Chart, diagram

Description automatically generated

**Python Code**

#Program to create Figure 3.3 from Giordano#

import pandas as pd

from matplotlib import pyplot as plt

thetalist=[] #list of data from calculations#

timelist=[] #list of data from calculations#

#variables#

length = 1

time = 0

timestep = 0.04

theta = 0.2

gravity = 9.8

omega = 0

#Euler-Cromer method for velocity without drag#

for i in range(250):

omega -= (gravity/length)\*theta\*timestep

theta += omega\*timestep

time += timestep

thetalist.append(theta) #adds data to a list#

timelist.append(time) #adds data to a list#

#Creates a plot with both sets of data#

%matplotlib

fig = plt.gcf()

fig.set\_size\_inches(5.9375, 5)

plt.plot(timelist, thetalist, 'k-')

plt.xlim(0,10)

plt.ylim(-0.3,0.3)

plt.yticks(ticks = (-0.3,-0.2,-0.1,0,0.1,0.2,0.3))

plt.xticks(ticks = (0,2,4,6,8,10))

plt.title("Simple Pendulum - Euler-Cromer method")

plt.xlabel("time (s)")

plt.ylabel("\u03B8 (radians)")

plt.text(1.6, 0.22, "Length = 1 m", fontsize=13, horizontalalignment='left', verticalalignment='bottom')

plt.text(4.8, 0.22, "time step = 0.04 s", fontsize=13, horizontalalignment='left', verticalalignment='bottom')

plt.tick\_params(direction = 'in', right = True, top = True)

plt.show()