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Breakup of Liquid Filaments (using Stheno computing platform and open software GERRIS (qfs.sf.net))

The breakup of liquid filaments has been studied experimentally, theoretically, and numerically, see e.q. [1, 2, 3]. In this study, we focus on the breakup of finite size liquid filaments on substrates, using direct numerical simulations. Although, there are many parameters involved when determining whether a liquid filament will break up, we will illustrate the effects of three parameters: Ohnesorge number, the ratio of the viscous forces to inertial and surface tension surfaces, the liquid filament aspect ratio, and a measure of the fluid slip on the substrate, i.e. slip length. Through these parameters we are able to determine whether a liquid filament will break up or collapse into a single droplet on the substrate. We will compare our results with the results in [1], for free standing liquid filaments, and show that the presence of the substrate support promotes breakup of the filament. We also discuss the effect of the degree of slip (friction) on the break up. Furthermore, we will illustrate how we leveraged the computing resources such as Stheno to run over 500 simulations over the course of this past fall semester.

1. Castrejón-Pita, Alfonso A., J. R. Castrejón-Pita, and I. M. Hutchings. "Breakup of Liquid Filaments." *Physical Review Letters* 108.7 (2012)

[2] Demetrios Papageorgiou. "On the breakup of viscous liquid threads". Physics of Fluids. 7 (7): 1529–1521 (1995).

[3] Stephane Popinet, "An accurate adaptive solver for surface-tension-driven interfacial flows", Journal of Computational Physics 228(16):5838-5866, (2009).