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Axisymmetric numerical simulations of viscoelastic jet thinning and breakup[1] KONSTANTINOS ZINELIS, THOMAS Y. ABADIE, Imperial College London, GARETH H. MCKINLEY, Massachusetts Institute of Technology, OMAR K. MATAR, Imperial College London — Spray formation in a non-Newtonian fluid is central to numerous industrial applications such as spray-drying and atomisation involving large interfacial deformations and complex dynamics. The aim of the present work is to establish a robust numerical basis for systematic examination of viscoelastic spray systems. To achieve this, we begin with two-dimensional axisymmetric numerical simulations of an impulsively-started jet entering into a stagnant gaseous phase using the volume-of-fluid technique to capture the interface and the log-conformation transformation for stable and accurate solution of the viscoelastic constitutive equation. This permits efficient exploration of material parameter space, capturing the competing effects of the elastic, viscous, and inertial forces on the ejected droplet size. First, we validate the numerical simulations against the predictions of linear stability analysis. Subsequently, the effect of shearing flow inside nozzle on the polymeric stress distribution along the jet is highlighted. Finally, we focus on the elasto-capillary regime, and systematically investigate the dependence of the rate of filament thinning on the initial flow rate, the fluid relaxation time, as well as the finite extensibility of the dissolved polymer.

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