Vortex Panel Method

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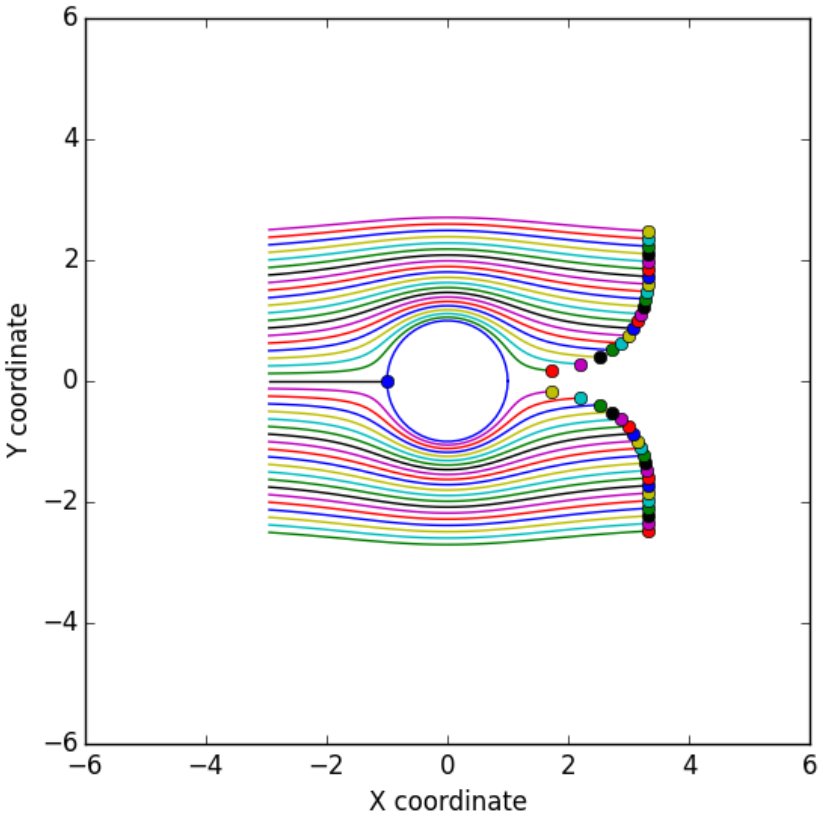
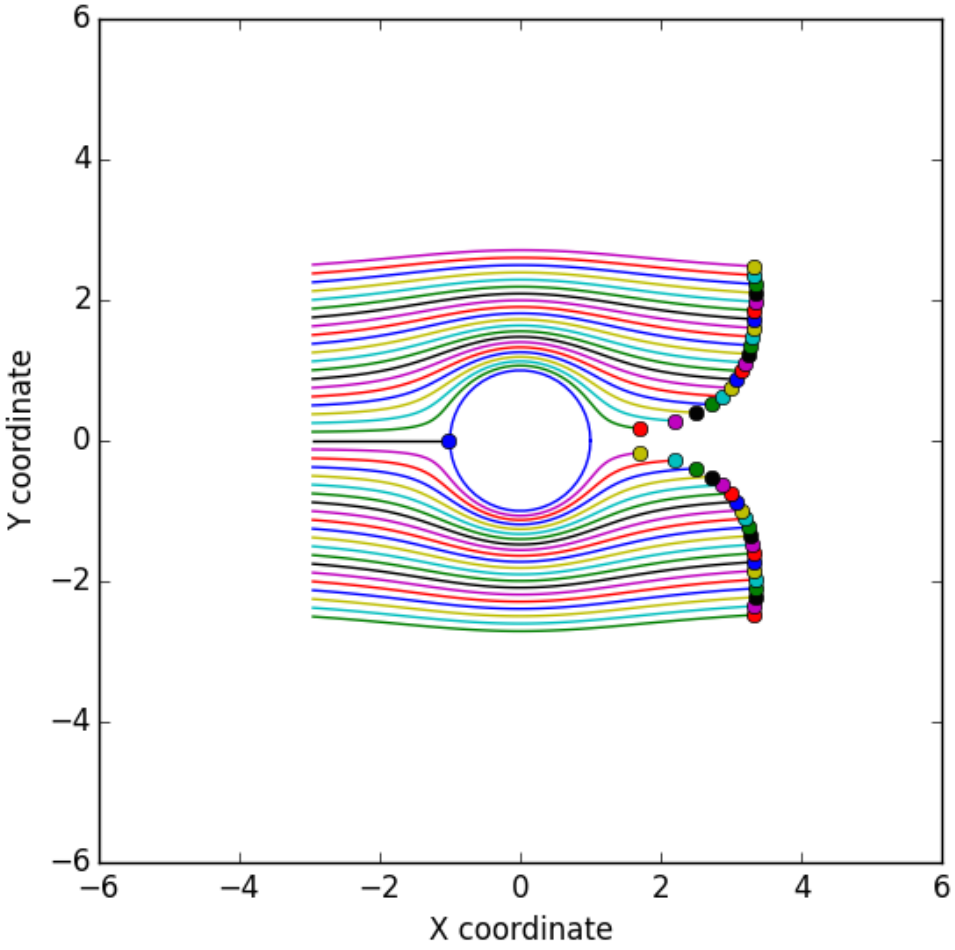
Notes:

- **time step = 0.05 seconds everywhere**
- **Number of tracers = 41 in every simulation**
- **Vortex strength = 1**
- **Freestream Velocity = 1**
- **Doublet Strength (corresponding to radius=1) = 2pi**
- **Number of Panels in cylinder = 50 (5*np points for velocity field calculation)**
- **Time Integrator = RK2**

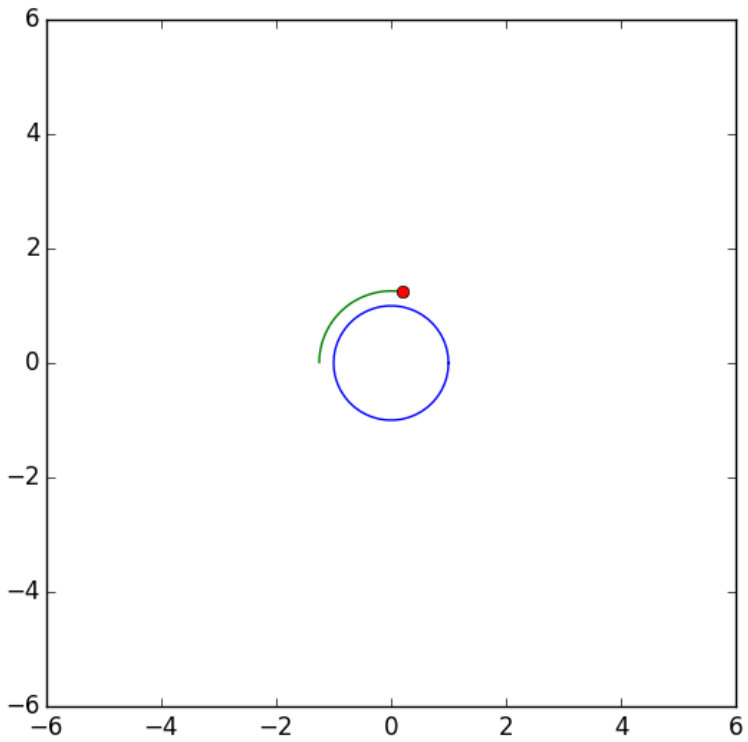
1) Flow Past cylinder with linear gamma panels and tracers in upstream (T=6 sec)



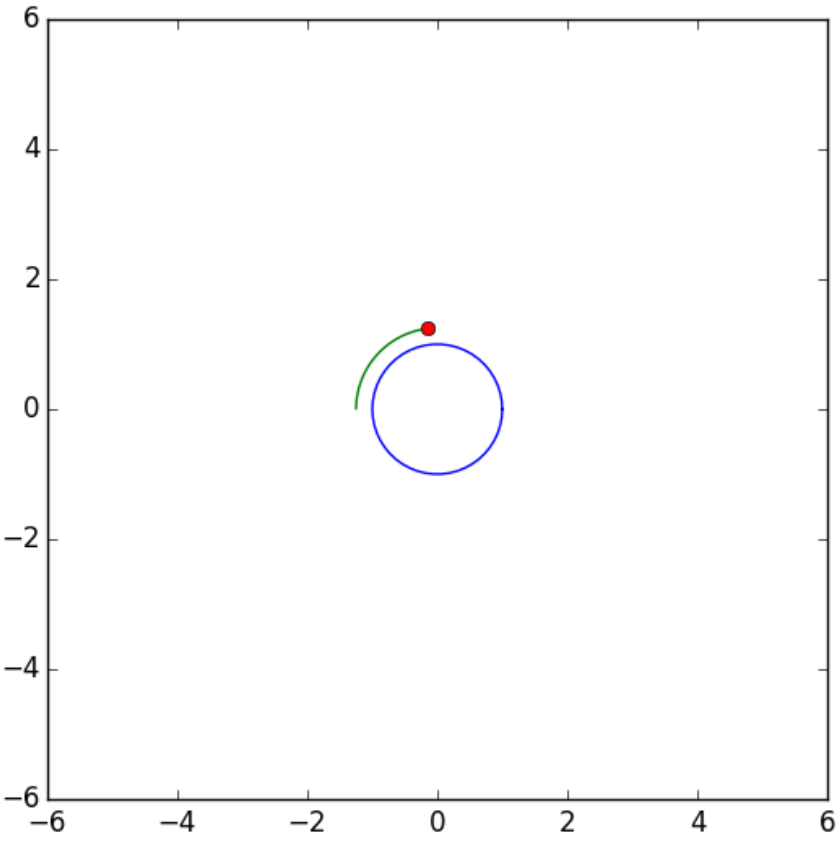
2) Flow Past cylinder with constant gamma panels and tracers in upstream (T=6 sec)

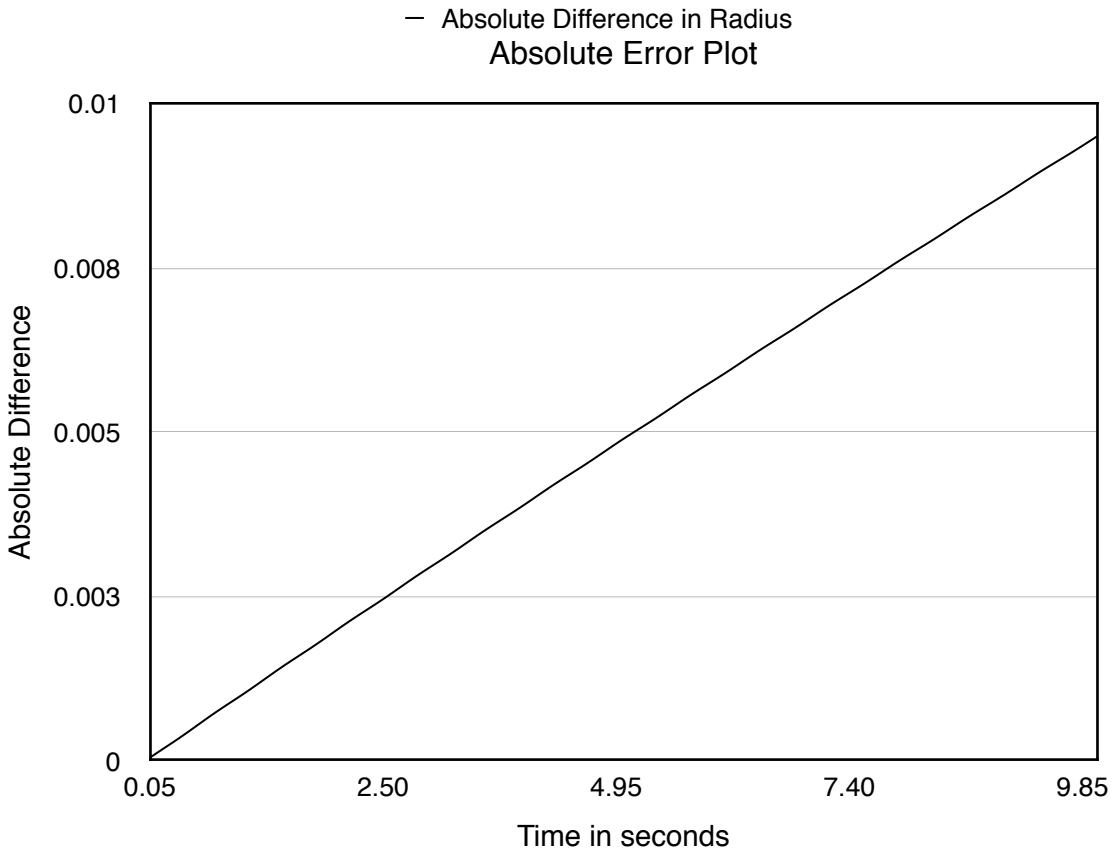


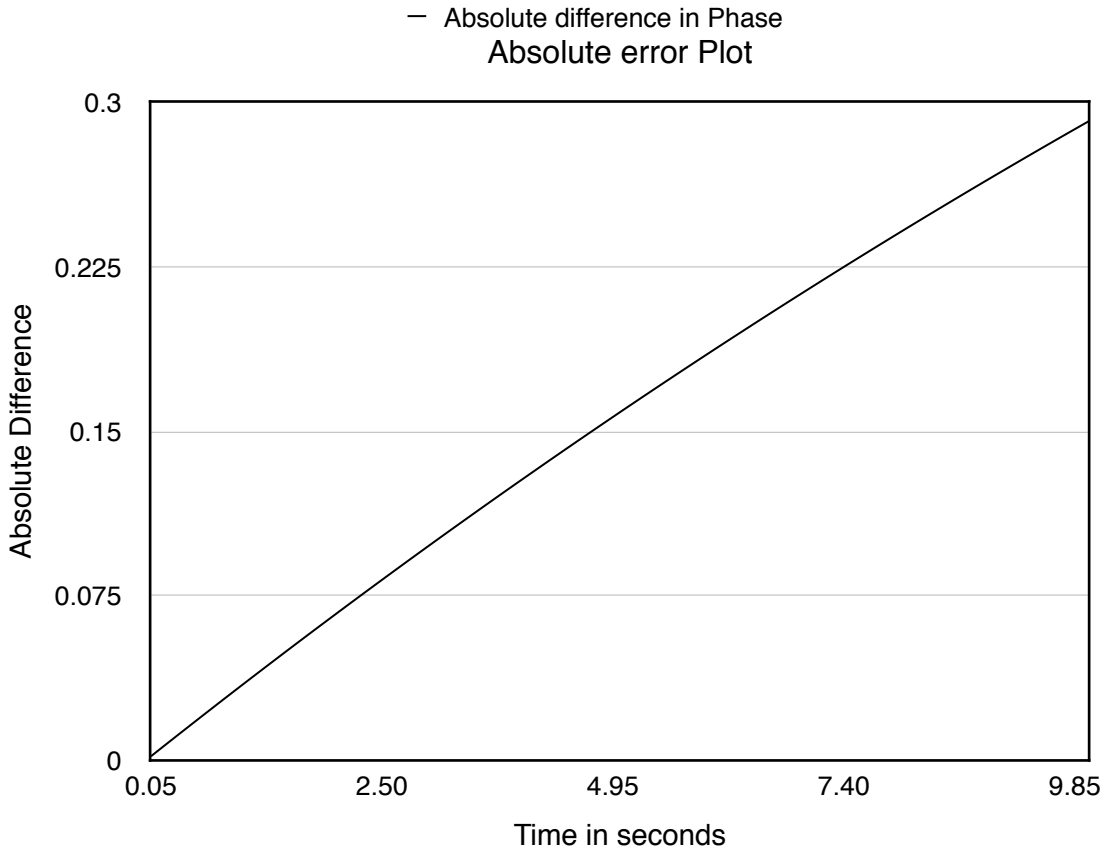
3) Motion of single point vortex around cylinder in absence of free stream and with linear gamma panels (T=10 sec)



4) Motion of single point vortex around cylinder in absence of free stream and using method of images (T=10 sec)

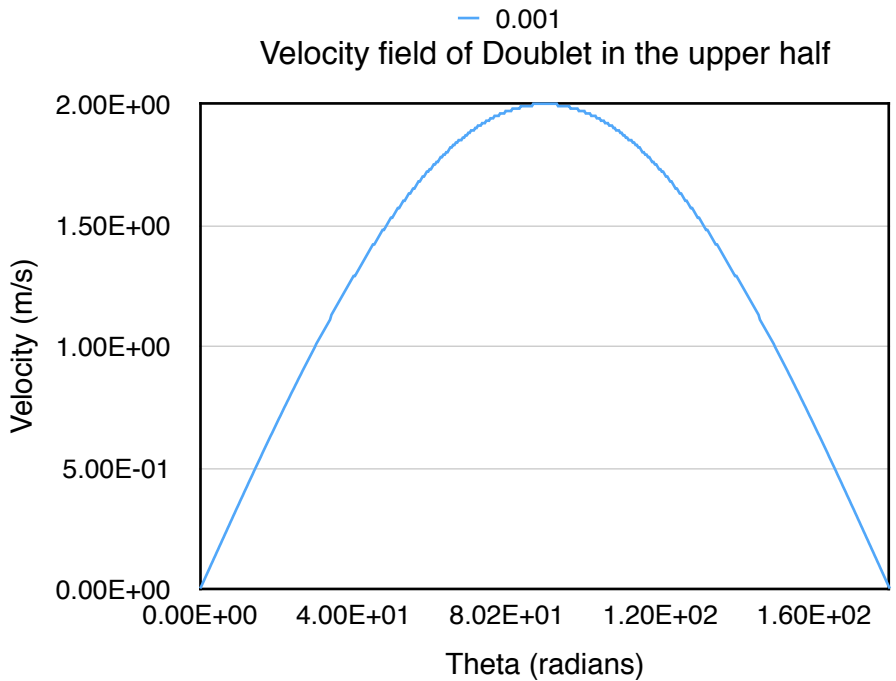


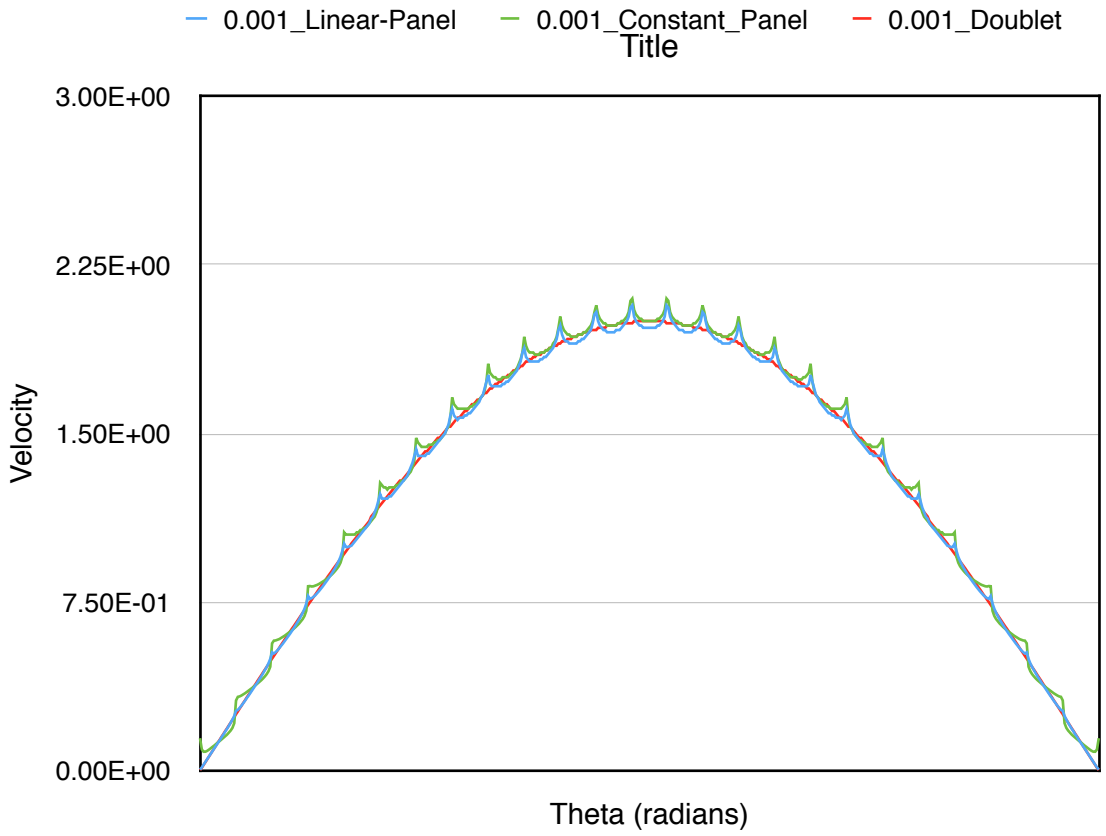


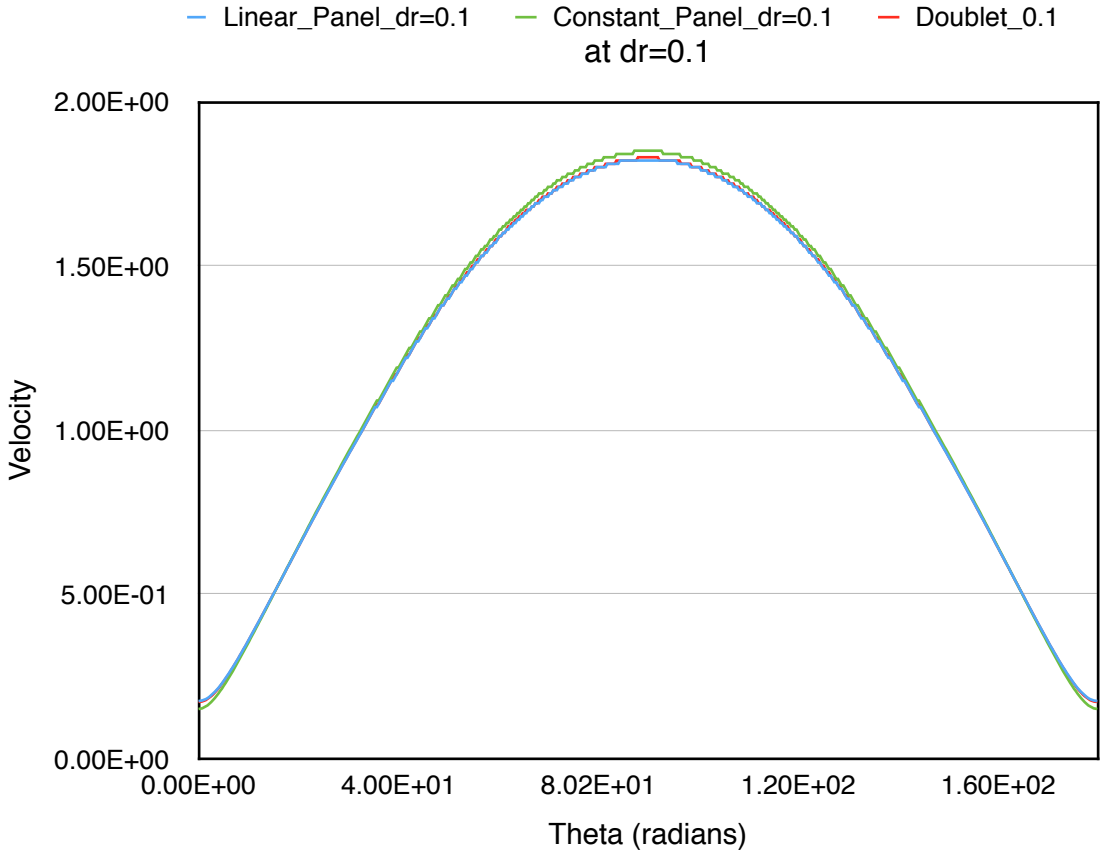


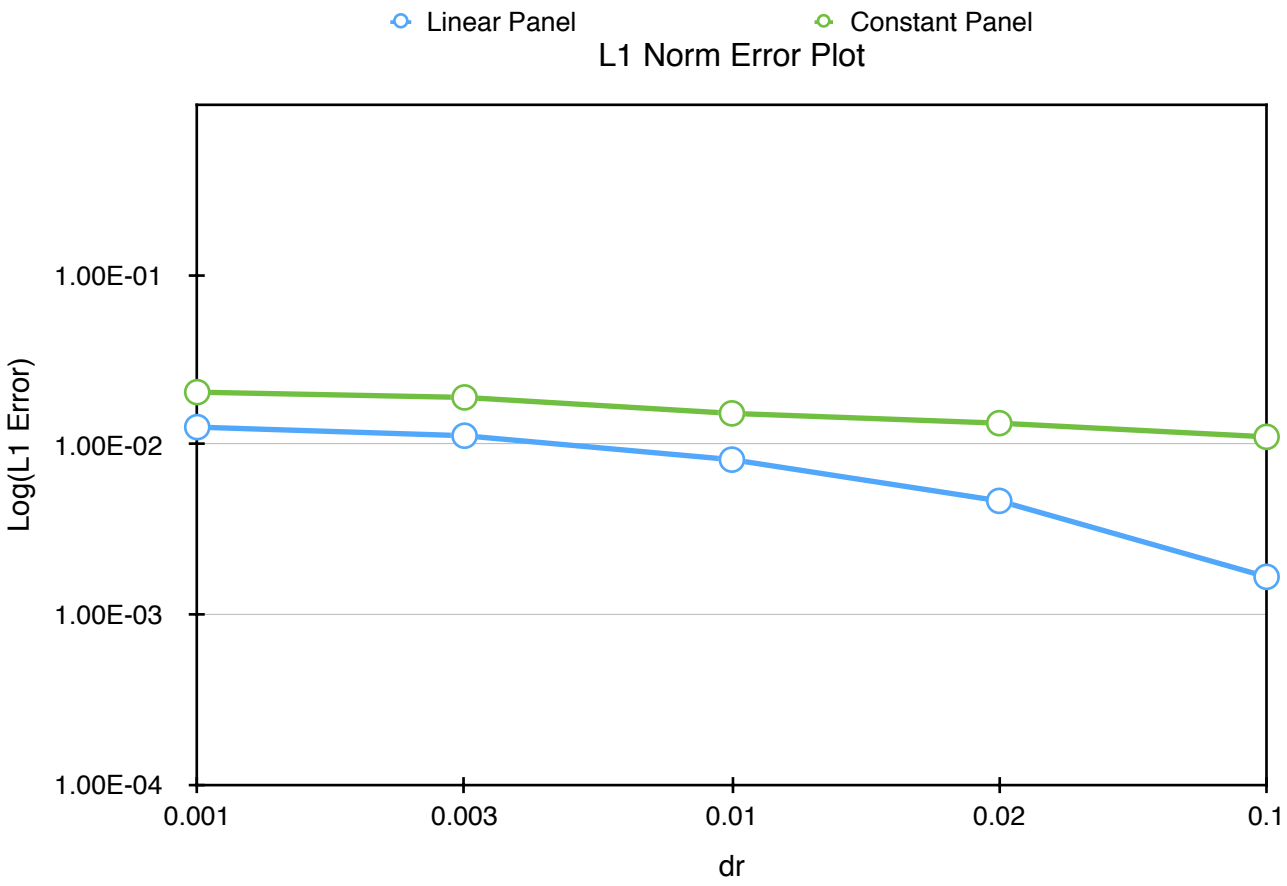
We can clearly see that there is quite a large difference between both the methods. Vortex in one of them is moving faster than the other (Linear Panel faster than method of images)

5) Difference between Linear panel and constant panel method when limiting to the surface of the cylinder




0.001_Linear-Panel
0.001_Constant_Panel
0.001_Doublet
Title
3.00E+00
2.25E+00
1.50E+00
7.50E-01
0.00E+00
Velocity
Theta (radians)


Linear_Panel_dr=0.1
Constant_Panel_dr=0.1
Doublet_0.1
at dr=0.1
2.00E+00
1.50E+00
1.00E+00
5.00E-01
0.00E+00
Velocity
0.00E+00
4.00E+01
8.02E+01
1.20E+02
1.60E+02
Theta (radians)



- **We can see that the L1-error increases much more rapidly for the constant panel than the linear panel as dr tends to 0.**
- **This is because of the discontinuity in the constant panel method.**
- **I couldn't find an optimum value of dr for which the system behaves optimally in linear panel method and constant panel method.**
- **The error shoots up for constant panel as dr tends to 0**