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Asymptotic structure of low frequency supersonic heated jet noise using LES data to re-construct a turbulence model[1] MOHAMMED AFSAR, University of Strathcylde, ADRIAN SESCU, VASILEIOS SASSANIS, Mississippi State University, GUILLAUME BRES, Cascade Technologies Inc., AARON TOWNE, SANJIVA LELE, Stanford University — The Goldstein-Sescu-Afsar (2012, vol. 695, pp. 199- 234) asymptotic theory postulated that the appropriate distinguished limit in which non-parallel mean flow effects introduces a leading order change in the propagator (which is related adjoint linearized Euler Greens function) within Goldstein's acoustic analogy must be when the jet spread rate is the same order as Strouhal number. We analyze the low frequency structure of the acoustic spectrum using Large-eddy simulations of two axi-symmetric jets (heated unheated) at constant supersonic jet Mach number to obtain the mean flow for the asymptotic theory. This approach provides excellent quantitative agreement for the peak jet noise when the coefficients of the turbulence model are tuned for good agreement with the far-field acoustic data. Our aim in this talk, however, is to show the predictive capability of the asymptotics when the turbulence model in the acoustic analogy is exactly re-constructed by numerically matching the length scale coefficients of an algebraic-exponential model for the 1212-component of the Reynolds stress auto-covariance tensor (1 is streamwise 2 is radial direction) with LES data at any spatial location and temporal frequency. In this way, all information is obtained from local unsteady flow.

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