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DEVELOPMENT OF A TWO-WAY COUPLED FULLY RESOLVED IMMERSED BOUNDARY METHOD NUMERICAL CODE FOR PARTICLE LADEN VISCOELASTIC FLOWS

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Abstract. *Understanding the behaviour of multiphase flows of solid in viscoelastic fluids is essential in several industrial applications, such as oil sands mining and polymer processing. For this aim, a novel numerical algorithm was implemented on an open-source finite-volume fluid flow solver coupled with an immersed boundary method, to allow the use of viscoelastic constitutive equations on the fluid (continuous) phase. To avoid numerical issues related to high Weissenberg number flows the log-conformation tensor approach can be employed on the newly developed algorithm. The accuracy of the algorithm was evaluated by studying several benchmark flows, namely: (i) the sedimentation of a sphere in a bounded domain surrounded by either Newtonian or viscoelastic fluids; (ii) rotation of a sphere in a homogeneous shear viscoelastic fluid flow; (iii) the cross-stream migration of a neutrally buoyant sphere in a steady Poiseuille flow, considering both Newtonian and viscoelastic suspending fluids. All the results obtained, on the referred case studies, allowed either to replicate the ones available on the published literature, or to describe additional effects promoted by the assumption of viscoelastic behaviour on the continuous phase. To illustrate the potential of the developed code, a newly case study of the shear-induced solid particle alignment in wall-bounded Newtonian and viscoelastic fluids was studied. The role of the fluid rheology and finite gap size on both the approach rate and pathways of the solid particles are described.*

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