Fluent Project 3

Flow Simulation around a cylinder 2D (Circle)

Team Members:
Maddox Gonzalez
Gabriel Ospina

Due Date: July 20th, 2025

Fluid Mechanics I EML 3701
Monday 2:00 PM – 3:50 PM

Video Link:
https://www.youtube.com/watch?v=H8ixr9LpOuI&ab_channel=Cacoman

Part A (Inviscid):

Figure 1: Velocity contours around the cylinder

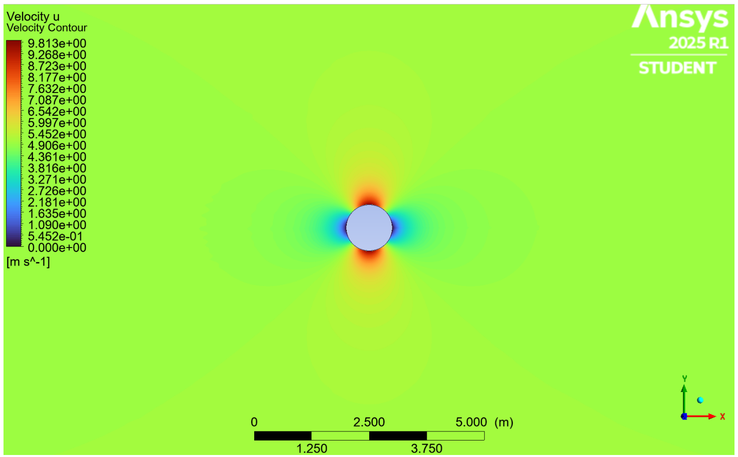


Figure 2: Streamlines around the cylinder

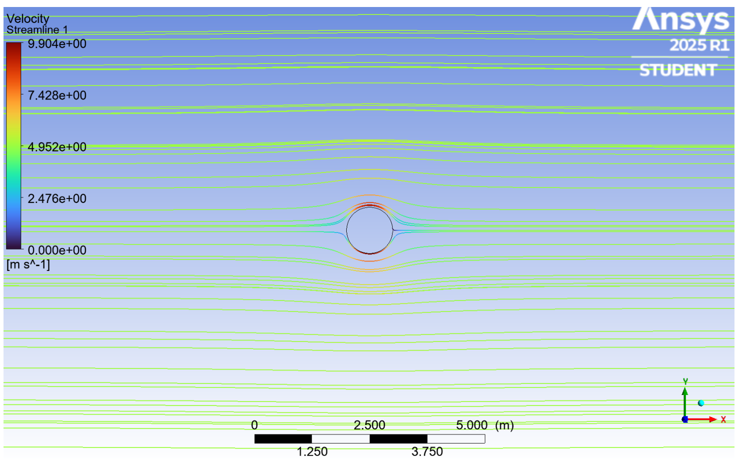
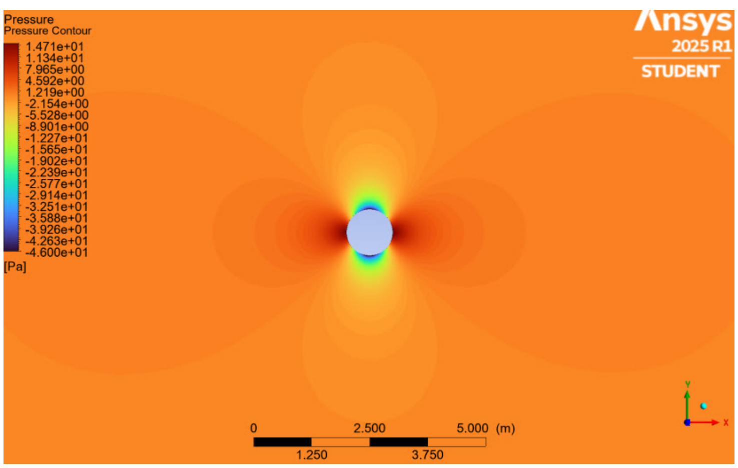


Figure 3: Pressure contours around the cylinder



Part B (Viscous Laminar):

Figure 4: Velocity contours around the cylinder

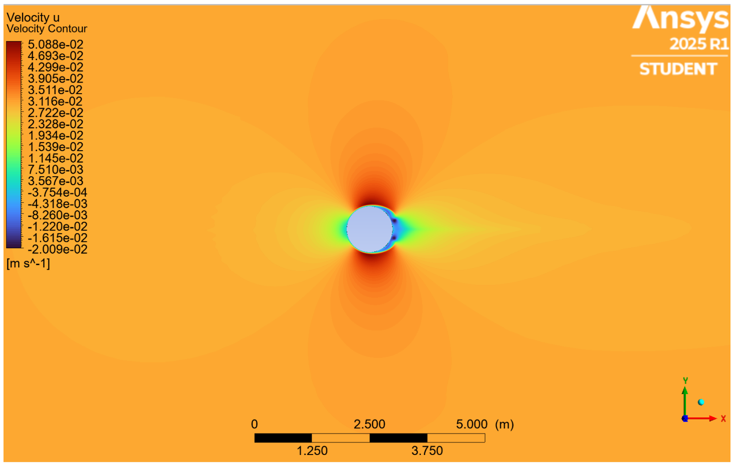


Figure 5: Streamlines around the cylinder

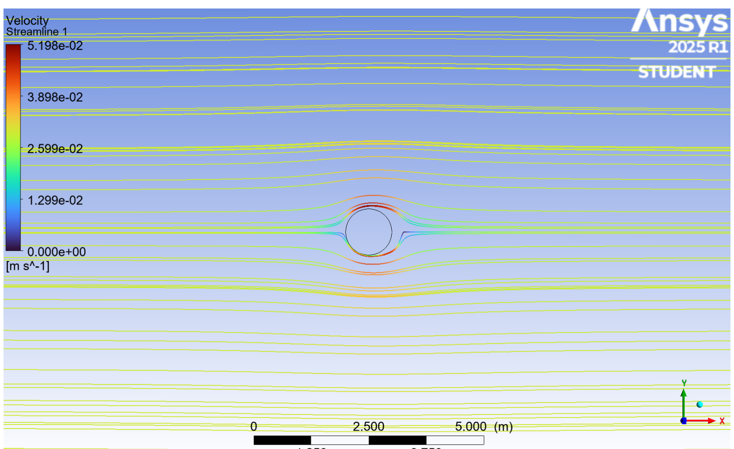
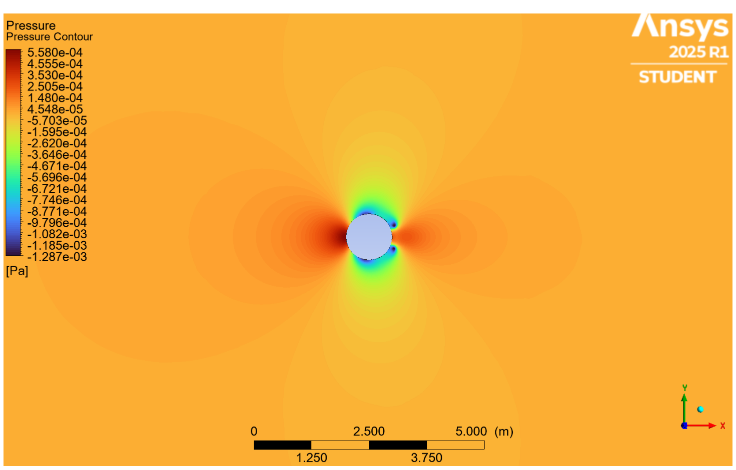


Figure 6: Pressure contours around the cylinder



Part C (Viscous Turbulent):

Figure 7: Velocity contours around the cylinder

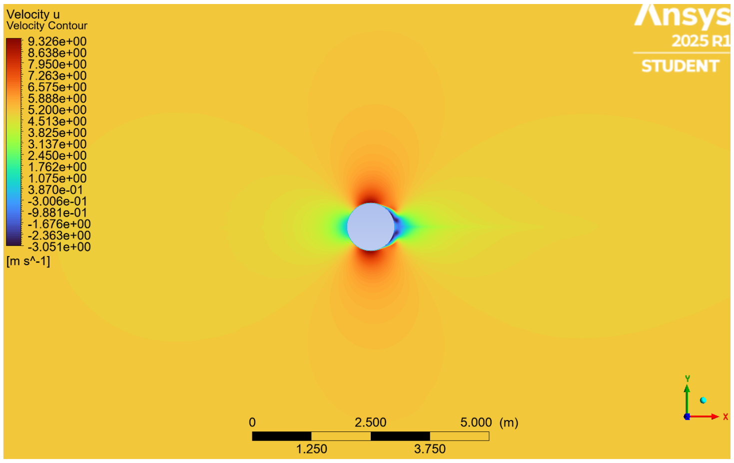


Figure 8: Streamlines around the cylinder

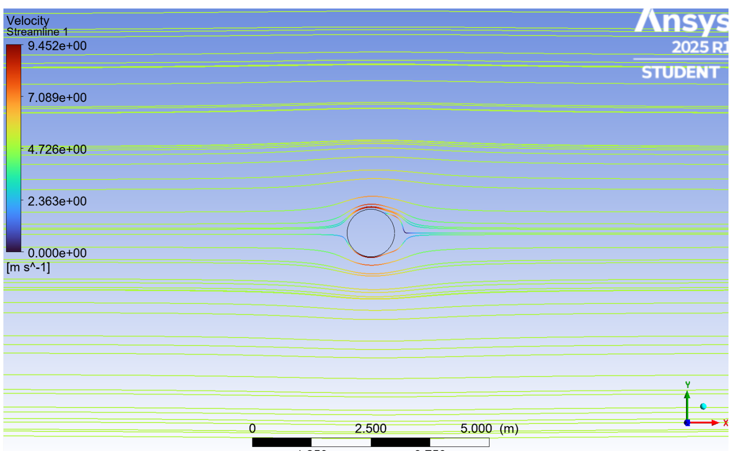
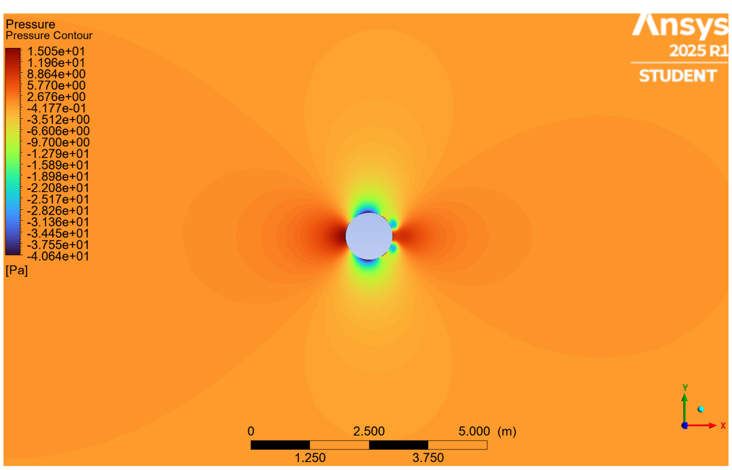
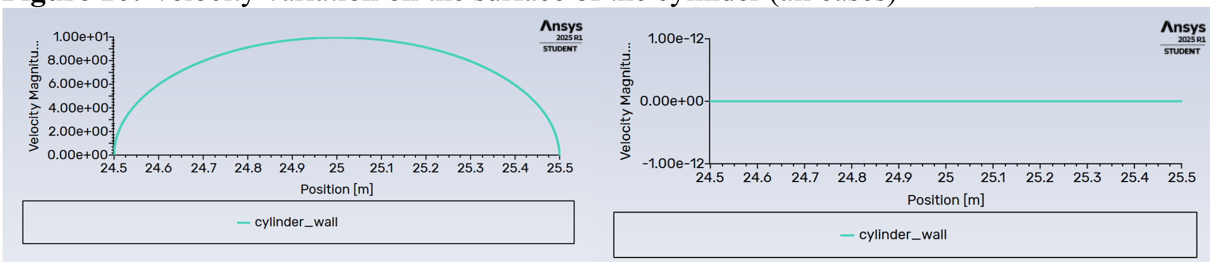


Figure 9: Pressure contours around the cylinder



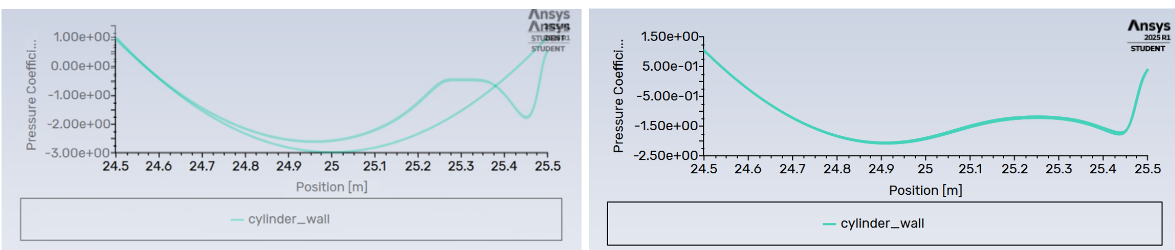
Combined Cases:

Figure 10: Velocity variation on the surface of the cylinder (all cases)



Cases B and C showed similar velocity variations, so they were plotted on the same graph; however, case A showed a wider range, so it was displayed on a separate graph with an altered y-axis

Figure 11: Pressure coefficient variation on the surface of the cylinder (all cases)



Cases A and C showed a similar range of values and were therefore plotted on the same graph; however, case B demonstrated a different variation in values, so it was plotted on a separate graph.

Figure 12: Drag coefficients (all cases)

Cases	Drag Coefficients
A	0.00010008464
B	0.88819704
C	0.47823076

When examining case A, it is known to be an inviscid flow, which relates to a fluid with no viscosity and therefore no shear stress. This is why the drag coefficient for case A turned out to be extremely low, almost zero, since the fluid has a net pressure drag virtually equal to zero. Case B views a scenario involving viscous laminar flow, where viscosity is now present and the fluid now displays a laminar boundary layer on the cylinder surface. The drag coefficient can be seen to be a lot greater than that of cases A and C because the laminar flow observed in case B causes a larger wake region at the rear of the cylinder, which creates a low-pressure region that in turn generates a high-pressure drag. Finally, case C simulates viscous turbulent fluid flow over the cylinder, and its drag coefficient value came out to be between that of cases A and B. This is because the fluid is viscous, which causes more drag than an inviscid flow, but it is also turbulent, which means that the fluid will have a smaller wake region at the rear of the cylinder, leading to a higher pressure region than in case B and this causes a smaller pressure drag that results in a lower drag coefficient.