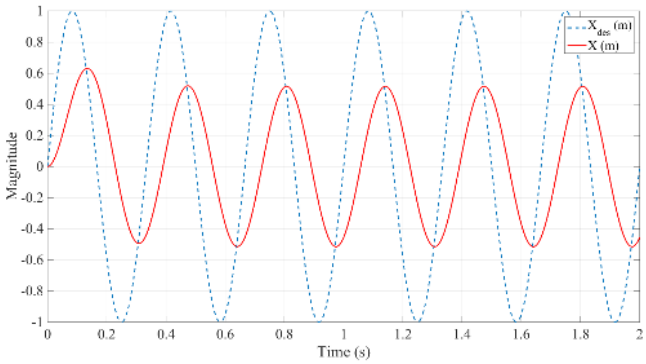
MECH 3140: Homework #5

To be worked by Wednesday, 9/20/2023

1. Develop a controller for the following system, such that the controlled system matches the response in the figure.

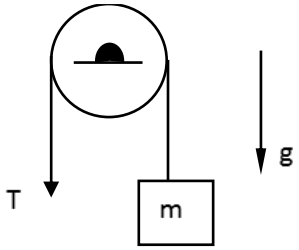
$$10\dot{x} = F(\mathrm{t})$$



2. Design a controller to control the speed of the following system. Design the system to have a controlled time constant of 2 seconds for some nominal speed (Vo).

$$m\dot{v} + Dv^2 = F$$

3. Design a controller to control the speed of the mass such that the controlled system has a bandwidth (called closed-loop bandwidth) of 1 Hz. The pulley has a mass moment of inertia of ***J***, radius ***R***, and a bearing that can be modeled with a rotational bearing loss of ***b***.



4. Consider the circuit below with a supply voltage (Vs) and disturbance voltage (e_d). Design a controller that uses the supply voltage to control the current in the circuit to reach steady state in 1 second (this is essentially how a current source works). Calculate the total steady state error including the disturbance voltage.