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Analysis of scaling during pinch-off of Newtonian filaments by numerical simulation SUMEET THETE, School of Chemical Engineering, Purdue University, USA, KRISHNARAJ SAMBATH, School of Chemical Engineering, Purdue University, USA and Chevron Corporation, USA, OSMAN BASARAN, School of Chemical Engineering, Purdue University, USA, RAFAEL CASTREJÓN-PITA, ALFONSO CASTREJÓN-PITA, IAN HUTCHINGS, Department of Engineering, University of Cambridge, UK, JOHN HINCH, JOHN LISTER, Department of Applied Mathematics and Theoretical Physics, University of Cambridge, UK — Drop formation is ubiquitous in diverse applications, e.g. ink-jet printing and atomization. As a drop is about to form, it is connected by a thinning filament to the rest of the liquid attached to a nozzle. Hence, the physics of filament thinning is key to understanding drop formation. For Newtonian liquids, it is known that the dynamics of filament thinning initially falls in one of two scaling regimes, a potential flow regime if liquid viscosity μ is small or a viscous regime if μ is large. Regardless of μ, the dynamics ultimately transitions to a final asymptotic regime, the inertial−viscous regime, where all forces−viscous, inertial, and surface tension−compete as the filament nears pinch−off. While the global dynamics of drop formation and these scaling regimes are well understood, less well appreciated is what happens during transitions between the initial and final regimes. Here, we investigate the dynamics during these transitions by computation. We also show that computed predictions accord well with experiments detailed in a complementary presentation.

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