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A Numerical Study of Mesh Adaptivity in Multiphase Flows with Non-Newtonian Fluids[1] JAMES PERCIVAL, DIMITRIOS PAVLIDIS, ZHIHUA XIE, Imperial College London, FEDERICO ALBERINI, MARK SIMMONS, University of Birmingham, CHRISTOPHER PAIN, OMAR MATAR, Imperial College London — We present an investigation into the computational efficiency benefits of dynamic mesh adaptivity in the numerical simulation of transient multiphase fluid flow problems involving Non-Newtonian fluids. Such fluids appear in a range of industrial applications, from printing inks to toothpastes and introduce new challenges for mesh adaptivity due to the additional "memory" of viscoelastic fluids. Nevertheless, the multiscale nature of these flows implies huge potential benefits for a successful implementation. The study is performed using the open source package Fluidity, which couples an unstructured mesh control volume finite element solver for the multiphase Navier-Stokes equations to a dynamic anisotropic mesh adaptivity algorithm, based on estimated solution interpolation error criteria, and conservative mesh-to-mesh interpolation routine. The code is applied to problems involving rheologies ranging from simple Newtonian to shear-thinning to viscoelastic materials and verified against experimental data for various industrial and microfluidic flows.

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