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Spatio-Temporal Flow Structure over a NACA-0015 Airfoil under the influence of ZNMF Jet Flow Control CALLUM ATKINSON, NICOLAS BUCHMANN, JULIO SORIA, Monash University — The spatio-temporal flow structure associated with Zero Net Mass Flux (ZNMF) jet forcing at the leading edge of a NACA-0015 airfoil (Re = 30000, AoA = 18 deg) is investigated using high-repetition rate Particle Image Velocimetry (HR-PIV). In the absence of forcing, flow separation occurs at the leading edge, while ZNMF jet forcing at a frequency of f+ = 1.3 leads to a nearly complete reattachment with a 45% lift increase. The structure and dynamics associated with both the forced and unforced case are considered and the dominant frequencies are identified. A triple-decomposition of the velocity field is performed to identify the spatio-temporal perturbations produced by the ZNMF jet forcing. This forcing results in a reattachment of the flow, which is caused by the generation of large-scale vortices that entrain high momentum fluid from the freestream. Forcing produces a series of vortices that are advected parallel to the airfoil surface. Potential mechanisms by which these vortices affect the flow reattachment are discussed.

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