ME 5200/6200 Classical Controls **Fall 2020**

Homework 11 **Due Wed Dec. 9 by 11:59 pm**

Problem 1 [30 pts]

Use Matlab to make the Bode plots for each below and determine the gain and phase margins.

(a) $L(s) = \dfrac{2000}{s(s+200)}$

(b) $L(s) = \dfrac{100}{s(0.1s+1)(0.5s+1)}$

(c) $L(s) = \dfrac{1}{s(s+1)(0.02s+1)}$

Problem 2 [20 pts]

Use Matlab to make the Bode plots for each below and determine the gain and phase margins.

(a) $L(s) = \dfrac{(s+2)}{s(s+10)(s^2+2s+2)}$

(b) $L(s) = \dfrac{(s+2)}{s^2(s+10)(s^2+6s+25)}$

Problem 3 [40 pts]

Consider the unity feedback system with the open-loop transfer function

$$G(s) = \frac{K}{s(s+1)[(s^2/25)+0.4(s/5)+1]}.$$

(a) Use MATLAB to draw the Bode plots for $G(j\omega)$ assuming $K = 1$.

(b) What gain K is required for a PM of 45°? What is the GM for this value of K?

(c) What is K_v when the gain K is set for PM = 45°?

(d) Create a root locus with respect to K, and indicate the roots for a PM of 45°.

Note for Part (c), Kv is the velocity constant from the steady-state error analysis lecture.