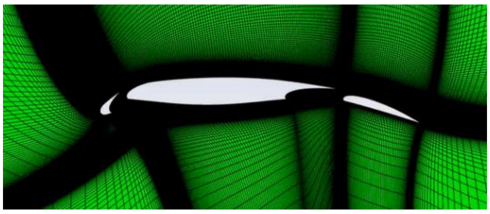
AE 433 CFD – HW4

DUE DATE: Beginning of the next lecture (31.12.2021 Friday, 8:30)

Consider a three element (NHLP 2D) airfoil. The mesh is given in the lecture.

Problem specifications:



Reynolds number: 3.52×10^6.

Angle of incidence (α): 0° to 23°.

Use sea-level atmospheric conditions and the unit chord.

1. Do the SST k-omega turbulence model solution for angle of attack values of 0, 2, 4, 6, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23 degrees.
2. Capture pressure contours around slat, main airfoil and flap, at α=4° and at α=20°. Did you notice any difference? Comment on it.
3. Capture velocity magnitude contours around slat, main airfoil and flap, at α=4° and at α=20°. Did you notice any difference? Comment on it.
4. Draw C_l vs α.
5. Draw C_d vs α.
6. Draw C_m vs α.
7. Draw C_p vs x at α=4°.
8. Draw C_p vs x at α=20°.
9. Export boundary layer profiles of total pressure coefficient C_{p_tot} for both 4 and 20° normal to the upper surface at:
   a. X=0.35 m on the main element.
   b. Main element shroud trailing edge.
   c. 50% flap chord.
   d. Flap trailing edge.
10. Calculate and plot C_p values on the airfoil at angle of attacks 0, 10 and 15 degrees. Compare them with the experimental data (cp_exp.xy) supplied in AE433 site.
11. You can use the references given below for validation of your graphs.

NOTES:

1. Report cannot be longer than 20 pages.
2. No additional submissions are needed other than **one printed report with a cover page**.

<u>**References**</u>:

1. Moir I.R.M. Measurements on a Two-Dimensional Airfoil with High-Lift Devices, AGARD AR 303. Aug 1994. Case A2.

2. De Rango, S. and Zingg, D.W., Higher-Order Spatial Discretization for Turbulent Aerodynamics Computations, AIAA Journal, Vol. 39, No. 7, July 2001.

3. Fejtek, I., Summary of Code Validation Results for a Multiple Element Airfoil Test Case, AIAA.