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Spatial stability analysis of a liquid jet J. ENRIQUE PORTILLO, GREGORY BLAISDELL, Purdue University — A spatial linear stability analysis of a liquid jet with a locally parallel base flow assumption is performed. It is found that a pocket of absolute instability is present in the region closest to the jet exit and, as suggested by Koch,[1] the most unstable mode occurs at the transition location between the absolutely and convectively unstable regions of the flow. Comparison with experimental results had previously employed the assumption that the wave velocity is close to the jet velocity. However, the obtained eigenvalues suggest a much smaller wave velocity ($\sim 0.5U_{jet}$). This discrepancy is resolved by performing a Doppler shift analysis on the flow, which takes into account the change in velocity at the jet surface. It is shown that the predicted eigenvalues are in good agreement with the measured wavelength. The validity of the parallel base flow assumption and the effects of weak and strong non-parallelism of the flow are further discussed.

[1]W. Koch, J. Sound and Vibration, 99, 53, 1985.

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