Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Viscous stabilisation of Rayleigh-Plateau modes on a cylindrical filament through radial oscillatory forcing[1] SAGAR PATANKAR, SASWATA BASAK, PALAS KUMAR FARSOIYA, RATUL DASGUPTA, Indian Institute of Technology, Bombay, Powai, Mumbai, India — Faraday waves are standing wave patterns appearing on a liquid surface subject to an oscillatory body force and have been observed in base states of Cartesian, spherical or cylindrical coordinate systems (Benjamin et. al., Proc. Roy. Soc. Lond., 1954; Adou et. al., J. Fluid Mech., 2016; Patankar et. al., J. Fluid Mech. 2018). In these geometries, under inviscid irrotational approximation, small-amplitude standing waves are governed by the Mathieu equation. Taking viscosity into account produces a memory term leading to an integro-differential, damped, Mathieu equation. In Cartesian geometry such an equation was derived by Beyer et. al., Phys. Rev. E, 1995. Here, we derive an analogous integro-differential equation governing Faraday waves on a cylindrical filament of a viscous liquid utilising the toroidal-poloidal decomposition (Boronski et. al., J. Comput. Phys. 2007). We demonstrate perpetual stabilisation of an unstable axisymmetric Rayleigh−Plateau mode ($kR_0 < 1$) perturbation in the viscous case by choosing the strength of forcing appropriately. Linearised theory is compared with Direct Numerical Simulations using the open-source code Gerris showing good agreement. We also show the possibility of generating droplets in a controlled manner by fragmenting the filament.

[1]Department of Science and Technology, DST-SERB grant EMR/2016/000830, and MTR/2019/001240 for funding support.

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Date submitted: 03 Aug 2020 Electronic form version 1.4