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Buffeting of NACA 0012 airfoil at high angle of attack TONG ZHOU[1], Beijing Institute of Technology, EARL DOWELL, Duke University — Buffeting is a fluid instability caused by flow separation or shock wave oscillations in the flow around a bluff body. Typically there is a dominant frequency of these flow oscillations called Strouhal or buffeting frequency. In prior work several researchers at Duke University have noted the analogy between the classic Von Karman Vortex Street behind a bluff body and the flow oscillations that occur for flow around a NACA 0012 airfoil at sufficiently large angle of attack. Lock-in is found for certain combinations of airfoil oscillation (pitching motion) frequencies and amplitudes when the frequency of the airfoil motion is sufficiently close to the buffeting frequency. The goal of this paper is to explore the flow around a static and an oscillating airfoil at high angle of attack by developing a method for computing buffet response. Simulation results are compared with experimental data. Conditions for the onset of buffeting and lock-in of a NACA 0012 airfoil at high angle of attack are determined. Effects of several parameters on lift coefficient and flow response frequency are studied including Reynolds number, angle of attack and blockage ratio of the airfoil size to the wind tunnel dimensions. Also more detailed flow field characteristics are determined. For a static airfoil, a universal Strouhal number scaling has been found for angles of attack from 30° to 90°, where the flow around airfoil is fully separated. For an oscillating airfoil, conditions for lock-in are discussed. Differences between the lock-in case and the unlocked case are also studied.

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