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Modification of Instability Waves and Radiated Sound due to Heating a Compressible Mixing Layer[1] DANIEL BODONY, University of Illinois at Urbana-Champaign — It is well known that heating a turbulent jet at constant velocity alters its sound field and, to a lesser extent, the turbulent statistics. For low speed jets ($U_j/a_\infty < 0.7$) heating increases the radiated sound while at higher speeds heating decreases the radiated sound. In both cases the turbulence root-mean-square levels increase by 10% relative to the unheated jet. The cause of the sound field change is not known. This work examines the early jet development by considering the modification of instability waves on a compressible mixing layer due to heating using calculations of the linearized Euler equations coupled to a multiple scale expansion analysis of the governing problem. The near-field instability wave solution is matched asymptotically to a globally valid acoustic field for a uniformly valid solution. It is found that for high-speed mixing layers the growth-and-decay cycle of the instability waves is altered by heating, leading to increased entropy fluctuations which are less efficient sound radiators relative to vortical fluctuations.

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