MAE 560

Applied CFD

Project-3

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Name	Task	Collaboration
Anurudh Kamma	Task 2	Geometry
Anurudh Kamma	Task 3	Table Calculation

Task – 1

a)

(D1) The Reynold's Number can be given from

$$Re = \frac{\rho v D}{\mu}$$

Here we know that the Diameter of the circle is 4 cm i.e

$$D = 0.04\ m$$

The density of the water is $\rho = 998.2 \frac{kg}{m^3}$

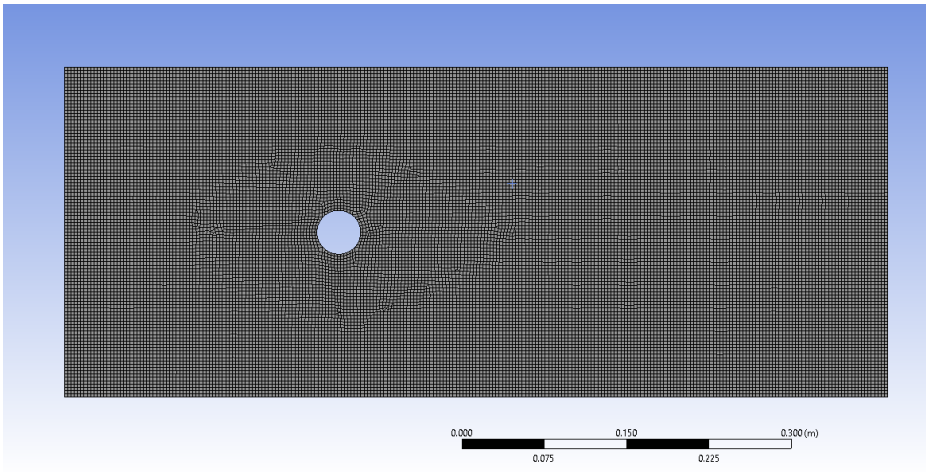
The velocity of the stream is $v = 0.025\ m/s$

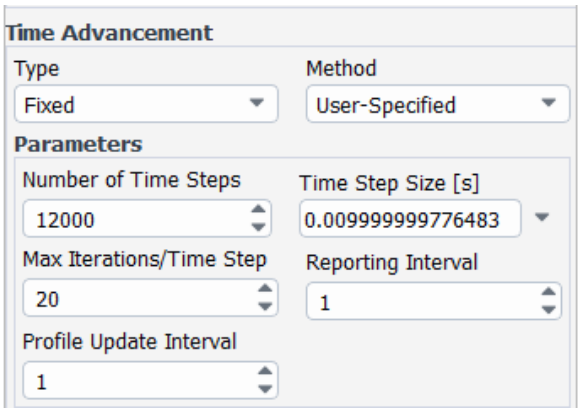
The dynamic viscosity of water is $\mu = 0.001003 \frac{kg}{m\ s}$

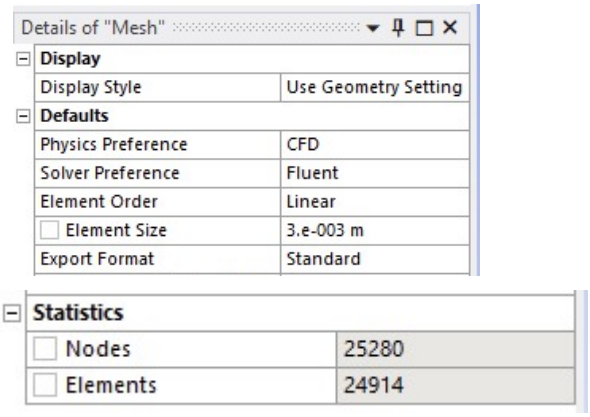
So, the Reynold's Number is $Re = 995.214$

(D2)

A 2-D cylinder is created on a plane with a diameter of 4 cm and the origin as the center. A computational domain is also created around the cylinder with the given dimensions as shown in the figure 1.1 below and is meshed with 3mm element size.

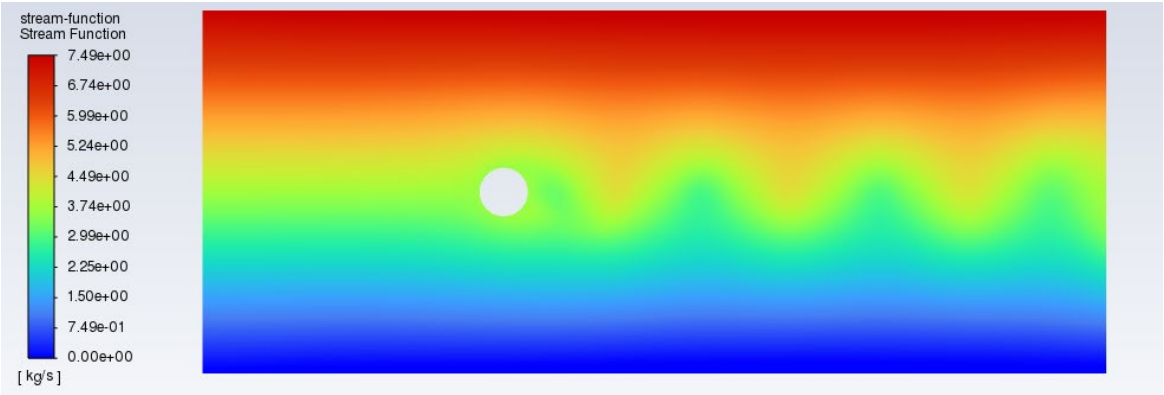




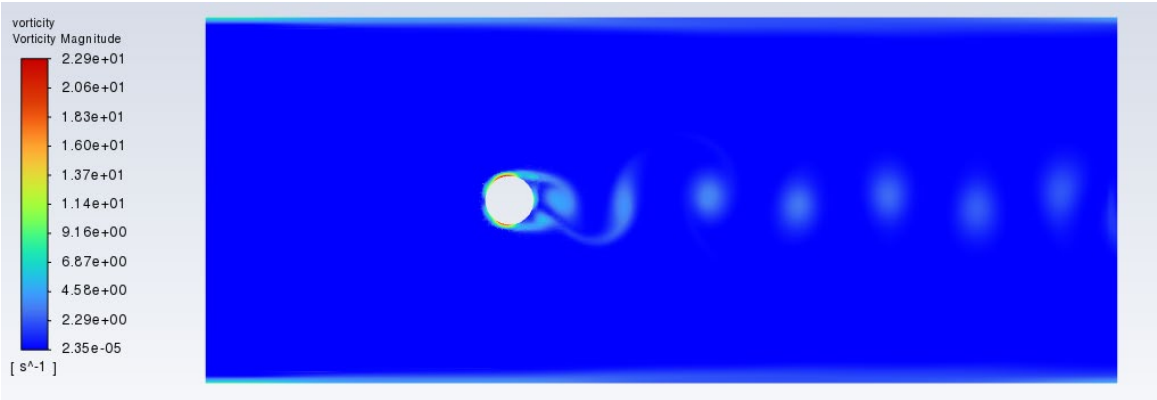


D3)

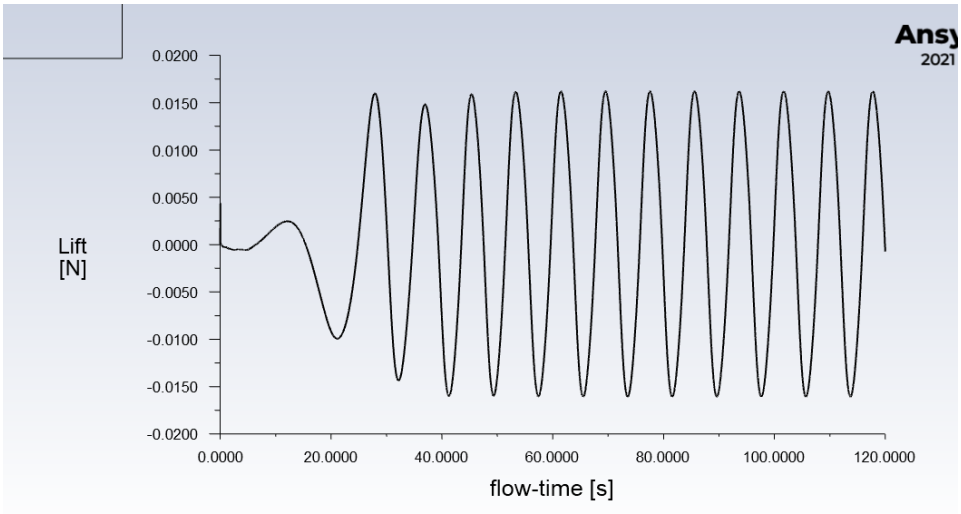
Stream function Contour:



Vorticity Magnitude Contour

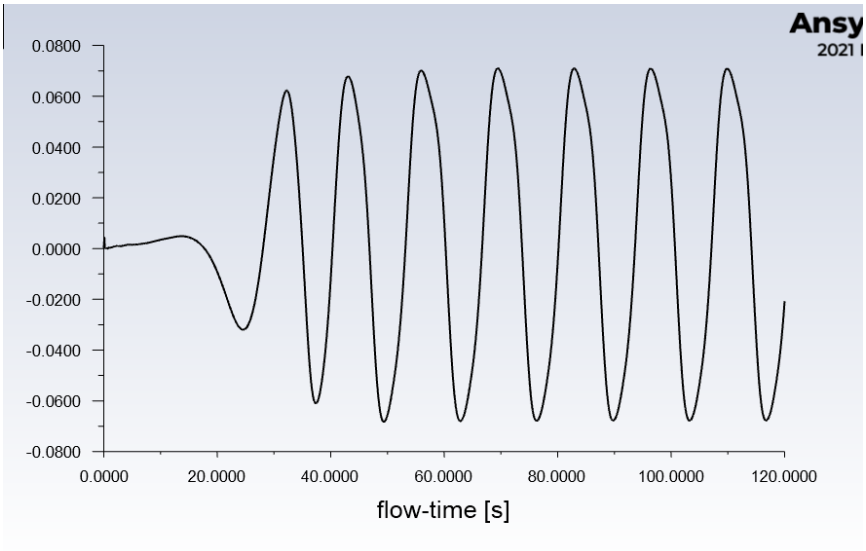


Lift Force Plot: The maximum and the minimum values of lift are 0.165 N and 0.1 N



b)
D5)

Lift Force Plot for Run1: The maximum and the minimum values of lift are 0.071 N and 0.062 N



Lift Force Plot for Run2: The maximum and the minimum values of lift are 0.026 N and 0.037 N

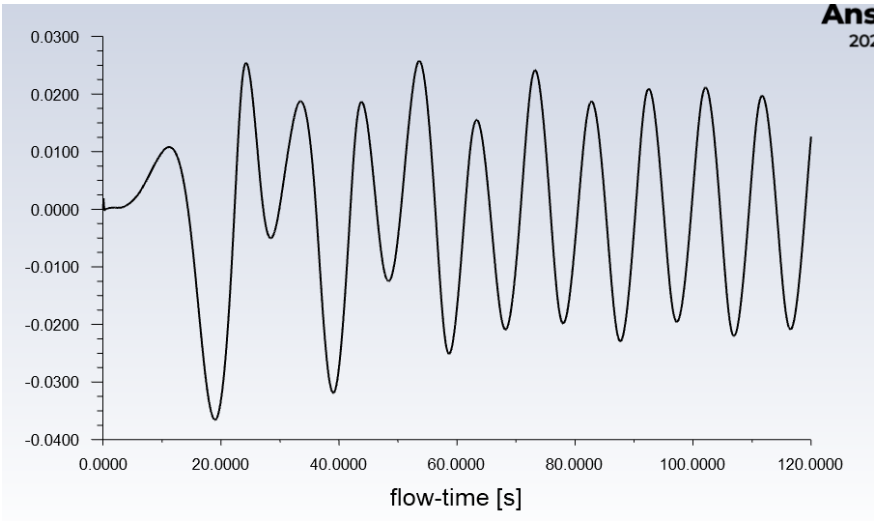
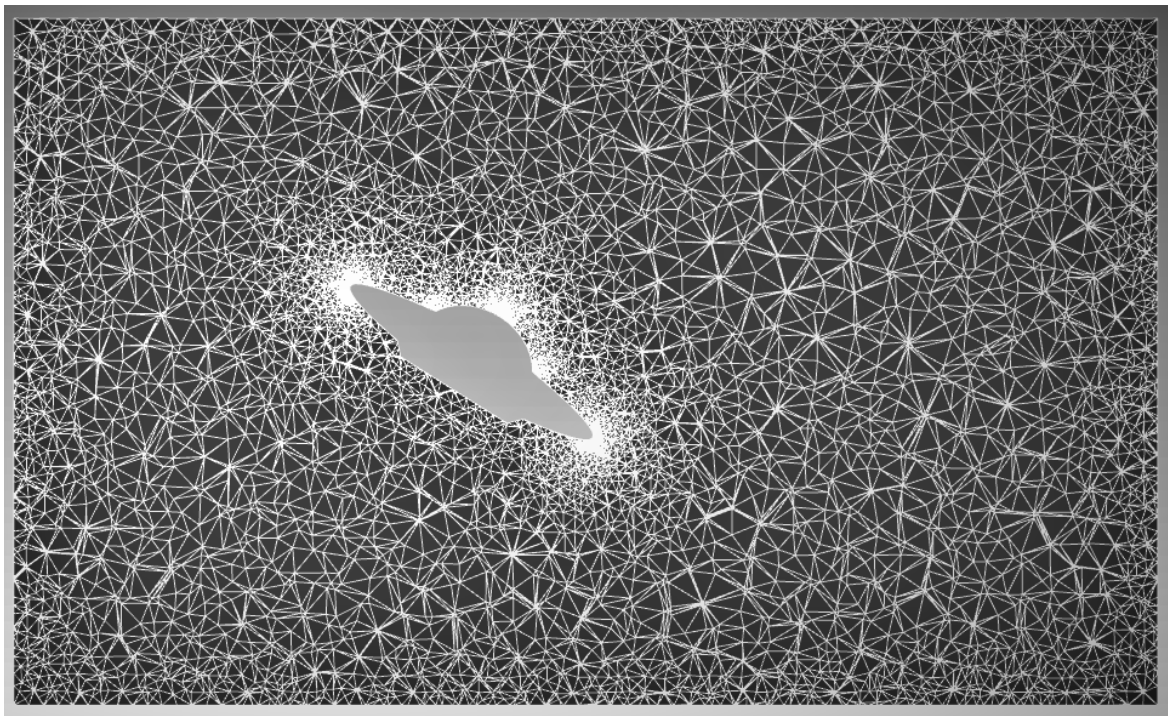


Table for amplitude and Time Period for all the above Lift Force Plots:

	Amplitude	Period (in sec)
Circular Cylinder	0.142	9.3
Run 1	0.0675	12.2
Run 2	0.0415	9.6

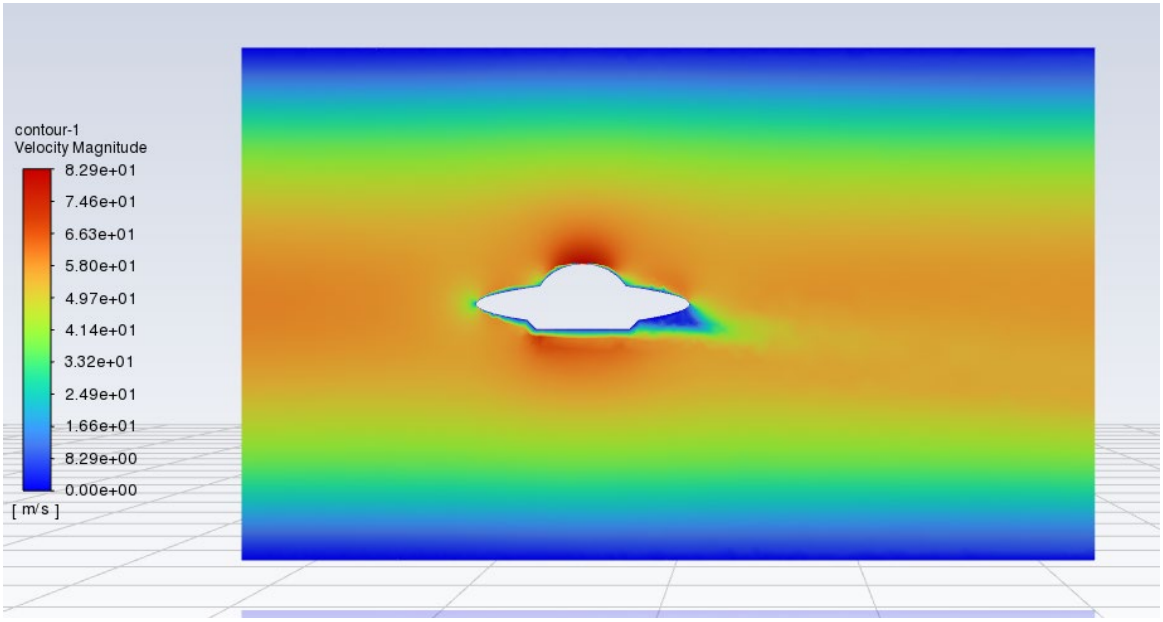
Task 2:

D6) Mesh along the plane of symmetry

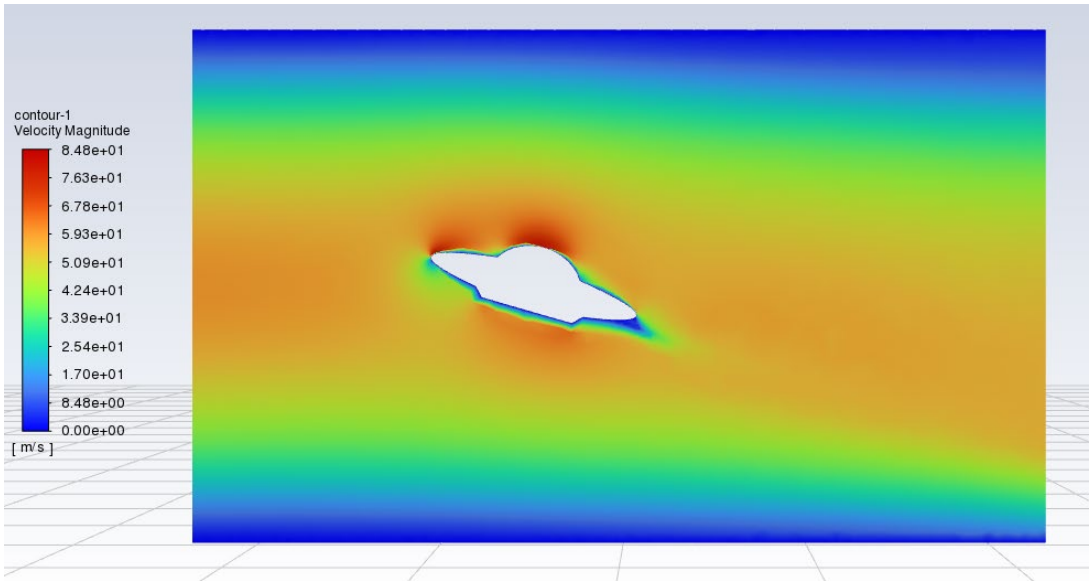


D7) X-Velocity Contour on the plane of symmetry for

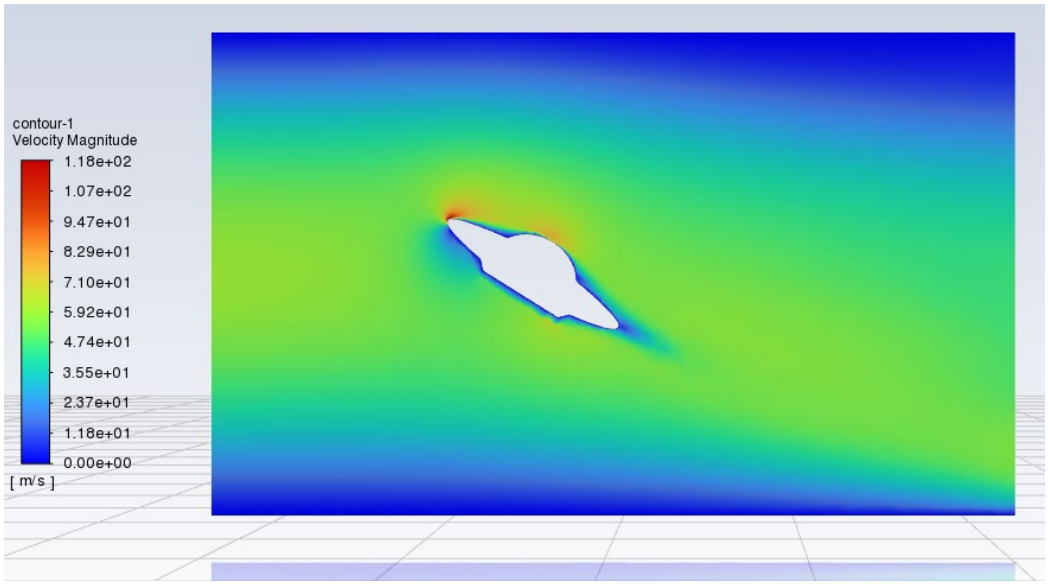
a) $\theta = 0°$



b) $\theta = 16°$



c) $\theta = 32°$



D8)

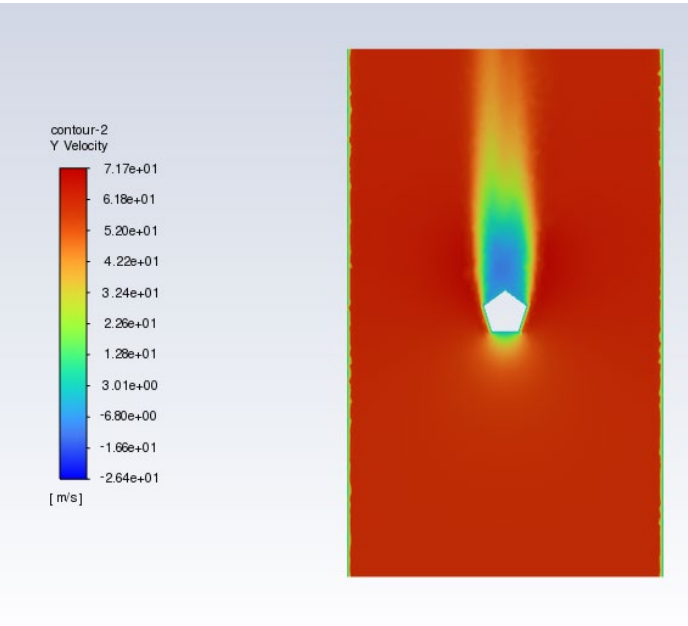
The values of lift force and drag force as a function of tilt angle is given in the table below:

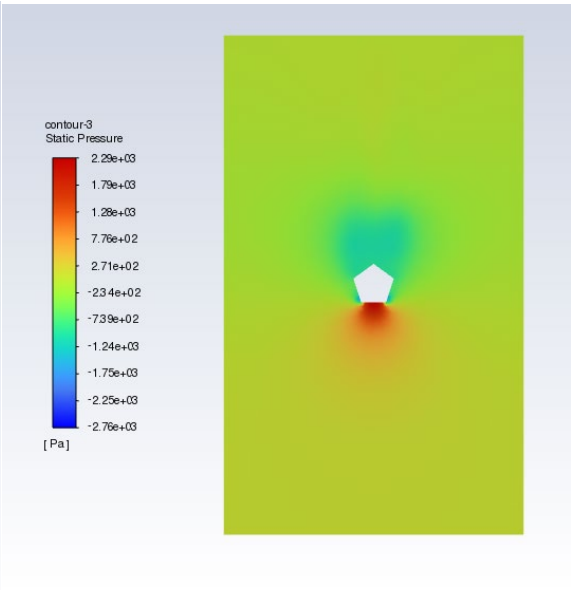
	Lift Force(N)	Drag Force (N)
$\theta = 0°$	19	11
$\theta = 16°$	85	36.5
$\theta = 32°$	122	116.5

Task 3:

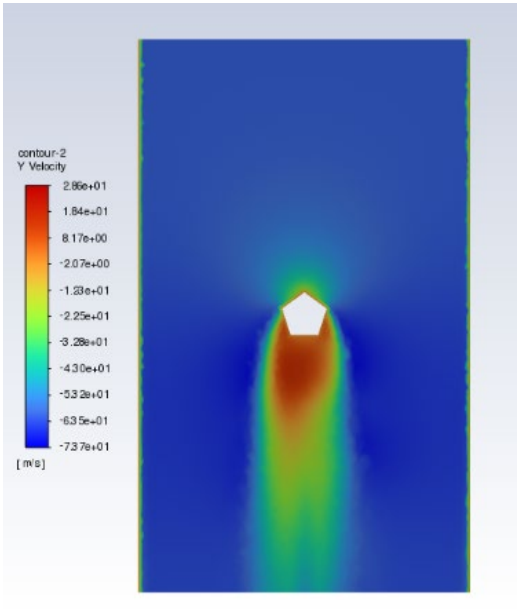
D9) The Static Pressure and the y-velocity plots on the horizontal plane with z=1.25m for Run1 and Run2 are given respectively:

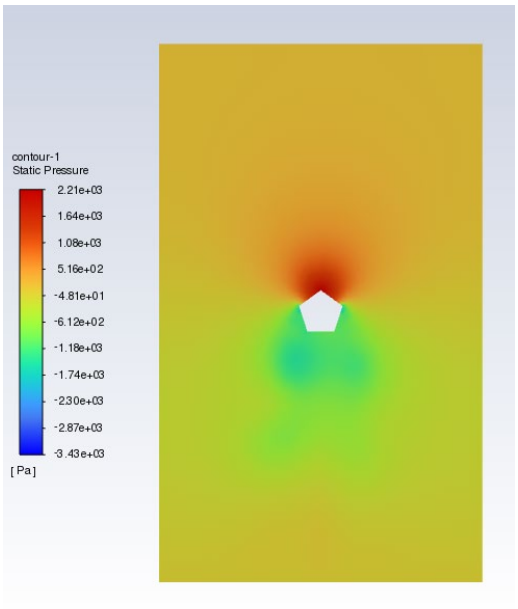
For Run 1:





For Run 2:

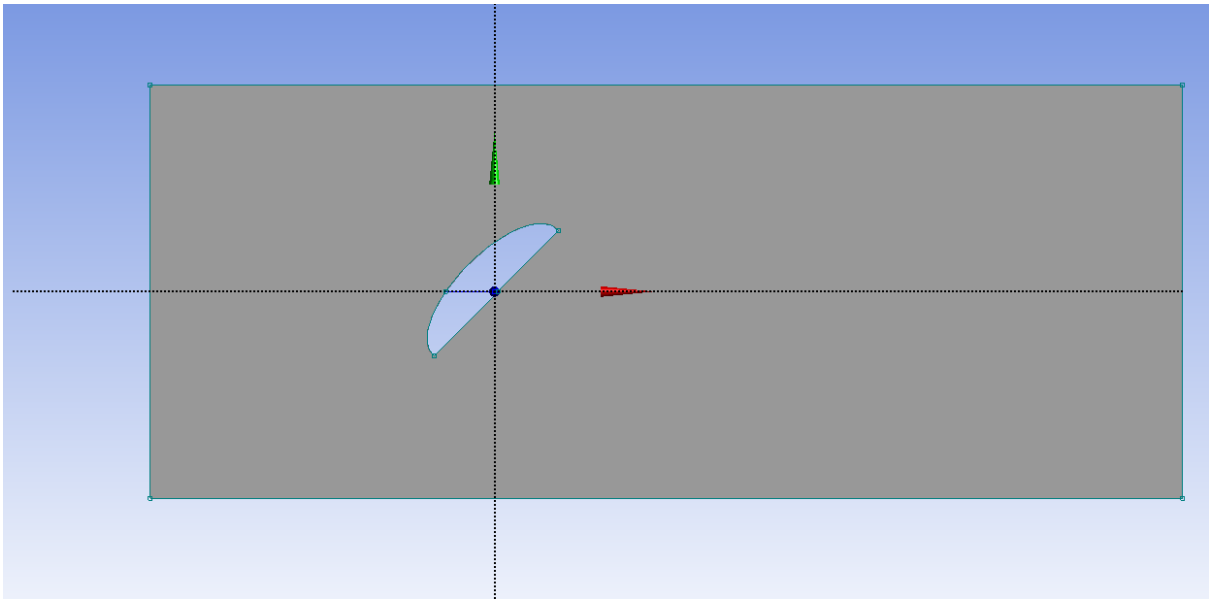




D10)

	Total Drag (N)	Pressure term of drag (N)	Viscous Term of drag (N)
Run 1	5434.392919	5428.598633	5.7942858
Run 2	8963.54665	8955.75293	7.7937202

D11) The geometry for the design of asymmetric cylinder is given below:



D12) The plot of lift force vs time from transient simulation is given below