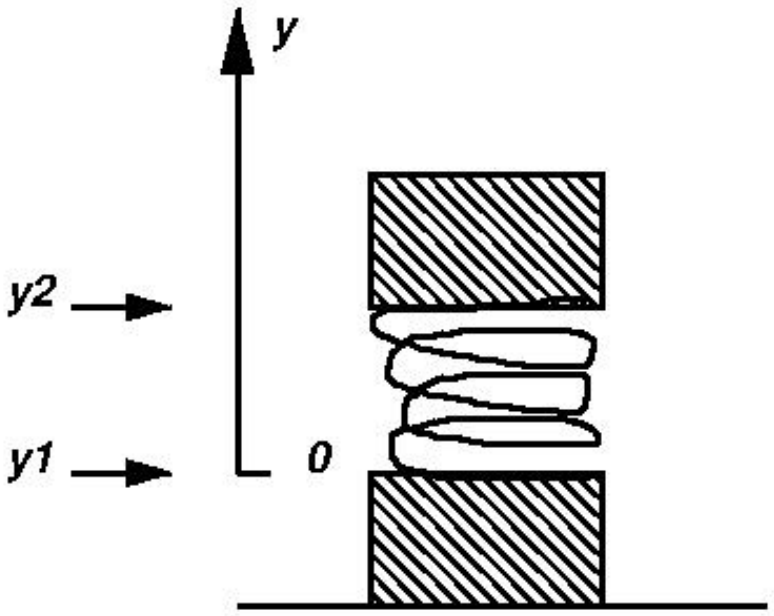
Phys 124 - Freshman Project
Spring 2022
Simulation Homework II

Two masses (0.1Kg each) are connected with a spring (with spring constant 200N/m) and placed on top of one another, on a flat surface as shown in the figure.



The length of the spring when it is neither stretched nor compressed is 10cm.

Initially, the spring is compressed so that $y_2 - y_1$=1cm. The system is released at time $t = 0$. Construct a computer code to simulte the motion of the masses. Take into account that the lower mass cannot go below the flat surface (*i.e.* you cannot have $y_1 < 0$). Assume that if at anytime the first mass hits the flat surface (*i.e.* whenever your code produces $y_1 < 0$), there is an elastic collision so that its position $y_1 \to -y_1$ and velocity $v_1 \to -v_1$ change sign.

Plot the height of the masses as a function of time for $0 < t < 2s$.

As an example, my code contains

```
import matplotlib.pyplot as plt
import numpy as np
##########################
# Bouncing masses
plt.clf()

dt=0.00001
kspr=200.
mass=0.1
n=200000
y1=[]
y2=[]
v1=[]
v2=[]
t=[]
# initial conditions:
y1.append(0.)
v1.append(0.)
y2.append(0.01)
v2.append(0.)
t.append(0.)
for i in range(1,n):
  . . .
  y1.append(y1[i-1] + v1[i-1]*dt)
  y2.append(. . .)
  v1.append(. . .)
  v2.append(. . .)
  t.append(. . .)
  if y1[i] < 0.:
    y1[i]=-y1[i]
    v1[i]=-v1[i]


plt.plot(t,y1)
plt.plot(t,y2)
plt.xlabel("time (s)")
plt.ylabel("Height (m)")
plt.show()
```

My program gives the plot

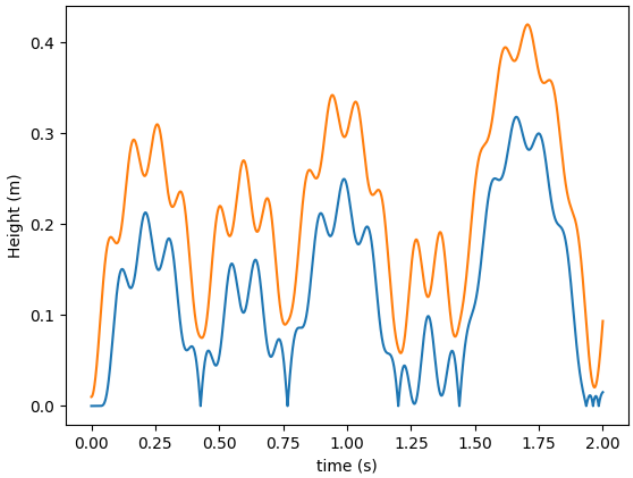


Figure 1: The positions of the masses as a function of time. Notice that the lower curve (corresponding to y_1) hits $y_1 = 0$ every once in a while.

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.