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Stability analysis of supersonic round jet with temperature non-uniformity MONIKA CHAUHAN, K. TODD LOWE, LUCA MASSA, Virginia Tech — We perform parallel and parabolized stability analyses of round supersonic jets supported by the adiabatic expansion in turbulent nozzle. We carry out Reynolds-average Navier-Stokes calculations in two and three dimensions and test various turbulence models to resolve the effects of incoherent turbulence created by the nozzle walls on coherent structures in the shear layer. The computed mean profiles are in reasonable agreement with the experiments using the SST turbulence model and show the presence of a region of low momentum near the axis due to matching of Mach number in the cold and hot streams. After validating the mean profiles against the experimental data, we determine the stability characteristics with axisymmetric injection at the upstream of the throat. We find that the maximum axisymmetric mode is weakened by cold injection at the axis, while the first and second circumferential modes are of similar magnitude but exist for a reduced range of Strouhal numbers. Next, we evaluate the effect of circumferential temperature non-uniformity in the mean profile by calculating the stability of three-dimensional mean-profiles with resonant coupling against the circumferential instability modes.

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