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Contraction dynamics of planar liquid filaments NICOLE DEVLIN, KRISHNARAJ SAMBATH, MICHAEL HARRIS, OSMAN BASARAN, School of Chemical Engineering, Purdue University — Thin liquid sheets are ubiquitous in nature and urban landscapes, e.g. waterfalls, and industry, e.g. in various atomizers where sheets of liquid emanate from a nozzle or off a solid surface. These liquid sheets contract due to surface tension and may or may not break into smaller fragments depending on physical properties and flow conditions. The cross-section of a liquid sheet in a plane perpendicular to the main flow direction is a planar or 2D filament. Here, we study the contraction dynamics of an idealized 2D filament of an incompressible Newtonian fluid the initial shape of which is a rectangle terminated by two identical semi-circles. The dynamics are analyzed by solving the full 2D Navier-Stokes system and a1D, slender-jet approximation to it by a numerical technique based on the Galerkin finite element method. Simulation results are summarized by means of a phase diagram in the space of Reynolds number and initial filament aspect ratio. The talk will conclude with a discussion of the different modes of contraction and a critique of the capabilities and limitations of the 1D model.

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