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An eXtended Finite Element Method (XFEM) for the simulation of the flow of viscoelastic fluids with suspended particles YOUNG JOON CHOI, MARTIEN HULSEN, HAN MEIJER, Eindhoven University of Technology — We present an eXtended Finite Element Method (XFEM) combined with DEVSS-G/SUPG formulations for the direct numerical simulation of the flow of viscoelastic fluids with suspended rigid particles. In this method, the finite element shape functions are extended through the partition of unity method (PUM) by using virtual degrees of freedom as the enrichment for the description of discontinuities across interface. For the whole computational domain including both the fluid and particles, we use a regular mesh which is not boundary-fitted. Then, the fluid domain and the particle domain are fully decoupled by using the XFEM enrichment procedures. The no-slip boundary condition on the interface between fluid and rigid body is realized by using constraints implemented with Lagrange multipliers. For moving particle problems, we incorporate a temporal arbitrary Lagrangian-Eulerian (ALE) scheme without the need of any re-meshing. Furthermore, local mesh refinements around the interface are achieved using grid deformation methods, in which the number of elements is not increased. We show the motion of a freely moving particle suspended in a Giesekus fluid between two rotating cylinders. We investigate the effect of the Weissenberg number in this problem, and the effects of the mobility parameter and particle size on the migration of particles.

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