

Cessna Citation X Performances Improvement by an Adaptive Winglet during the Cruise Flight

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Abstract : As part of a 'Morphing-Wing' idea, this study consists of measuring how a winglet, which is able to change its shape during the flight, is efficient. Conventionally, winglets are fixed-vertical platforms at the wingtips, optimized for a cruise condition that the airplane should use most of the time. However, during a cruise, an airplane flies through a lot of cruise conditions corresponding to altitudes variations from 30,000 to 45,000 ft. The fixed winglets are not optimized for these variations, and consequently, they are supposed to generate some drag, and thus to deteriorate aircraft fuel consumption. This research assumes that it exists a winglet position that reduces the fuel consumption for each cruise condition. In this way, the methodology aims to find these optimal winglet positions, and to further simulate, and thus estimate the fuel consumption of an aircraft wearing this type of adaptive winglet during several cruise conditions. The adaptive winglet is assumed to have degrees of freedom given by the various changes of following surfaces: the tip chord, the sweep and the dihedral angles. Finally, results obtained during cruise simulations are presented in this paper. These results show that an adaptive winglet can reduce, thus improve up to 2.12% the fuel consumption of an aircraft during a cruise.

Keywords : aerodynamic, Cessna, Citation X, optimization, winglet

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