25.12.2018

Due to:02.01.2019

MAT 116E

HOMEWORK-4

This homework is designed to give you practice with writing functions and visualizing data. When you produce your figure, **do not use Matlab's graphic editor. You have to use appropriate graphic options in command form. Otherwise, you will get lower grade.**

Homework must be submitted on the ninova system.

What to turn in: Copy the text from your scripts and paste it into a document. If a question asks you to plot or display something to the screen, also include the plot and screen output your code generates. Submit either a *.doc or *.pdf file.

Keep all your code in scripts. If a specific name is not mentioned in the problem statement, you can choose your own script names.

Q1. Create a MATLAB script file that uses the Euler Method discussed in class to solve the following differential equation. Plot the solution from $0 \leq t \leq 0.2$. Provide a plot title and labels for the axes. You must use a `for` loop to solve this problem. Show that $y(t=0.2)=4.9364$.

$$\dot{y} = y^{3/2} + 2, \qquad y(0) = 3$$

Euler Method: $y(t_{k+1}) = y(t_k) + \Delta t \cdot f[t_k, y(t_k)]$

Q2.

The following equation describes the motion of a certain mass connected to a spring, with viscous friction on the surface

$$3\ddot{y} + 39\dot{y} + 120y = f(t)$$

where $f(t)$ is an applied force. Suppose that $f(t) = 0$ for $t < 0$ and $f(t) = 10$ for $t \geq 0$.

a. Plot $y(t)$ for $y(0) = \dot{y}(0) = 0$.

b. Plot $y(t)$ for $y(0) = 0$ and $\dot{y}(0) = 10$. Discuss the effect of the nonzero initial velocity.

Use the ode45 solver for this problem.

Q3.

The following equation describes the motion of a certain mass connected to a spring, with no friction

$$3\ddot{y} + 75y = f(t)$$

where $f(t)$ is an applied force. Suppose the applied force is sinusoidal with a frequency of ω rad/s and an amplitude of 10 N: $f(t) = 10\sin(\omega t)$. Suppose that the initial conditions are $y(0) = \dot{y}(0) = 0$. Plot $y(t)$ for $0 \leq t \leq 20$ s. Do this for the following three cases. Compare the results of each case.

a. $\omega = 1$ rad/s
b. $\omega = 5$ rad/s
c. $\omega = 10$ rad/s

Use the ode45 solver for this problem.