Simulating the flow of Bingham fluids in expansion-contraction geometries: comparison with physical experiments

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We present simulations of the flow of viscoplastic materials in expansion-contraction geometries. We designed a specific parallel code (making use of MUMPS [1]) with Augmented Lagrangian solvers to compute accurately the rigid zones. Structured staggered meshes are used for the discretization in space in order to study their accuracy under heavy mesh refinement. Comparisons with experiments of [2] and [3] are done. We recover interesting features of the velocity fields such as :

- the evolution of the boundary layer width in frustrated regimes,
- the existence of the so called slip line and the Poiseuille-like behaviour of the velocity above this line.

We also give a zoology of plug zones in this geometry and updated views of the structure of the pseudo-plug zones.

Références

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[2] T. Chevalier, S. Rodts, X. Chateau, J. Boujlel, M. Maillard and P. Coussot, *Boundary layer (shear-band) in frustrated viscoplastic flows.* EPL (Europhysics Letters), 102(4):48002, 2013.

[3] L.-H. Luu, P. Philippe and G. Chambon, *Experimental study of the solid-liquid interface in a yield-stress fluid flow upstream of a step.* Physical Review E 91(1):013013, Jan. 2015.

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