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Acoustic Radiation from a Mach 14 Turbulent Boundary layer¹

CHAO ZHANG, LIAN DUAN, Missouri Univ of Sci & Tech, MEELAN CHOUDHARI, NASA Langley Research Center — Direct numerical simulations (DNS) are used to examine the pressure fluctuations generated by a high-speed turbulent boundary layer with a nominal freestream Mach number of 14 and wall temperature of 0.18 times the recovery temperature. The emphasis is on characterizing the acoustic radiation from the turbulent boundary layer and comparing it with previous simulations at Mach 2.5 and Mach 6 to assess the Mach-number dependence of the freestream pressure fluctuations. In particular, the numerical database is used to provide insights into the pressure disturbance spectrum and amplitude scaling with respect to the freestream Mach number as well as to understand the acoustic source mechanisms at very high Mach numbers. Such information is important for characterizing the freestream disturbance environment in conventional (i.e., noisy) hypersonic wind tunnels. Spectral characteristics of pressure fluctuations at the surface are also investigated.

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Lian Duan
Missouri Univ of Sci & Tech

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