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Simulations in Agreement With Experiments Confirm That Blood Plasma Exhibits A Pronounced Viscoelastic Behavior.[1] JOHN TSAMOPOULOS, STYLIANOS VARCHANIS, YIANNIS DIMAKOPOULOS, Laboratory of Fluid Mechanics and Rheology, Department of Chemical Engineering, University of Patras, Patras 26500 — Blood plasma is a dilute aquatic solution that contains proteins and hormones such as fibrinogen, cholesterol, etc. Many studies have assumed that it behaves rheologically like a Newtonian fluid. However, more recent experimental observations (Brust et al., 2013) suggest that it exhibits significant viscoelastic effects. Understanding plasma's rheology is of crucial importance as it is well-known that deviations of plasma's shear viscosity from physiological values can indicate serious diseases. In addition, the viscoelastic character of the blood solvent should be taken into consideration as it can have a great impact on hemodynamics, especially in very narrow or stenotic microvessels. We investigate the capability of e-PTT model, which is a widely used constitutive model for macromolecular solutions, to predict inhomogeneous flows of plasma in 1) a capillary breakup extensional rheometer (CABER), using a 2D axisymmetric model and 2) a microfluidic contraction-expansion device, solving the full 3D transient governing equations. Although we use a single-mode approximation, the results are in very good agreement with the experiments, because they predict important features of blood plasma's flow, such as the bead-on-a-string formation in CABER and elongational thinning in the 3D flow.

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