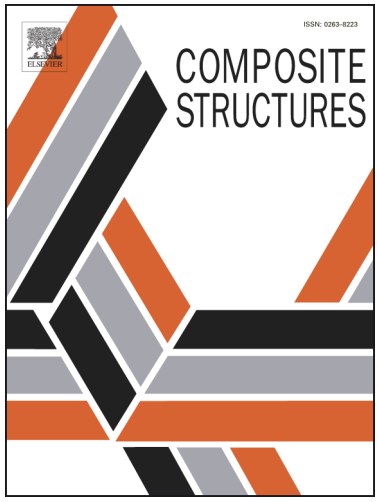

The effect of off-axis angles on the mesoscale deformation response and failure behavior of an orthotropic textile carbon-epoxy composite

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The effect of off-axis angles on the mesoscale deformation response and failure behavior of an orthotropic textile carbon-epoxy composite

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Abstract:

The deformation response and failure behavior of an orthotropic textile carbon-epoxy composite were investigated under off-axis tensile loading. Digital image correlation (DIC) was utilized to effectively capture the full-field and mesoscale strain distribution. The macroscale mechanical performance was strongly sensitive to the fiber bundles orientation relative to the loading direction. Based on the experimental data, a quantitative relation between the rotation angle and off-axis angle was established, and a negative correlation between the failure strength and the rotation angle was observed. The underlying failure mechanisms of the specimens with different off-axis orientations were analyzed using scanning electron microscopy (SEM) and DIC techniques. The load-bearing mechanisms were different between the on- and off-axis cases. High local shear strain eventually resulted in the brushy shear-type fracture in the off-axis case, and the local micro cracks developed during the loading caused the reduction and imbalance of local load-bearing capacity.

Keywords: Textile composites; Off-axis tension; Digital image correlation(DIC); Deformation response; Failure strength; Fracture morphology.