

EMT 101- Engineering Programming Homework 3

Handed out 25/11/2014

1 Contour and Surface Plots(30 %)

You are to create a three-dimensional plot of the function

$$z = f(x, y) = (x^2 + y^2) \frac{\sin(y)}{y} \quad (1)$$

over domain $-10 \leq x \leq 10$ and $-10 \leq y \leq 10$.

Can you detect there is a problem with the function? If yes, please rectify the problem.

Once rectified, please use the available MATLAB function *meshgrid* to create a mesh based on $f(x, y)$. Type help meshgrid to understand more on using the function.

Plot the following:

1. The mesh of the system $z = f(x, y)$
2. The 2D contour map of the system
3. The 3D surface plot with 2D contour map drawn beneath.

2 Free Vibration Response of Undamped Single Degree of Freedom System(70 %)

The free vibration response of an undamped single degree of freedom (SDOF) oscillator is given by its displacement $x(t)$ satisfying

$$x(t) = x(0)\cos(\omega t) + \frac{v(0)}{\omega}\sin(\omega t) \quad (2)$$

where t is time in seconds and $\omega = \sqrt{\frac{k}{m}}$ is the natural frequency of the system with m and k being the mass and the stiffness of the system. Define $v(t)$ as the time dependent velocity of the system. Determine $v(t)$.

Write an M-file using functions that will compute and plot

1. The displacement of the system $x(t)$ as a function of time
2. The velocity of the system $v(t)$ as a function of time

for time interval $0 \leq t \leq 10$ s. Assume $m = 10$, $k = 1$ and that $x(0) = v(0) = 10$.

Note that both $x(t), y(t)$ should be on ONE plot. Use the a solid line for the displacement and broken-lines for the velocity.

To ensure that your plot will be reasonably smooth, choose an increment in your displacement and velocity calculations that is no larger than 1/10th of the system period $T = 2\pi\sqrt{m/k}$.

Using the period estimation, can you verify if your computations are correct?

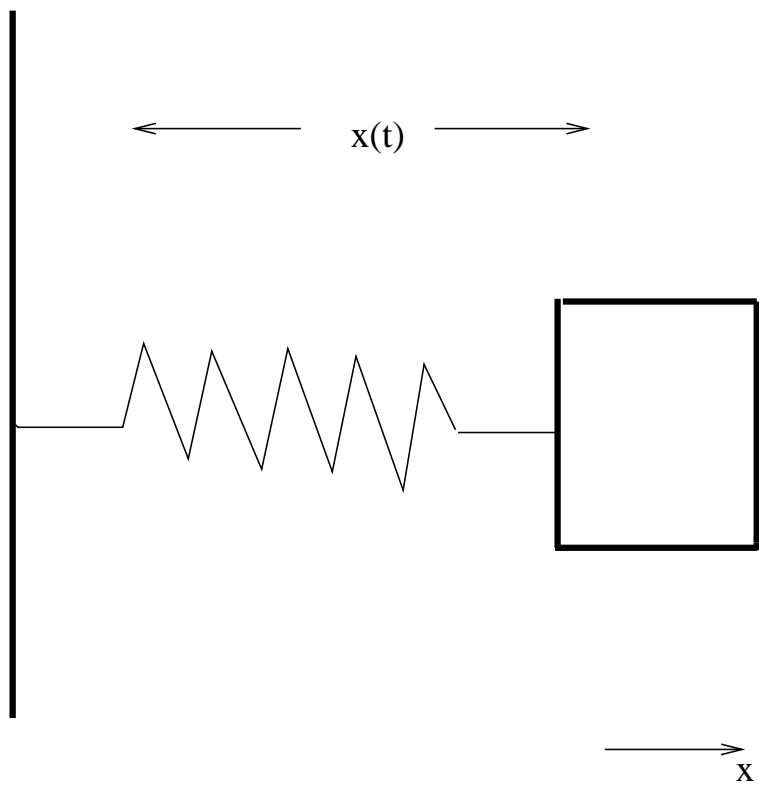


Fig. 1: Vibration of the System.