ECE 463/663 - Homework #12

LQG/LTR. Due Monday, April 25th, 2022

LQG / LTR

1) For the cart and pendulum system of homework set #4:

$$s\begin{bmatrix} x \\ \theta \\ sx \\ s\theta \end{bmatrix} = \begin{bmatrix} 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & -14.7 & 0 & 0 \\ 0 & 24.5 & 0 & 0 \end{bmatrix}\begin{bmatrix} x \\ \theta \\ sx \\ s\theta \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \\ 0.5 \\ -0.5 \end{bmatrix} F$$

Design a control law so that the cart and pendulum system behaves like the following reference model:

$$y_m = \left(\frac{0.4}{s^2+0.7s+0.4}\right) R$$

1) Give a block diagram for your controller

2) Plot the step response of the model and the linearlized plant for yor control law for

- Q = 100 e^2 or 100 z^2
- Q = 1,000 e^2 or 1,000 z^2
- Q = 10,000 e^2 or 10,000 z^2