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Stability Analysis of Flow Past a Wingtip[1] ADAM EDSTRAND, Florida State University, PETER SCHMID, Imperial College in London, KUNIHIKO TAIRA, LOUIS CATTAFESTA, Florida State University — Trailing vortices are commonly associated with diminished aircraft performance by increasing induced drag and producing a wake hazard on following aircraft. Previously, stability analyses have been performed on the Batchelor vortex (Heaton et al., 2009), which models a far field axisymmetric vortex, and airfoil wakes (Woodley & Peake, 1997). Both analyses have shown various instabilities present in these far field vortex-wake flows. This complicates the design of control devices by excluding consideration of near field interactions between the wake and vortex shed from the wing. In this study, we perform temporal and spatial bi-global stability analyses on the near field wake of the flow field behind a NACA0012 wing computed from direct numerical simulation at a chord Reynolds number of 1000. The results identify multiple instabilities including a vortex instability, wake instability, and mixed instability that includes interaction between the wake and vortex. As these modes exhibit wave packets, we perform a wave packet analysis (Obrist & Schmid, 2010), which enables the prediction of spatial mode structures at low computational cost. Furthermore, a bi-global parabolized stability analysis is performed, highlighting disparities between the parallel and parabolized analysis.

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