Abstract Submitted
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The effect of sweep on forward-step noise[1] JIN HAO, MENG WANG, University of Notre Dame — The flow and acoustic fields of swept forward-facing steps in low-Mach-number turbulent boundary layers are investigated using large-eddy simulation in combination with Lighthill's theory. The step height is 13% of the thickness of the unperturbed boundary layer at $Re_\theta = 4755$, and the step sweep angle is varied from 0° to 45° with an increment of 15°. For the same incoming flow and step height, larger sweep angles produce smaller perturbations to the boundary layer, leading to weaker surface pressure fluctuations and acoustic radiation and speedier recovery towards an equilibrium boundary layer in the downstream. With proper normalization using the free-stream velocity component normal to the step face, the sweep-independence principle is found to be approximately valid for the reattachment length, mean step-normal velocity profiles and pressure and skin friction coefficients at all sweep angles examined. In terms of surface-pressure fluctuations and radiated acoustics, sweep independence is observed for sweep angles up to 30° at relatively low frequencies.

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