Abstract Submitted
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A Computational Study of an Atomizing Liquid Sheet SURAJ DESHPANDE, MARIO TRUJILLO, University of Wisconsin - Madison — Atomization of a liquid sheet is studied using simulations based on a volume of fluid (VoF) method. Our aim is to evaluate the primary atomization models which are often used in Lagrangian-Eulerian simulations, a prominent spray simulation method. The models assume that growth of sinuous unstable waves on the sheet causes its breakup and use linear theory to predict the wavelength [Dombrowski & Johns 1963; Senecal et al. 1999]. With respect to this, we address two points: (1) applicability of linear theory to instability prediction, and (2) relevance of this prediction to sheet breakup. To this end, a more general linear analysis considering capillary, viscous and boundary layer is performed using Orr-Sommerfeld (OS) theory. Our VoF simulations show that instability mechanism does selectively amplify indistinct noise into discernible interfacial waves, which are very well predicted by OS analysis. These waves, however, do not cause sheet breakup, and this contrasts prior linear theories. The structures which eventually do lead to breakup are shown to be practically independent of viscous and surface tension effects (unlike the linear waves). They scale with sheet thickness, and are $\sim O(100)$ times larger than predicted by linear theories.

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