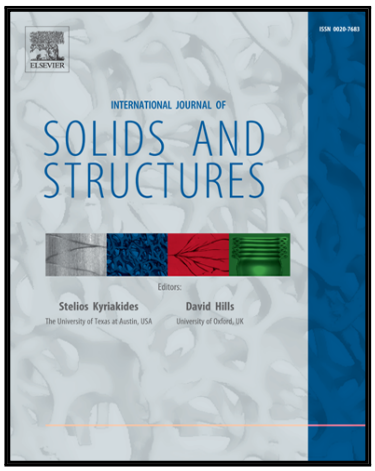

Hyperelastic constitutive modeling with exponential decay and application to a viscoelastic adhesive

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Hyperelastic constitutive modeling with exponential decay and application to a viscoelastic adhesive

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Abstract

Hyperelastic materials models are well established to describe the non-linear stress-strain relations of elastomers. In this paper, a polyurethane adhesive is considered as an exemplary material and subjected to tensile, compressive and shear tests. Conventional hyperelastic models are unable to capture the mechanical behaviour satisfyingly: If the model agrees with the test results at large strains, it underestimates the stiffness at low strains significantly. We propose a model extension to describe a kind of exponential decay of stiffness which bears some similarity with a specific model developed by Yeoh. The new hyperelastic model is coupled with linear viscoelasticity to account for the strain rate dependence observed for the tested material.

The model parameters are identified using a tensile test at a single strain rate only and a creep test. Furthermore, the compressibility is determined by comparison of the stiffness in two butt joint tests with different aspect rations of the adhesive layer. Using this parameter set the new model provides a very

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