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Linear System Analysis

ENGR-305

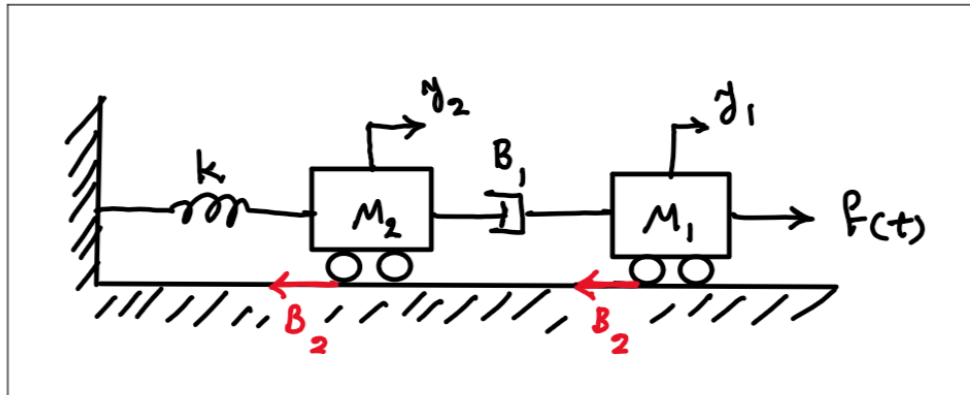
Closed Book

Mid-term #1

Time: 60 min.

- 1) (20 pts) For the following mechanical system, write a set of equations to describe the dynamical behavior of the system:

B_1 : damping coefficient B_2 : viscous friction coefficient K : spring constant



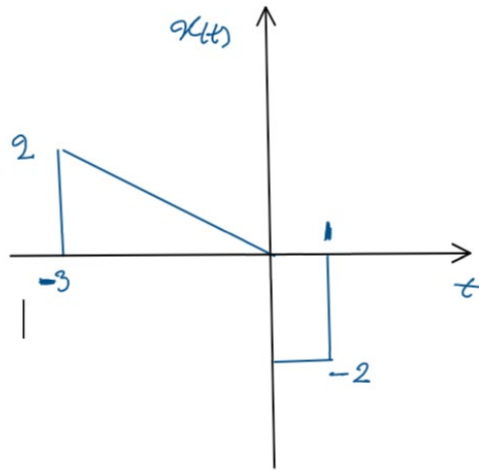
- 2) (20 pts) (a) Find the response of the system when input signal is impulse and initial condition are $y(0)=2$ and $y'(0)=3$.

$$(D^2 + 4)y(t) = (D + 1)x(t)$$

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3) (20 pts) If the signal $x(t)$ is given as



- a) Plot the signal $y(t) = d(x(-2t))/dt$
- b) Plot the function $y(t) = u(-t)x(t) + x(-t)\delta(t - 1)$

4) (30 pts) Answer the following questions and **justify your answers**.

a) is the system given by $y(t) = 8x(t - 3) + x(t)^2$ represent a stable system? Is it a linear system?

b) is the following system, $(D^2 + 5D + 6)y(t) = Dx(t)$, linear?

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c) Is the following system, $y(t) = tx(t)$ time invariant

5) (10 pts) Is the following signal an energy signal? if it is what is its energy?

$$x(t) = e^{-5t}u(t)$$