MODELING THE ELASTO-VISCOPLASTIC THIXOTROPIC BEHAVIOR OF STRUCTURED FLUIDS

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A constitutive model for structured fluids is presented. Its predictive capability includes thixotropy, viscoelasticity and yielding behavior. It is composed by two differential equations, one for the stress and the other for the structure parameter - a scalar quantity that represents the structuring level of the fluid. The equation for stress is obtained in accordance with a simple mechanical analog composed by a structuring-level-dependent Maxwell element in parallel with a Newtonian element, leading to an equation of the same form of the Jeffreys (or Oldroyd-B) equation. The relaxation and retardation times that arise are functions of the structure parameter. The ideas found in de Souza Mendes, J. Non-Newtonian Fluid Mech, 2009, vol.164, 66 are employed for the structure parameter equation as well as for the dependencies on the structure parameter of the structural viscosity and structural shear modulus. The model is employed in constant-rate, constant-stress, and oscillatory shear flows, and its predictive capability is shown to be excellent for all cases.