Abstract Submitted
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Modal and non-modal evolution of perturbations for parallel round jets[1] JOSE IGNACIO JIMENEZ-GONZALEZ, Universidad de Jaen, PIERRE BRANCHER, Institut de Mecanique des Fluides de Toulouse, CARLOS MARTINEZ-BAZAN, Universidad de Jaen — We investigate the local modal and non-modal stability of round jets for varying aspect ratios and Reynolds numbers. The competition between axisymmetric (azimuthal wavenumber m = 0) and helical (m = 1) perturbations depending on the jet aspect ratio, α =R/θ, where R is the jet radius and θ the shear layer momentum thickness, is quantified at different time horizons. Optimal excitation and optimal perturbation analyses allow us to characterize the transient dynamics of jets, showing that two mechanisms may cause large energy gains, namely the Orr mechanism at small wavelengths and the "shift-up" mechanism, in the long wavelength limit, which is found to shift the jet as a whole in a way that resembles the classical lift-up effect active in wall shear flows. The "shift-up" mechanism is found to be especially efficient for vanishing perturbations axial wavenumbers. Furthermore, it has been found that adjoint modes drive the transient process at relatively short temporal horizons, in such a way that, for large aspect ratios, an optimal excitation analysis might suffice to properly characterize transient dynamics.

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