Coursework Assignment

This coursework is worth 50% of the total mark for the module.

A. Grid Design [25% of total marks for module]

Objectives: Demonstrate two different methods of gridding for the problem of 2D steady flow around an aerofoil in an infinite fluid at moderate Reynolds number (e.g. U_∞ =10/s, chord length=1m), and moderate angle of attack (0-15^0).

- Choose an aerofoil section from the NACA (or other) series, obtain the coordinates, and use these to define the aerofoil section using Gambit. It will be checked that every student has chosen a different aerofoil section.
- Pay attention to how the finite computational domain approximates an infinite domain, the boundary conditions, and how the grid points are distributed so as to capture the expected flow field.
- Build **TWO** computational grids using different approaches (for example, a structured grid, and an unstructured grid) taking into account any characteristics of the expected flow that might influence your grid design (for example, a boundary layer mesh is required for the unstructured grid).
- For the unstructured grid, check the quality of the mesh.

B. Solution and Grid refinement [25% of total marks for module]

Objectives: Demonstrate a good quality solution for the flow problem and provide supporting evidence for its quality by, for example, refining and adjusting the grid to improve the solution and to show a degree of grid convergence. Extract some aerodynamic performance measures for the aerofoil.

- Take **ONE** of the grids above and use it in Fluent/CCM+ to obtain a solution at a moderate angle of attack and moderate Reynolds number. Use a standard turbulence models (e.g Spalart-Allmaras or k-epsilon) model and steady state solver.
- **Evaluate the solution and consider how it might be improved by making changes to the grid or how you could demonstrate that it's relatively insensitive to changes in the grid.**
- **Obtain a new solution on the new grid and re-evaluate. You only need to iterate around this loop once, but you should aim to show how you have adapted the grid to improve the solution or how you have shown that the solution is converged with respect to changes in the grid (e.g. a comparison of the results between the two meshes).**
- **Produce plots: lift coefficient versus angle of attack, including near the stall point; and pressure coefficient versus chord length on the upper and lower surfaces.**