# Abstract

**Seeking the Optimal Winglet for the UAV ethERAs: Theoretical Background, Parametric Design and Computational Study**

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Increasing the range of aircrafts and reducing fuel costs are essential in the aeronautics sector. According to the international literature, this can be achieved with special devices at the ends of the wings, the so-called winglets, since they manage to reduce the induced drag. Aim of the present study is the parametric design of various winglets for the wing of the UAV ethERAs and their computational study in order to find the optimal geometry, based on the theoretical principles of aerodynamics and computational fluid dynamics. Optimal is defined as the one with the best aerodynamic efficiency or the highest lift-to-drag ratio ($L/D$ or $C_L/C_D$). The programs CATIA V5 and Spaceclaim were used for the design, while the Poly-Hexcore method of the ANSYS Mosaic Meshing technology was used for the construction of the computational mesh. The simulations were performed for an air flow of 20 $m/s$ velocity and for an angle of attack of 0°, using the turbulence model k-ω SST and the program ANSYS Fluent. The results show that four of the five winglets that were designed, have a positive effect on the aerodynamic efficiency of the wing, as they manage to reduce the size of the wingtip vortex. We conclude that the optimal winglet is the so-called Blended, which offers 8.92 % higher efficiency, compared to the wing without a winglet. However, further research is needed to experimentally validate the results.

**Key words:**
UAV, winglet, Poly-Hexcore, k-ω SST, CATIA V5, ANSYS Fluent, aerodynamics, computational fluid dynamics