Garimella, Sai Manikiran; **Anand, Mohan**; **Rajagopal, Kumbakonam R.**
Start-up shear flow of a shear-thinning fluid that approximates the response of viscoplastic fluids. (English) [Zbl 07426976]

Summary: In this paper we study a start-up shear flow of a recently proposed model of a shear-thinning fluid that mimics the response of a class of viscoplastic materials, namely the flow between parallel plates, one of which is fixed and the other is started impulsively. In simple shear flows while the generalized viscosity blows up, the shear stress is yet finite and thus the fluid is able to mimic the response of viscoplastic fluids. The analytical solution of the velocity profile is obtained using the semi-inverse approach for a perturbation approximation. The partial differential equation for the perturbation approximation is solved numerically, and compared with the analytical solution in order to validate the numerical scheme. The full equations are then solved numerically and the effect of the various material moduli are assessed by introducing appropriate dimensionless variables.

MSC:

76Axx	Foundations, constitutive equations, rheology, hydrodynamical models of non-fluid phenomena
76Dxx	Incompressible viscous fluids
74Cxx	Plastic materials, materials of stress-rate and internal-variable type

Keywords:

shear-thinning fluid; viscoplastic model; unsteady flow; semi-inverse approach

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