EE 301P: Control Systems Laboratory

Lab Exercise 2

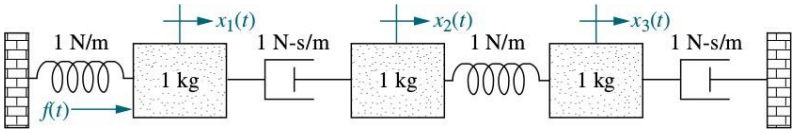
Lab session:August 25, 2023 ***Report due: September 1, 2023***

1 Objective

To obtain the state-space representation of a given system, and find the transfer function using MATLAB. To use the transfer function so obtained to find the response of the system to standard test signals.

2 Pre-lab exercise

Consider the below mechanical system.



(a) Use Newton's laws of motion and Hooke's law to determine the equations governing the interaction between the positions $x_1(t)$, $x_2(t)$, $x_3(t)$ of the three masses and the external force $f(t)$.

(b) Considering $x_3(t)$ as the output of the system, find the transfer function $X_3(s)/F(s)$.

(c) Assume that $f(t)$ is a unit step signal. Find the corresponding output $x_3(t)$.

3 Lab exercises

(a) Use MATLAB/Simulink to find the (i) impulse response, and (ii) step response of the system using the transfer function so derived in the pre-lab exercise.

(b) Plot the step response $x_3(t)$ derived analytically in Pre-lab exercise (c). Compare with the step response obtained in (a) above.

(c) What do you understand about the position $x_3(t)$ from the impulse and step response obtained in (a) above?