Assignment #6 : CFD 1

ME 412

due 10/19/2016 before midnight via Learning Suite

50 possible points

6.1 Provide a brief progress report on your project (a paragraph or two). What have you accomplished and what are your plans going forward? What is your biggest challenge? Are there any resources that you need? What interested you in this particular problem?

6.2 StarCCM: Perform a verification and validation study on the 2D backward facing step problem described here. (Further details are available in an AIAA Journal paper linked from our website.) One of the key metrics in this study is predicting the reattachment position. You will need to perform a grid convergence study to aid in verification and a comparison to experimental data to aid in validation. Show the following:

(a) A plot showing the reattachment position for different grids using some measure of grid size. You should include as many simulations as necessary to demonstrate good grid convergence. Show the experimental reattachment point on the same plot.

(b) Report the grid size that you recommend using and include **at least 3** pictures of the corresponding mesh (full domain, around the step, at boundary level scale).

(c) A plot of skin friction coefficient (C_f) along the lower wall from $x/H = 0$ to 10 for your grid converged case **and at least 2 other** coarser grids (demonstrating progress towards the grid-independent solution). Also show the experimental attachment location on the same plot.

(d) For your grid independent case, plot the boundary layer velocity profile at $x/H = 1, 4, 7, 10, 13$ on one plot.

To aid you in this study I recommend completing (or at least skimming through) the following two tutorials:

- Incompressible Flow/Steady Flow: Backward Facing Step
- Automation/Simple Java Macros: Post-Processing Objects

The first one is helpful for obvious reasons. The latter introduces you to automation in StarCCM, which can be helpful when running multiple similar cases. The tutorials aren't required and you don't need to turn anything in for them, but would be helpful in your understanding.