Abstract Submitted
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Dynamics of separation over airfoils at low Reynolds numbers, Part I: 2D equilibria and reduced-order models[1] SUNIL AHUJA, CLARENCE W. ROWLEY, MINGJUN WEI, IOANNIS G. KEVREKIDIS, Princeton University, TIM COLONIUS, California Institute of Technology — We present results of a computational study of dynamics of separation over airfoils using an immersed boundary method and a collection of other tools. Computational wrappers are developed to enable the DNS code to perform bifurcation studies (using Newton-GMRES iterations) and linear stability analysis (using Arnoldi's method). These techniques are used to study the flow past a flat plate at large angles of attack and low Reynolds numbers. We compute the unstable steady states and compare them with the periodically shedding unsteady flow. We observe that the unstable steady state resembles the unsteady flow at times corresponding to the minimum lift, in which a strong trailing edge vortex is present, while at maximum lift for the unsteady flow, a stronger leading edge vortex is present. Low-dimensional models of the flow linearized about the stable fixed points at low angles of attack are obtained using an approximate balanced truncation technique and POD modes, and compared with standard POD/Galerkin models.

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