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The dynamics of a simple model for a yield stress fluid[1] YURIKO RENARDY, Virginia Tech, KARA MAKI, University of Minnesota — A simple model for a yield stress fluid is obtained from Larson's partially extending convection (PEC) strand model by replacing the zero shear stress limit for large shear rates with a non-negative limit (PECR), and augmenting with a Newtonian solvent (PECR-N). The constitutive behavior of PECR-N exhibits the typical non-monotonic shear stress versus shear rate behavior which allows for yielding to occur above a critical value of applied stress. The experimental determination of yield stress can be complicated by extremely slow yielding which may occur for a range of applied stresses. We therefore focus on the case where the elastic time scale is large compared with the viscous time scale and study the evolution of the conformation tensor for parallel shear flow with prescribed shear stress. The resulting dynamical system is solved both numerically and with asymptotic methods to clarify the different types of solution behavior. We find that multiple time scales are responsible for the path to transition from a fast curve, landing on a slow manifold, and escaping to yielded states which are steady or time-periodic. Novel solution types will be discussed.

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