

## **Design and Validation of an Aerodynamic Model of the Cessna Citation X Horizontal Stabilizer Using both OpenVSP and Digital Datcom**

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**Abstract :** This research is the part of a major project at the Research Laboratory in Active Controls, Avionics and Aeroservoelasticity (LARCASE) aiming to improve a Cessna Citation X aircraft cruise performance with an application of the morphing wing technology on its horizontal tail. However, the horizontal stabilizer of the Cessna Citation X turns around its span axis with an angle between -8 and 2 degrees. Within this range, the horizontal stabilizer generates certainly some unwanted drag. To cancel this drag, the LARCASE proposes to trim the aircraft with a horizontal stabilizer equipped by a morphing wing technology. This technology aims to optimize aerodynamic performances by changing the conventional horizontal tail shape during the flight. As a consequence, this technology will be able to generate enough lift on the horizontal tail to balance the aircraft without an unwanted drag generation. To conduct this project, an accurate aerodynamic model of the horizontal tail is firstly required. This aerodynamic model will finally allow precise comparison between a conventional horizontal tail and a morphed horizontal tail results. This paper presents how this aerodynamic model was designed. In this way, it shows how the 2D geometry of the horizontal tail was collected and how the unknown airfoil's shape of the horizontal tail has been recovered. Finally, the complete horizontal tail airfoil shape was found and a comparison between aerodynamic polar of the real horizontal tail and the horizontal tail found in this paper shows a maximum difference of 0.04 on the lift or the drag coefficient which is very good. Aerodynamic polar data of the aircraft horizontal tail are obtained from the CAE Inc. level D research aircraft flight simulator of the Cessna Citation X.

**Keywords :** aerodynamic, Cessna, citation, coefficient, Datcom, drag, lift, longitudinal, model, OpenVSP

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