Abstract Submitted
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On the lift increments with the occurrence of airfoil tones at low Reynodls numbers[1] TOMOAKI IKEDA, Japan Aerospace Exploration Agency, DAISUKE FUJIMOTO, AYUMU INASAWA, MASAHITO ASAI, Tokyo Metropolitan University — The aeroacoustic effects on the aerodynamics of an NACA 0006 airfoil are investigated experimentally at relatively low Reynolds numbers, $Re = 30,000$ - $70,000$. By employing two wind-testing airfoil models at different chord lengths, $L = 40$ and 100 [mm], the aerodynamic dependence on Mach number is examined at a given Reynolds number. In a particular range of Reynolds number, tonal peaks of trailing-edge noise are obtained from a shorter-chord airfoil, while no apparent tones are observed with longer chord length at a lower Mach number. Surprisingly, the occurrence of a tonal noise leads to a greater lift slope in the present wind-tunnel experiment, evaluated via a PIV approach. The lift curves obtained experimentally at higher Mach numbers agree well with two-dimensional numerical simulations, performed at $M = 0.2$. At the Mach number, the numerical results clearly indicate the occurrence of an acoustic feedback loop with discrete tones, within a range of angle of attack. A few three dimensional numerical results are also presented. In the simulation at $Re = 50,000$, the suppression of tonal noise corresponds to the development of a turbulent wedge in the suction-side boundary layer at the angle of attack 4.0 [deg.], which agrees with the experiment.

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