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The frequency spectrum of sound generated by turbulent shear flows GUOWEI HE, XIN ZHAO, XING ZHANG, LNM, Institute of Mechanics, Chinese Academy of Science — The frequency spectrum of sound radiated by turbulent shear flows is analytically calculated from Lighthill's acoustic analogy by evaluating space-time correlations. The turbulent shear flow is a simple model for jet noise, with the assumptions that its large scales are steady shear and its small scales are isotropic. Ribner (J. Fluid Mech. 38 1-24 1969) calculates the noise intensity for this model, which shows the basic directivity of jet noise. Recently, a non-frozen flow model is developed for space-time correlations in turbulent shear flows (Phys. Rev. E. 79 046316 2009) and experimentally verified against the Rayleigh-Benard convection (Phys. Rev. E. 81 065303 2010). We use the non-frozen flow model to calculate the noise spectra for turbulent shear flows. The result obtained is explicitly dependent on the lateral angle. It offers a scaling form of noise spectra at high frequencies, which is consistent with the two noise source model by Tam et. al. (AIAA paper 96-1716). The results obtained are also compared with the experiments and numerical simulations.

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