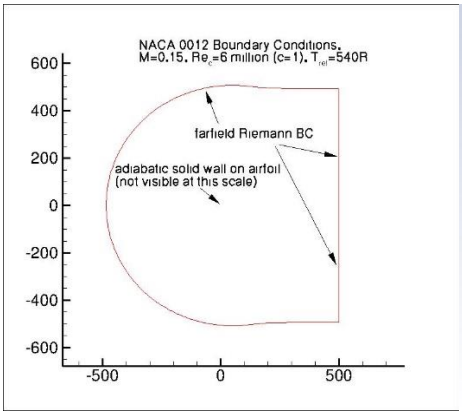
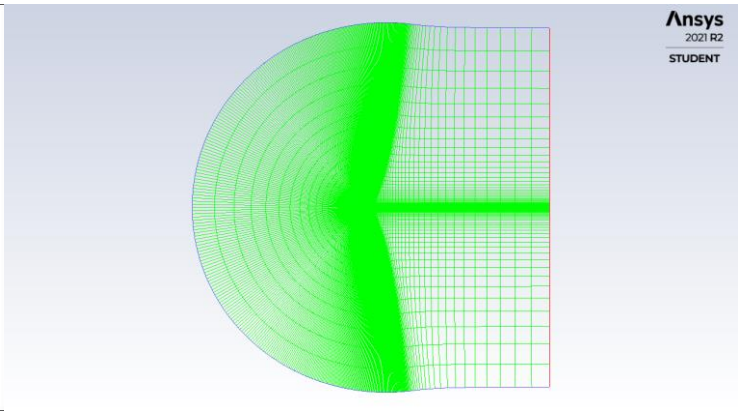
AE 433 CFD – HW3

DUE DATE: Beginning of the next lecture (24.12.2021 Friday, 8:30)

Consider the same case study (NACA 0012– Re = 6 000 000 – M = 0.15) given in the lecture. The figure for boundary conditions and example mesh are given as follows:





Use the C-mesh given during lecture and the CLCD_Ladson_expdata.dat file for comparison. For angle of attack values of 0, 2, 5, 7, 10, 12, 15, 18, 20:

1. Do the Spalart-Allmaras and SST k-omega turbulence model solutions.
2. Calculate, tabulate and plot C_l, C_d values vs. angle-of-attack over the airfoil. Compare them on the same graph with the experimental data of Ladson supplied in lecture.
3. Calculate, tabulate and plot C_p values vs. angle-of-attack on the airfoil. Compare them on the same graph with the same experimental data supplied in lecture.
4. Export and add into your report for angle of attack = 12°:
    a. Contours of velocity magnitude
    b. Contours of pressure
    c. Contours of Mach number
    d. Contours of density
    e. Contours of turbulent viscosity
    f. Contours of TKE
    g. Contours of specific dissipation rate
    h. Contours of viscosity ratio and velocity vectors (in the same figure)
    i. Residual graph
    j. C_m convergence graph
    k. C_d convergence graph
    l. C_l convergence graph
    m. y^+ distribution on the airfoil wall
    n. C_p distribution on the airfoil wall

NOTES:

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

Reference: Ladson, C. L. (1988). Effects of independent variation of Mach and Reynolds numbers on the low-speed aerodynamic characteristics of the NACA 0012 airfoil section (Vol. 4074). National Aeronautics and Space Administration, Scientific and Technical Information Division.