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Investigation of Instability Wave Dynamics in High-Speed Turbulent Jets Using LES JAIYOUNG RYU, SANJIVA K. LELE, Stanford University — Instability waves have been frequently invoked to explain the dominant noise from high-speed jets. Current methods for predicting jet noise do not, as of yet, use the instability wave formalism. We decompose the results of the large-eddy simulation of high-speed jets (Bodony and Lele, 2005) by Fourier, adjoint (Ryu, Lele and Viswanathan, 2007) and POD methods (Suzuki, 2007) to extract the instability wave contribution to the fluctuations. Three operating conditions are analyzed. Jet instability modes at different frequencies and azimuthal mode numbers as a function of downstream position are traced. The deduced instability wave amplitude and phase dynamics are compared with the predictions of the parabolized stability equations (Cheung, 2007). The least square method is used to provide the amplitude estimate for the linear PSE results. The decomposed LES database shows "the physics of instability waves" to a limited extent. The agreement is best for the lowest frequency considered (St=0.1) and for the first azimuthal mode (n=1). For higher St and other modes larger discrepancies are observed.

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