# 1(b) Turbulent Flow Around a 2D Airfoil

The airfoil is a NACA 2415 section with 0.127 m chord and the velocity is 40 m/s. At your first angle of attack (say 10 deg), again do a cell size check by changing the “level of refining fluid cells”. Calculate the flow for 0, 6, 12 degrees aoa. Write a short report of the results as follows:

As before, plot the mesh at 6 deg angle of attack and discuss how you chose the mesh settings. Select streamline plots and plots of velocity magnitude to describe the flows and show the effects of angle of attack. How do these results differ from the laminar airfoil? Compare your results to the smoke and surface paint flow visualization you performed in the wind tunnel at each angle of attack. Make sure you talk about flow separation – if you can identify a separation point, compare to the location previously identified in the flow visualization.

Generate a contour plot of vorticity and compare to what you observed at the corresponding aoa for the laminar airfoil.

You previously calculated the Re based on chord for this airfoil (report for experiment 3,4,5). Compare this value to the values for the laminar airfoil experiment and the dragonfly wing and the AIAA DBF wing as previously discussed, and comment on the differences and their significance.

Plot lift, drag, and pitching moment coefficients as a function of aoa. To this plot, add the lift, drag, and pitching moment coefficients for the laminar airfoil, compare and discuss.

Again, plot lift, drag, and pitching moment coefficients as a function of aoa. To this plot add the NACA measurements of a 2D NACA 2415 airfoil given in lecture 1 (Course Outline and Aerodynamics Review) slide 23. Select the line at the lowest ReC (3x106), compare, and discuss. What reasons might there be to get different results. Consider the effect of Reynolds number on CL,max observed in the NASA data and any potential uncertainties in the CFD.

Submit a separate report for this due November 2nd.