

https://dspace.org/

Effect of added vorticity on trailing vortices in the extended near wake

Wood, Andrew Robert

2013-07-23
http://hdl.handle.net/10539/12889

Downloaded from a DSpace repository. https://dspace.org/

Abstract

Wind Tunnel testing of a rectangular semi-span NACA0012 wing with an actuating trailing edge flap and two small oscillating tabs, affixed to the model's wingtip and flaptip, was undertaken with a view to introduce instabilities in the resulting wake. The tabs were oscillated sinusoidally at frequencies of 0.5, 1.0, and 2.0 Hz, both independently and together. The impact on the resulting wake was then studied; by examining the upper surface pressure distribution over the wing, and through images captured of the wake cross-section at three positions downstream of the model. Images were captured by seeding the flow with neutrally buoyant helium bubbles illuminated under a plane of light. Oscillation of the tabs at all frequencies was shown to impart instabilities in the near wake. The motion of the resulting vortex core under the oscillation of the tabs was mapped and shown to behave in a consistent manner through all angles of attack tested. An oscillation frequency of 2.0Hz showed the largest evidence of instabilities and greatest wake dispersion of the frequencies tested. A study into the transient pressure changes at the leading edge during oscillation of the tabs revealed a pressure oscillation equal to twice the frequency of the input tab oscillation. It was shown that synchronous oscillation of the two tabs at a frequency of 2.0 Hz, introduced sufficient instabilities into the flow to reduce the core diameter and wake extents of the primary wingtip vortex.