Computational Fluid Dynamics
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NUMERICAL SIMULATIONS OF AIRFOILS IN TANDEM CONFIGURATION WITH FLAP ON LEADING AIRFOIL

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Contents

1. Summary

This report presents numerical simulations of two airfoils in tandem configuration with a flap on the leading airfoil.
The study begins with the applications of the numerical methods for solving Euler and complete Navier-Stokes equations on 4-digits naca airfoils for which the solution (in terms of pressure, entropy and velocity distribution) is well known in order to verify the reliability of the code.
Once that task is completed, a flap is added to the main lifting surface (leading surface), a naca 4416, and the results obtained are compared to the data obtained by nasa from experiments. [1]

Finally a (smaller) trailing surface is added and a parametric analysis is performed varying the (horizontal and vertical) distance between the surfaces, the angle of attack and the flap deflection angle.

The goal of the work is to compare lift and drag of the isolated airfoils with the values obtained in tandem configuration hence to find the effects of the primary lifting surface (upstream) on the secondary (downstream). [2]

[1] The article from which experimental data are taken https://ntrs.nasa.gov/archive/nasa/casi.ntrs.nasa.gov/19740013521.pdf
[2] This can be considered a 2D approximation of the flow on wing and tail surfaces of a plane

2. Problem definition and background

[*Introduce the problem and state the objective of your work. Briefly present the state of the art regarding the chosen topic and report a reference solution (i.e. numerical or experimental, or the exact one if available).*]

2.1 Literature review

2.2 Reference solution

3. Design of Experiment

[*Describe the process used to meet the project goal.*]

4. Computational model

[*Describe thoroughly the computational model/s used in the project*]

4.1 Problem geometry and setup

4.2 Mesh generation and description

4.3 Numerical schemes

5. Results

[*Report the results of the simulations. Validate your work, i.e. show that the computational model (4) and the simulations you run (the DoE 3) were able to obtain the goal of the project*]

5.1 Test 1

5.1.1 Grid convergence

6. Conclusions

Appendix A: Resources

[*Report the config files of the software used (i.e. SU2 [**?**] and the mesher). Also attach to this report an archive with the mesh files, solutions and the reference solution data (e.g. data points of a Cp plot ...)*]

Mesh configuration files

SU2 configuration files