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RANS-calibrated resolvent models of turbulent jets[1] ETHAN PICKERING, TIM COLONIUS, Caltech — For turbulent jets, resolvent modes computed using a linear eddy-viscosity model show quantitative agreement with structures educed using spectral proper orthogonal decomposition of large-eddy simulation (LES) data. To make these models predictive, the amplitudes of the resolvent modes and their correlations need to be determined. We pose an optimization approach where the coefficients are determined by matching first-order statistics available from Reynolds-Averaged Navier-Stokes (RANS) computations, with the ultimate aim of a fully RANS-based approach to predicting the dominant coherent structures. We examine such models for a Mach 0.4, isothermal, turbulent round jet at $Re = 450,000$. For example, using only the turbulent kinetic energy (TKE) field from RANS, we find that a drastically reduced model (i.e. $10^1 - 10^2$ degrees of freedom) can correctly infer Reynolds stresses, and other quantities that are not directly available from RANS such as turbulence intensities and pressure fluctuations. We validate the latter quantities through comparison with LES data.

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