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STRAIN RATE DEPENDENCY OF UNIDIRECTIONAL COMPOSITE PLIES IN COMPRESSIVE LOADING

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Fibre-reinforced polymer composites are widely used in structural applications due to their specific stiffness and strength. However, some applications of composite materials involve dynamically loaded components and structure. For example, automobile crashes, bird strikes on aeroplane etc where the dynamic behaviour of composites is not very well understood. To address this demand, we present a novel transversely - isotropic viscoelastic-viscoplastic constitutive model for a unidirectional carbon-epoxy composite. The model applies to the ply scale and it is based on a structural tensor-based formulation along the lines set out in Larsson et al [1] for the representation of fibre compression/extension and shear.

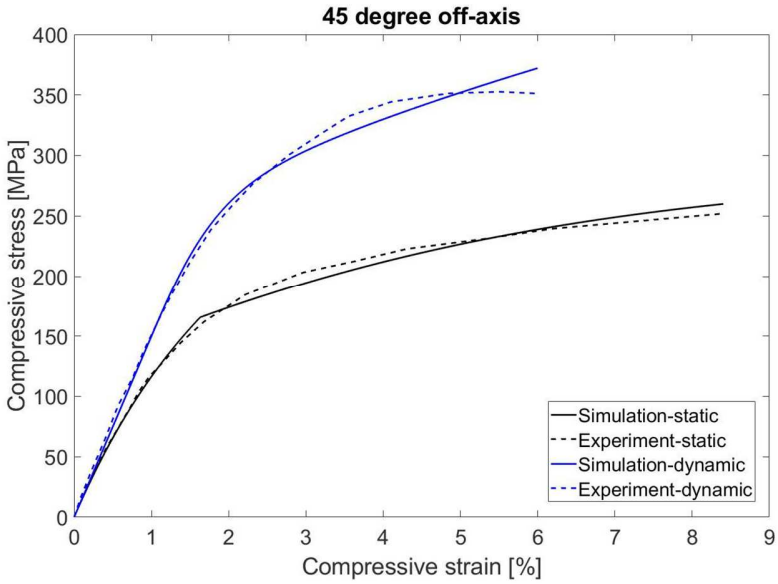

Figure 1. Model validation with quasi-static & dynamic response from off-axis compression test in [2].

In this paper, the pressure dependence of the onset of plastic yielding in matrix shear dominated response under compressive loading of the ply has been considered. The present formulation is applied to capture the non-linear rate dependent anisotropic ply behaviour under quasi-static and dynamic loading. As shown in Figure 1, the model predicts a good correlation between measured and numerical stress – strain response of IM7-8552 material system in compression [2].

[1] Larsson *et al.* (2018). *Mechanics of Materials*. **127**, 77-90.
[2] Koerber *et al.* (2010). *Mechanics of Materials*. **42**:1004-1019.