

Prerak Kishor Dongaonkar

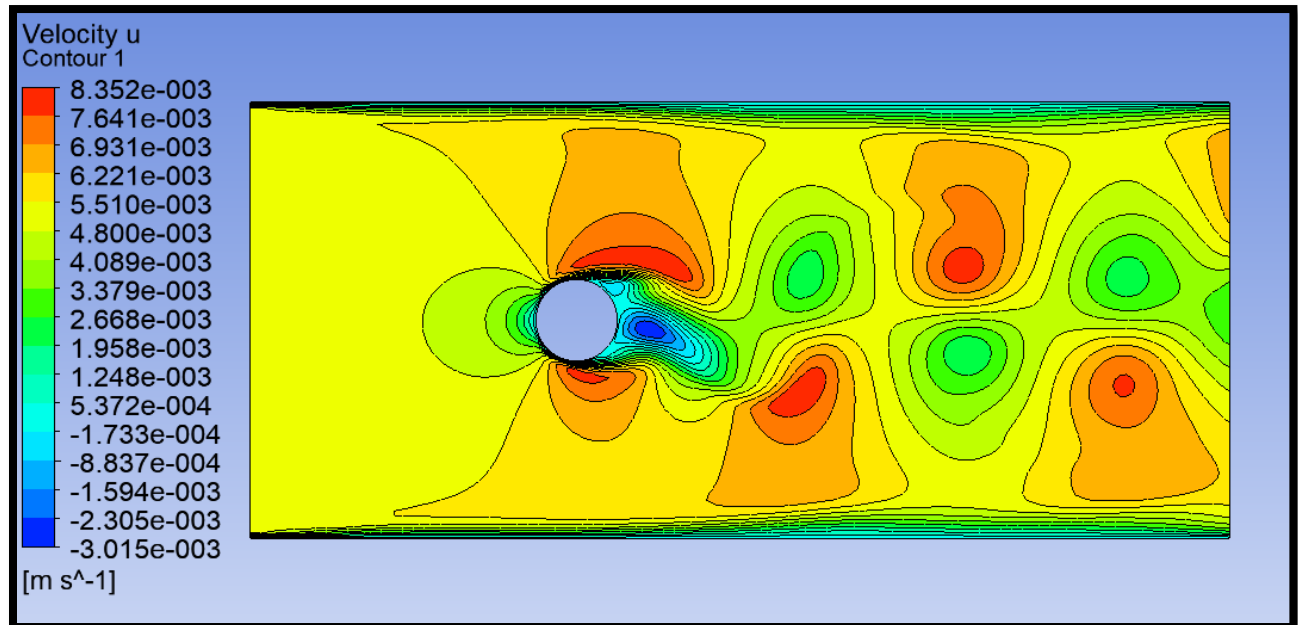
Task 1

Task 1a

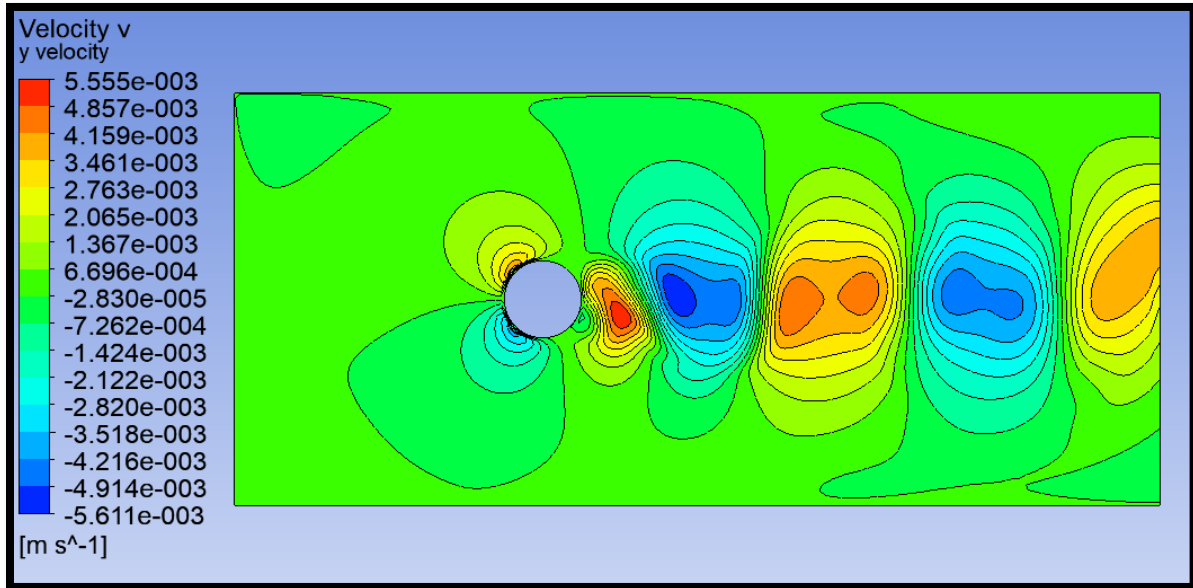
1.1

Reynold's Number (Re): $(\rho \cdot v \cdot D) / \mu = (780) \cdot (0.005) \cdot (0.3) / 0.0024 = 487.5$

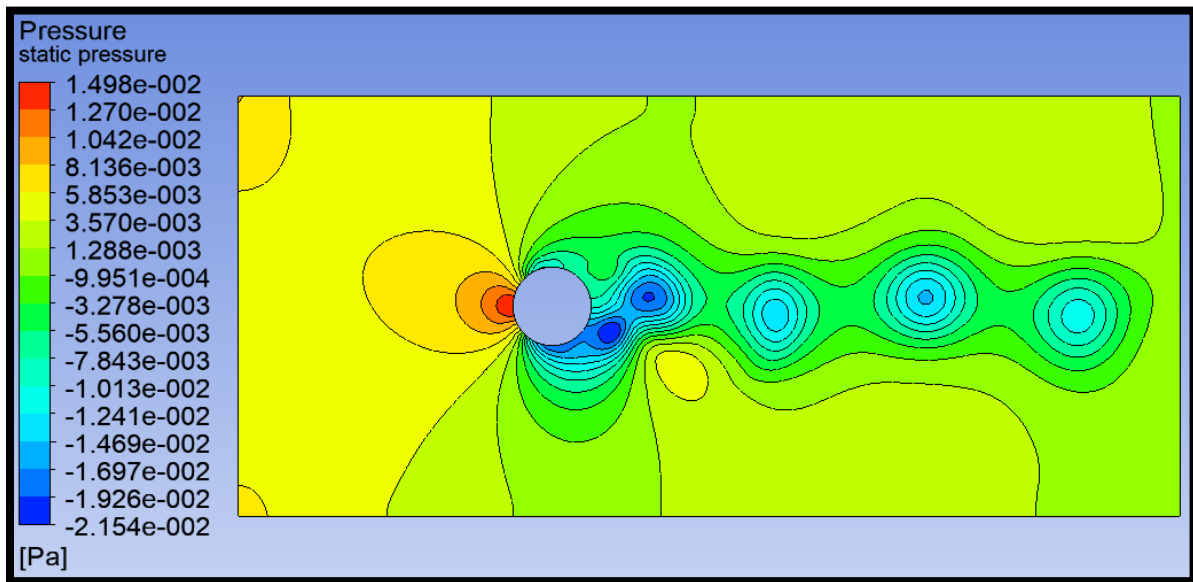
1.2 Contour Plots -



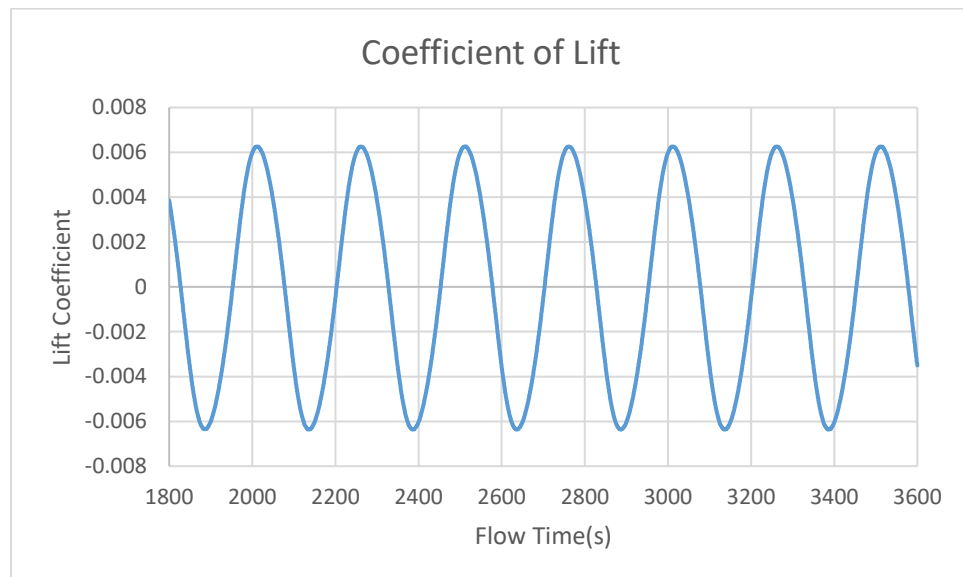
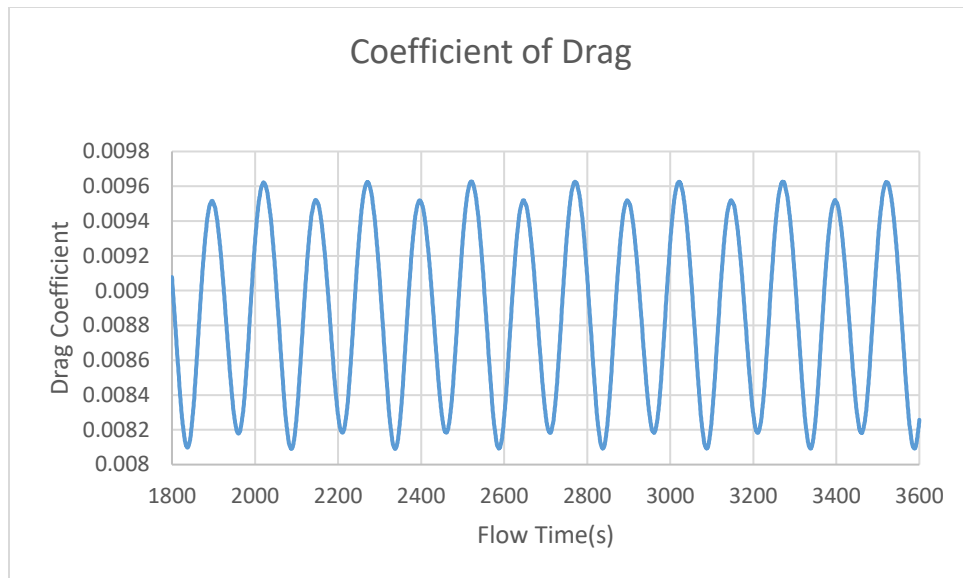
X velocity contour plot



Y velocity contour plot



Static pressure contour plot



Yes, the flow oscillates in the case of lift as well as drag.

Period of oscillation for:

Lift = 233 s

Drag = 117 s

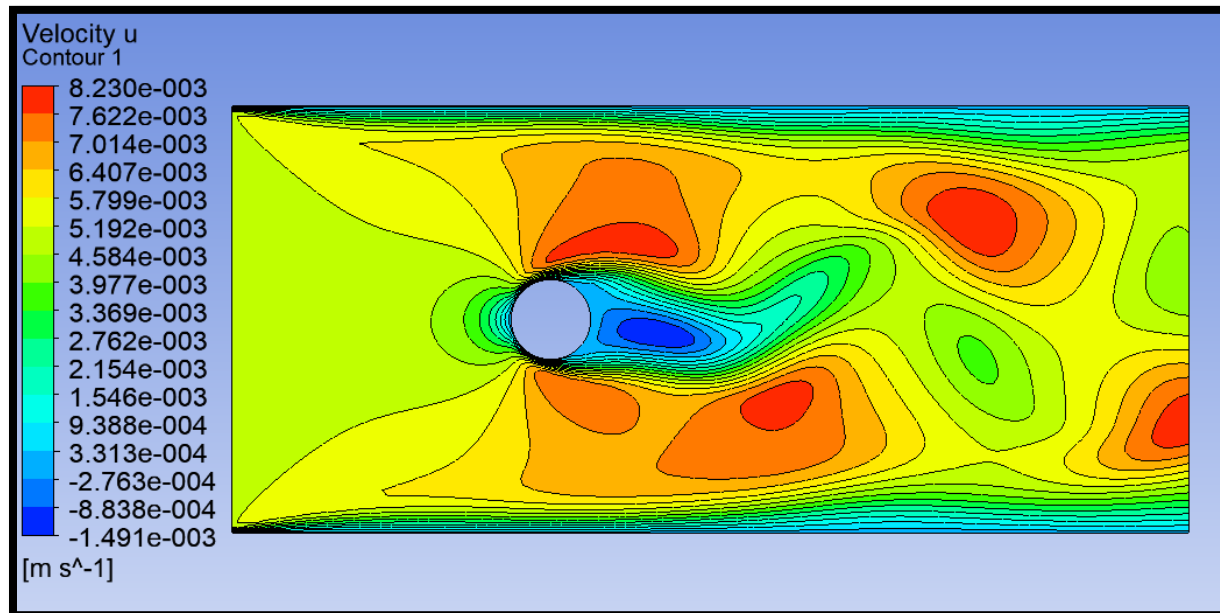
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Task 1b

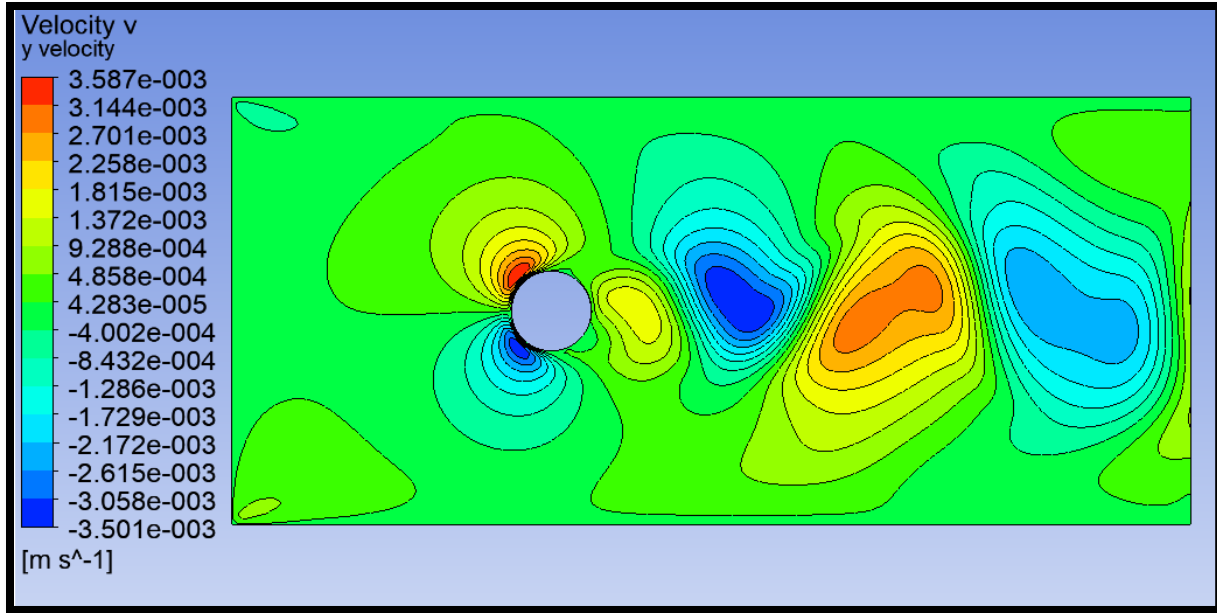
1b.1

Reynold's Number (Re): Reynold's Number (Re): $\rho * v * D / \mu = (1.225) * (0.005) * (0.3) / 0.0000179 = 102.19$

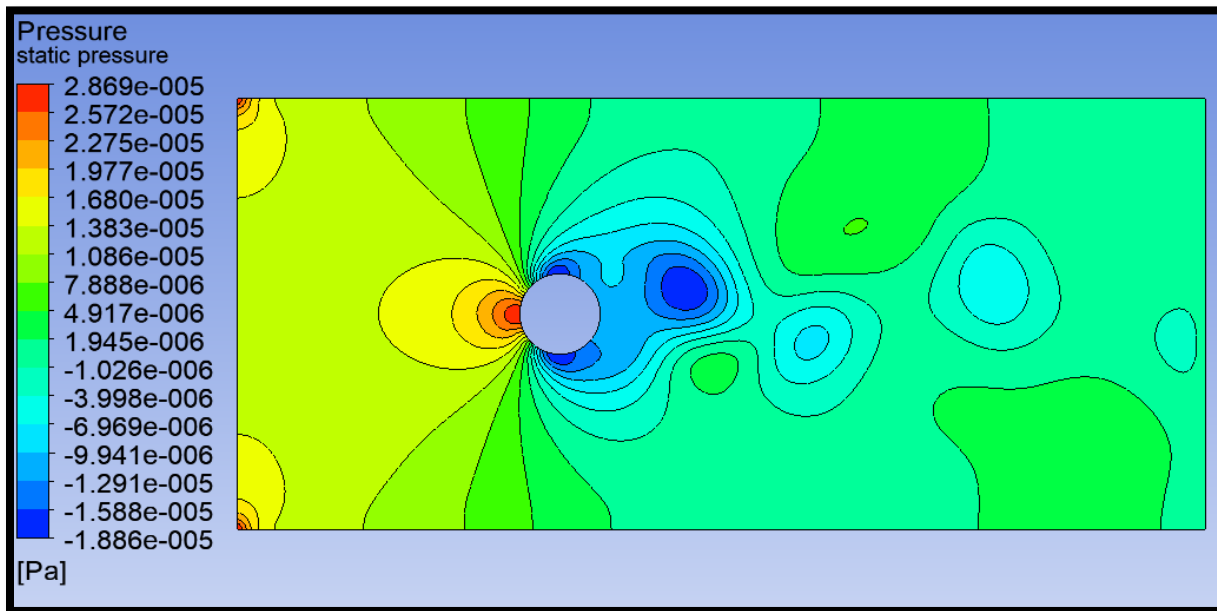
1b.2 Contour Plots –



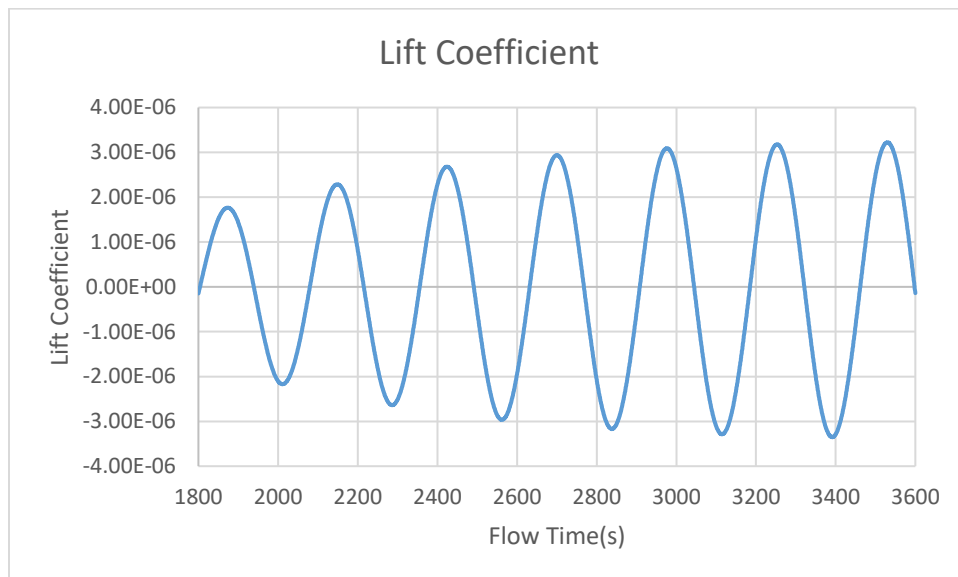
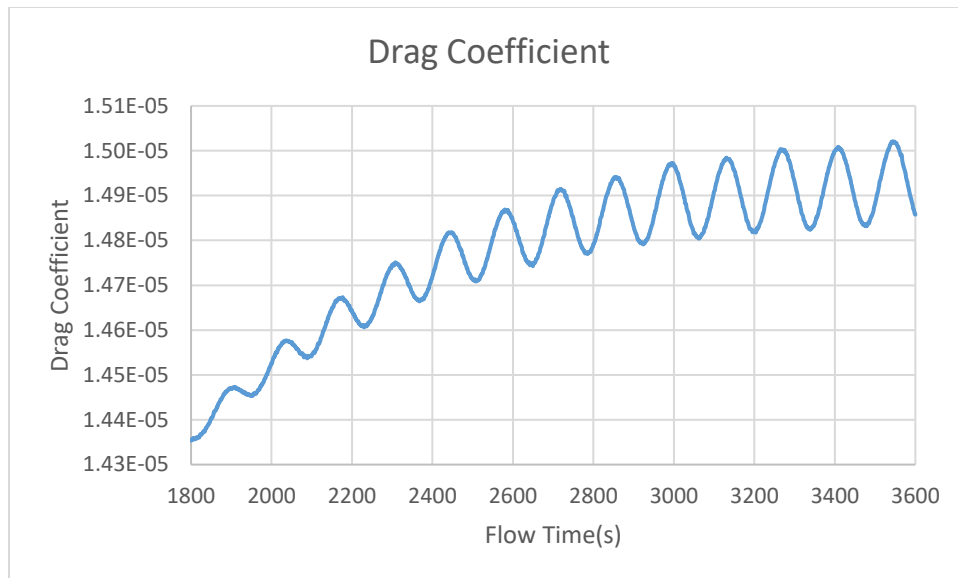
X velocity contour plot



Y velocity contour plot



Static pressure contour plot



Yes, the flow oscillates for both Lift and Drag.

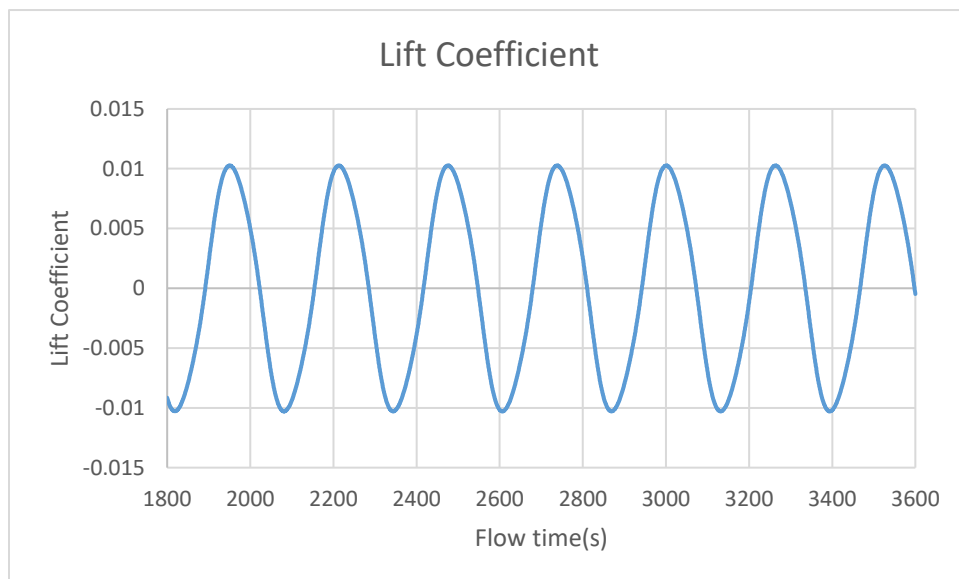
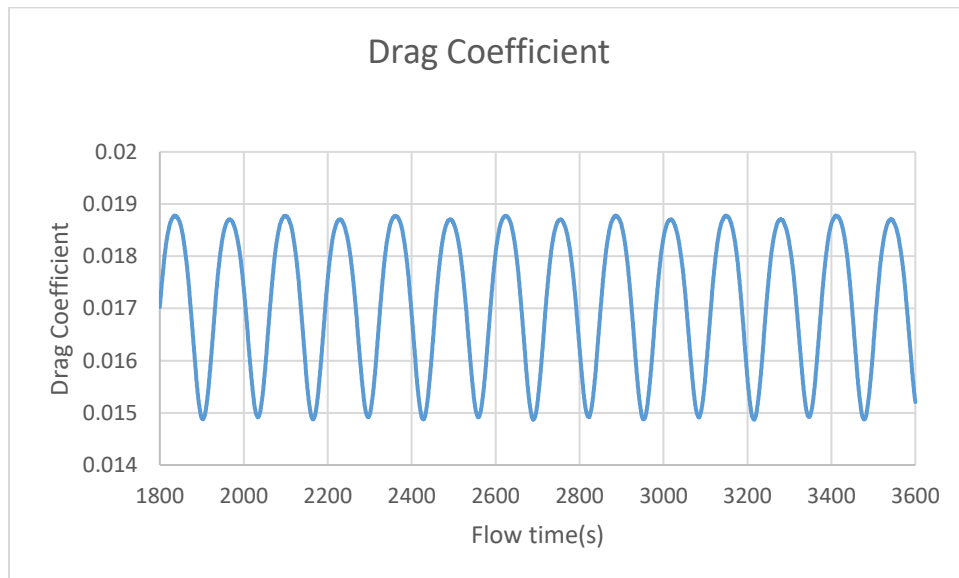
Period of oscillation for:

Lift = 261 s

Drag = 130 s

Task 1c

Case (i) - Ellipse with Y major axis (36 cm) and X minor axis (24 cm)



Yes, the flow oscillates for both lift and drag.

Period of oscillation for:

Lift = 251 s

Drag = 119 s

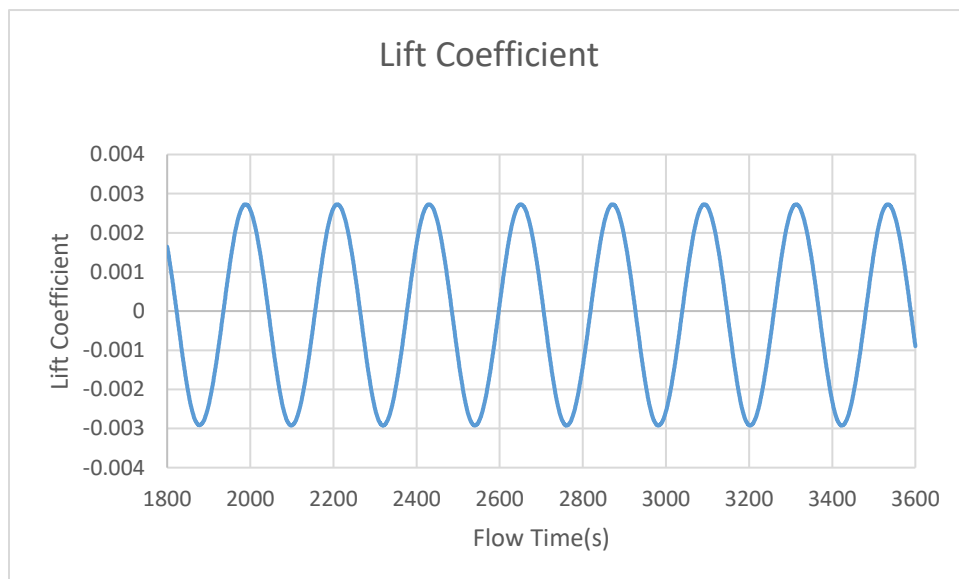
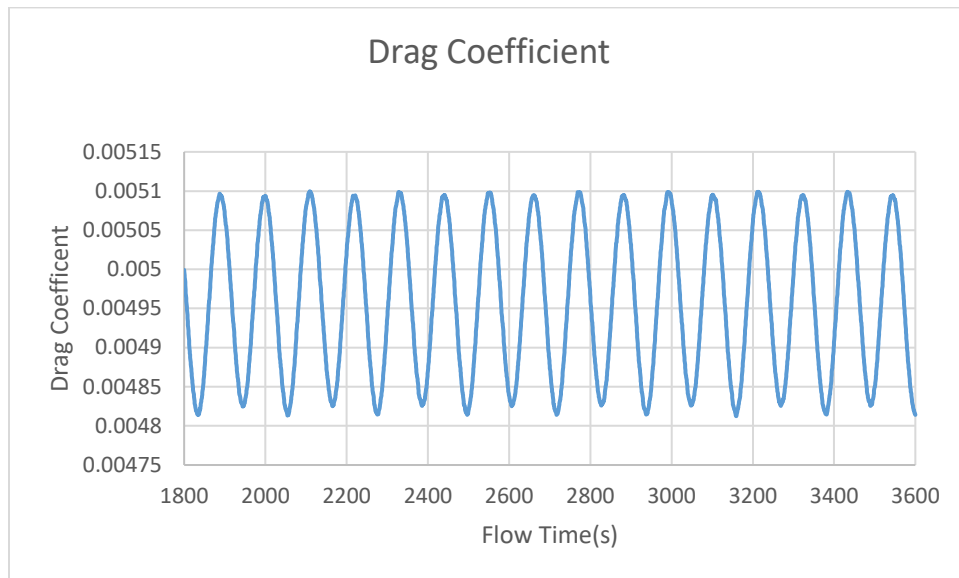
Amplitude:

Lift: 0.010611

Drag: 0.01932

Task 1c

Case (ii) - Ellipse with X major axis (36 cm) and Y minor axis (24 cm)



Yes, the flow oscillates for both lift and drag.

Period of oscillation for:

Lift = 214 s

Drag = 108 s

Amplitude:

Lift: 0.002799

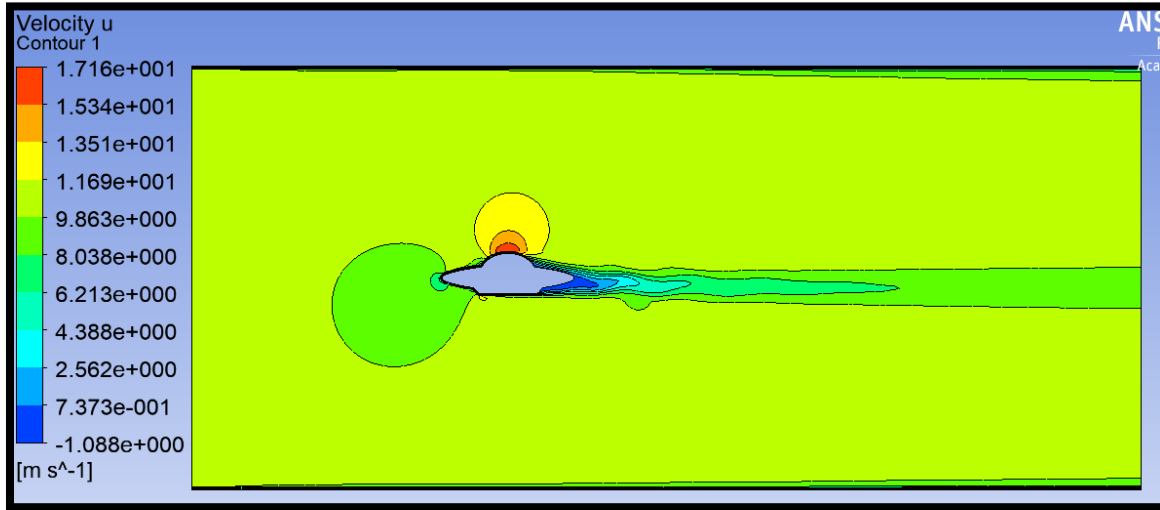
Drag: 0.0048566

Task	Shape	Environment Material	Period of oscillation for Lift (s)	Amplitude for Lift	Period of oscillation for Drag (s)	Amplitude for Drag
1a	Circle	Kerosene	233	0.006	117	0.008
1b	Circle	Air	261	3.00e-06	130	0.01e-05
1c (i)	Ellipse (Y Major)	Kerosene	251	0.010611	119	0.01932
1c (ii)	Ellipse (X Major)	Kerosene	214	0.002799	108	0.0048566

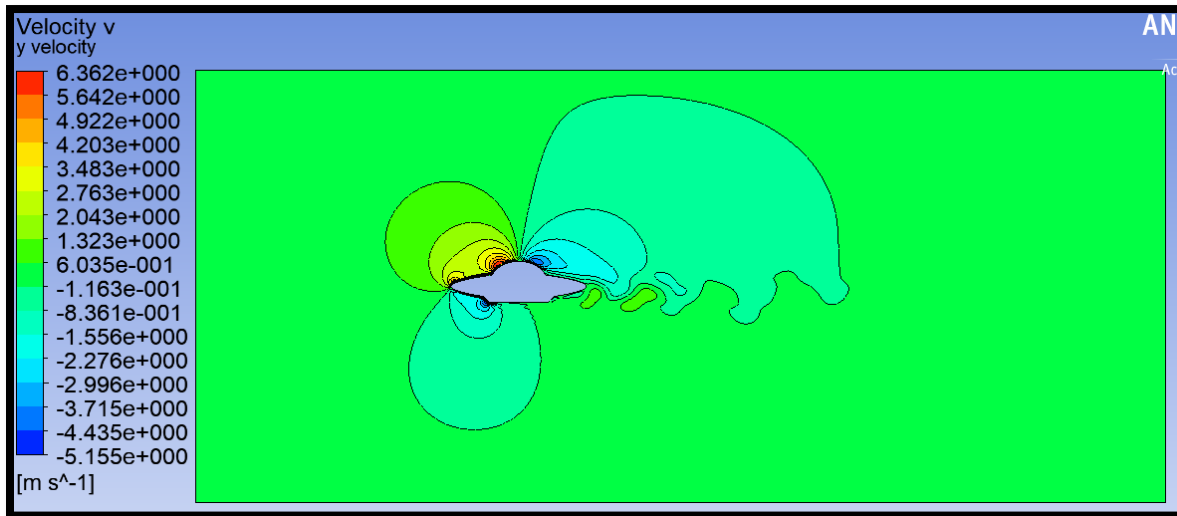
Task 2

2a.1

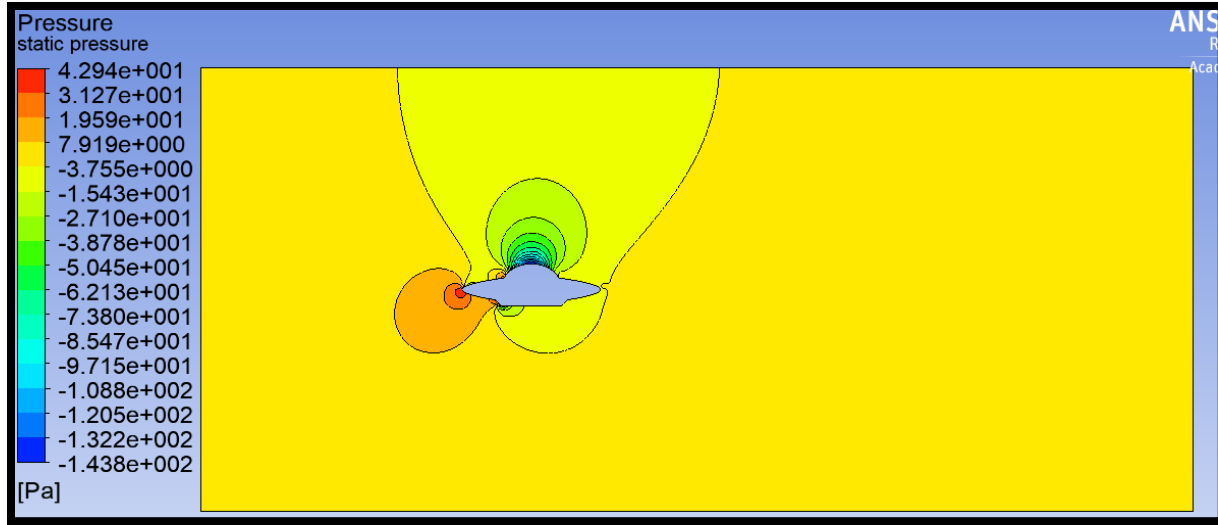
Transient analysis was conducted with a time step size of 1s and run for a flow time of 3600 s.



X velocity contour plot

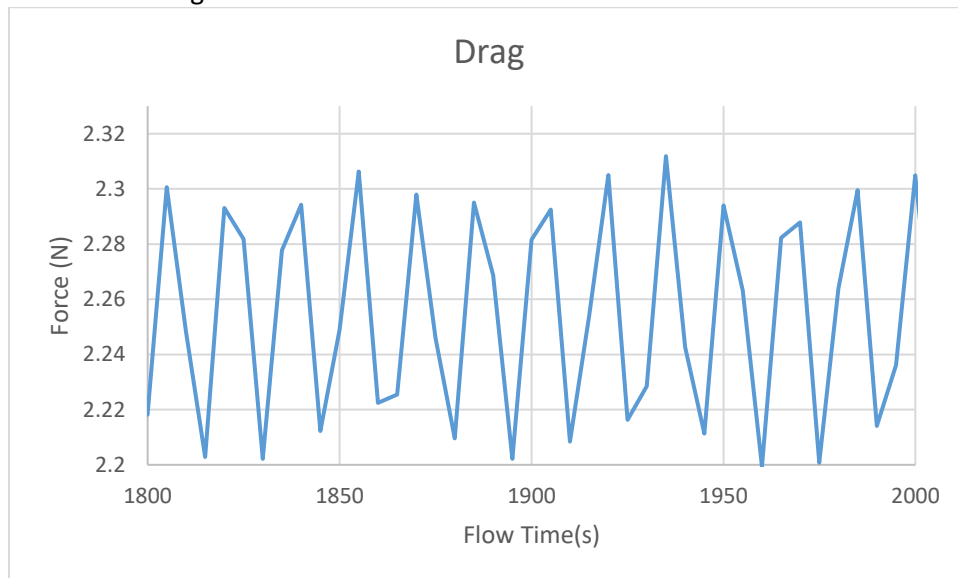


Y velocity contour plot



Static pressure contour plot

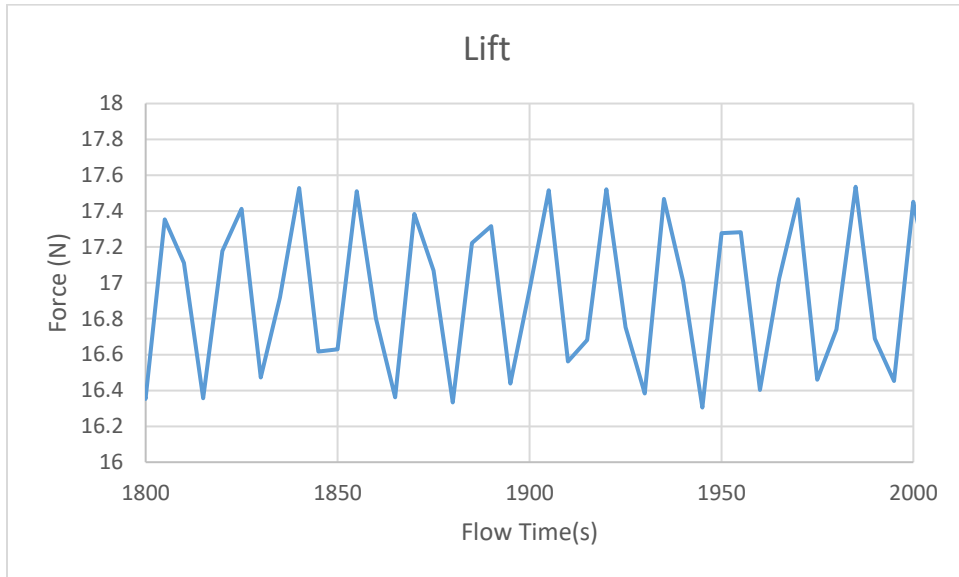
Drag Force trend and average value



Forces - Direction Vector (1 0 0)			
	Forces (n)		
Zone	Pressure	Viscous	Total
saucer	2.0857576	0.19734979	2.2831074

Net	2.0857576	0.19734979	2.2831074

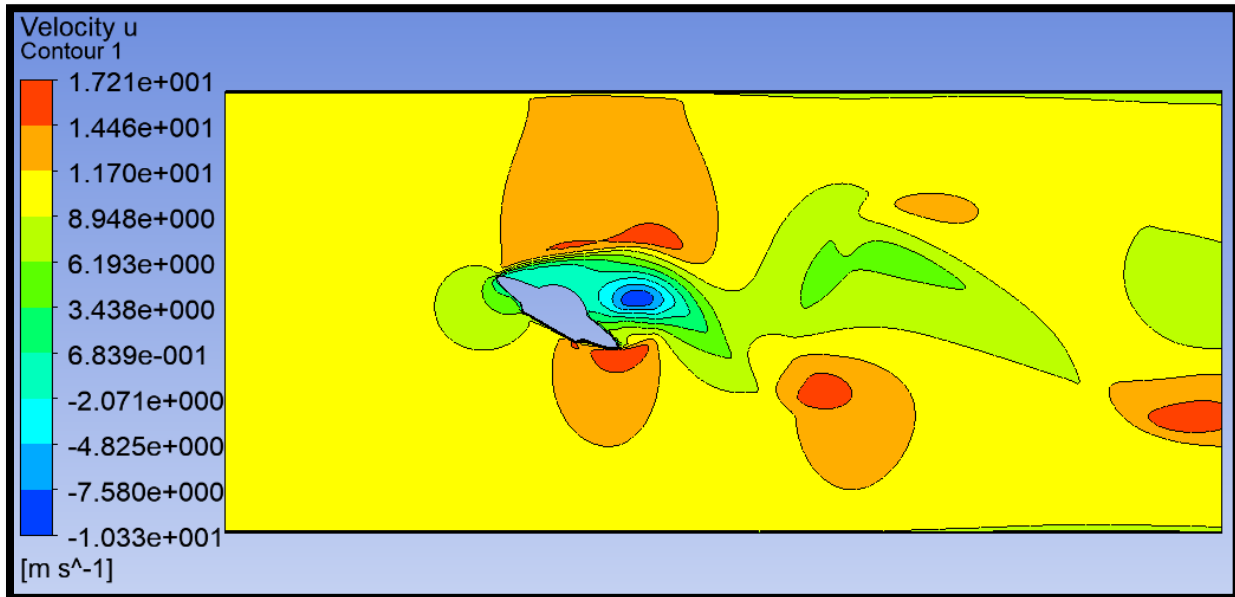
Lift Force trend and average value



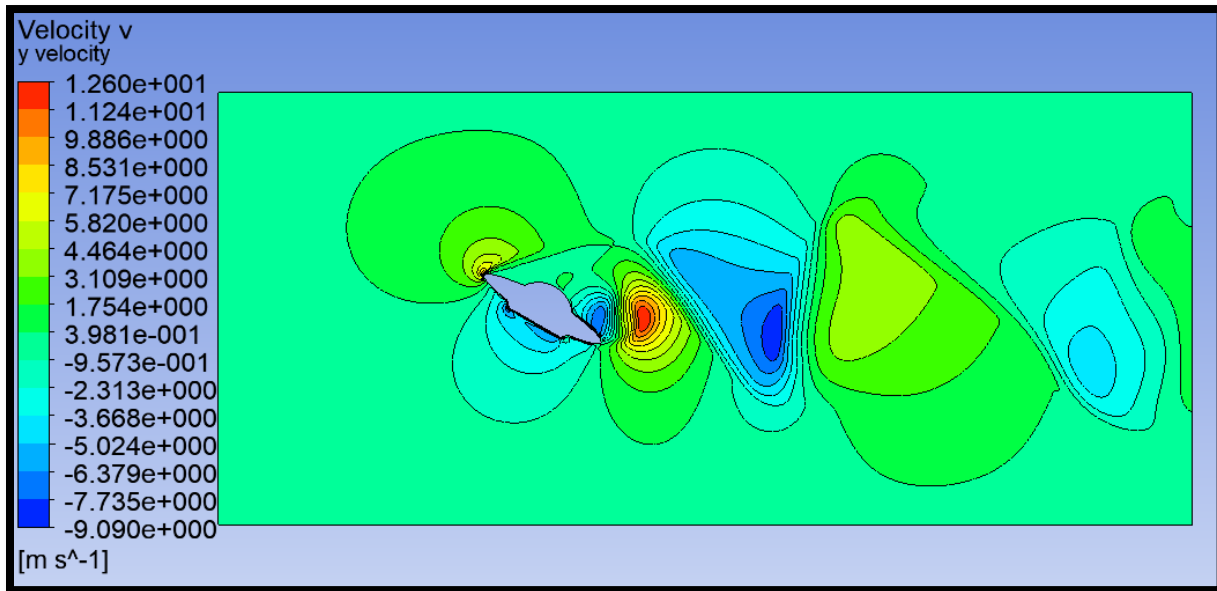
```
Forces - Direction Vector (0 1 0)
Forces (n)
Zone      Pressure      Viscous      Total
saucer    16.559782     -0.0033340287  16.556448
-----
Net       16.559782     -0.0033340287  16.556448
```

2b.1

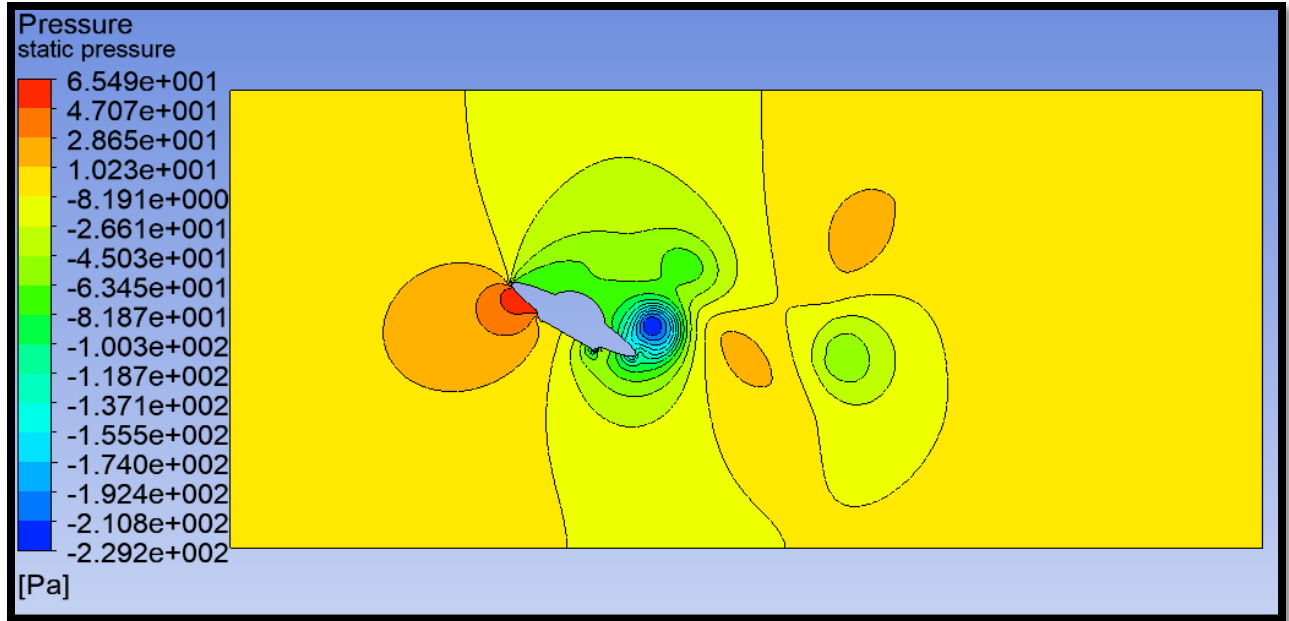
Transient analysis was conducted with a time step size of 1s and run for a flow time of 3600 s.



X velocity contour plot

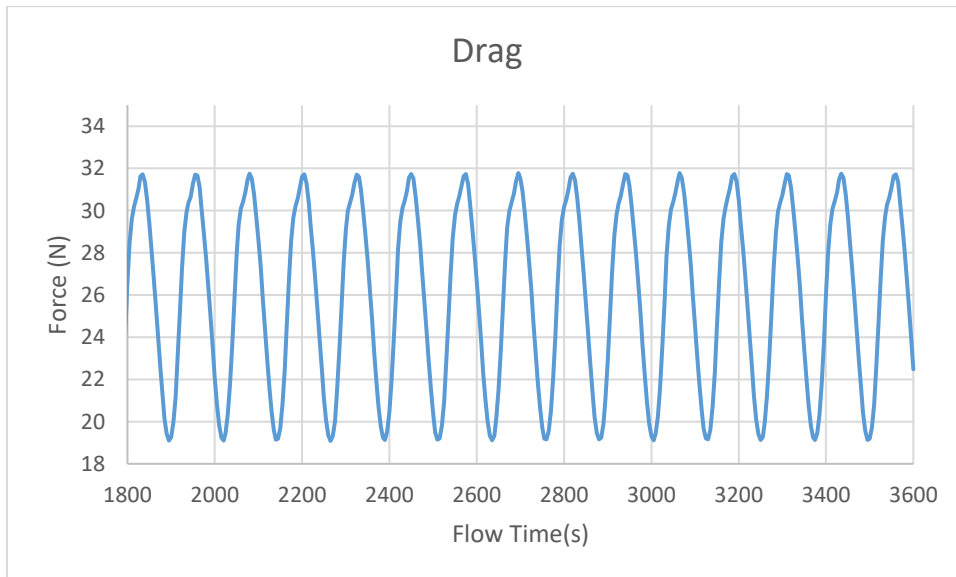


Y velocity contour plot



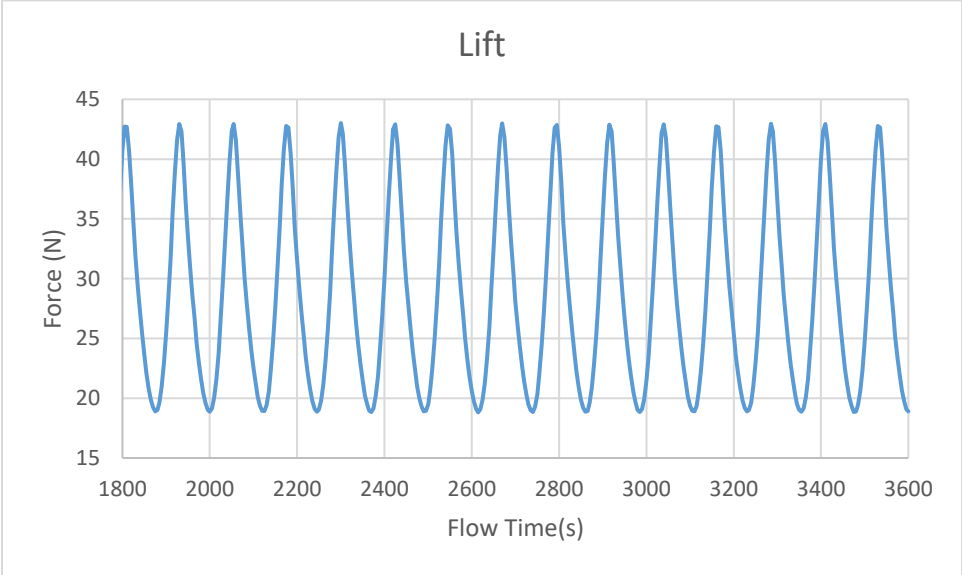
Static pressure contour plot

Drag Force trend and average value



Drag Force (N) = 25

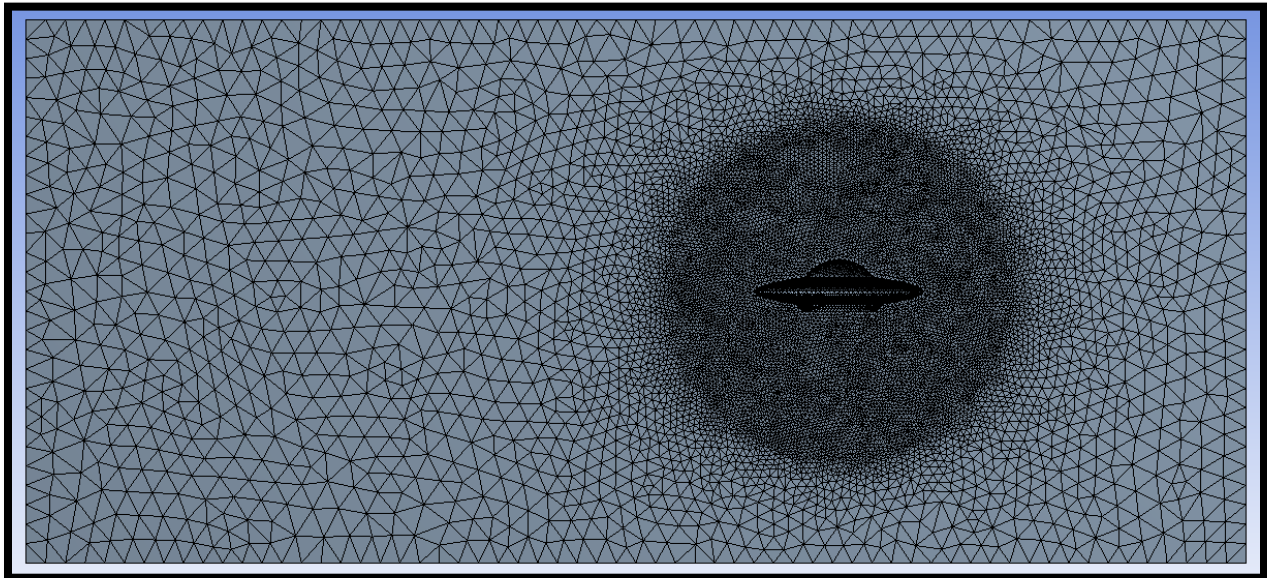
Lift Force trend and average value



Lift Force (N) = 28.5

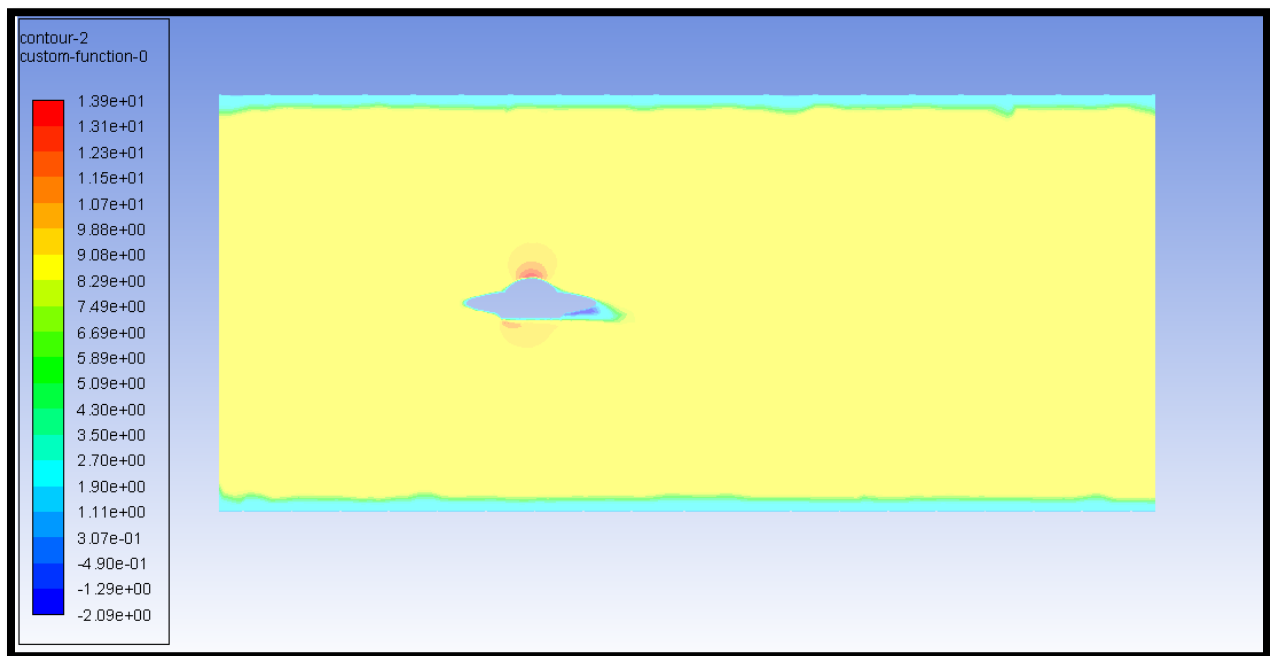
Task 3

3a.1



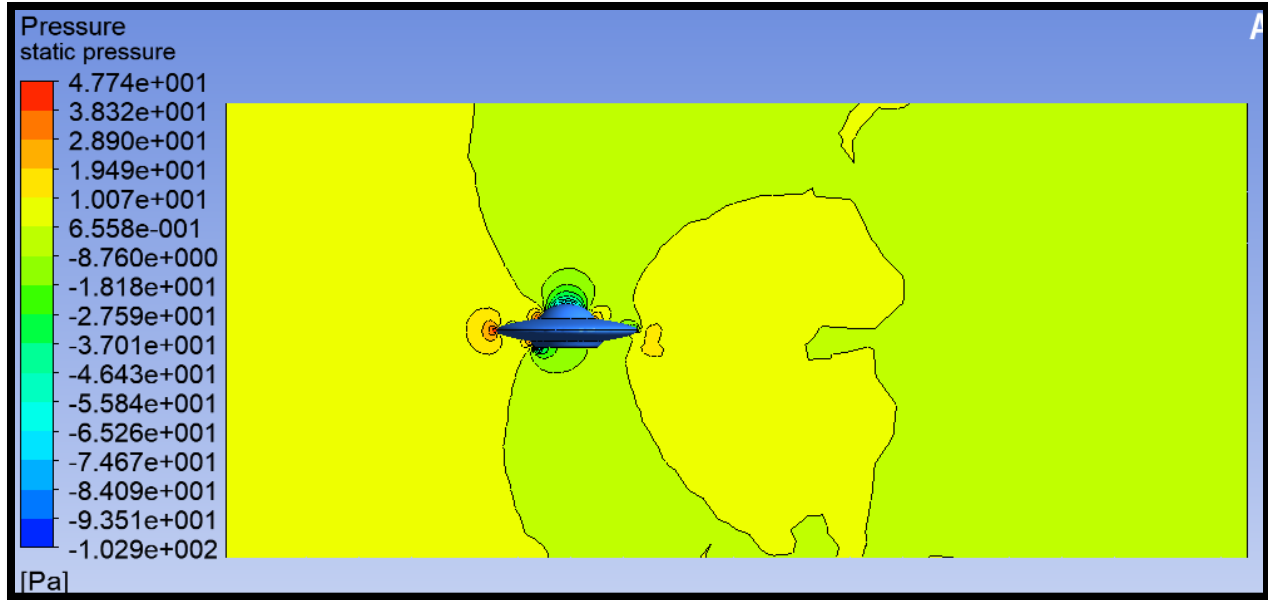
3a.2

Along the plane of symmetry



X velocity contour plot

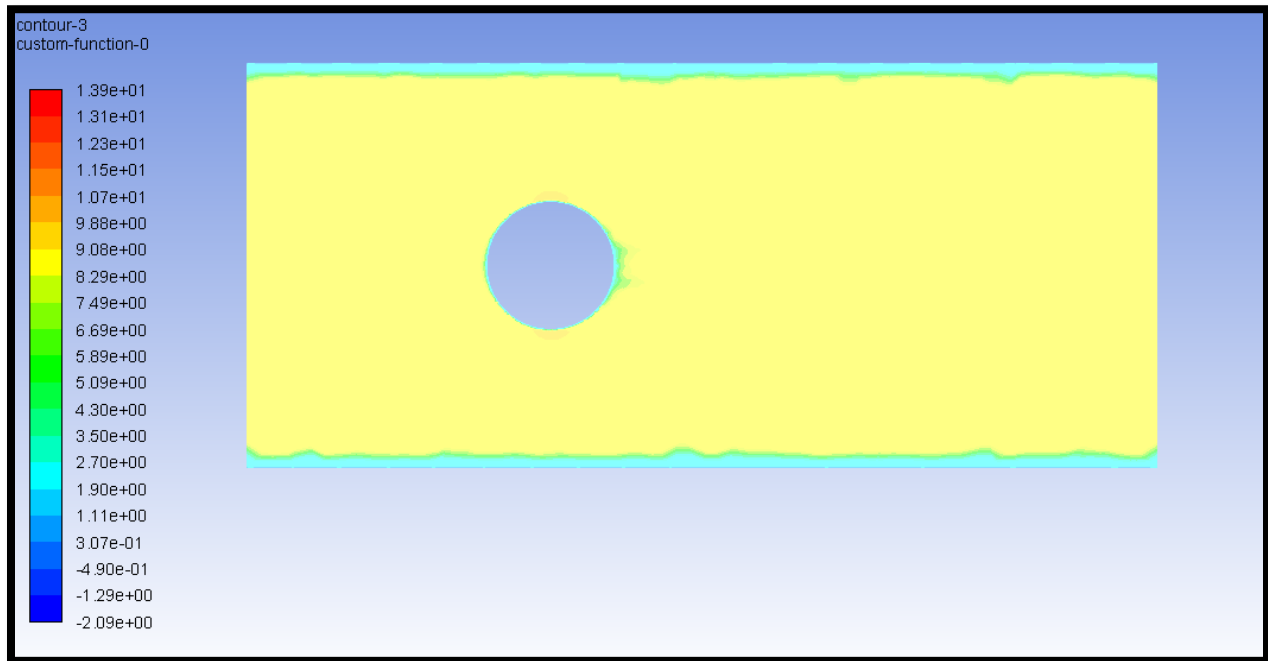
All the units are m/s



Static pressure contour plot

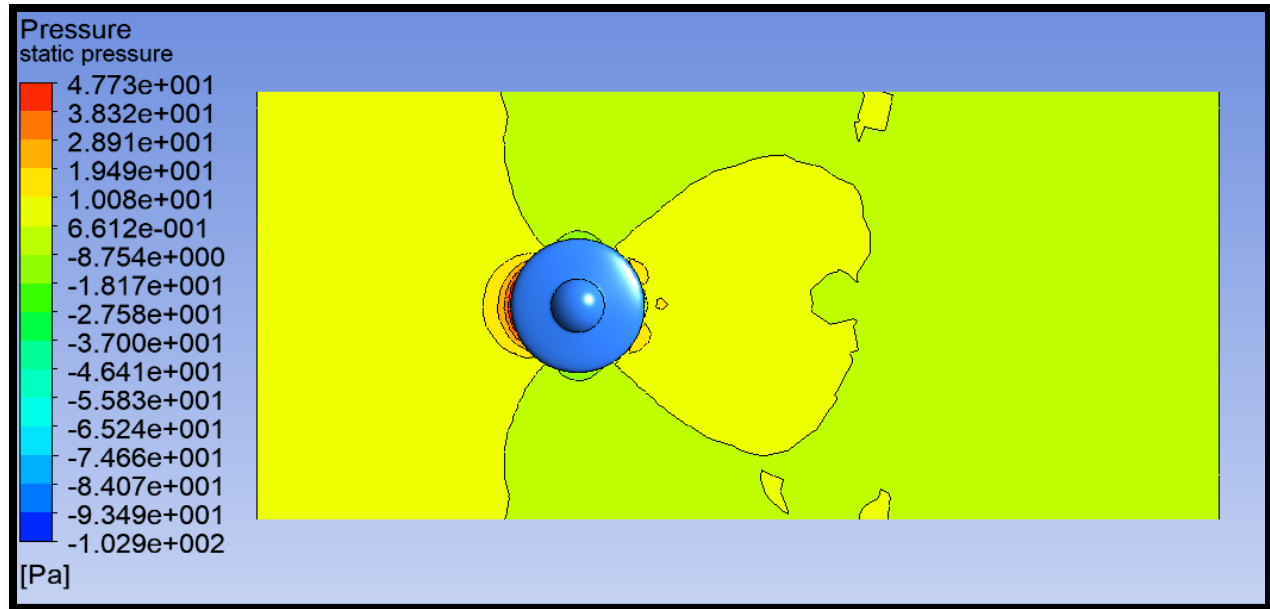
3a.3

Along the perpendicular plane

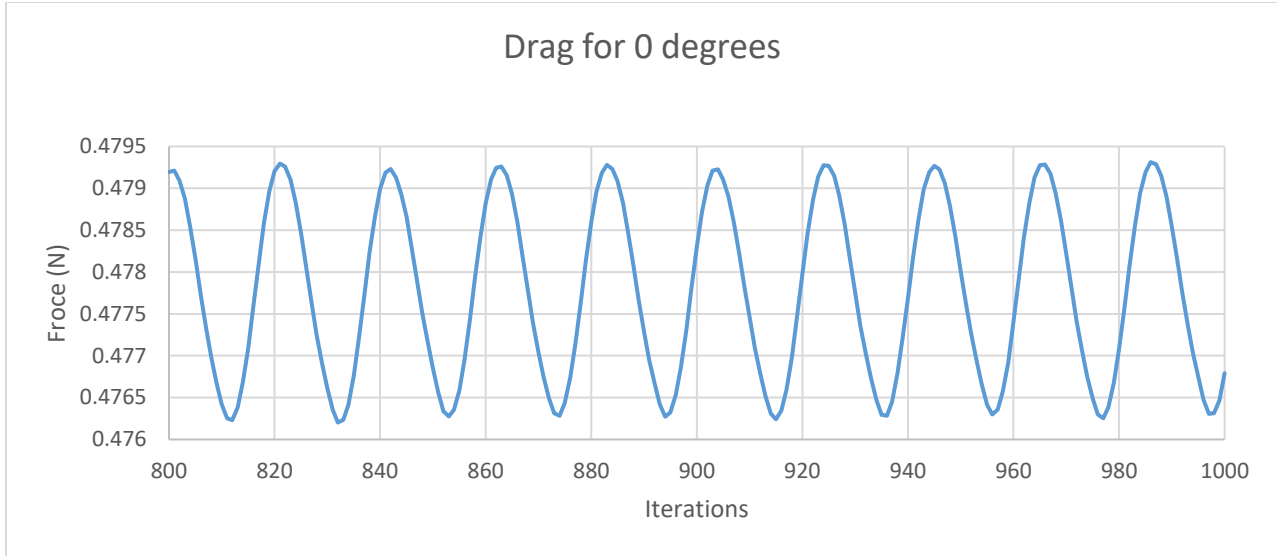


X velocity contour plot

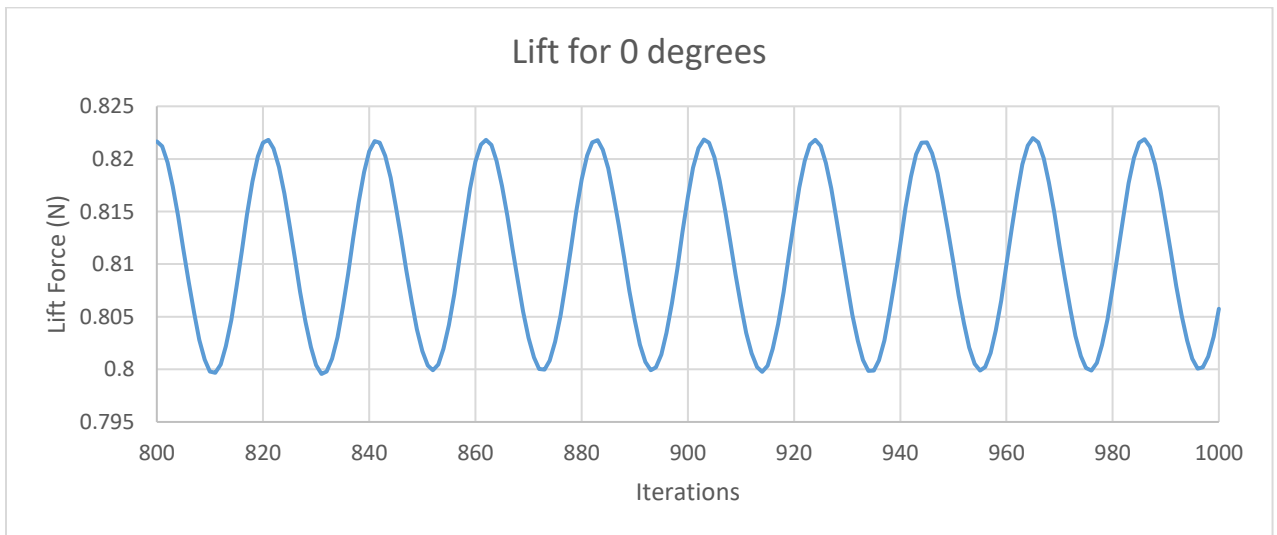
All the units are m/s



Static pressure contour plot



Average Drag Force (N) = 0.4777

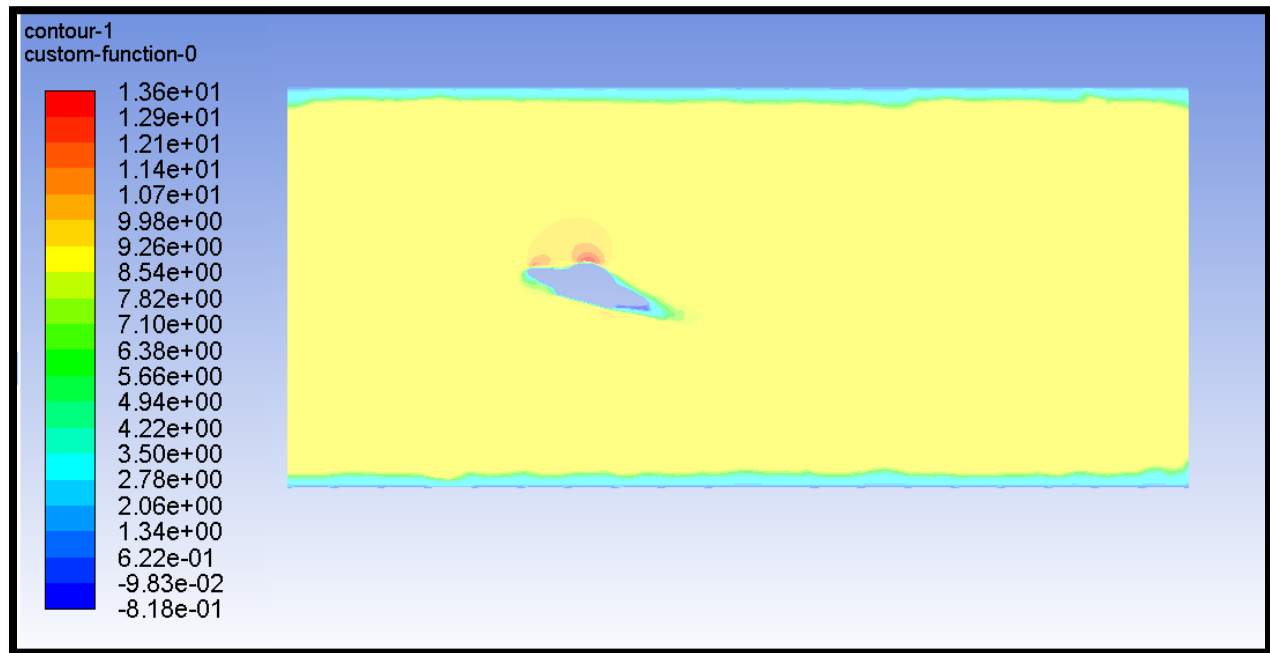


Average Lift Force (N) = 0.812

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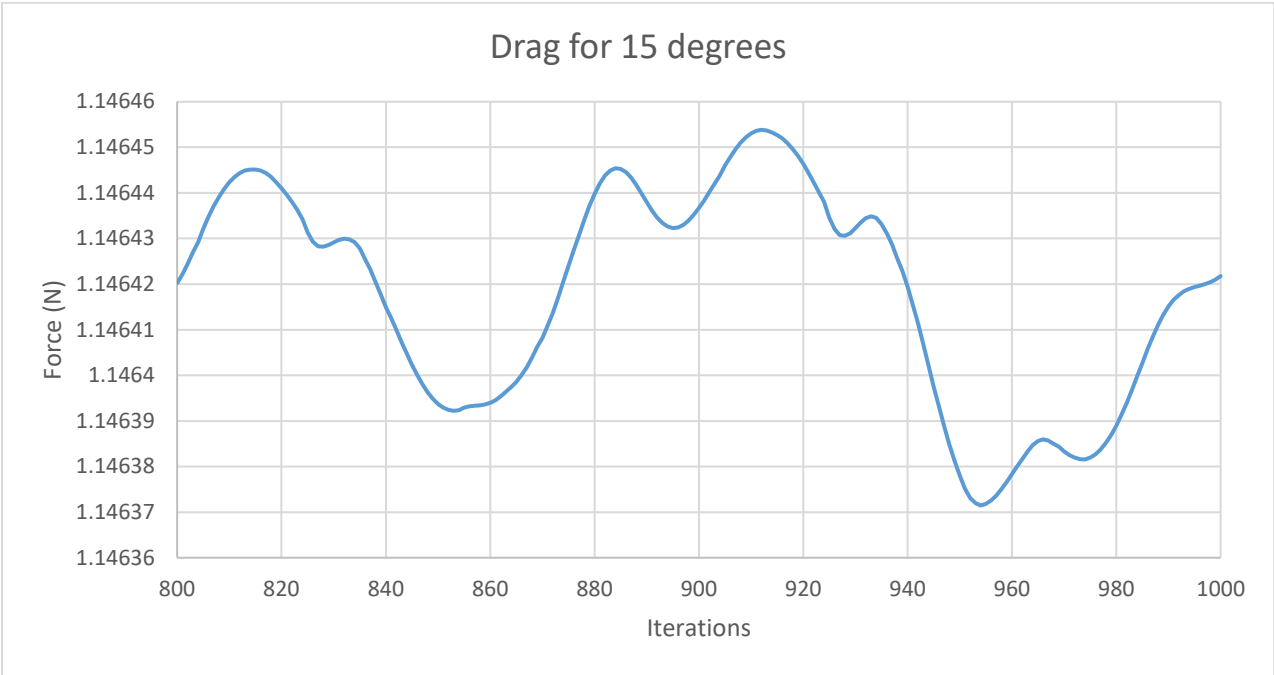
Task 3b. The oscillation was found to appear before 800 iterations, but the plots are from 800 – 1000 iterations which show the oscillation trend of lift and drag.

3b.1 Theta = 15 degrees

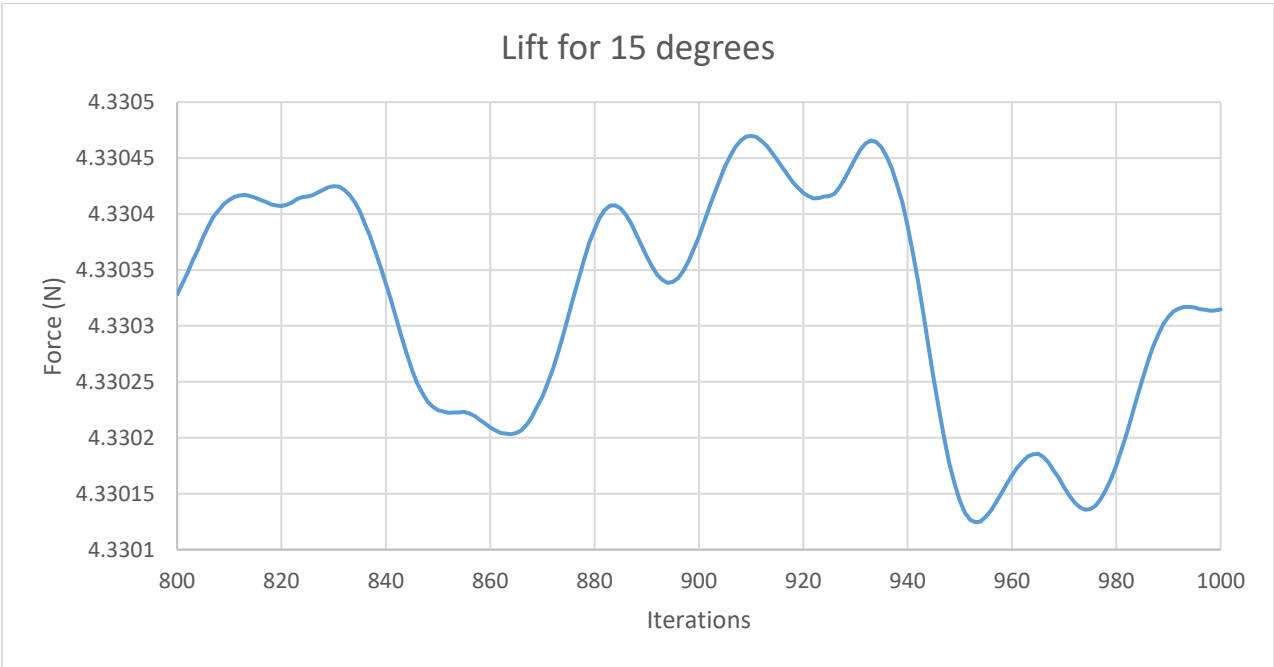


x velocity contour plot

All the units are in m/s

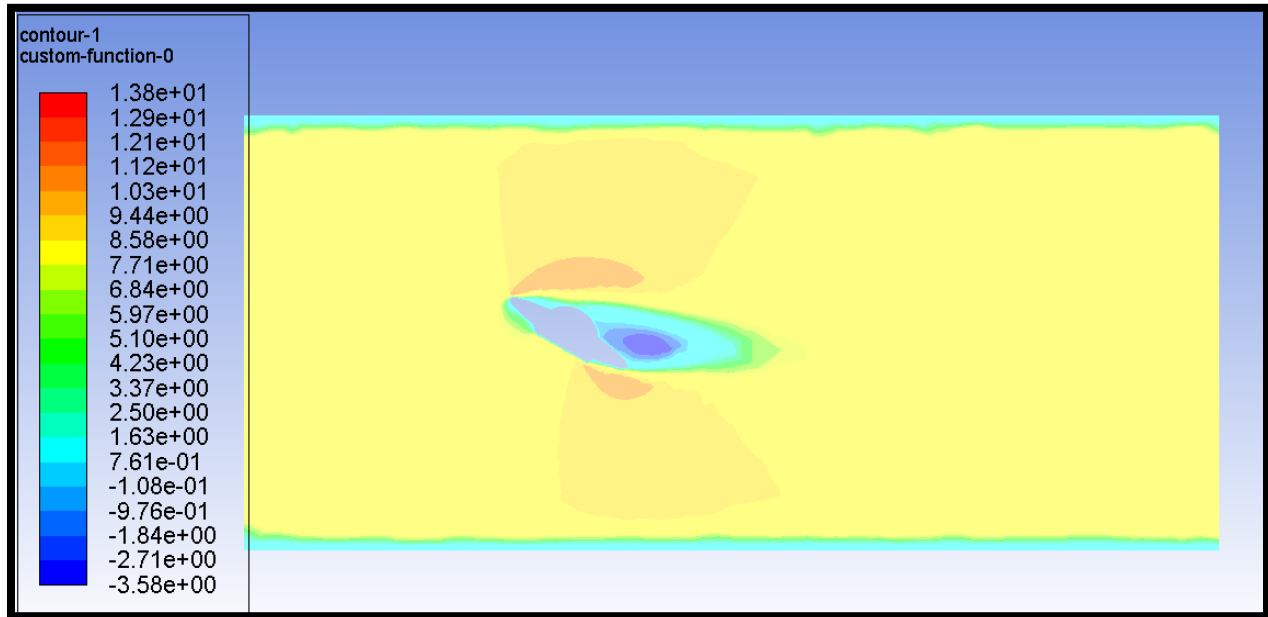


Average Drag Force (N) = 1.146



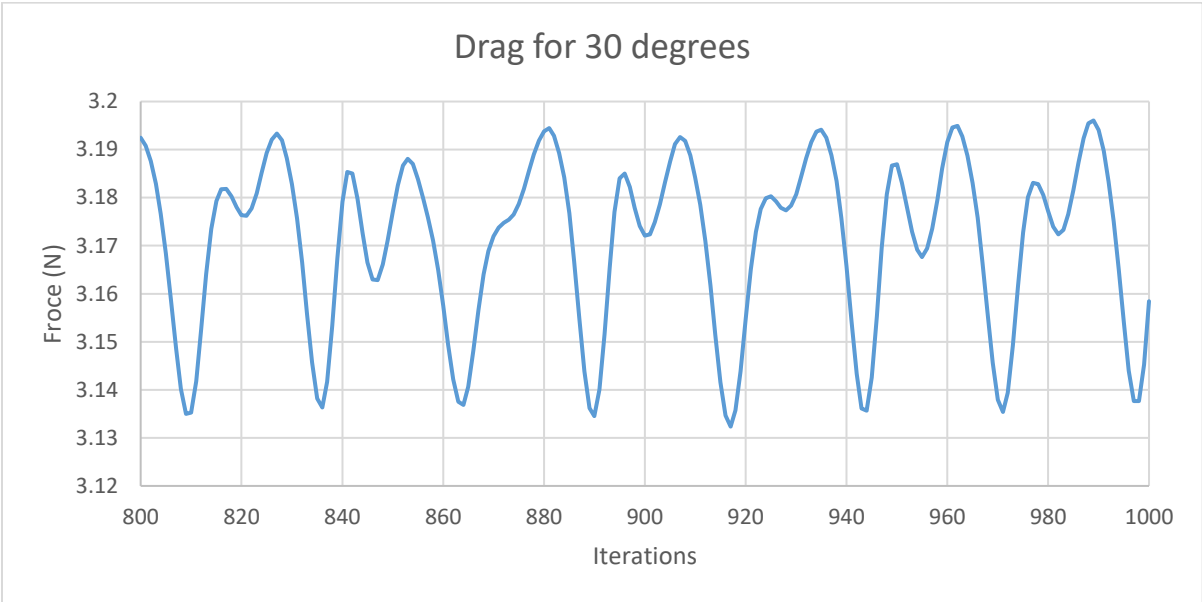
Average Lift Force (N) = 4.33

3b.2 Theta = 30 Degrees

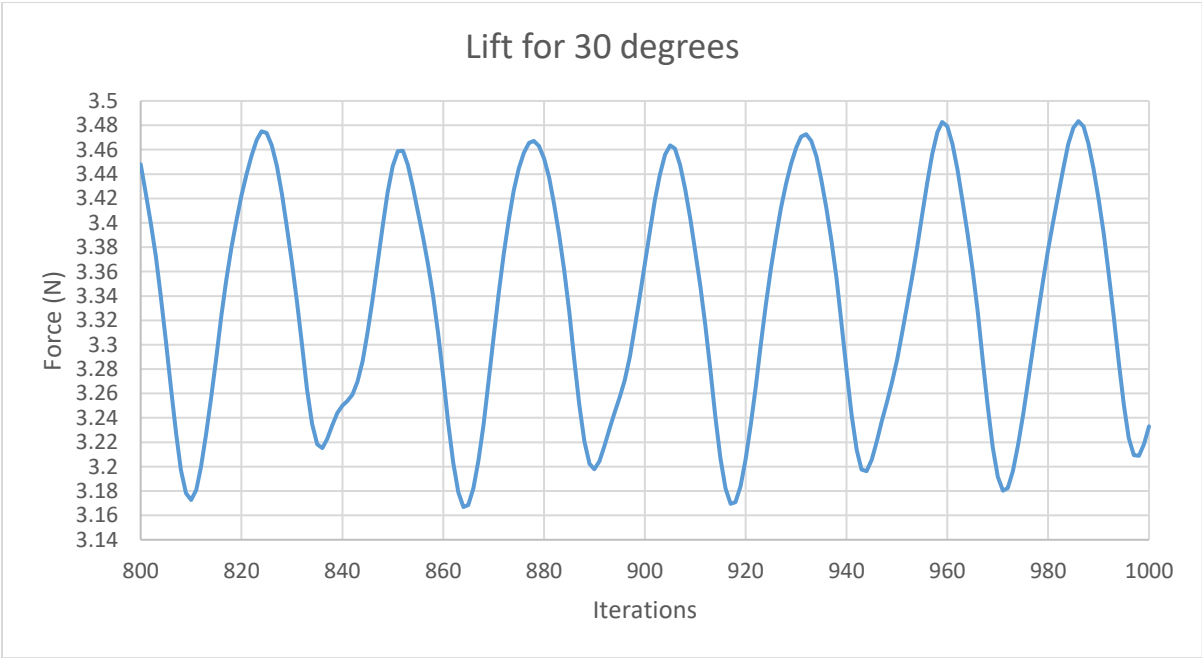


x velocity contour plot

All the units are in m/s



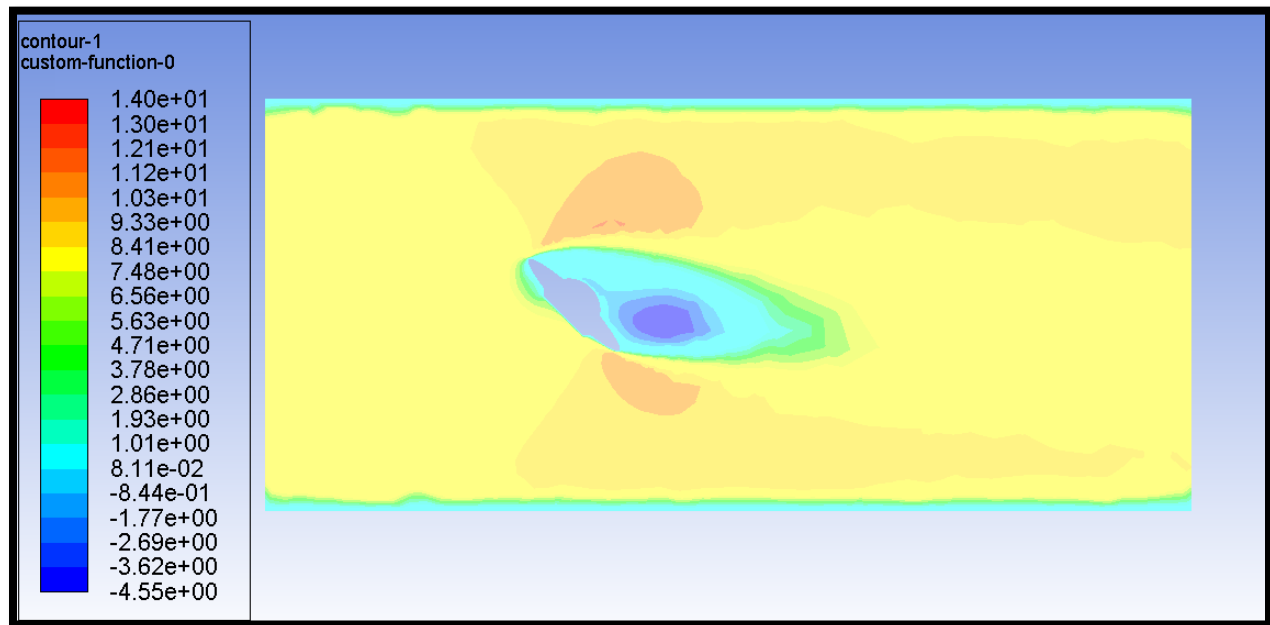
Average Drag Force (N) = 3.165



Average Lift Force (N) = 3.33

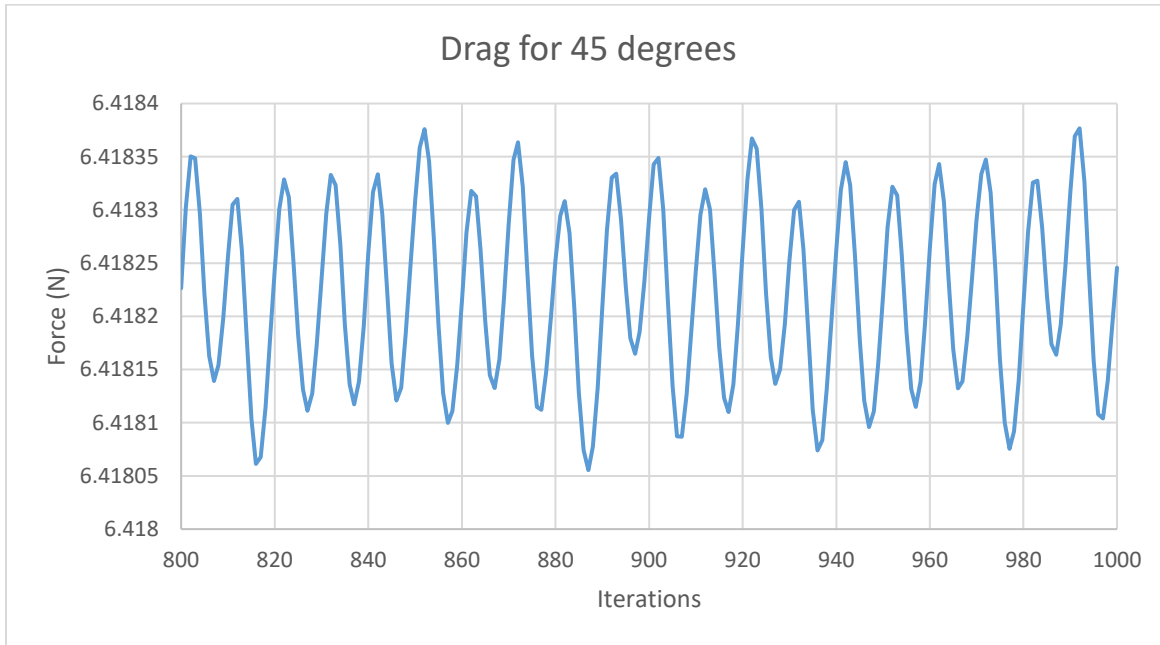
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3b.3 Theta = 45 degrees

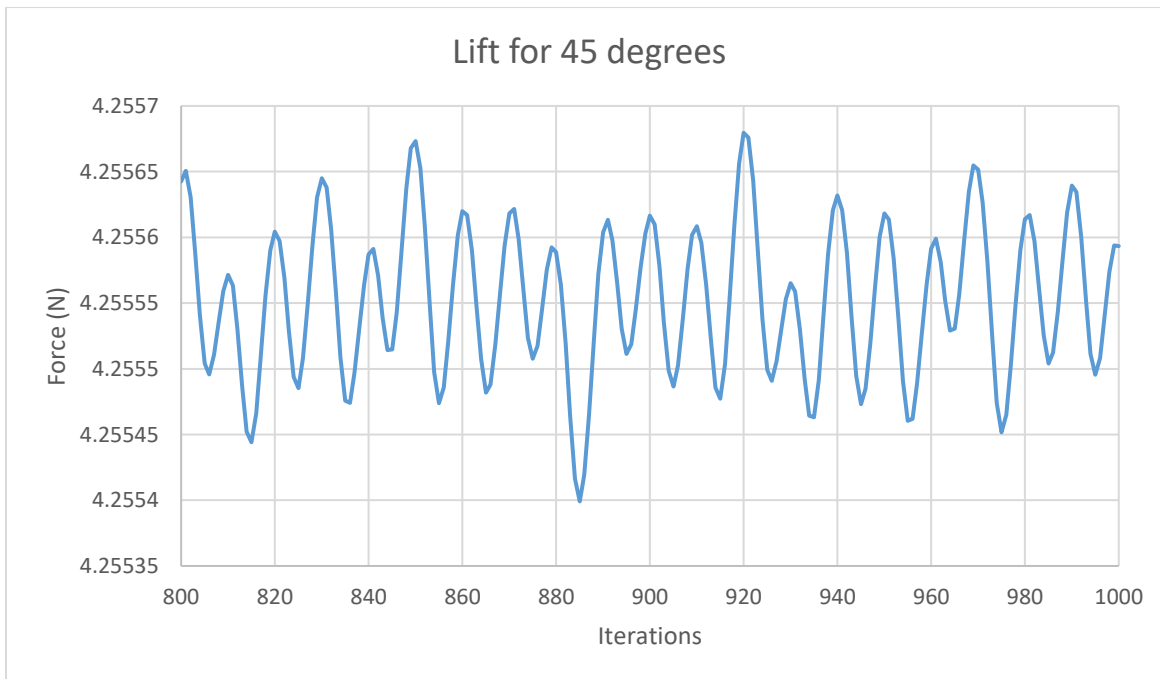


x velocity contour plot

All the units are in m/s



Average Drag Force (N) = 6.41



Average Lift Force (N) = 4.2555

Comparison of Lift and Drag for different Theta (Tilt Angles)

