Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Stability analysis of the compressible flow past a NACA0012 airfoil at low Reynolds numbers LAURA VICTORIA ROLANDI, THIERRY JARDIN, JEROME FONTANE, JEREMIE GRESSIER, LAURENT JOLY, ISAE-SUPAERO, Universite de Toulouse, France — Compressible flows at low Reynolds number are characterized by very low density and/or pressure and, nowadays, they are of very interest since these conditions can be found in many innovative applications such as the Hyperloop train, the stratospheric flight and the martian exploration. In the view of stratospheric flight, our work aims to investigate how compressibility affects the wake dynamics of a NACA0012 profile. We first characterize the unsteady flow past the airfoil at $Re = 1000$ using DNS for various angles of attack $\alpha \in [0°; 20°]$ and Mach numbers up to $M = 0.5$. Compressibility is found to attenuate the double harmonic oscillations of the wake, which is directly observable in the aerodynamic coefficients. Then, a steady flow is obtained using the filtering technique of Åkervik *et al.* (2006). These flow fields are used as base flows for a global stability analysis. At these angles of attack the neutral curves are determined in the (M, Re) plane. For a given Reynolds number, we observe a stabilizing or a destabilizing effect of compressibility depending on the angle of attack, while the increase of the Mach number always results in a decrease of the critical Reynolds number for all α.

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Date submitted: 28 Jul 2020 Electronic form version 1.4