Phys 124 - Freshman Project
Spring 2023
Simulation Homework I

A platform with mass M is attached to a wall with a spring, and can slide frictionlessly on a horizontal surface. Another mass m is attached to the platform with another spring and may slide frictionlessly on the platform. Both masses are 1Kg, and have stiffnesses $K = k$=10N/m. The length of both springs when they are neither stretched nor compressed is 1m. The figure shows the masses, when they are at rest, at time t=0.

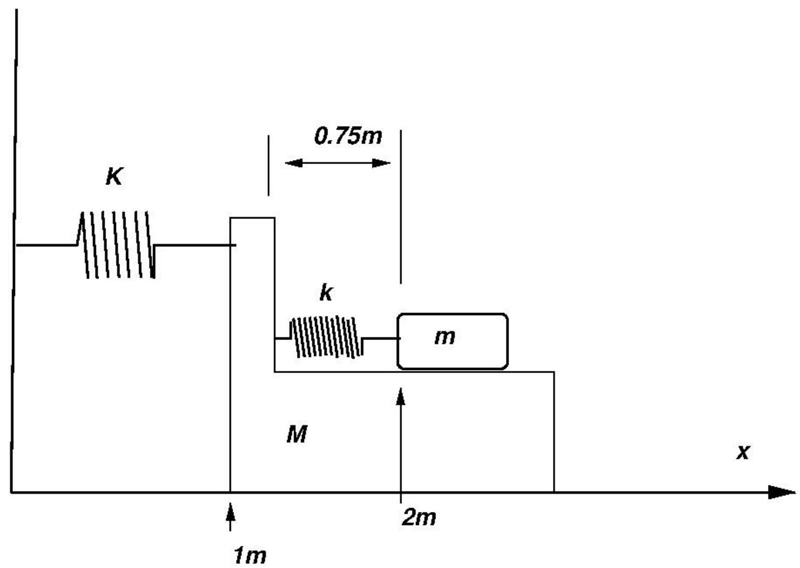

Figure 1: The masses, at t=0. Note that the spring k has been compressed by 25cm.

Construct a computer code to simulate the motion of the masses. Plot the x-coordinates of the masses (taking them as 1m for M and 2m for m at t=0) for the time period $0 < t < 5$s.

As an example, my code contains

```
import matplotlib.pyplot as plt
import numpy as np

#############################################
# Two coupled masses and springs

plt.clf()

n = 5000
dt = 0.001
K=10.0
mass= 1.

xm=[]
xM=[]
t=[]

xm.append(2.)
xM.append(1.)
t.append(0.)

vm=0.
vM=0.

for i in range(1,n):
   xm.append( ... )
   xM.append( ... )
   t.append( ... )
# compression force of the two springs:
   F2 = ( ... )*K
   F1 = ( ... )*K
   vm = vm + dt*F2/mass
   vM =  ...

plt.plot(t,xM)
plt.plot(t,xm)
plt.xlabel("time (s)")
plt.ylabel("x (m)")
plt.show()
```

My program gives the plot

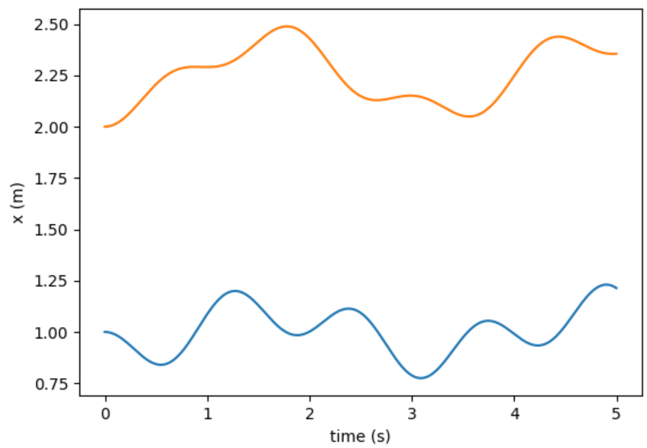

Figure 2: The positions of the masses as a function of time.

You can check that the size of the timestep (`dt`) strongly influences the accuracy of the solution.

Please display your results in a PDF manuscript format, using the double-column format of the APS journals and submit it through the Moodle system.

An example LaTex file is provided through the assignment page to serve as a template which you can modify for your assignment.