ECE311S: Dynamic Systems and Control

Problem Set 10

Problem 1

Show that the eigenvalues of the linear system $\dot{x}(t) = Ax(t)+Bu(t)$ with a linear state feedback, $u(t) = Kx(t)$, can be arbitrarily assigned for

$$A = \begin{bmatrix} 3 & 4 \\ -2 & 6 \end{bmatrix} \quad B = \begin{bmatrix} 3 \\ 1 \end{bmatrix}$$

.

Problem 2

Consider the linear system $\dot{x}(t) = Ax(t) + Bu(t)$ with

$$A = \begin{bmatrix} -2 & 0 & 0 \\ 3 & -5 & 0 \\ -9 & 0 & 7 \end{bmatrix} \quad B = \begin{bmatrix} 1 \\ 2 \\ 1 \end{bmatrix}$$

The eigenvalues for A are -2, -5 and 7, hence the open loop system is unstable. Show that for any linear state feedback, $u(t) = Kx(t)$, the matrix $A + BK$ will always have 7 as an eigenvalue and hence no linear state feedback can stabilize this system.