ME EN 2450

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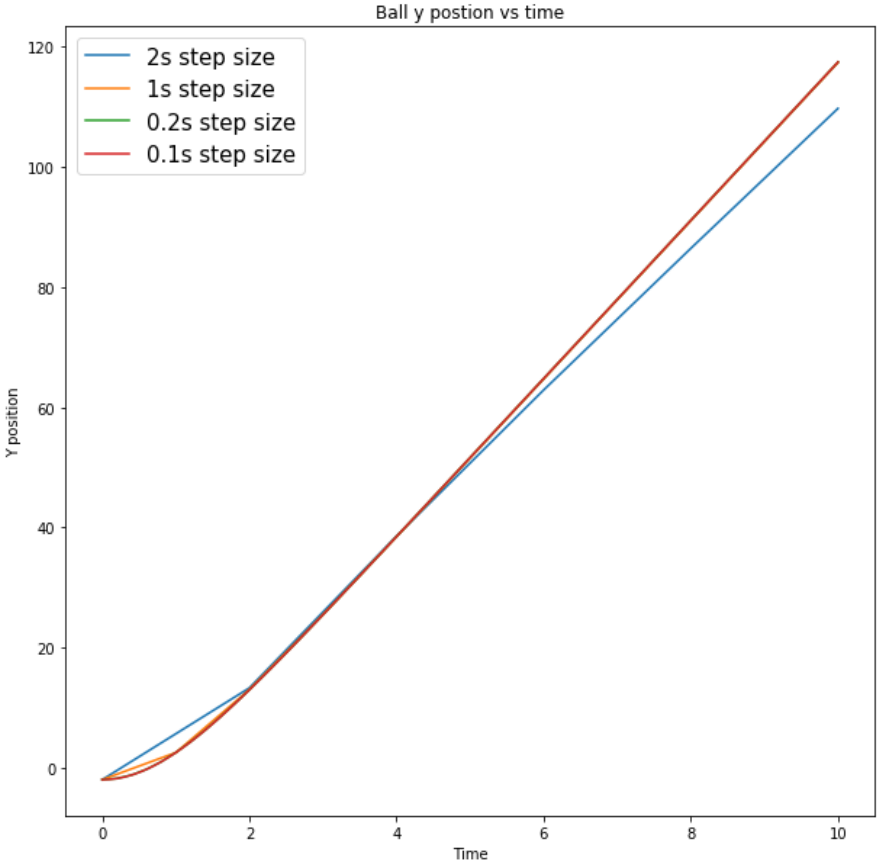
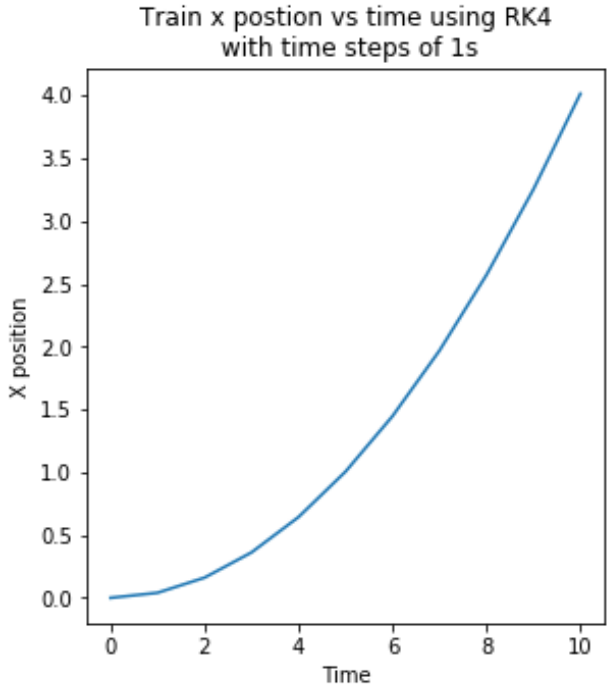
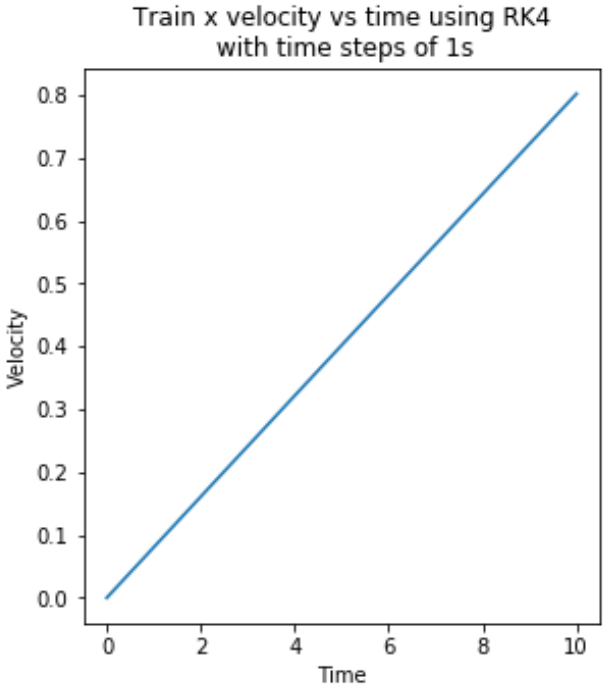
Lab 09b

At a step size of approximately 0.2 seconds or less for an RK4 solver a plot of position versus time is virtually indistinguishable from the position versus time plot a very small step size RK4 solver (which can be seen a fully converged solution). On my plots the 0.2s and 0.1s step size plots are virtually converged. The unchanging shape of the plot from 0.2s to 0.1s indicates that there is convergence to some type of solution.

The best step size for this problem would likely be below 0.2s since our computational demand for this problem is not a factor that really needs to be considered. A step size of less than 0.2s is represented accurately enough by the computer and thus we do not get roundoff error and we would rather prevent truncation error by making the step size smaller. Other factors that may have to be considered is the application of this solution and how accurate we need it to be for that application.


Ball y postion vs time
2s step size
1s step size
0.2s step size
0.1s step size
Y position
Time
0
20
40
60
80
100
120
0
2
4
6
8
10


Train x postion vs time using RK4
with time steps of 1s
X position
Time
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
0
2
4
6
8
10


Train x velocity vs time using RK4
with time steps of 1s
Velocity
Time
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0
2
4
6
8
10