Abstract Submitted
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Nearfield Flow Topology of a Rounded Wingtip Subject to Circulation Control[1] ADAM EDSTRAND, LOUIS CATTAFESTA, Florida State University — Trailing vortices are an adverse byproduct of lift causing induced drag, accounting for 40% of the total drag on aircraft, and impose a wake hazard on trailing aircraft (Spalart 1998). The metric used to quantify the wake hazard is the average maximum swirl velocity measured in a velocity snapshot. Circulation control uses tangential blowing along a rounded surface, causing the flow to wrap around the surface. This control methodology is extended to a NACA 0012 wingtip by blowing tangentially over a rounded wingtip to control the circulation of the trailing vortex. Stereo particle image velocimetry measurements are acquired along the chord and downstream of the wingtip to characterize the effects of circulation control on vortex formation and evolution. Compared to the baseline case, the vortex core develops along the upper surface of the airfoil further upstream. This upstream development causes more rapid spatial growth of the vortex, resulting with a larger, less intense vortex than the baseline case. However, the circulation, five chords downstream of the leading edge, increases rather than decreases. This increase implies that favorable control of the circulation does not occur. However, there is a 30% reduction in the wake hazard metric due to the increased vortex size.

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