THE THERMORHEOLOGICALLY COMPLEX MATERIAL

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ABSTRACT

An approximate quantum mechanical description of molecular energy transitions leads to fractional order time derivative descriptions of linear viscoelastic stress relaxation in polymers. The resulting fractional calculus stress-strain constitutive laws are mathematically compact and suitable for rheological and engineering analyses. The mathematical form of the models suggests a modification to the thermorheologically simple material that enables the description of temperature-dependent changes to the shape of curves representing a material's modulus in the transition region. The fractional calculus models are seen to be extensions of the traditional exponential models of stress relaxation.

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