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

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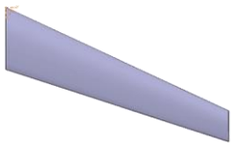
1. Abstract

- At first, the wing and five winglets for the UAV ethERAs, were parametrically designed using CATIA V5.
- Next, a Poly-Hexcore mesh was created using the Mosaic Meshing technology of ANSYS Fluent Meshing.
- Finally, a CFD study was conducted to find the optimal geometry, using the k-ω SST turbulence model, for $V_\infty = 20\ m/s$ and $a = 0°$.

2. Geometry

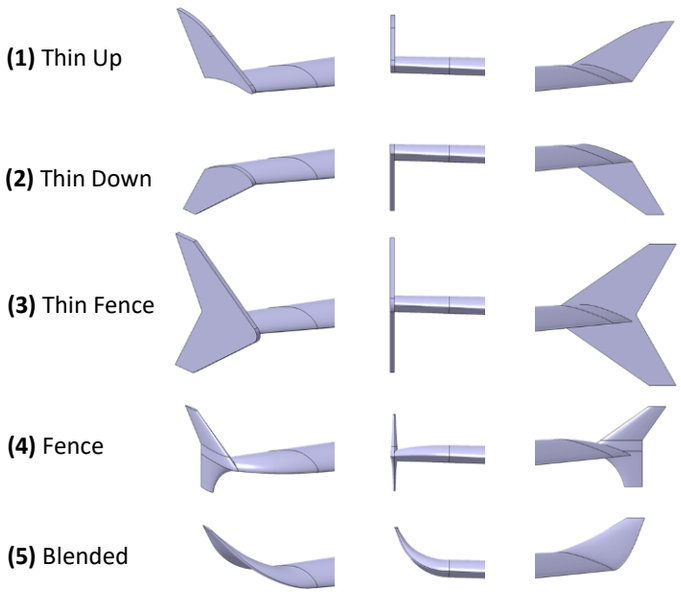
(a) Side View



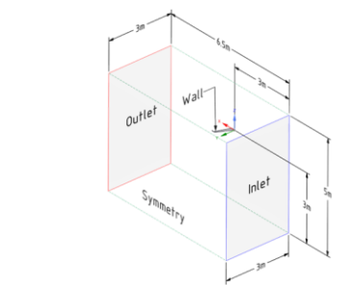
(b) Top View

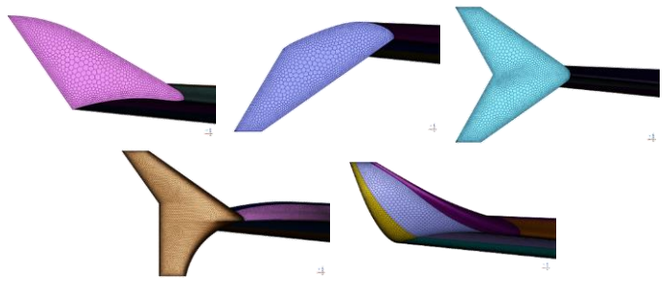
(c) Back View

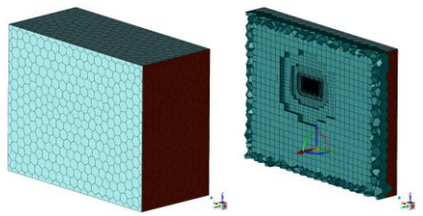
The wing of ethERAs (also called Simple) and the five winglets that where designed.

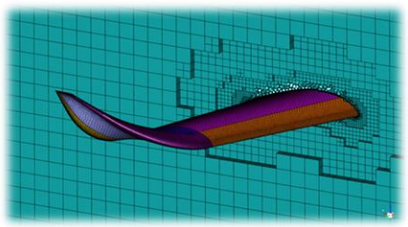


3. Mesh

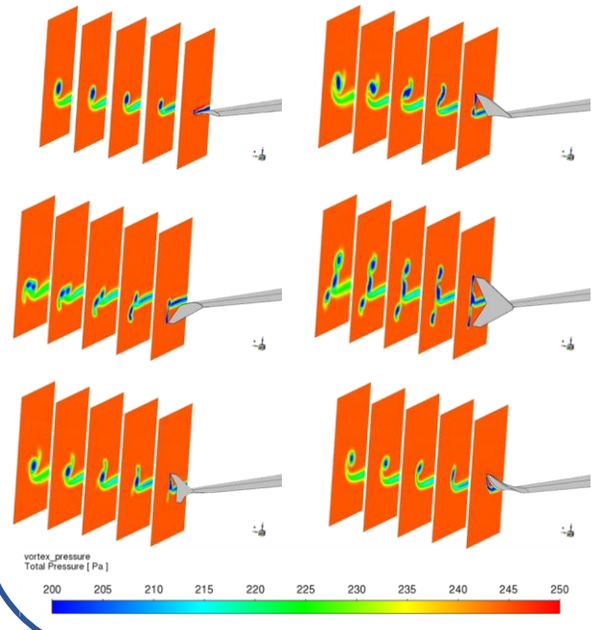


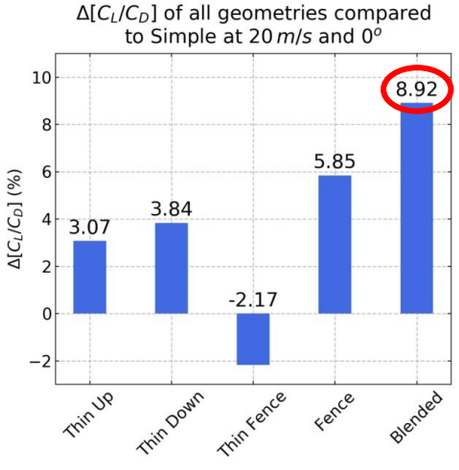






4. Results





5. Conclusions

- Most of the winglets seem to reduce the size of the wingtip vortex, resulting in a lower induced drag.
- All winglets, apart from Thin Fence, perform better than the Simple wing without a winglet.
- The Blended winglet shows the highest aerodynamic efficiency (C_L/C_D), which is 8.92 % higher than that of Simple.