CFD applications on the design and analysis of aeronautical products at FAdeA SA

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ABSTRACT

Computational fluid dynamics (CFD) is a simulation tool, which uses powerful computers and applied mathematics to model fluid flow situations for the prediction of heat, mass and momentum transfer and optimal design in industrial processes. In this work the results obtained in the calculation of aerodynamic loads with CFD on the wing of an aircraft which underwent an engine change comparatively between the original plane, the modified one and calculations made with potential theory are presented. In this sense, it was calculated the streamlines on both aircraft configurations, and then the aerodynamic behavior was checked when the flow goes around the each type of nacelles. These numerical estimations reduce the complexities and the cost of using wind tunnel testing.

Another case study presented is the calculation of the aerodynamic loads on the flaps of this plane with the effects of the power plant included, comparing the levels of loads between the original aircraft and the re-engined one. The results of these calculations were the basis of a later analysis with FEM of the structure of the wing which is not presented in this work. Moreover, a study of the diffusion of hot gases and their influence on the speed measurement probes in the aforementioned plane is presented.

As a final example the design cycle of the control surfaces and flaps on a primary / basic training aircraft starting from the two-dimensional profiles until the final results on the three-dimensional configurations are presented.

Finally, the importance of using commercial software and custom made software to reduce time and reducing risks in the design process for an aeronautical product is highlighted.