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Title: Asymptotic and Numerical Investigations on viscoelastic fluid flows

Abstract: Viscoelastic flow with singularities is a challenge in the area of computational fluid dynamics, since the presence of singularities can result in spurious solutions or simulation breakdown. Furthermore, for such flows, analytical solutions are not known. However, through the use of asymptotic analysis it is possible to obtain some analytical progress in such flows. In this sense, this study determines the asymptotic behavior of the stress tensor which describes the viscoelastic fluids. In particular, we have investigated the stick-slip flow which is a benchmark problem for studying the effect of singularities. In addition, boundary layer equations were determined in the stick and slip boundary layer regions. Our investigations included comparison between the asymptotic and numerical solutions in a transient fluid flow considering different viscoelastic models. The results of this study aim to bring more understanding on the behavior of stresses close to the singularity, as well as guide the construction of stable and accurate numerical methods.