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Low-Reynolds number compressible flow around a triangular airfoil PHILLIP MUNDAY, KUNIHIKO TAIRA, Florida State University, TETSUYA SUWA[1], DAIJU NUMATA, KEISUKE ASAI, Tohoku University — We report on the combined numerical and experimental effort to analyze the nonlinear aerodynamics of a triangular airfoil in low-Reynolds number compressible flow that is representative of wings on future Martian air vehicles. The flow field around this airfoil is examined for a wide range of angles of attack and Mach numbers with three-dimensional direct numerical simulations at $Re = 3000$. Companion experiments are conducted in a unique Martian wind tunnel that is placed in a vacuum chamber to simulate the Martian atmosphere. Computational findings are compared with pressure sensitive paint and direct force measurements and are found to be in agreement. The separated flow from the leading edge is found to form a large leading-edge vortex that sits directly above the apex of the airfoil and provides enhanced lift at post stall angles of attack. For higher subsonic flows, the vortical structures elongate in the streamwise direction resulting in reduced lift enhancement. We also observe that the onset of spanwise instability for higher angles of attack is delayed at lower Mach numbers.

[1]Currently at Mitsubishi Heavy Industries, Ltd., Nagasaki

Phillip Munday
Florida State University

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