Accounting for sheared textile composite unit cell properties in macro scale FE simulations

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Shear is the dominant deformation mechanism in the forming process, as the 2D fabric conforms to 3D shapes. This change in fabric geometry is carried through the consolidation process and is locked into the finished, cured, composite component. This changes the local material behaviour and is generally not taken into account in mechanical performance simulations at component level. Including the effect of shear may improve the accuracy of macro-scale simulations.

Shear is when the fibres rotate away from the original orthogonal axes.

The shear orientation direction, where the fibres rotate to, have the highest Young’s modulus at high shear angle.

Young’s modulus in the direction of shear orientation

Simple linear elastic analysis for model (a) and (b). Difference in in-plane strain can be as high as 20%