Abstract Submitted
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Numerical investigation of acoustic radiation from vortex-airfoil interaction[1] ANNE LEGAULT, MINSUK JI, MENG WANG, University of Notre Dame — Numerical simulations of vortices interacting with a NACA 0012 airfoil and a flat-plate airfoil at zero angle of attack are carried out to assess the applicability and accuracy of classical theories. Unsteady lift and sound are computed and compared with the predictions by theories of Sears and Amiet, which assume a thin-plate airfoil in an inviscid flow. A Navier-Stokes solver is used in the simulations, and therefore viscous effects are taken into consideration. For the thin-plate airfoil, the effect of viscosity is negligible. For a NACA 0012 airfoil, the viscous contribution to the unsteady lift and sound mainly comes from coherent vortex shedding in the wake of the airfoil and the interaction of the incoming vortices with the airfoil wake, which become stronger at higher Reynolds numbers for a 2-D laminar flow. When the flow is turbulent at chord Reynolds number of 4.8×10^5, however, the viscous contribution becomes negligible as coherent vortex shedding is not present. Sound radiation from vortex-airfoil interaction at turbulent Reynolds numbers is computed numerically via Lighthill's theory and the result is compared with the predictions of Amiet and Curle. The effect of the airfoil thickness is also examined.

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