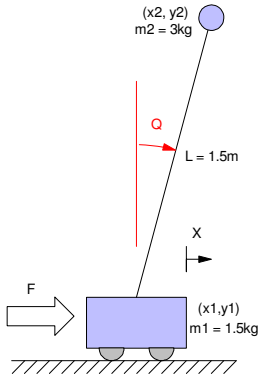
ECE 463/663 - Homework #12

LQG/LTR. Due Monday, April 28th
Please submit as a hard copy, email to jacob.glower@ndsu.edu, or submit on BlackBoard

LQG / LTR

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

$$s\begin{bmatrix} x \\ \theta \\ \dot{x} \\ \dot{\theta} \end{bmatrix} = \begin{bmatrix} 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & -19.6 & 0 & 0 \\ 0 & 19.6 & 0 & 0 \end{bmatrix}\begin{bmatrix} x \\ \theta \\ \dot{x} \\ \dot{\theta} \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \\ 0.667 \\ -0.444 \end{bmatrix} F$$



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

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

LQG/LTR without a Servo Compensator:

1) Give a block diagram for your controller

2) (20pt) Plot the step response of the model and the linearlized plant for yor control law for

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

LQG/LTR with a Servo Compensator:

3) Give a block diagram for your controller plus servo compensator

4) (20pt) Plot the step response of the model and the linearlized plant for yor control law for

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