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Measurements and predictions of the viscoelastic properties of a composite lamina and their sensitivity to temperature and frequency

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ABSTRACT

We perform finite element analysis of the mechanical response of random RVEs representing the microstructure of a unidirectional (UD) fibre composite, predicting its anisotropic stiffness and damping properties and their sensitivity to temperature and frequency, using as inputs only the measured response of the constituents. The simulations are validated by DMTA measurements on a UD composite; then, the numerical predictions are compared to those of previously published theoretical models. New equations are proposed to predict the viscoelastic constants, providing better accuracy than existing models. The accuracy of these new equations is tested, over wide ranges of fibre volume fractions and stiffness ratios of the constituents, against the numerical predictions.

Keywords: Microstructure, Vibrations, Viscoelastic, Composite, Finite Elements.

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