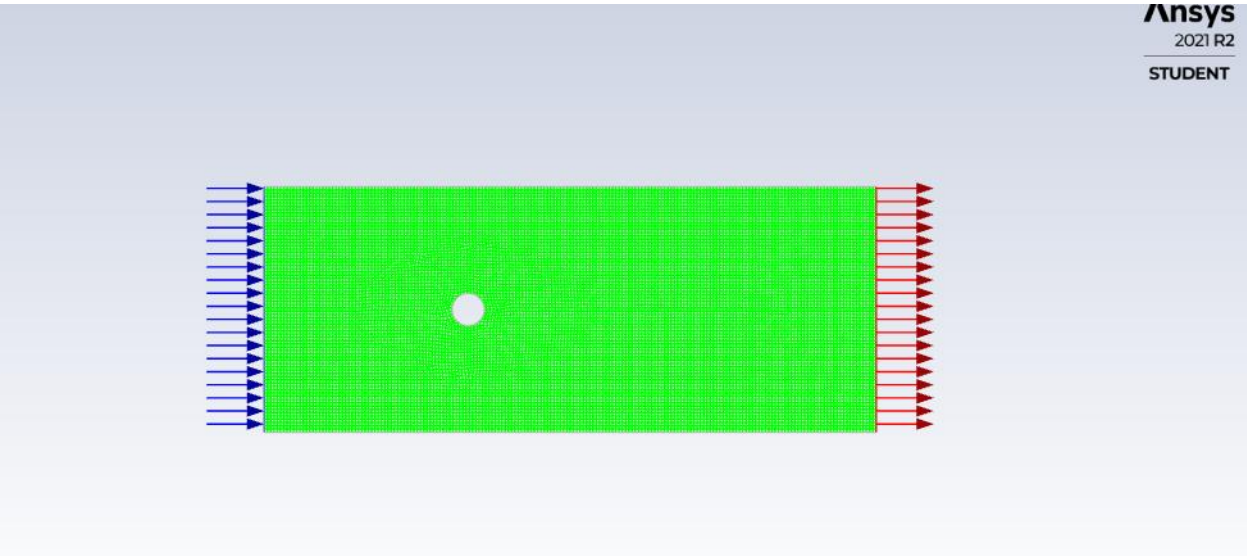
Nadine Iradukunda
MAE 560 Project 3
External Flow
Statement of collaboration: No collaboration

Task 1 2-D flow passing a cylinder



D1) Reynolds number for this system

Re=$\frac{\rho VD}{\mu}$; $\mu = 0.001003 kg/ms \rho = 998.2 kg/m^3 D = 0.04m; v = 0.025 m/s$

Re=998.2*0.025*0.04/0.001003

Re= 995.214

D2) Mesh used 0.4cm, time step size 0.05 sec, number of time steps 2400 10 iterations.

D3)

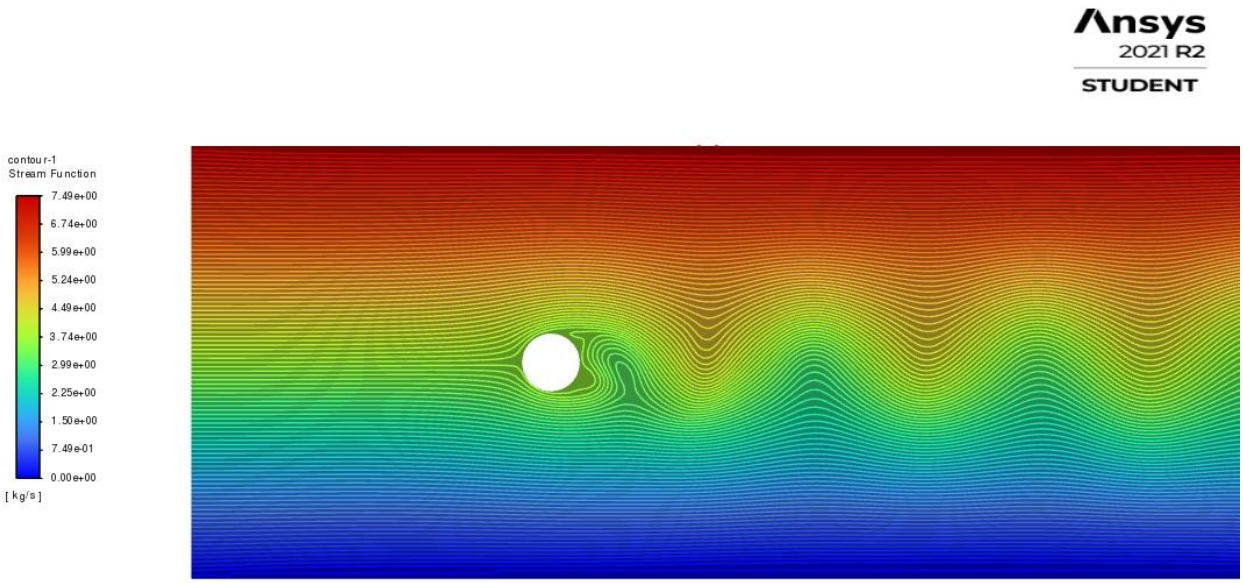


Fig 1. Contour plot of stream function at t=2min

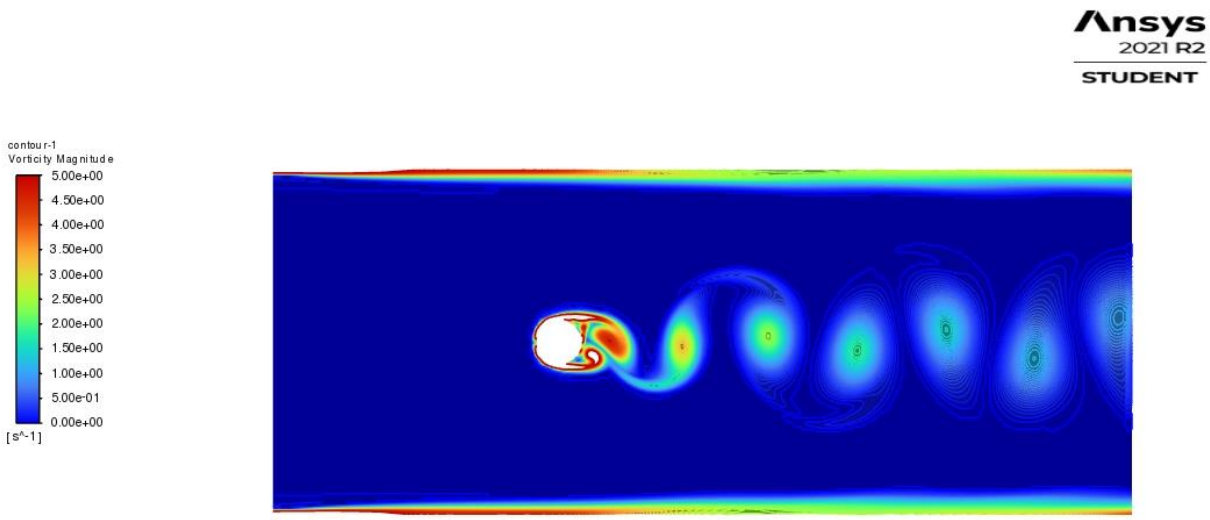
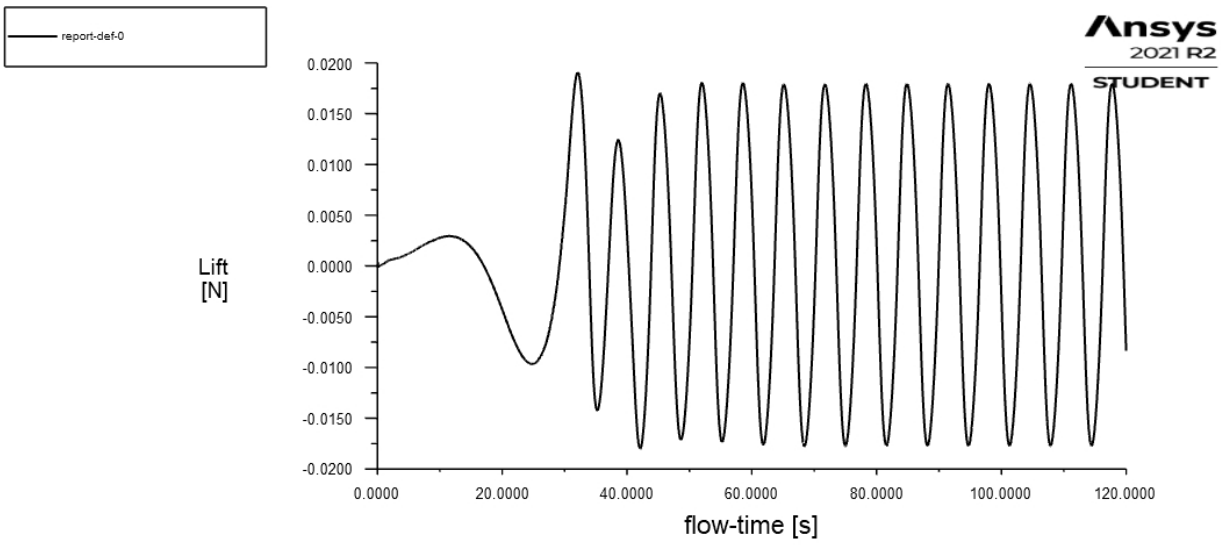


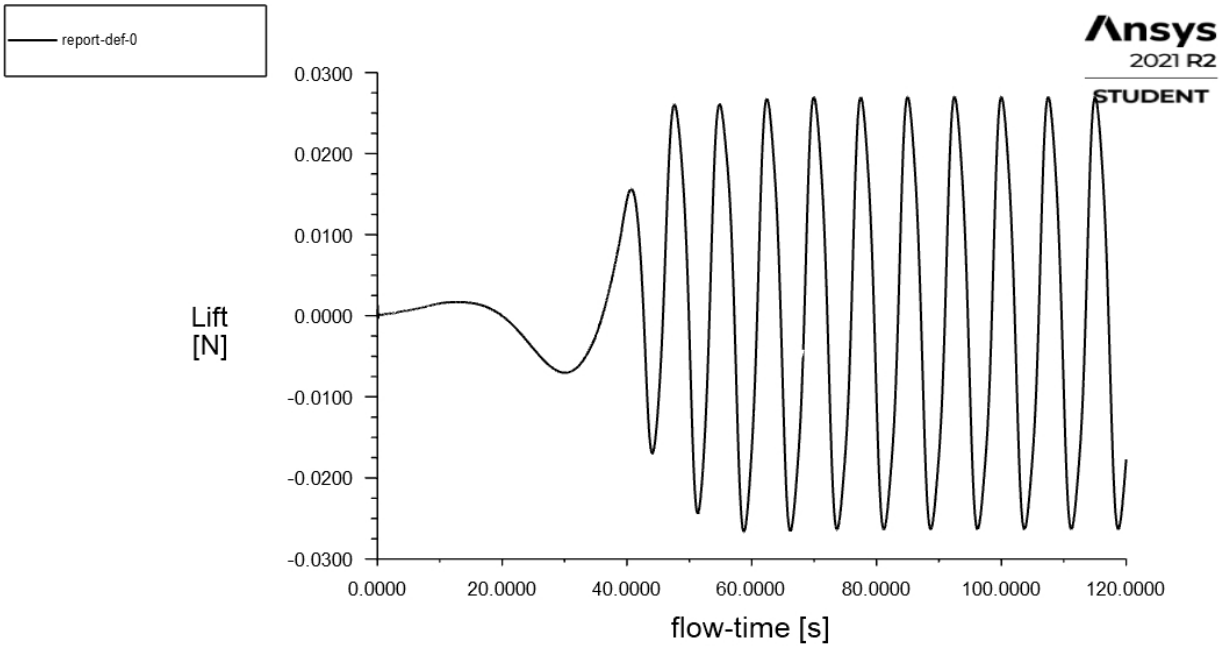
Fig 2. Contour plot of vorticity magnitude at t=2min

D4) Plot of lift force as a function of time from t=0 to t=2min



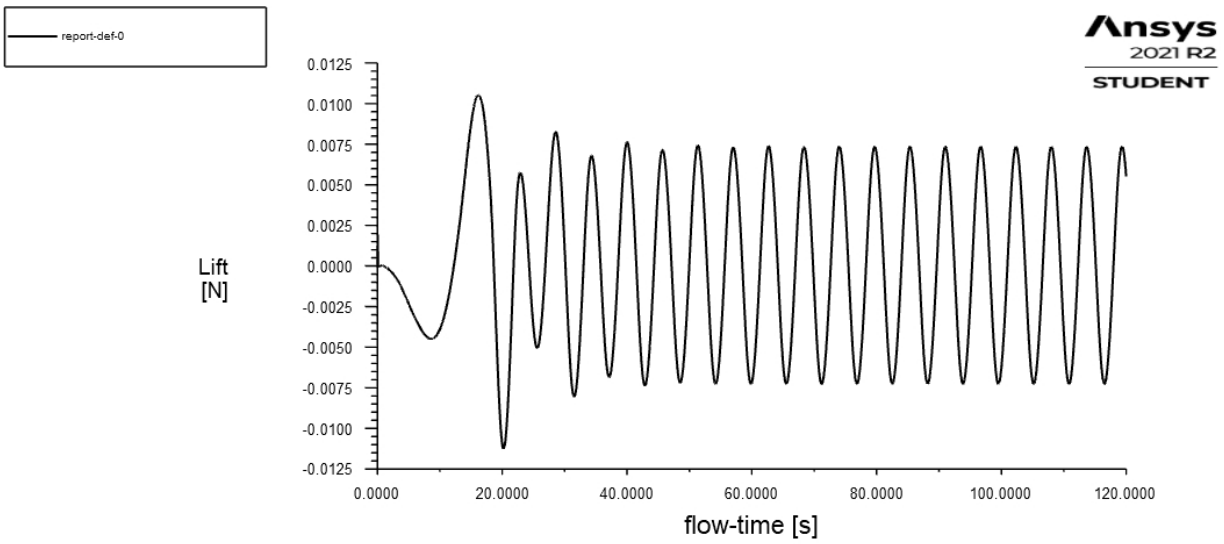
D5)

Run1 Ellipse elongated in y-direction



A plot of lift force as a function of time from t=0 to t=2min

Run2: Ellipse elongated in x-direction



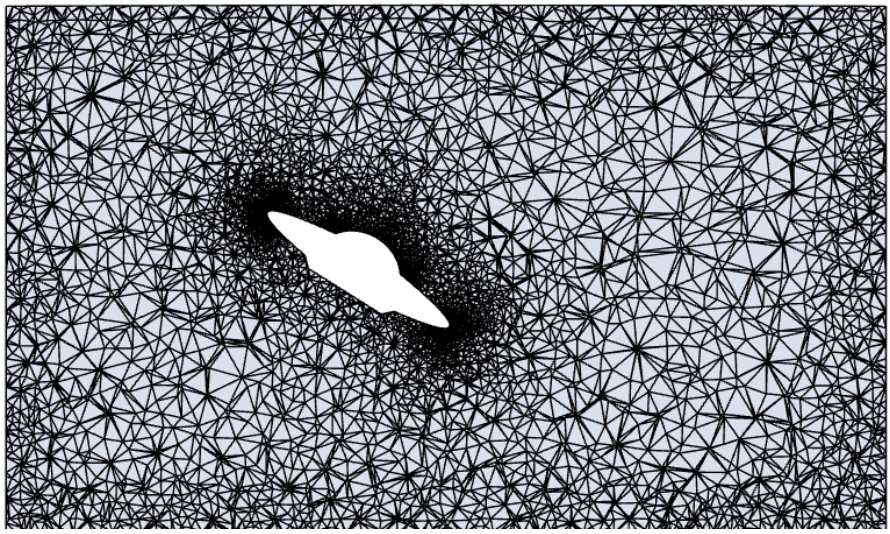
A plot of lift force as a function of time from t=0 to t=2min

Amplitude and period of oscillation

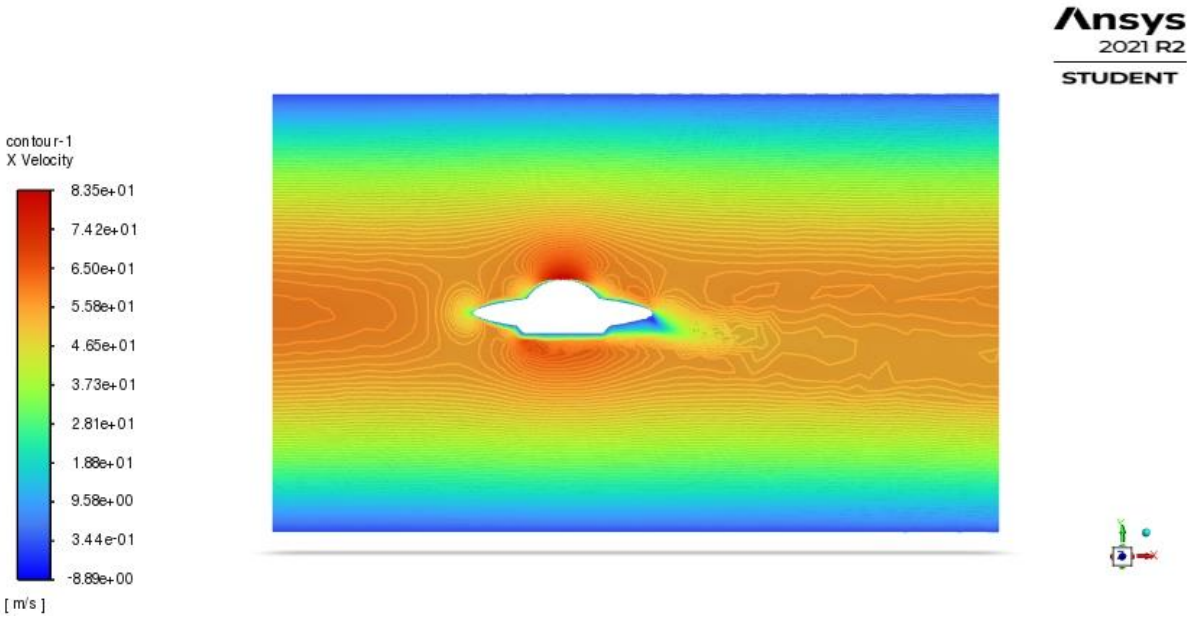
	Amplitude (in Newton)	Period (in second)
Circular cylinder	0.017	6.5
Elliptical cylinder, Run 1	0.0266	7.55
Elliptical cylinder, Run 2	0.0072	5.75

Task 2 3D flying saucer

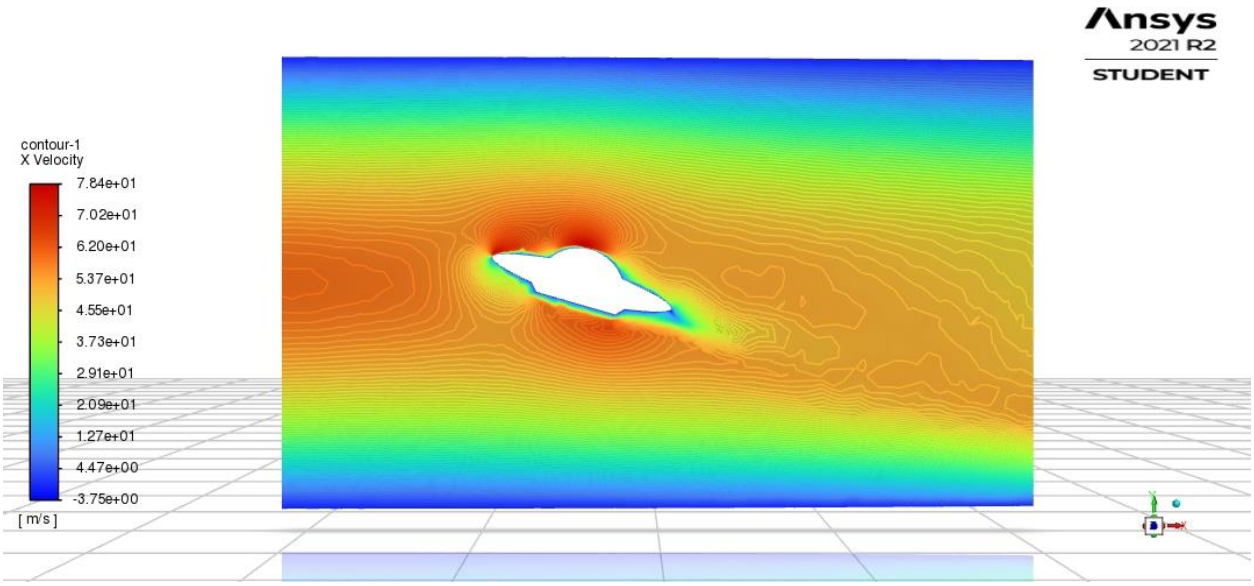
D6) A plot of the mesh along the plane of symmetry for the case with $\theta = 32°$



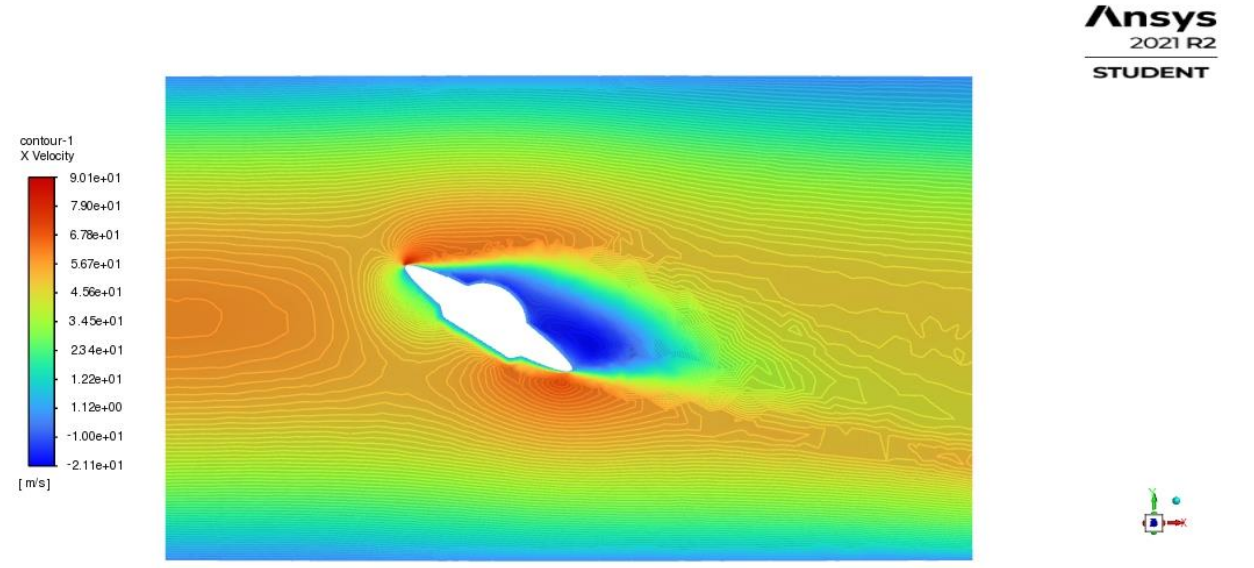
D7) Contour plots of x-velocity on the plane of symmetry for θ = 0°



Contour plots of x-velocity on the plane of symmetry for the θ = 16°



Contour plots of x-velocity on the plane of symmetry for the θ = 32°



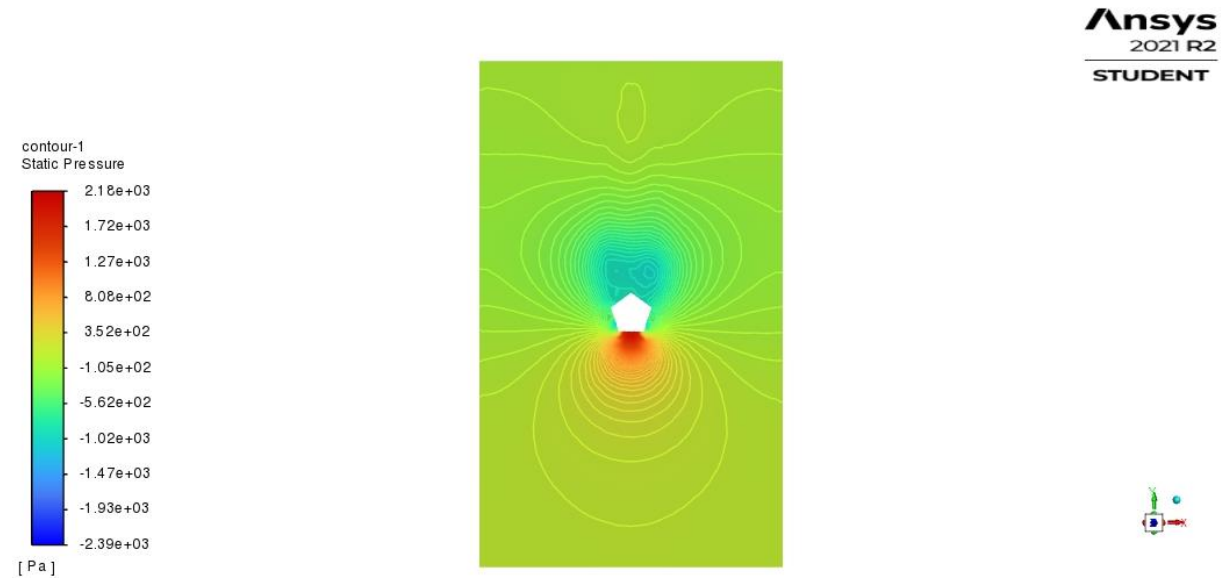
D8)

	Lift force (in Newton)	Drag force (in Newton)
θ = 0°	11.34	7.67
θ = 16°	66.97	17.81
θ = 32°	57.73	52.68

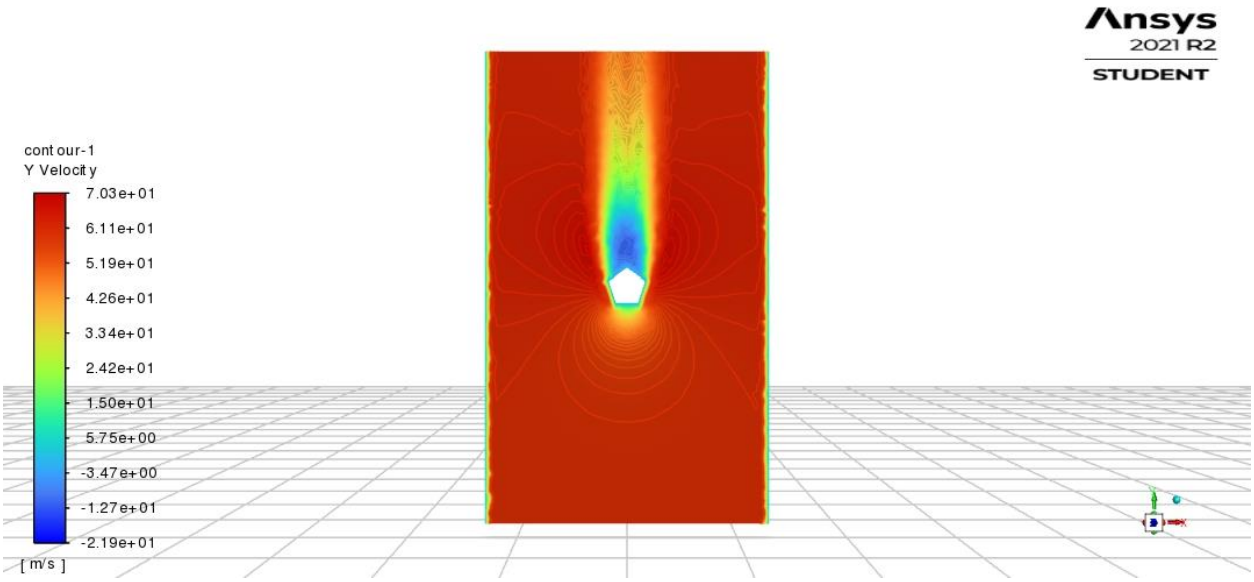
Task 3 3-D flow over a pentagon-shaped building in a virtual wind tunnel

D9) Run 1

Contour plots of static pressure on the horizontal plane with z=1.25m

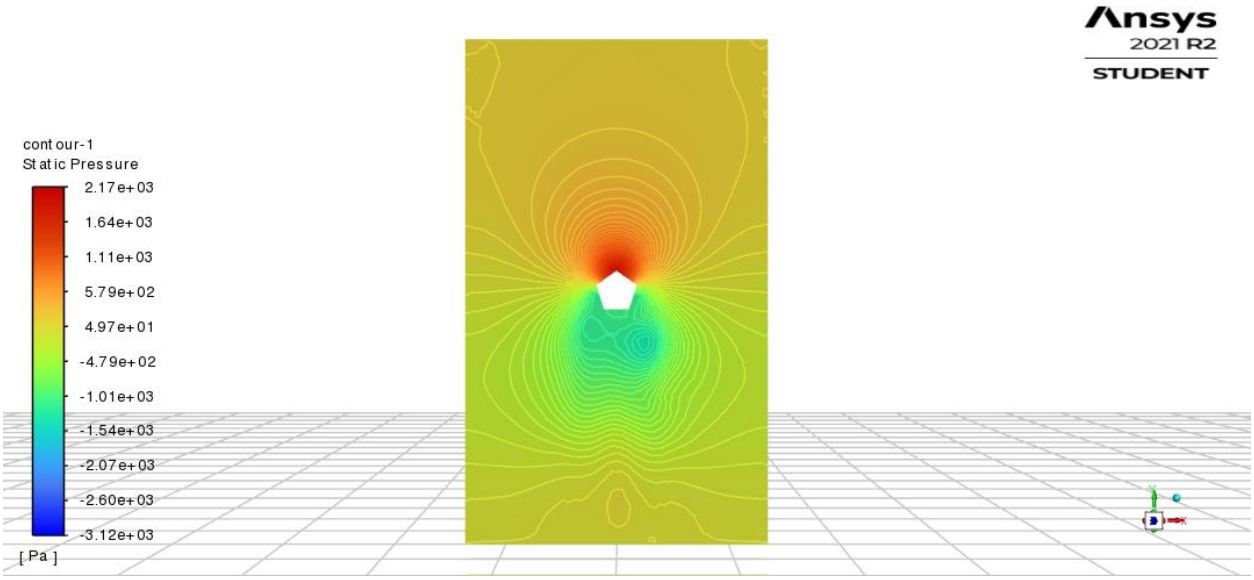


Contour plots of y-velocity on the horizontal plane with z=1.25m

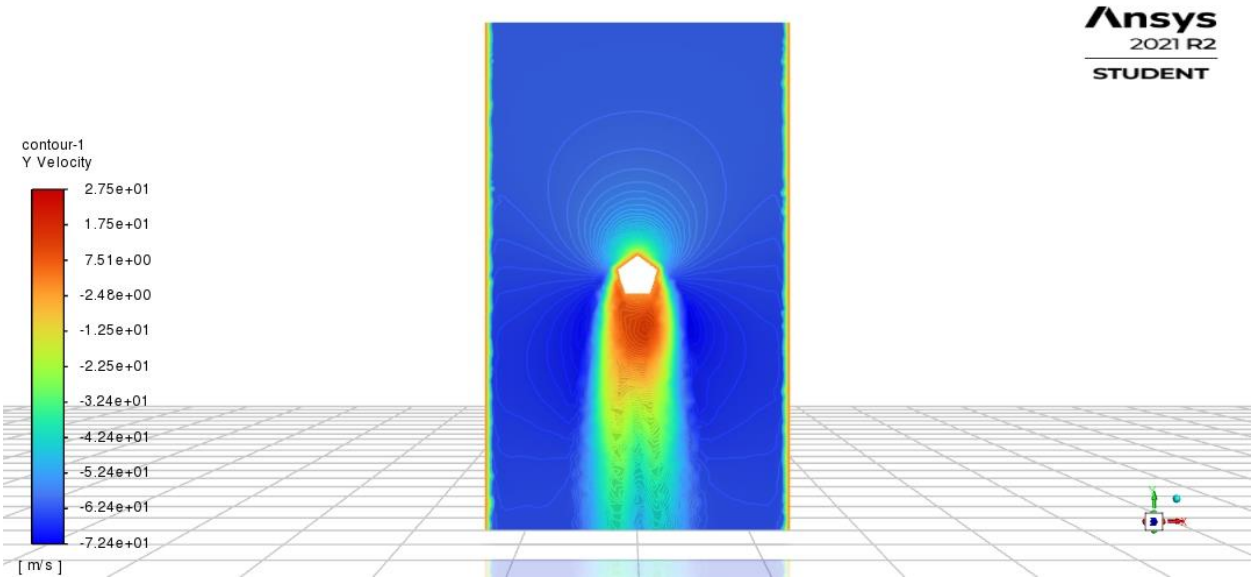


Run 2

Contour plots of static pressure on the horizontal plane with z=1.25m



Contour plots of y-velocity on the horizontal plane with z=1.25m

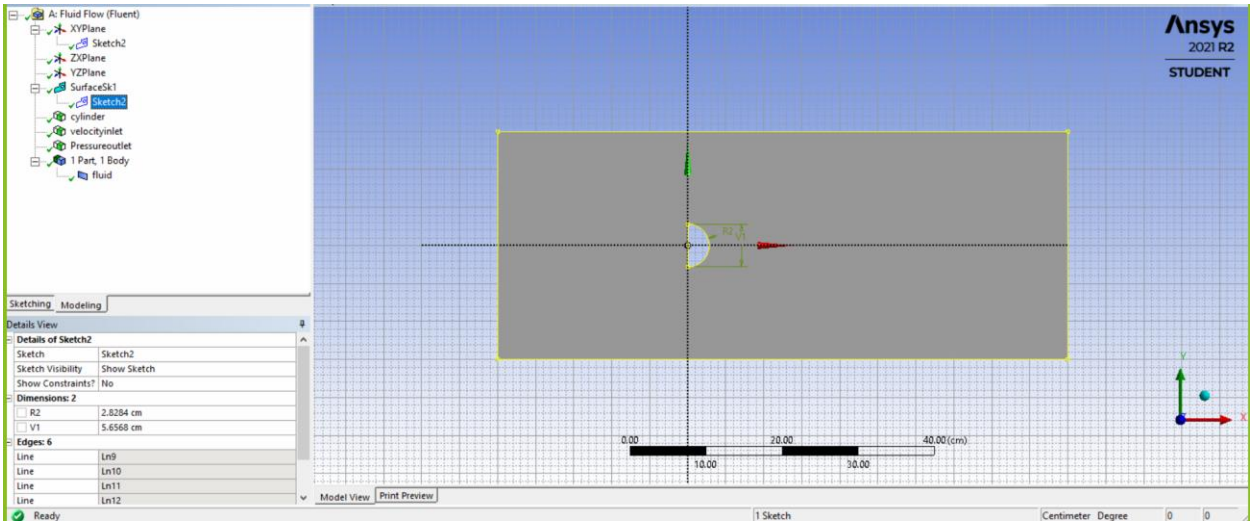


D10)

	Total drag(N)	Pressure term of drag(N)	Viscous term of drag(N)
Run 1	6423.67	6405.89	17.78
Run 2	9348.48	9344.29	4.19

Task 4 Extension of task 1 with asymmetric cylinder

D11) A plot of the geometry of design of asymmetric cylinder



D12) A plot of lift force vs time