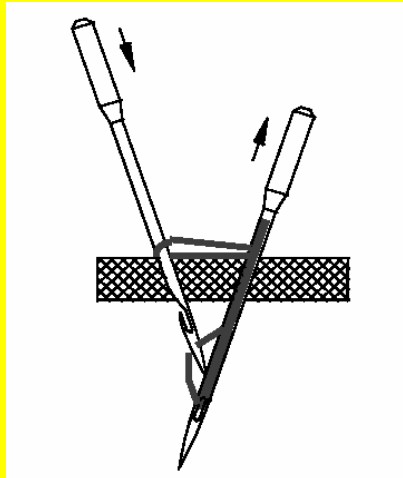
(b)

Figure 1.2 Comparison of in-plane and through-thickness mechanical properties of some engineering composites.

Solution: 3-D Stitching Fabric



Stitch Patterns thru a Composite Laminate



Liang, 2004

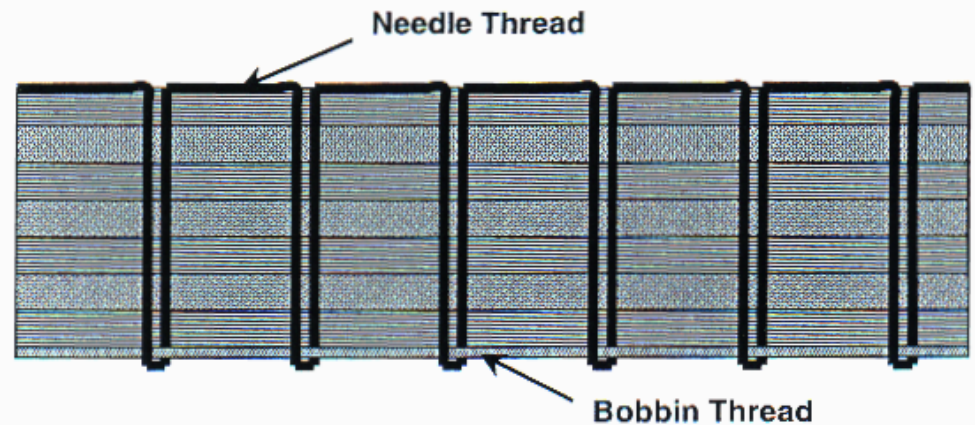
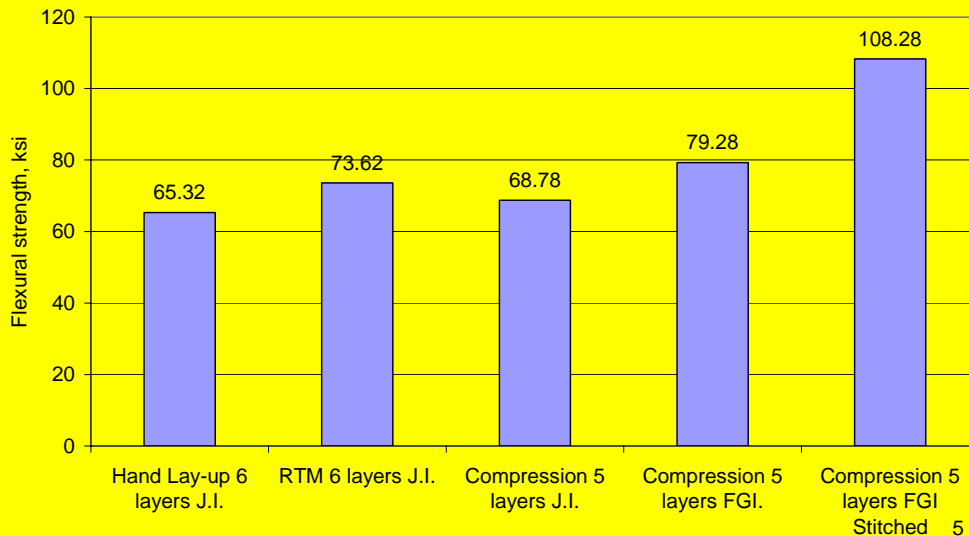


Figure 2.31 Illustration of a stitch pattern through a composite laminate

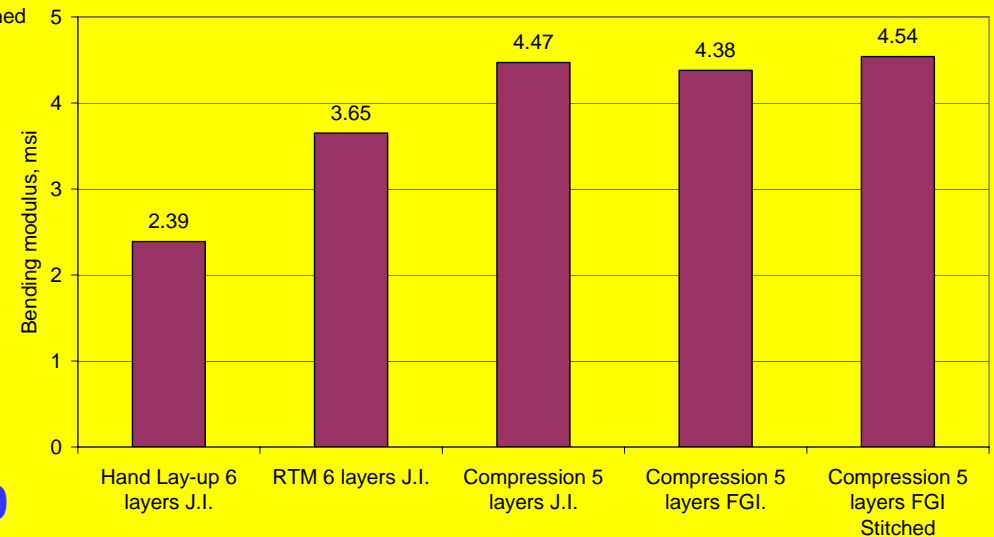
3-D Stitching of Fabric for Higher Damage Tolerance Composites

Effect of manufacturing method on the bending failure strength of laminates



- Ashland Hetron 922L-25 vinyl ester
- FGI S2400A2 E-glass
- Typical FVF for 5 layers 57.9% (73.8 wt%)
- Various fabric configurations studied
- Stitching parameters investigated

Effect of manufacturing method on the bending modulus of laminates



Three Point Bending Test ASTM D-790