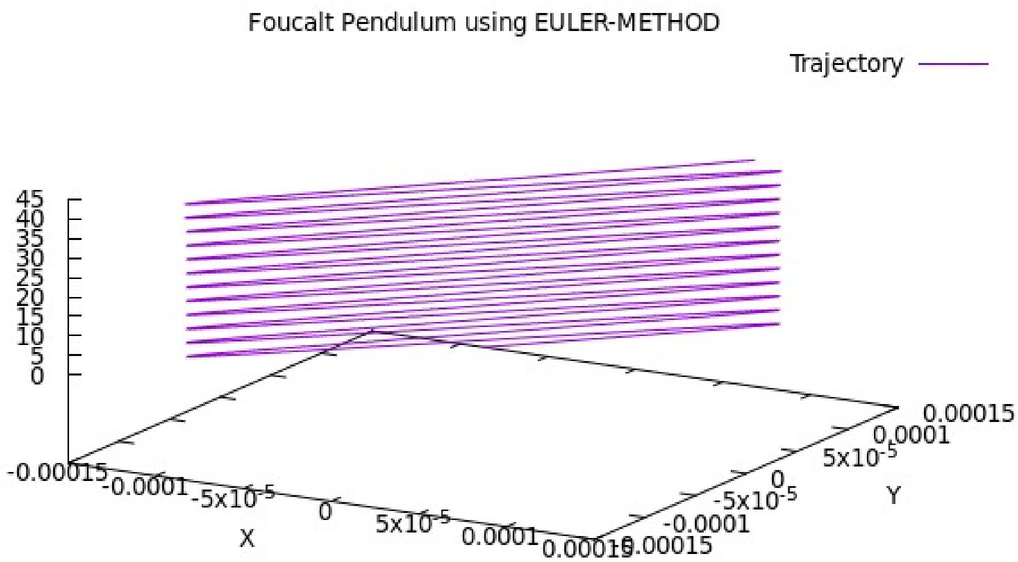
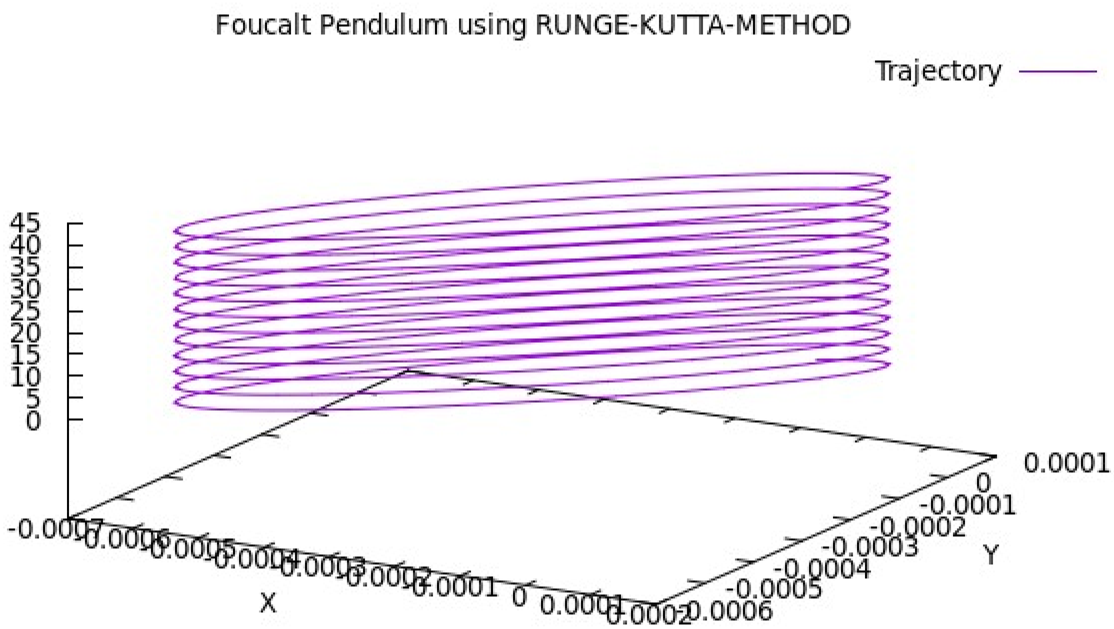
Simulation of Foucault Pendulum

for the actual value of the Omeega-earth and Time Period of 24hrs(1 day) using the four listed methods

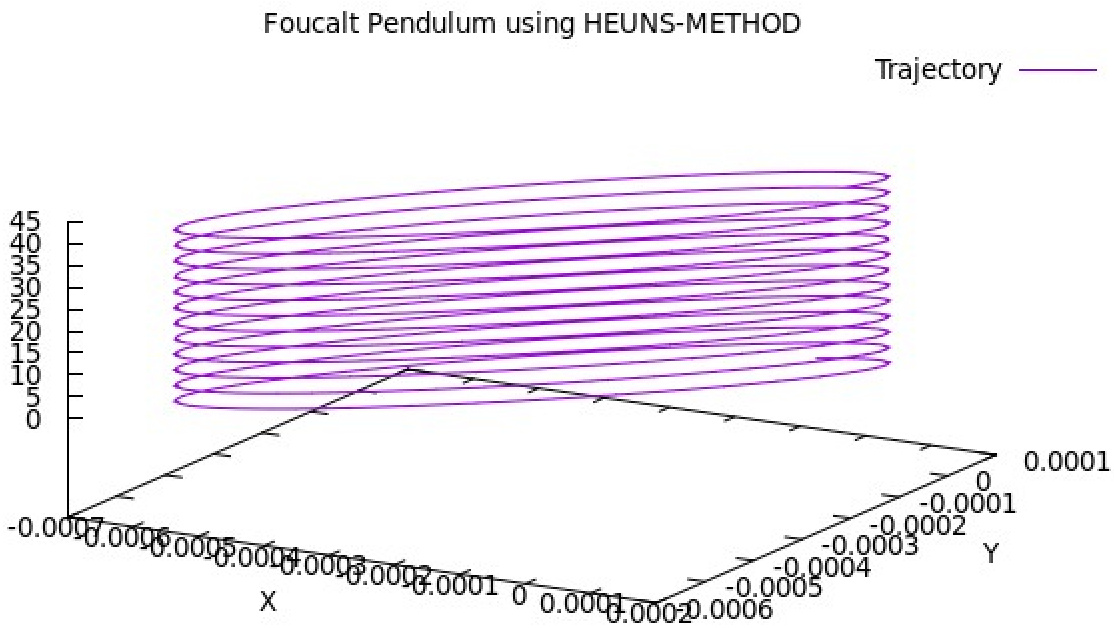
1.Euler's Method



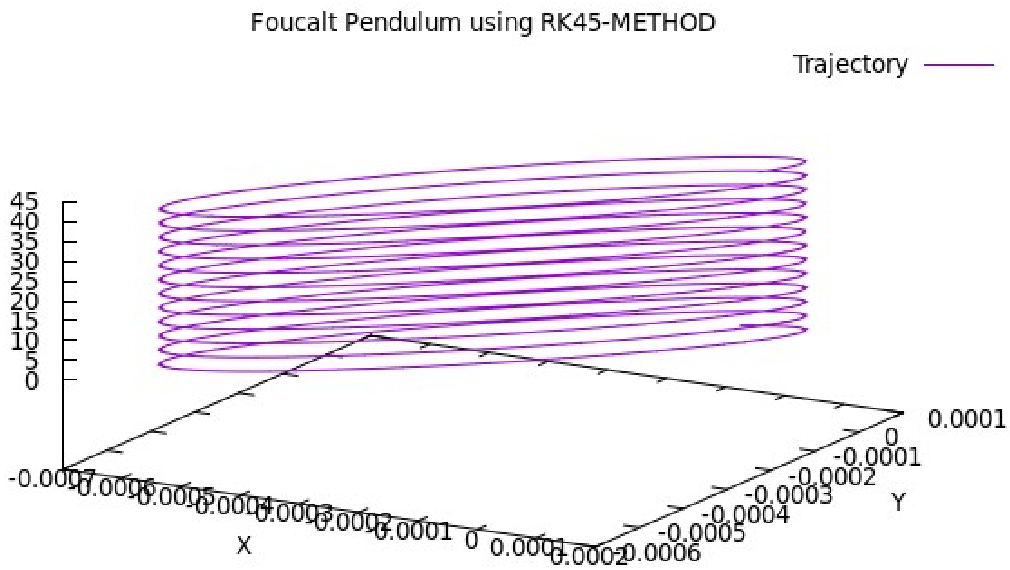
2.Euler-Heun's Method



3.Runge-Kutta Method



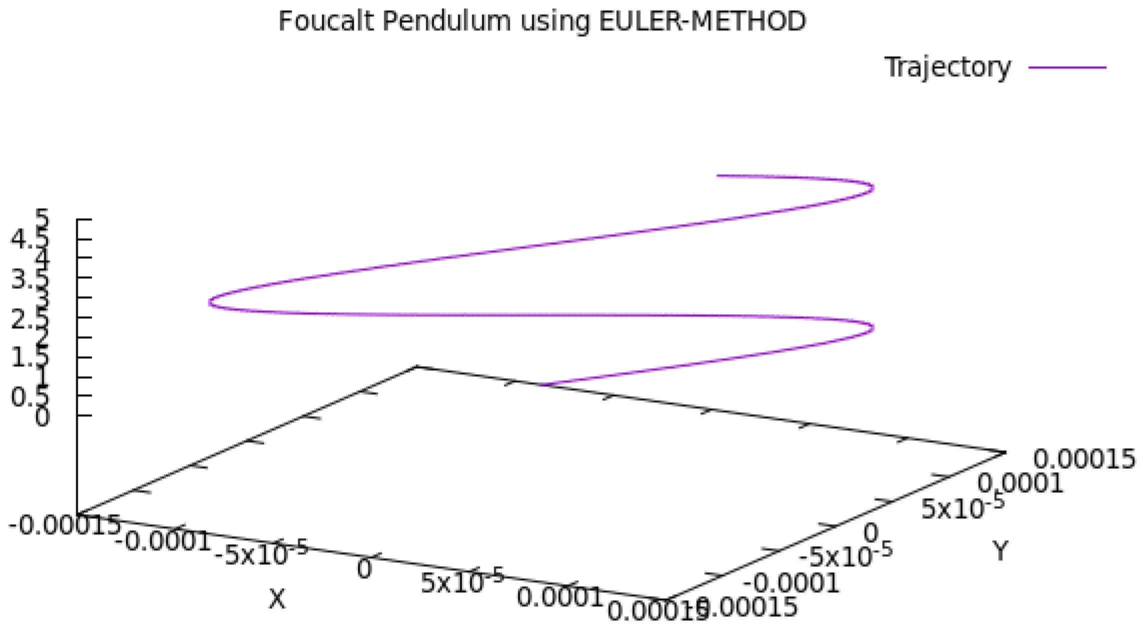
4.RK45 Method



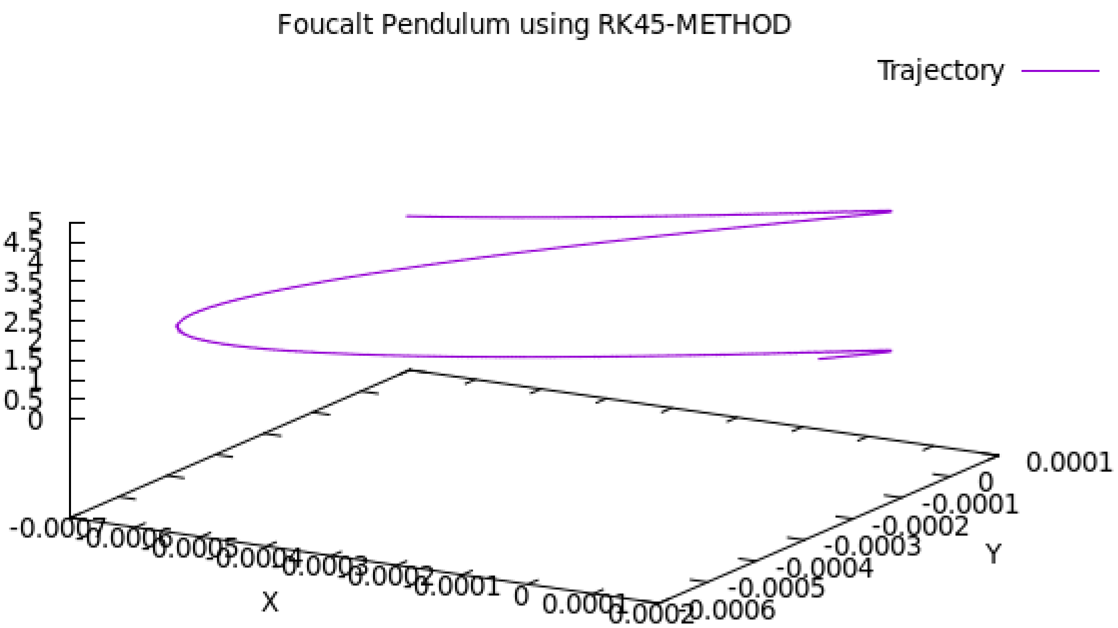
Note: In all the above plotted simulations we have taken N=86400(Total-time) and the step-size to be as 0.0005.

Comparison between Euler's Method and RK45 for different step sizes

1.For a step size of 0.0005

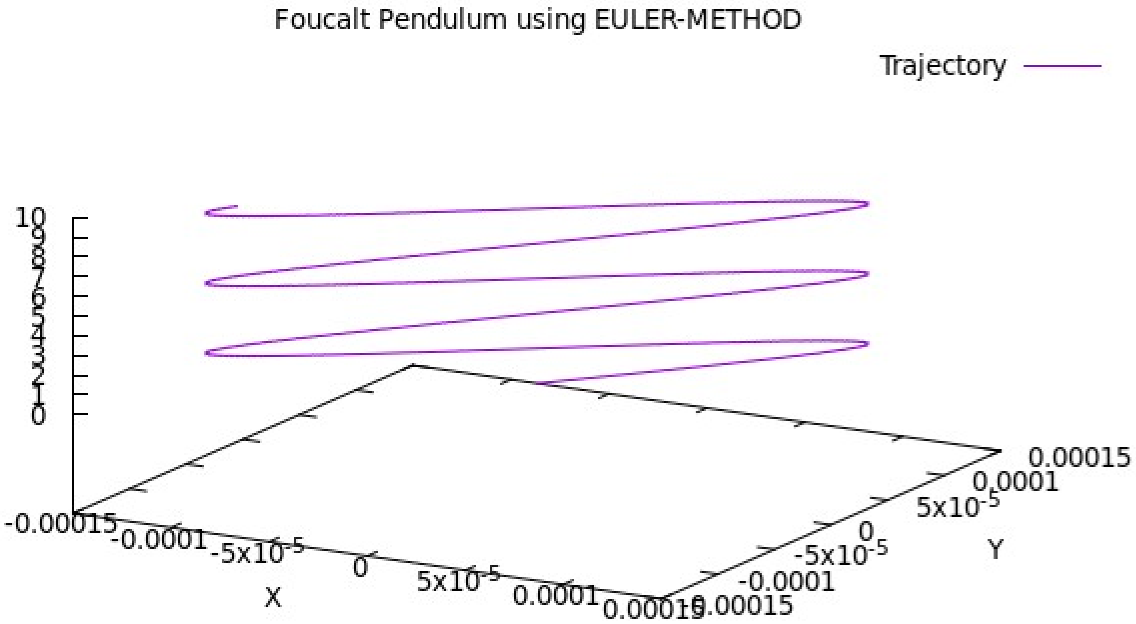


Euler's Method

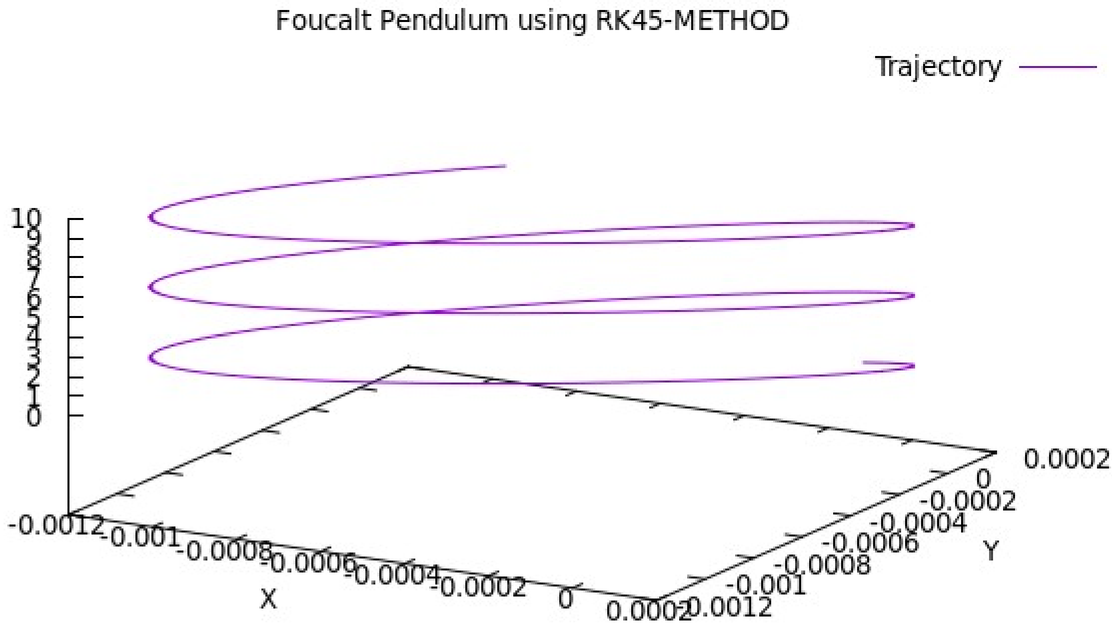


RK45 Method2.For a step size of 0.001

Euler's Method

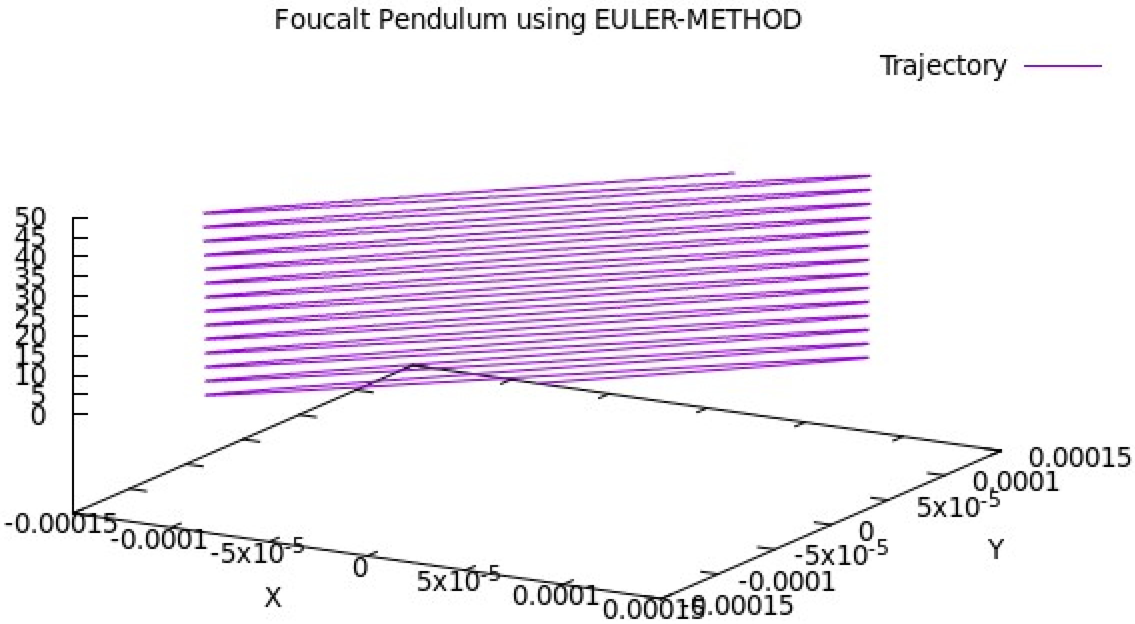


RK45 Method

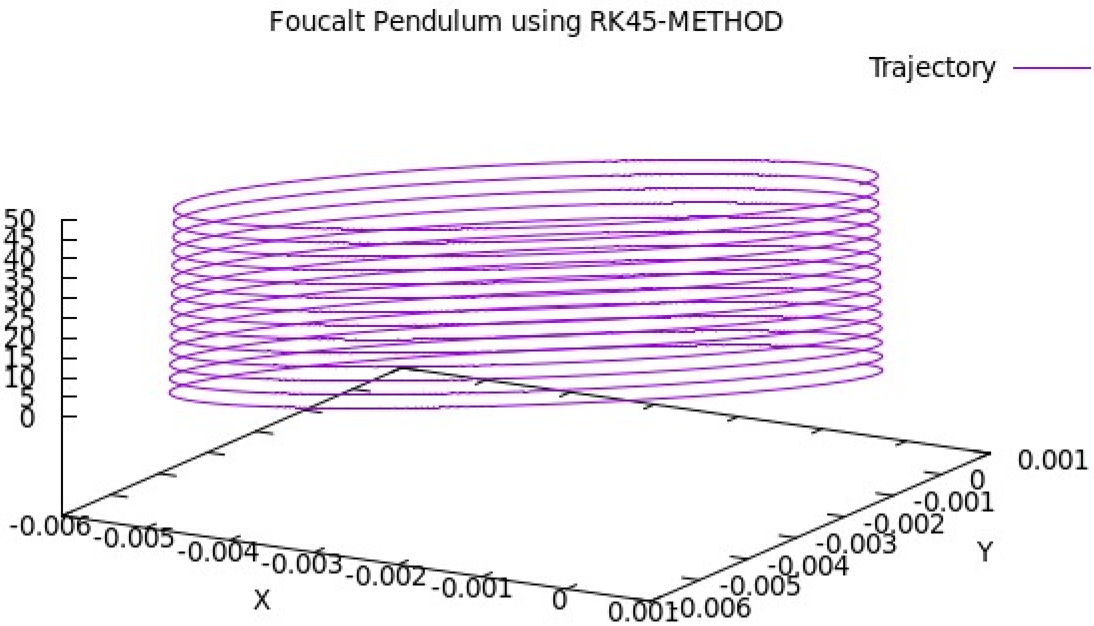


3.For a step size of 0.005

Euler's Method

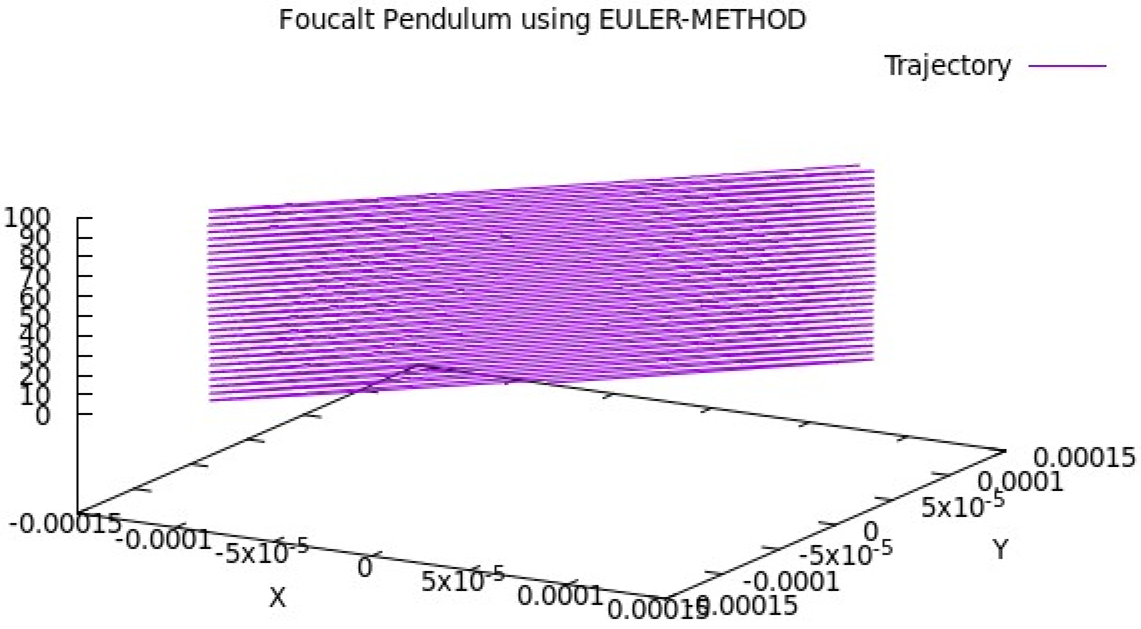


RK45 Method

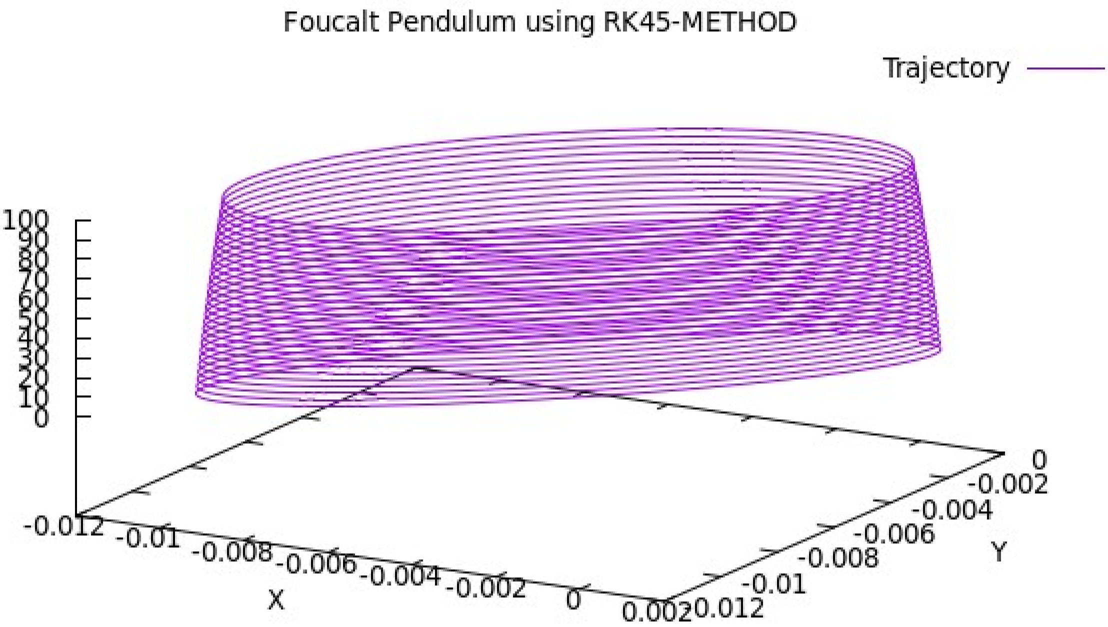


4.For a step size of 0.01

Euler's Method

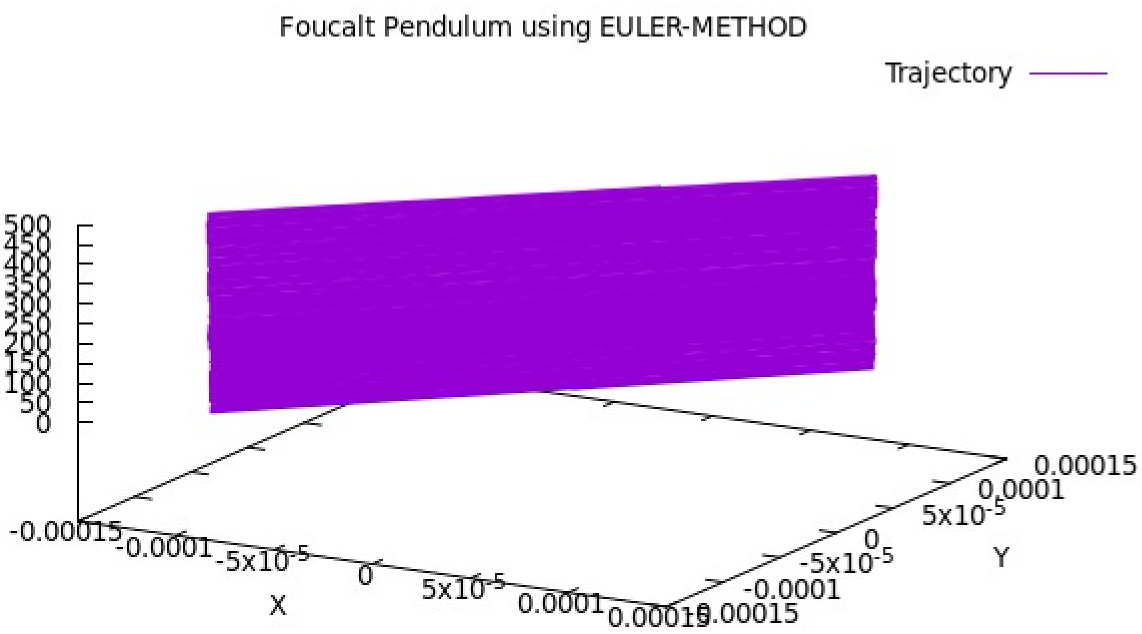


RK45 Method



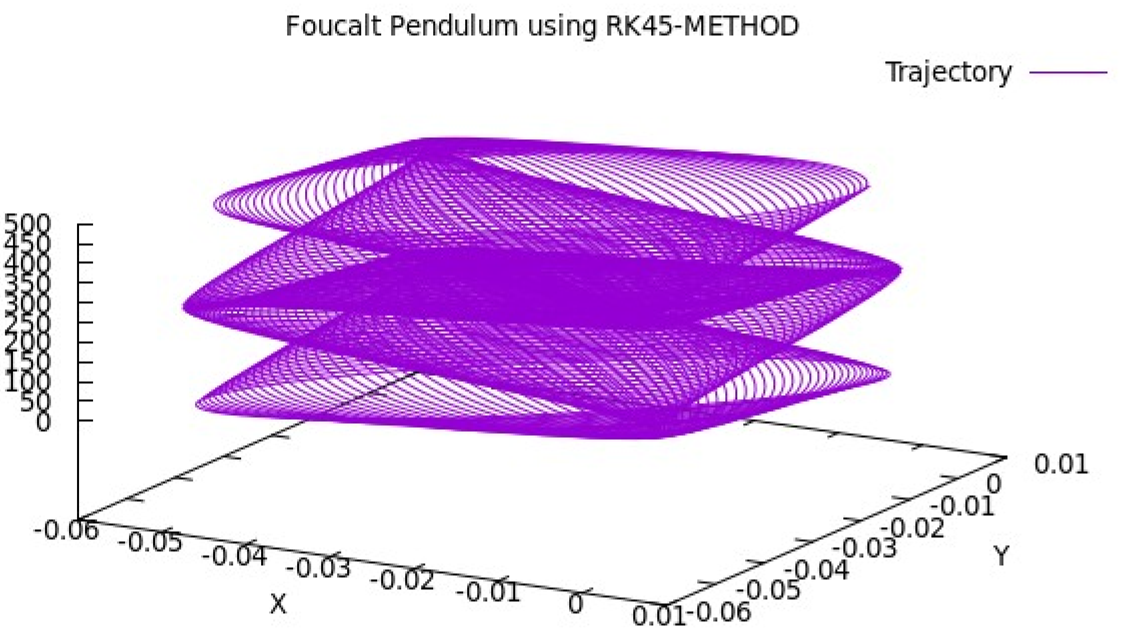
5.For a step size of 0.05

Euler's Method



Foucalt Pendulum using EULER-METHOD
Trajectory
500
450
400
350
300
250
200
150
100
50
0
-0.00015
-0.0001
-5x10-5
0
5x10-5
0.0001
0.00015
X
-0.00015
-0.0001
-5x10-5
0
5x10-5
0.0001
0.00015
Y

RK45 Method

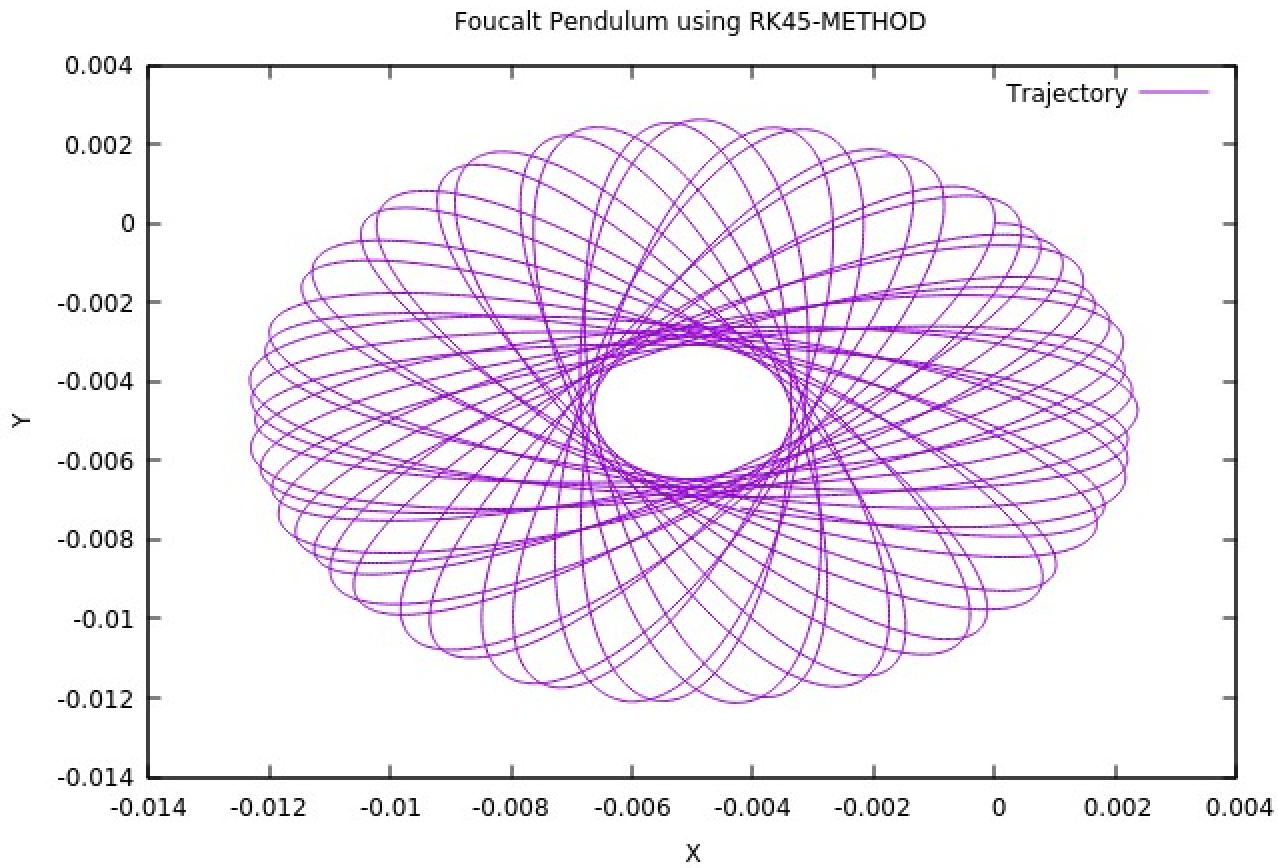


Foucalt Pendulum using RK45-METHOD
Trajectory
500
450
400
350
300
250
200
150
100
50
0
-0.06
-0.05
-0.04
-0.03
-0.02
-0.01
0
0.01
X
-0.06
-0.05
-0.04
-0.03
-0.02
-0.01
0
0.01
Y

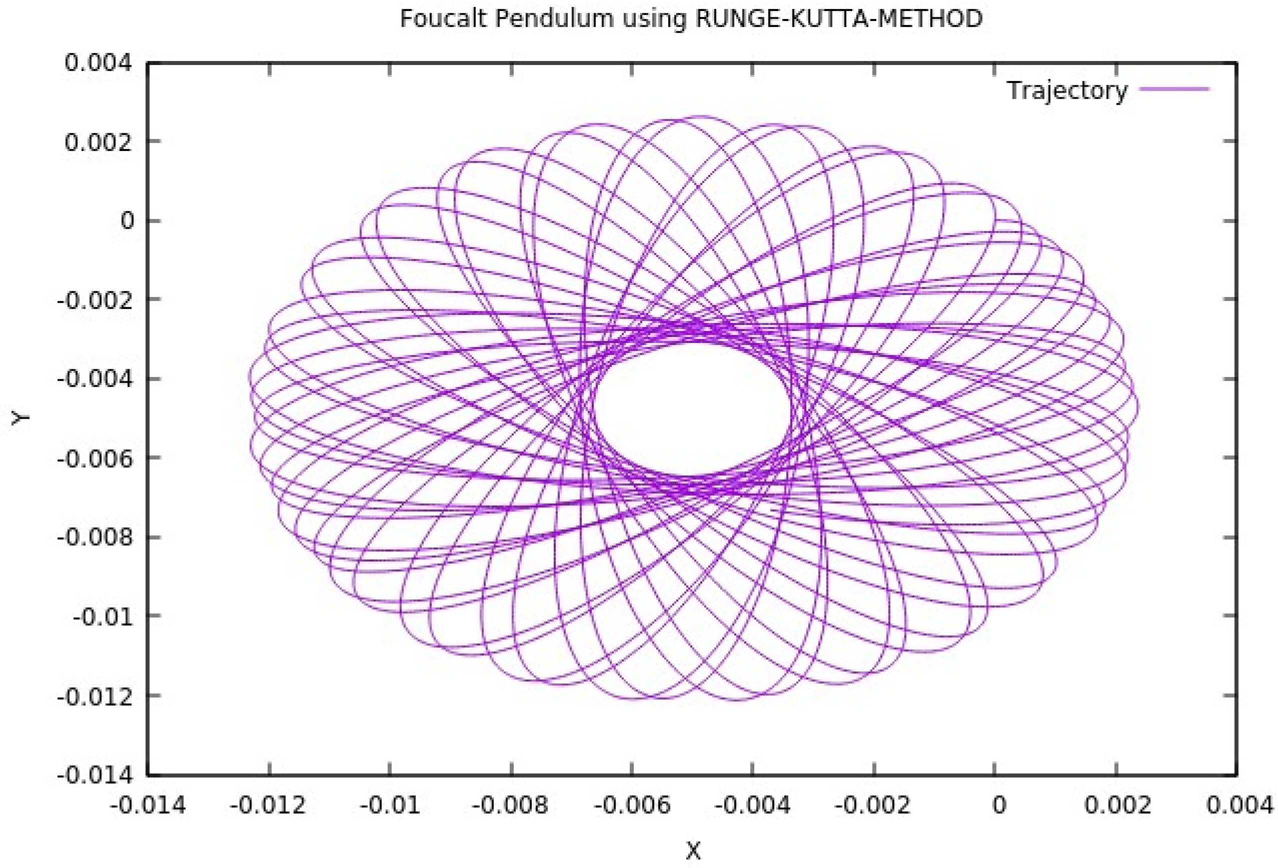
From the above five comparison plots between Euler's Method and RK45 Method, we find that as the step-size increases then Euler's Method go much worse than that compared to that from RK45.

It can be said so since the RK45 method works on values of differentials at intermediate values in the step and hence making it more accurate than the Euler method which uses only the inital point values of function and its derivative to generate the next value.

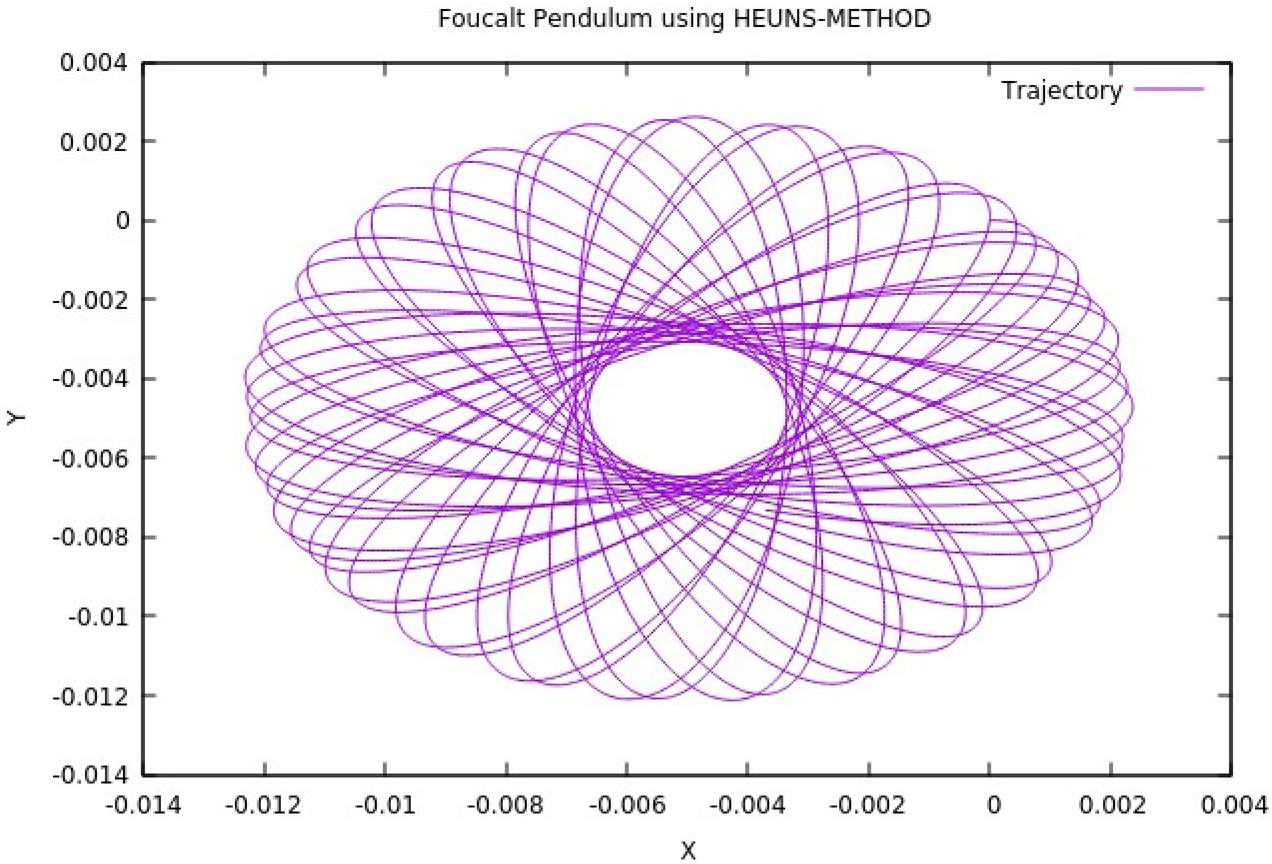
Extra: Graphs of foucault's pendulum with Omega_Earth less(0.0727) in 2d



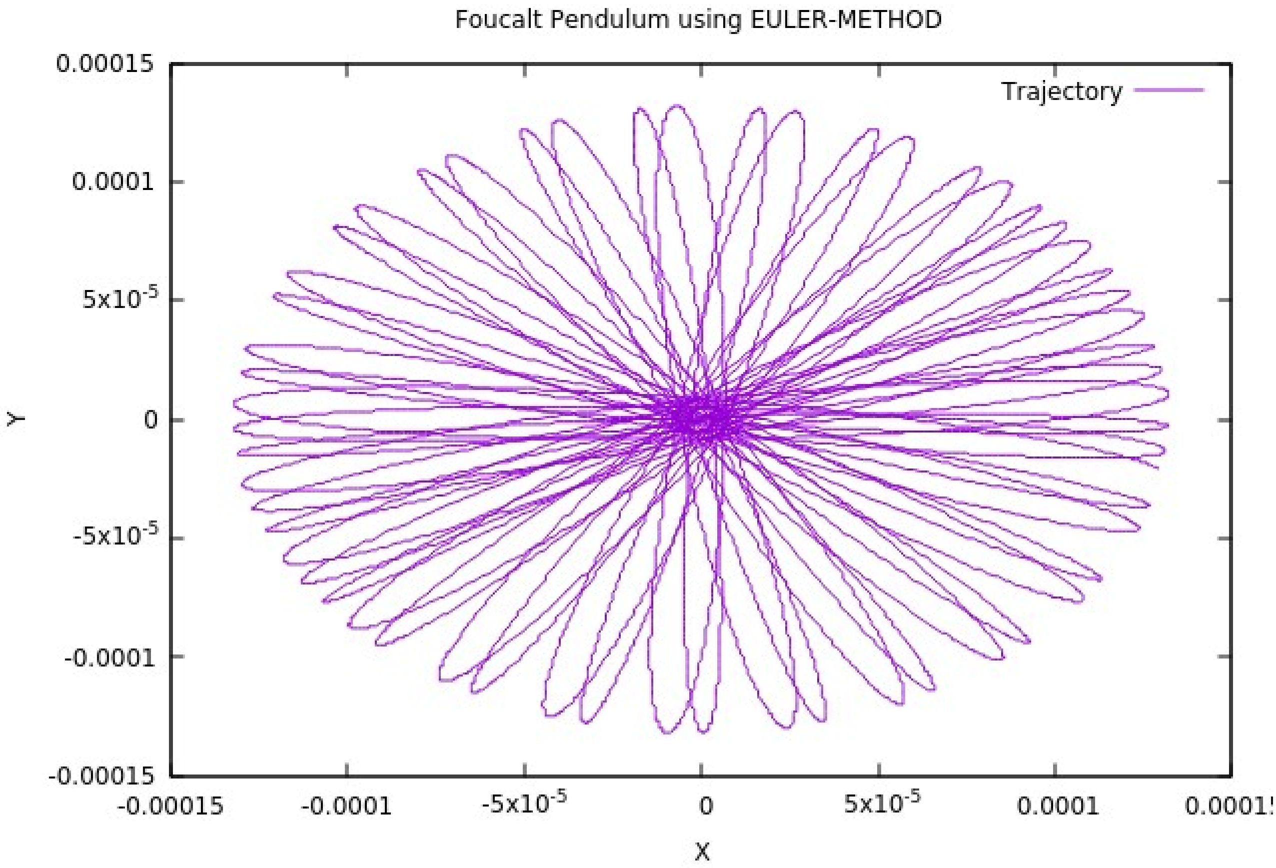
RK45 Method, n=10000, timestep=0.01



Runge Kutta Method(4th Order), n=10000, timestep=0.01



Heuns Method, n=10000, timestep=0.01



Euler's method, n=10000, timestep=0.01