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Absolute instability of hot round jets discharging from tubes W. COENEN, U Carlos III Madrid, A. SEVILLA, U Jaen, A.L. SANCHEZ, U Carlos III Madrid — The spatiotemporal, inviscid linear instability of hot gas jets emerging from a round tube of radius a is studied for jet Reynolds numbers $Re \gg 1$. The analysis focuses on the influence of the injector length l_t on the stability characteristics of the resulting jet, whose base velocity profile at the exit is computed in terms of the dimensionless tube length $L_t = l_t/(Re\, a)$ by integrating the boundary-layer equations along the injector. Both axisymmetric modes ($m = 0$) and first azimuthal modes ($m = 1$) of instability are investigated for values of the jet-to-ambient density ratio $S = \rho_j/\rho_\infty < 1$. For short tubes $L_t \ll 1$ the jet becomes absolutely unstable for critical density ratios $S_c \simeq (0.66, 0.35)$ for $m = (0, 1)$, in agreement with previous results of uniform velocity jets. For increasing L_t both modes are seen to exhibit absolutely unstable regions for all values of L_t and small enough values of the density ratio. For $m = 1$ we find a critical density ratio which increases monotonically with L_t, reaching its maximum value $S_c \simeq 0.5$ as the exit velocity approaches the parabolic profile for $L_t \gg 1$. In the case $m = 0$ the critical density ratio achieves a maximum value $S_c \simeq 0.9$ for $L_t \simeq 0.04$ and then decreases to approach $S_c = 0.7$ for $L_t \gg 1$. The absolute growth rates in this limiting case are however extremely small, in agreement with the fact that the parabolic velocity profile is neutrally stable to axisymmetric disturbances.

Francisco Rodriguez
University of California, San Diego

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