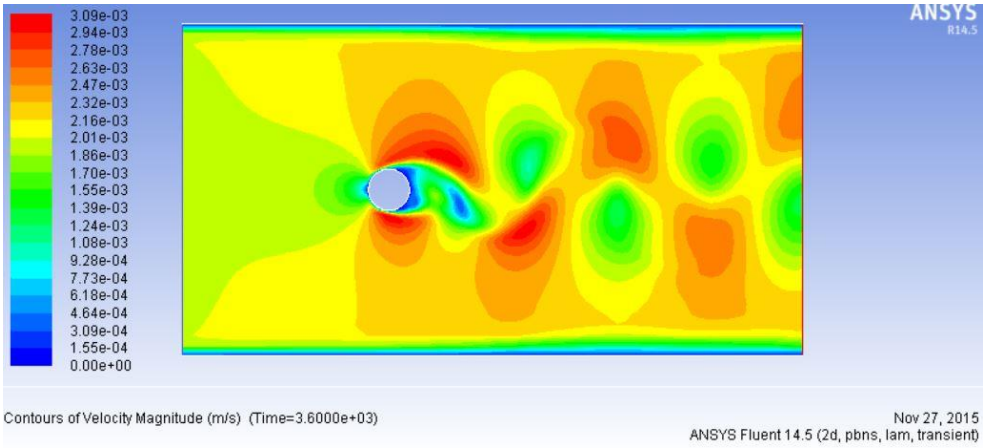
Task 1:

Part a)

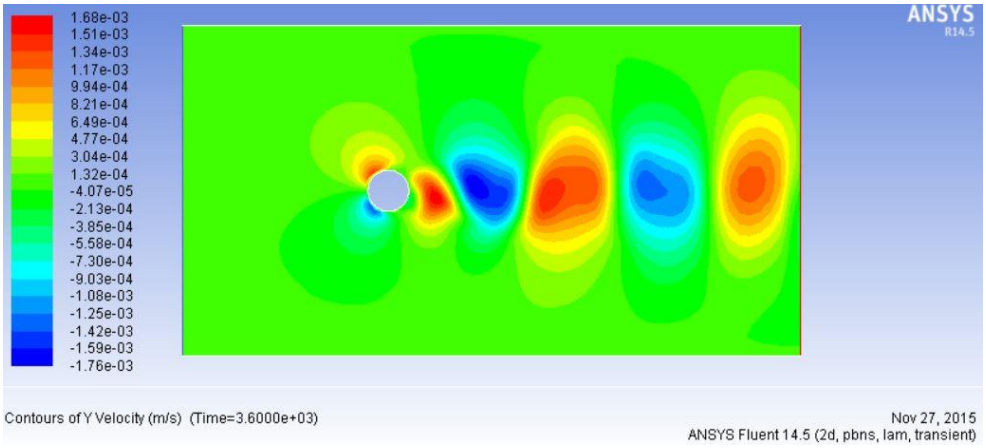
1. For an estimate of the Reynold's number of the system, the velocity is inlet velocity, the density is 998.2, the dynamic viscosity is 0.001003 and the hydraulic diameter is the diameter of the cylinder (0.2 m).

The Reynold's number is thus 398.0857

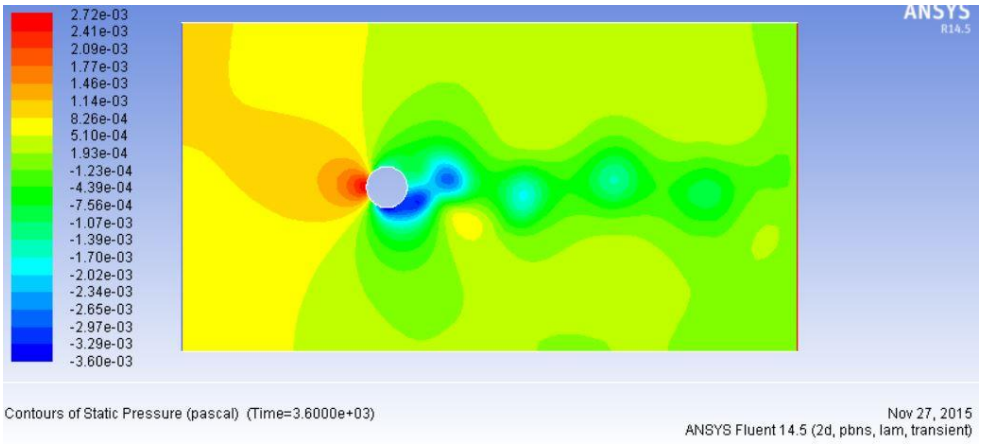
2. Contour plot of velocity magnitude



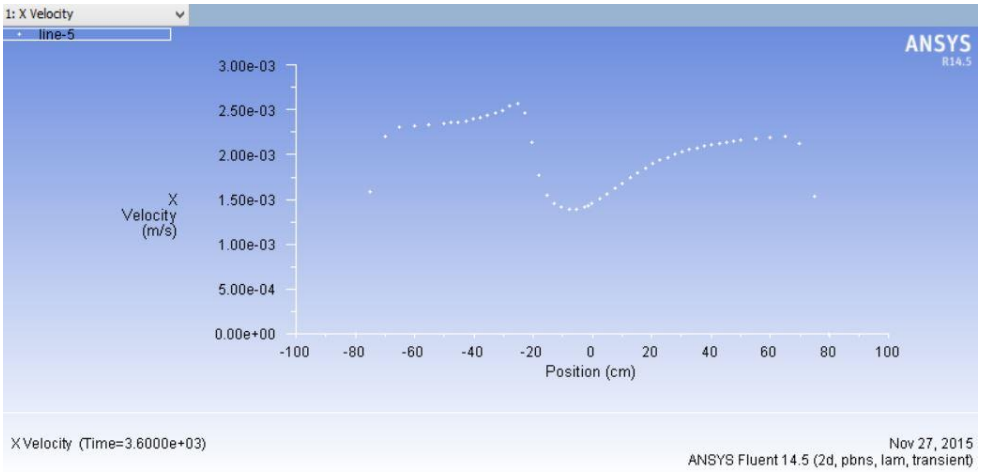
Contour plot of Y-component of velocity



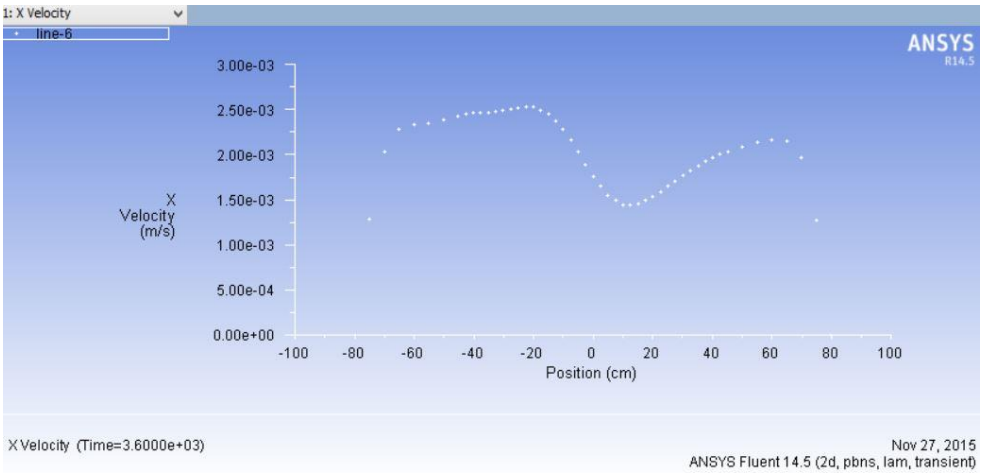
Contour plot of static pressure



3. Line plot of the X-component of velocity along the vertical line of x = 50 cm



Line plot of the X-component of velocity along the vertical line of x = 150 cm

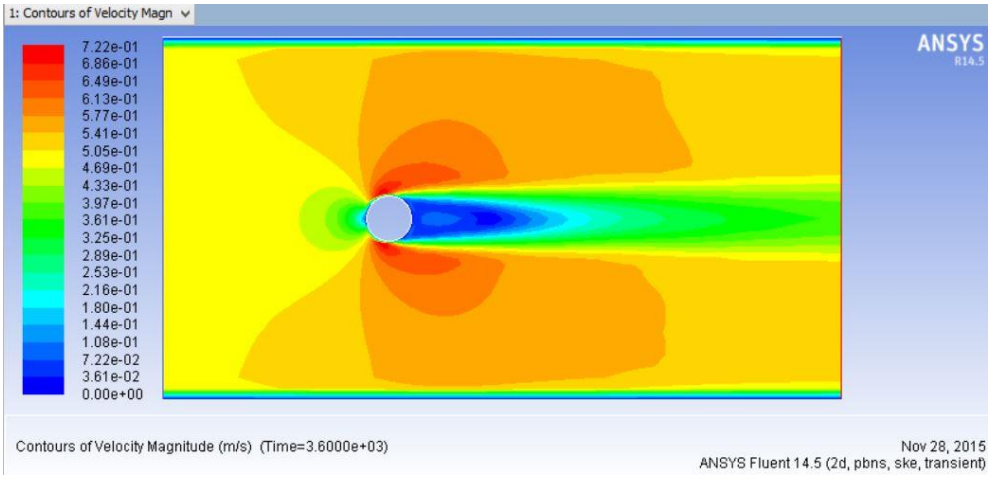


Part b)

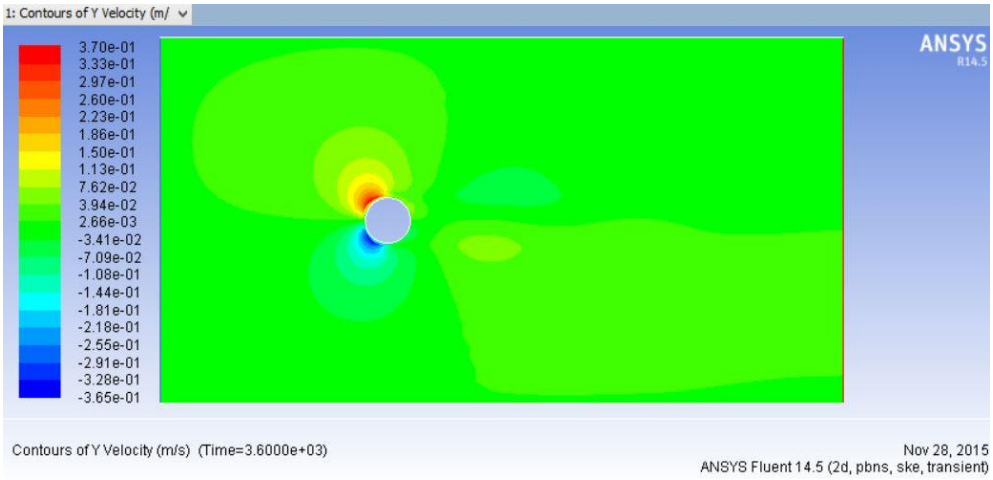
1. For an estimate of the Reynold's number of the system, the velocity is inlet velocity, the density is 1.225, the dynamic viscosity is 0.000017894 and the hydraulic diameter is the diameter of the cylinder (0.2 m).

The Reynold's number is thus 6845.87

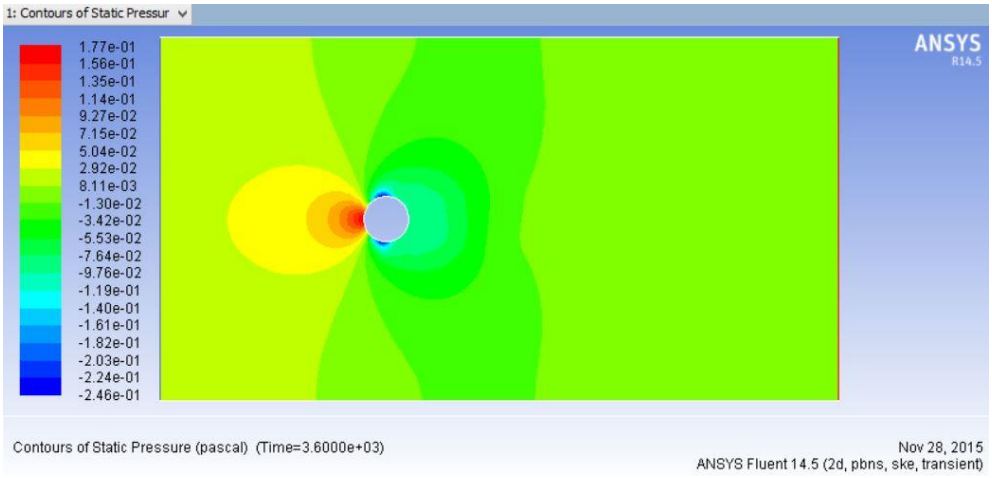
2. Contour plot of velocity magnitude



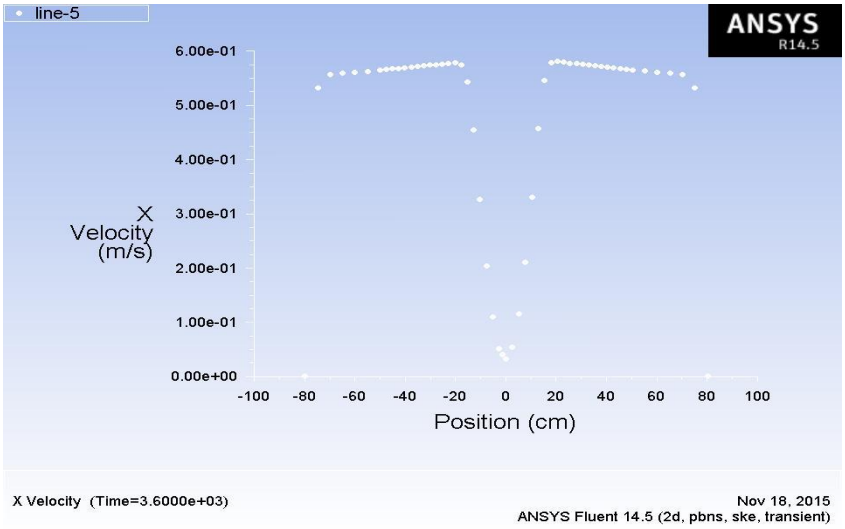
Contour plot of Y-component of velocity



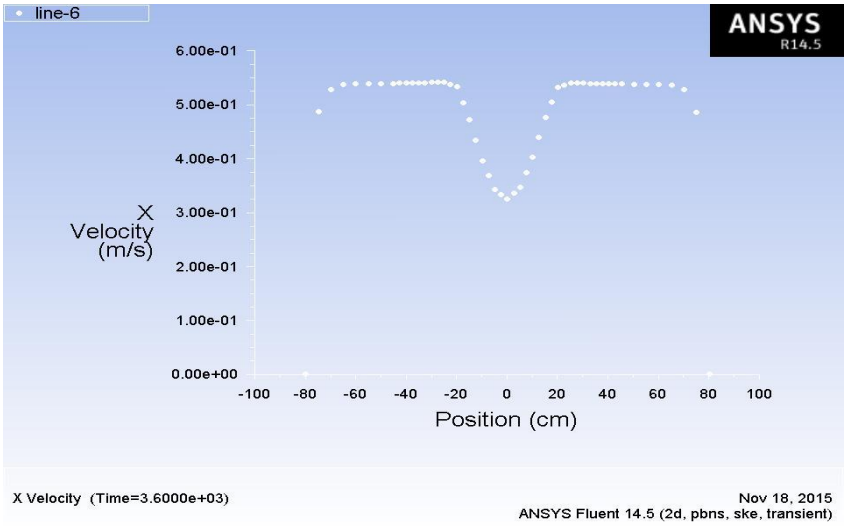
Contour plot of static pressure



3. Line plot of the X-component of velocity along the vertical line of x = 50 cm

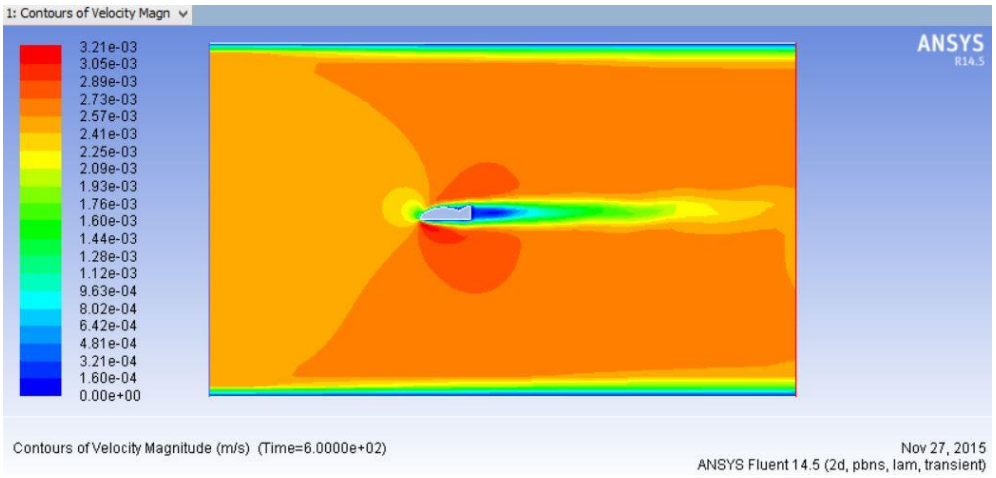


Line plot of the X-component of velocity along the vertical line of x = 150 cm

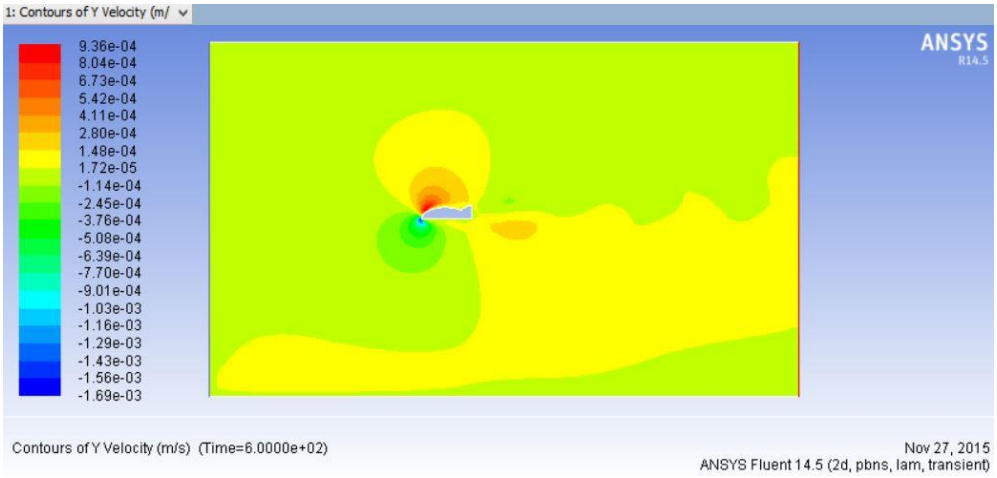


Task 2:

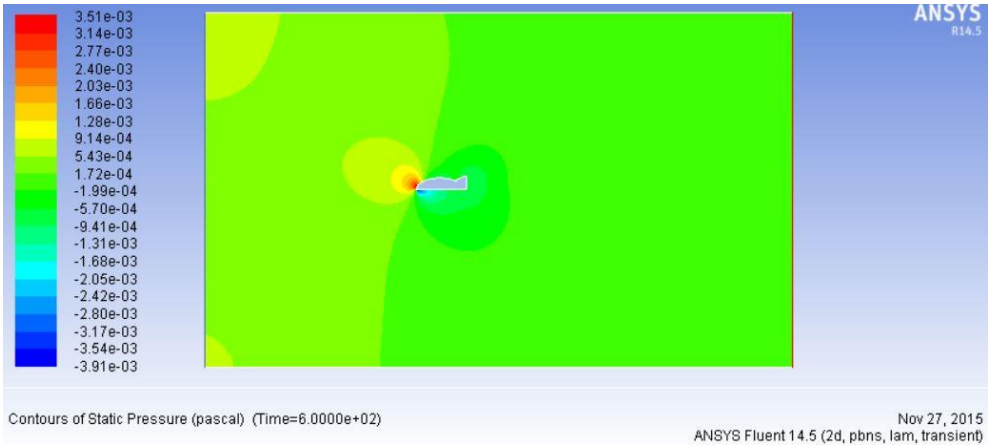
1. Contour plot of velocity magnitude



Contour plot of Y-component of velocity



Contour plot of static pressure



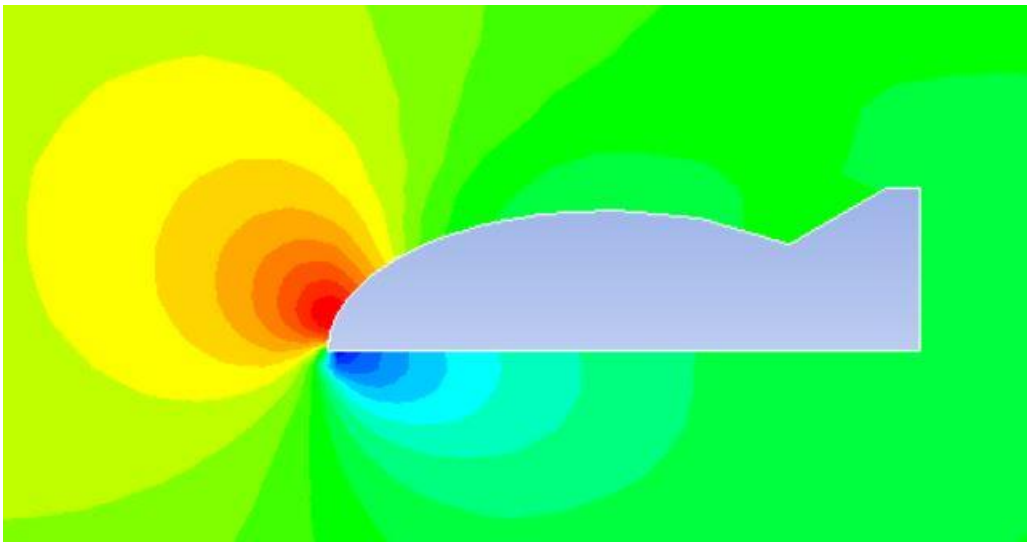
2. Calculation of the lift that the fluid exert on the whole “half fish”

Forces - Direction Vector (0 1 0)

	Forces (n)		
Zone	Pressure	Viscous	Total
edge1	-0.00024300523	-6.4963979e-06	-0.00024950162
edge2	1.3979685e-05	1.0474066e-05	2.445375e-05
edge3	1.3642593e-05	-7.808444e-07	1.2861749e-05
edge4	7.4824075e-06	3.3730973e-07	7.8197172e-06
edge5	0	3.9250193e-07	3.9250193e-07
Net	-0.00020790054	3.9266351e-06	-0.00020397391

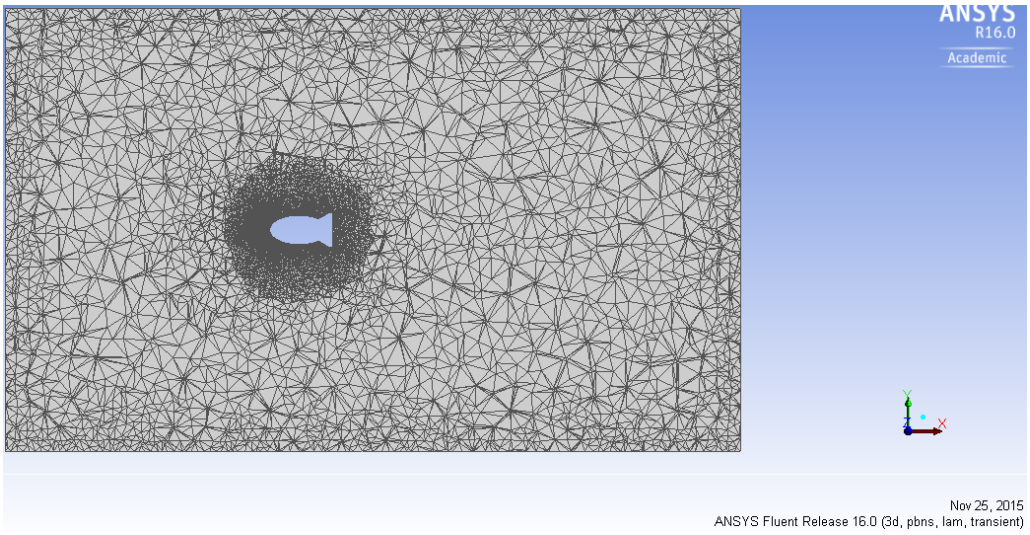
edge1 is the bottom straight edge if the fish for which the pressure contribution is negative while the net pressure contribution for the remaining faces is positive (which are above the x-axis). Thus, the net force is exerted in negative y-direction. It is apparent from the pressure contour plot as well.

See the zoomed in static pressure plot for the same:

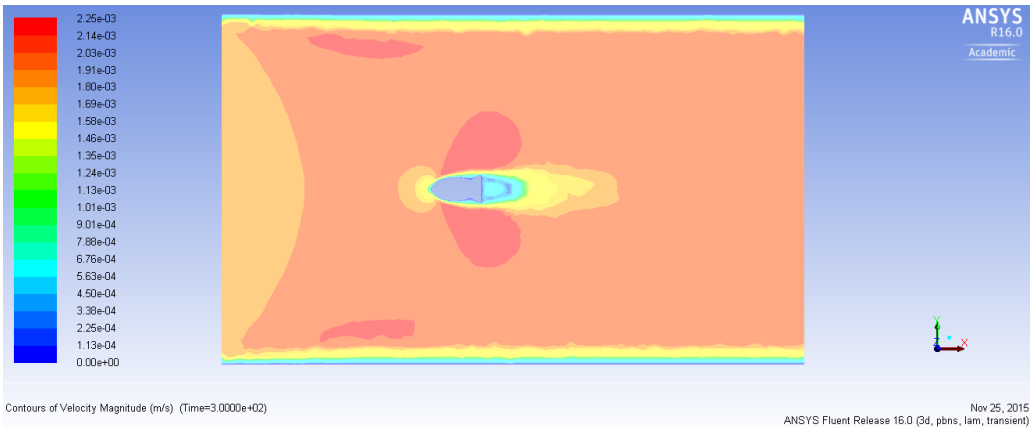


Task 3:

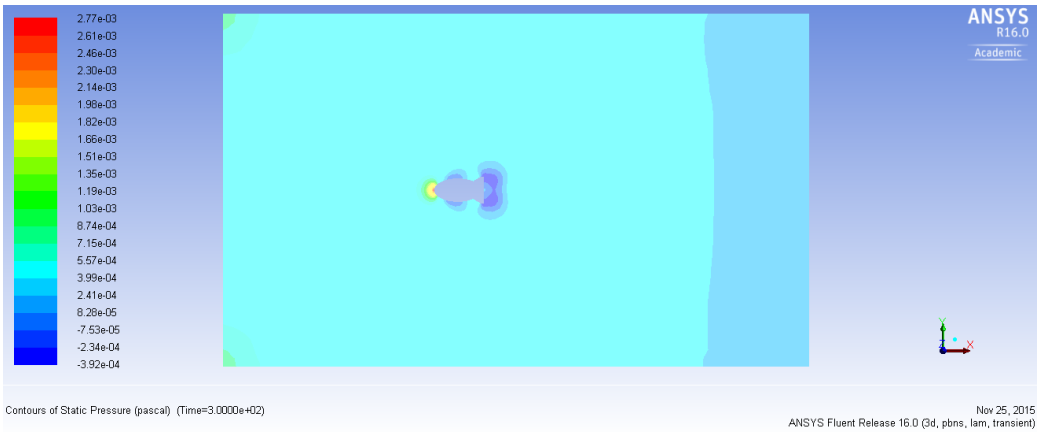
1. Mesh of the system



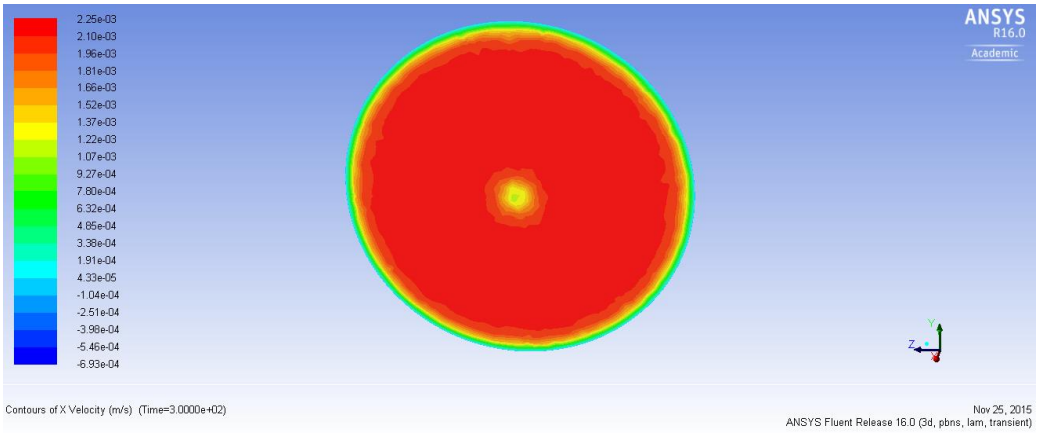
2. Contour plot of velocity magnitude on the x-y plane



Contour plot of pressure on x-y plane

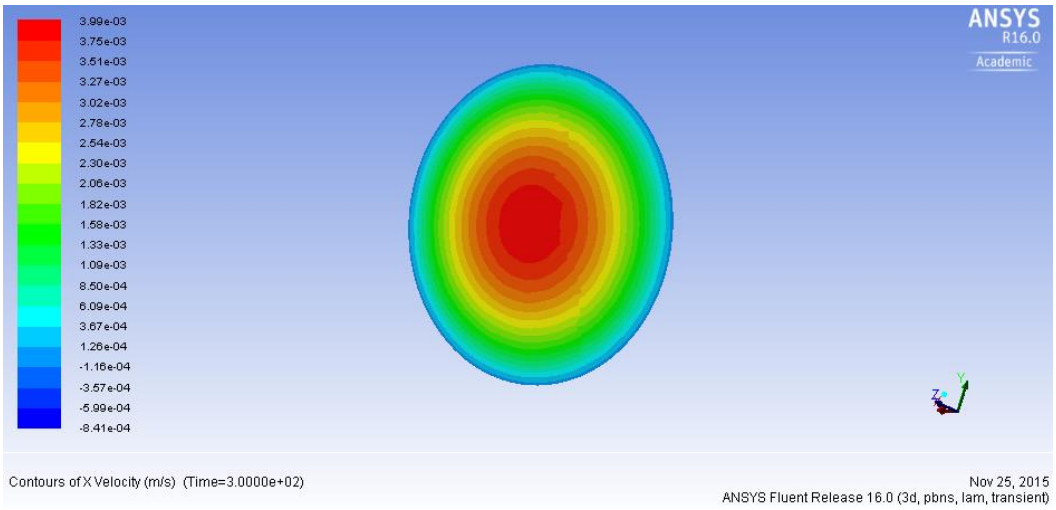


X-component of velocity on the vertical plane (parallel to the y-z plane and with a circular cross section) at x = 25 cm.

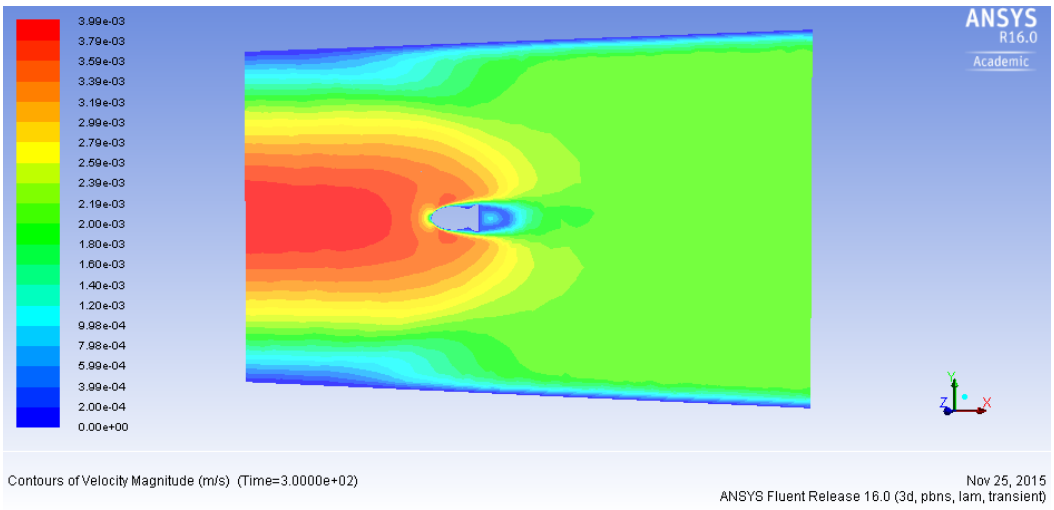


Task 4:

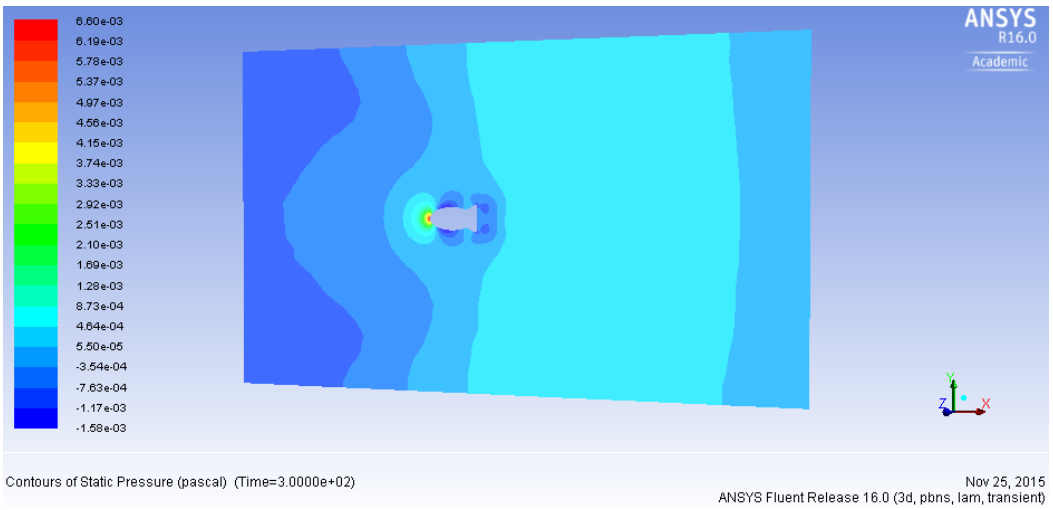
1. Contour plot of the x-component of velocity at the inlet



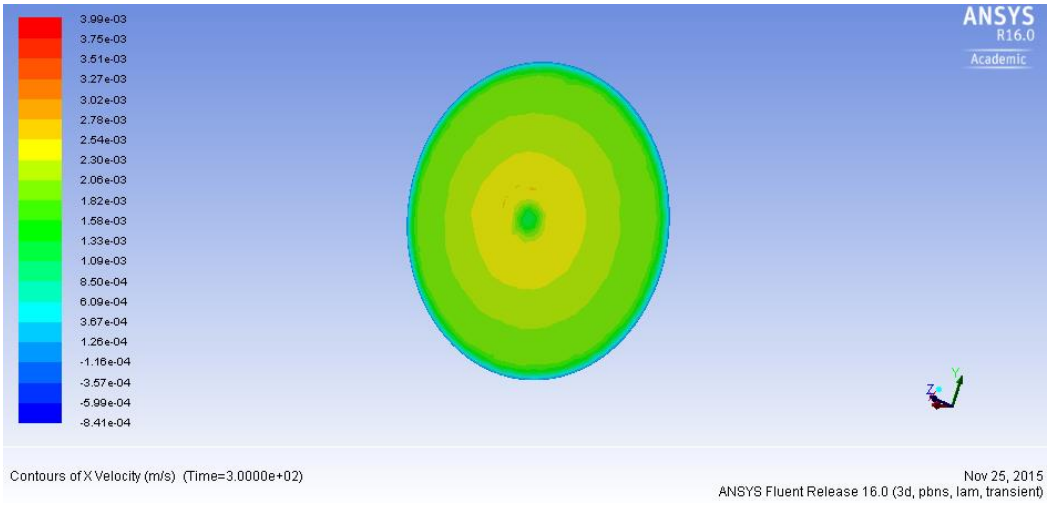
2. Contour plot of velocity magnitude on the x-y plane



Contour plot of pressure on the x-y plane



X-component of velocity on the vertical plane (parallel to the y-z plane and with a circular cross section) at x = 25 cm.



UDF used:

```
#include "udf.h"
DEFINE_PROFILE(inlet_x_velocity, thread, position)
{
real x[ND_ND];
real y;
real z;          /*For three dimensional profile*/
face_t f;
begin_f_loop(f, thread)
{
F_CENTROID(x,f,thread);
y = x[1];
z = x[2];
F_PROFILE(f, thread, position) = 0.004-0.004*y*y/(0.6*0.6)-0.004*z*z/(0.6*0.6);    /*Additional z term for 3D*/
}
end_f_loop(f, thread)
}
```