Vibrations - 2

For part 1, consider the 2 degree of freedom, underdamped, linear time-invariant system shown in Figure 1. The degrees of freedom, labeled x_1 and x_2, are measured from static equilibrium. The system is at rest prior to t=0 and is subjected to an input at t=0, such that the displacement, *y(t)*, is a dirac delta function. That is

$$y(t) = \delta(t)$$

where

$$y(t) = 0, \forall t \neq 0$$

$$\int_{-\infty}^{\infty} y(t)dt = 1$$

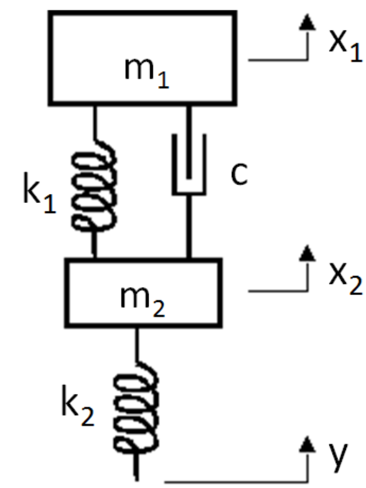

Figure 1: 2 DOF system

What is:

- The force acting on mass 2 due to the input y(t=0) (**10 pts**)
- The impulse exerted by spring 2 (with stiffness k_2) on mass 2 at time t=0 (**20 pts**)
- The equivalent initial velocity, v_0, of mass 2 (**10 pts**)

For part 2 consider the one degree of freedom, time invariant, linear system shown in Figure 2

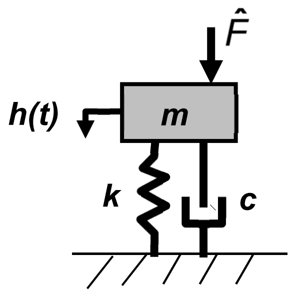

Figure 2: 1 DOF system

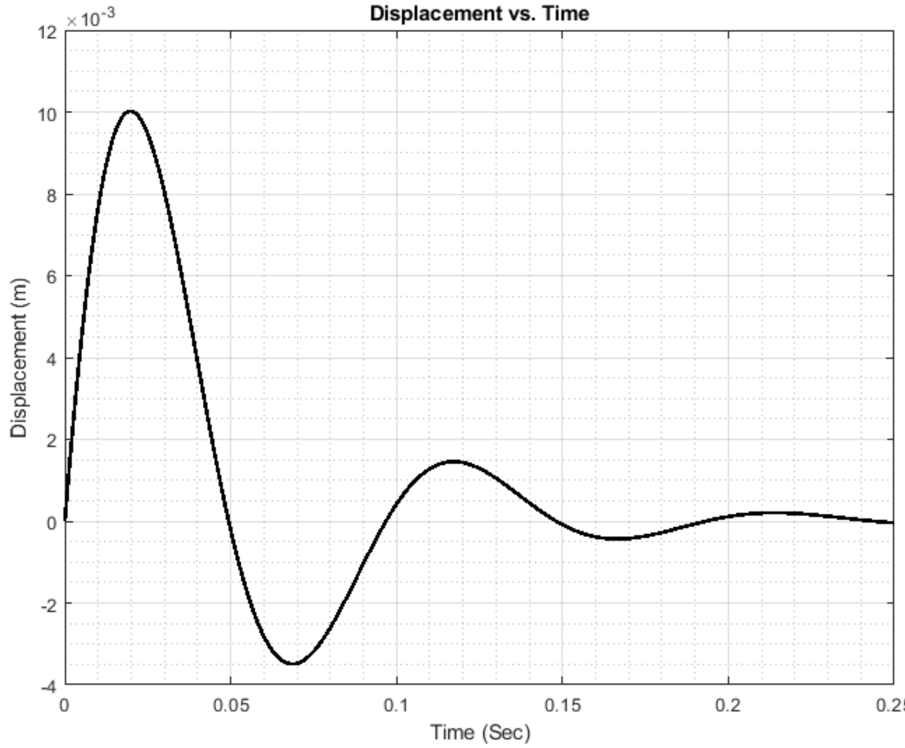

Figure 3: unit impulse response

Figure 3 shows the unit impulse response, h(t), as a solid line. Note that the first peak has an amplitude P_1=10mm at t_1 = 0.020 seconds, and the second peak has an amplitude P_2=1.5mm at t_2 = 0.117 seconds. Use this displacement response to calculate:

- The damped natural frequency (**15 pts**)
- The damping ratio (**15 pts**)
- The natural frequency (**15 pts**)
- The mass of the system (**15 pts**)