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Viscoelastic Fluid Flows in a Falling Cylinder Viscometer and the Evaluation of Shear Viscosity

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In this paper we consider the problem of a falling cylinder viscometer filled with a viscoelastic fluid (second grade fluid, third grade fluid and a class of second order fluid respectively). If the problem for a second grade fluid is similar to the problem for a linear viscous fluid, largely discussed in Cristescu and all [1], the coresponding boundary value problems for a third grade fluid and for a second order fluid are different. We prove the existence and uniqueness of the solutions (which are numerically computed) and we graphically compare the obtained results. The differences concerning the velocity field as well as the shear stress are put into evidence. In particular, we remark that the formula obtained for shear viscosity of a third grade fluid can be interpreted as a relation for the determination of the sum $\beta_2 + \beta_3,$ of constitutive moduli, once the shear and plateau viscosities are known.

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