Abstract Submitted
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Sound generation by boundary-layer flow over steps[1] MINSUK JI, MENG WANG, University of Notre Dame — Large-eddy simulations of turbulent boundary layer flows over backward and forward facing steps are performed to study flow-induced noise at low Mach number. The Reynolds number is 21000 based on the step height and free-stream velocity. The boundary layer thickness is approximately twice the step height near the step. Statistics of wall pressure fluctuations such as the root-mean-square values and frequency spectra yield favorable comparisons with previous experimental measurements. Sound generated by flow over backward and forward steps is examined in the framework of Lighthill's acoustic analogy. Green's function for the step geometry that is valid for an acoustically compact step height is employed to evaluate the volume integral in the solution to Lighthill's equation. For a far-field observer, the steps act primarily as a dipole source aligned in the streamwise direction. In line with experimental results, the flow over a forward step emits sound that is significantly stronger than that from a backward step. The underlying reason is analyzed in terms of source strength and distribution relative to the Green's function distribution. It is found that the forward step generates stronger source in regions closer to the upper step corner, which is acoustically most important.

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