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Nonlinear Schapery viscoelastic material model for thermoplastic polymers

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The application of polymer-based composites has increased significantly in the last years due to their potential as low-weight materials, combining low weight with high specific stiffness and strength, accompanied by design freedom for structural parts. Herein, thermosets and thermoplastics are often used as polymeric matrix. Regarding thermoplastic polymers, the solid material behavior is characterized by pronounced thermo-viscoelastic material properties. Based on dynamic mechanical analysis (DMA) tests, the isochronous stress-strain curves indicate a nonlinear viscoelastic material response. This nonlinear viscoelastic material behavior is modeled based on the Schapery integral model [1] containing internal variables. In this context, a one-dimensional formulation with strain-dependent nonlinear functions for a sinusoidal load case is presented. In addition to the viscoelastic storage and loss modulus, the higher order harmonic oscillations in the stress response are compared to experimental data from Fourier transform rheology of Polyamide 6 (PA6) and discussed [2].

REFERENCES

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