Abstract Submitted
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A new pathway for the amplification of distortions to the surface of liquid jets[1] HANUL HWANG, PARVIZ MOIN, M. J. PHILIPP HACK, Center for Turbulence Research, Stanford Univ — The atomization process of liquid jets often begins with the linear amplification of small perturbations to the material interface. We identify and characterize a novel mechanism for the amplification of interface distortions of liquid jets. The mechanism is independent of the exponential instability of the flow and, depending on the parameters, can intensify small perturbations to the material interface by several orders of magnitude and at a faster pace than the exponential Kelvin-Helmholtz instability. Analysis of the budget of the perturbation kinetic energy sheds light on the underlying physics. It is shown that energy is extracted from the mean shear by the production term in the axial velocity component and redistributed to the radial velocity component where it is transferred into the surface-tension energy of the material interface. Parameter studies show that the gain in surface tension energy scales linearly with the Reynolds number. Furthermore, a critical Weber number is identified as a lower bound beyond which the mechanism becomes active. Asymptotic analysis establishes a power-law relationship of a critical Weber number to the Reynolds number which is confirmed by computational results.

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