Abstract Submitted
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Numerical and experimental investigation of flow instabilities in the presence of a viscosity gradient[1] RYAN KEEDY, Sandia National Laboratories, ALBERTO ALISEDA, University of Washington — Laboratory experiments were performed to understand the effect of viscosity ratio on the development of the round jet when a miscible liquid is injected into another stagnant ambient liquid. Altering the viscosity of the injected liquid jet resulted in noticeable changes in the turbulent/non-turbulent interface in the jet's developing region, including the instability wavelength. The change in the formation of structures at the interface is apparent even when several key non-dimensional numbers (Pe, Re) associated with the flow are kept constant. Large, coherent structures in the turbulent jet resulting from the shear instability of the interface may affect the downstream development of the self-similar profile. Hence, it is important to examine and understand the characteristics of the shear layer instability in order to better understand the role that a viscosity gradient plays in turbulent jet development. The spatial stability equations for a flow in which viscosity varies arbitrarily as a function of scalar concentration are presented. These equations are evaluated at various viscosity ratios and the predicted instability frequencies are compared to experimental results in the range of $\mu_{jet}/\mu_{amb} = 0.5 - 2$ and $Re \approx 10^4$.

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