HW5

1.

CP6.6 Consider the feedback control system in Figure CP6.6. Using the for function, develop an m-file script to compute the closed-loop transfer function poles for $0 \leq K \leq 5$ and plot the results denoting the poles with the "$\times$" symbol. Determine the maximum range of K for stability with the Routh–Hurwitz method. Compute the roots of the characteristic equation when K is the minimum value allowed for stability.

2.

CP6.7 Consider a system in state variable form:

$$\dot{\mathbf{x}}(t) = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -5 & -12 & -8 \end{bmatrix} \mathbf{x}(t) + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} u(t),$$

$$y(t) = [1 \quad 1 \quad 0]\mathbf{x}(t).$$

(a) Compute the characteristic equation using the poly function. (b) Compute the roots of the characteristic equation, and determine whether the system is stable. (c) Obtain the response plot of $y(t)$ when $u(t)$ is a unit step and when the system has zero initial conditions.

3.

CP5.4 Consider the control system shown in Figure CP5.4.

(a) Show analytically that the expected percent overshoot of the closed-loop system response to a unit step input is $P.O. = 50\%$.

(b) Develop an m-file to plot the unit step response of the closed-loop system and estimate the percent overshoot from the plot. Compare the result with part (a).