Effect of KFm Airfoils Application on Aerodynamic Characteristics on the Example of NACA 0012

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Introduction:

The paper presents of the application of Kline-Fogleman modified to deterine aerodynamic characteristics and flow filed around the exemplary airfoil [1]. This type of airfoil is currently used in models and small unmanned aircraft. Work on the use of this profile in larger aircraft is ongoing [2], however, the increase in Reynolds number requires an active step change in the size of the stairs to improve the aerodynamic characteristics.

Computational Methods and Meshing:

The SST turbulence model was used in CFD calculations in COMSOL Multiphsycis® [3]. The discretization of the computational domain is shown in Figure 1.

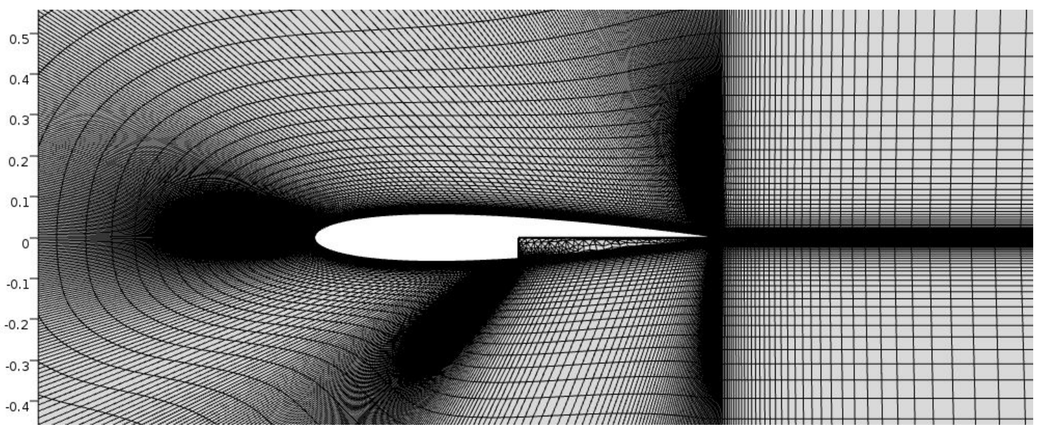

Figure 1. Example mesh

Results:

The results obtained from the CFD Module software of flow around the air profile model are shown in Figures 2, 3 and 4.

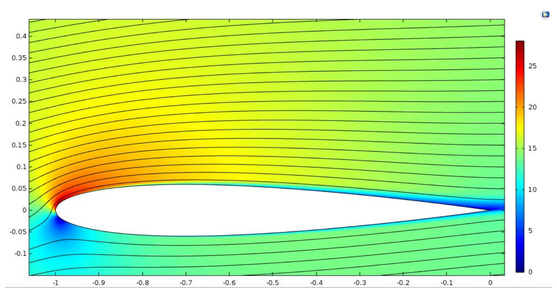

Figure 2. The velocity field around the airfoil without modified

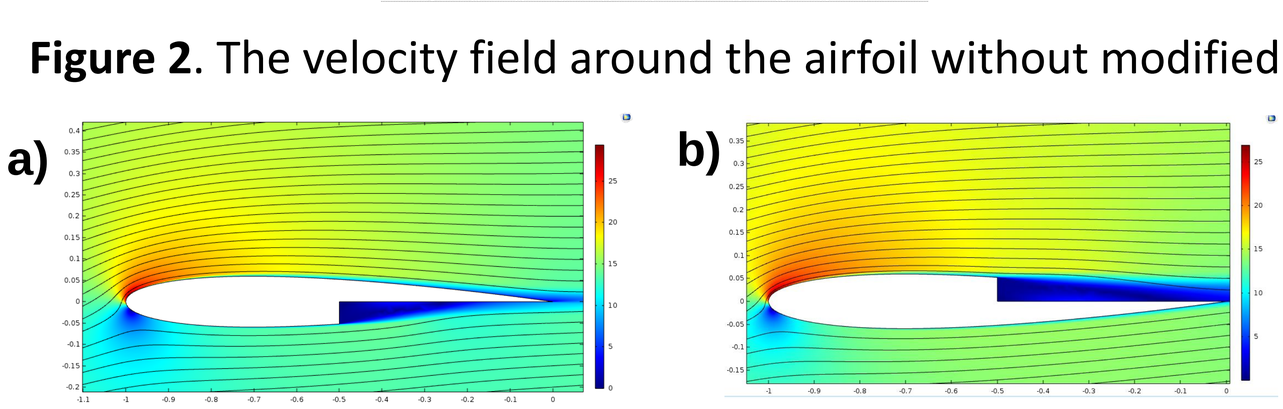

Figure 3. The velocity field around the airfoil a) KFm - 2, b) KFm - 1

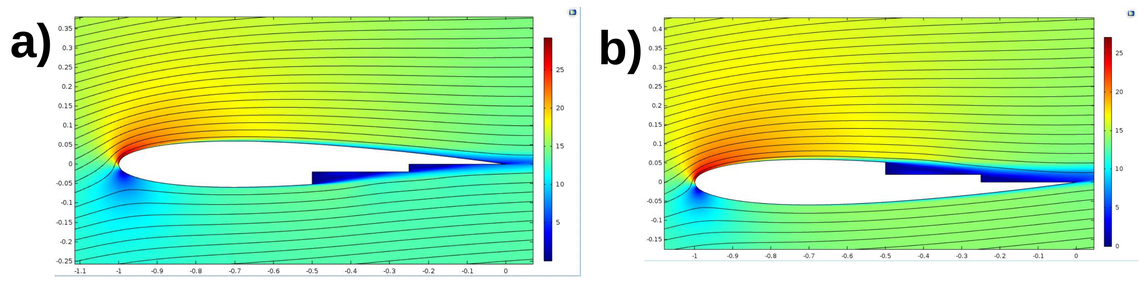

Figure 4. The velocity field around the airfoil
a) KFm – 3 upside-down, b) KFm – 3

The results of lift and drag coefficients determination in COMSOL Multiphysics are presented in figures 5 and 6.

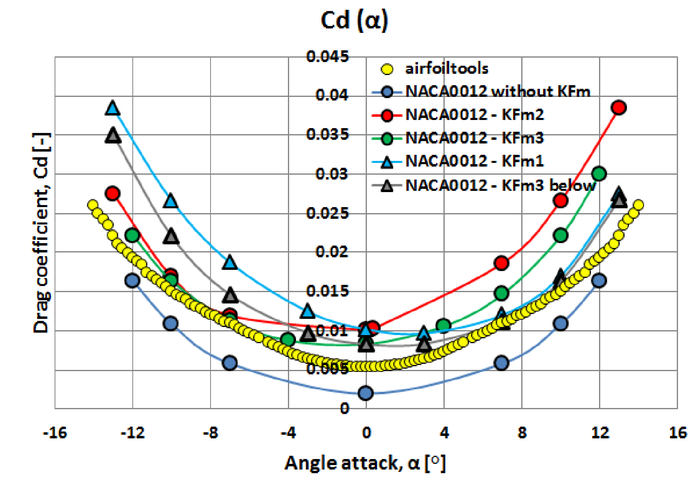

Figure 5. Drag coefficient vs. angle attack

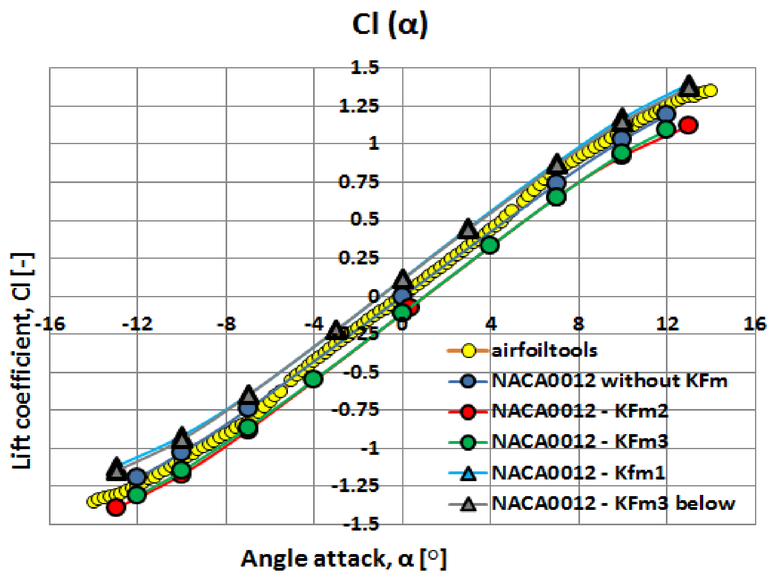

Figure 6. Lift coefficient vs. angle attack

Conclusions:

- The use of the CFD Module allowed determination of aerodynamic characteristics
- Introduction of KF modifications caused an increase in Cl for (KFm1 and KFm3 below) and decrease (KFm2 and KFm3)
- Accurate qualitative results were obtained in terms of Cd and Cl determination

References:

1. Airfoil Data Information airfoiltools.com
2. Enhancing the aerodynamic performance of stepped airfoils, Ranganadhan Voona, A thesis master, 2012
3. Application Library path: CFD_Module/Single-Phase_ Benchmarks/naca0012_airfoil