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Numerical Analysis of Gravity-driven Spreading of Viscoelastic Fluids: Investigation of the Effect of Shear-thinning and Elastic Behavior
BIN HU, SARAH KIEWEG, University of Kansas — Many complex fluids of interest exhibit viscoelastic behavior. Polymeric drug delivery vehicles, such as anti-HIV topical microbicides, are among these fluids. For the optimal design of microbicides, the combined effect of shear-thinning and elastic behavior on the gravity-driven spreading of viscoelastic fluids is studied. We develop a 2D model to simulate the fluids spreading down an incline using ANSYS POLYFLOW software package. Arbitrary Lagrangian-Eulerian (ALE) method combined with Lagrangian remeshing is applied to track the moving free surface of fluids during spreading. Adaptive meshing method is used to generate high quality mesh for the remeshing process. Based on an elastic viscous split stress (EVSS) approach, several differential viscoelastic constitutive models are studied to investigate the combined effect of shear-thinning and elastic behavior. Mesh convergence test and constant volume check are studied to verify the new model. Moreover, the new model with zero elasticity is compared with previous studies of Newtonian and power-law fluids.

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