

EEL 4612 Homework # 1 – Due Tu Jan 28

1. Obtain the transfer function of the system described by the following state-space model:

$$\begin{pmatrix} \dot{x}_1 \\ \dot{x}_2 \end{pmatrix} = \begin{pmatrix} -5 & -1 \\ 3 & -1 \end{pmatrix} \begin{pmatrix} x_1 \\ x_2 \end{pmatrix} + \begin{pmatrix} 2 \\ 5 \end{pmatrix} u$$
$$y = (1 \quad 2) \begin{pmatrix} x_1 \\ x_2 \end{pmatrix}$$

2. Obtain the transfer **matrix** of the system described by the following state-space model:

$$\begin{pmatrix} \dot{x}_1 \\ \dot{x}_2 \\ \dot{x}_3 \end{pmatrix} = \begin{pmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -2 & -4 & -6 \end{pmatrix} \begin{pmatrix} x_1 \\ x_2 \\ x_3 \end{pmatrix} + \begin{pmatrix} 0 & 0 \\ 0 & 1 \\ 1 & 0 \end{pmatrix} u$$
$$y = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \end{pmatrix} \begin{pmatrix} x_1 \\ x_2 \\ x_3 \end{pmatrix}$$

3. Find the eigenvalues of the matrix

$$A = \begin{pmatrix} 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \\ 1 & 0 & 0 & 0 \end{pmatrix}$$

Find a matrix P to diagonalize the matrix A such that the new matrix has the eigenvalues of A as its diagonal elements.

4. Obtain the controllable and observable canonical forms for

$$\frac{Y(s)}{U(s)} = \frac{s + 6}{s^2 + 5s + 6}$$

Use MATLAB to find state-space representation for

$$\frac{Y(s)}{U(s)} = \frac{10.4s^2 + 47s + 160}{s^3 + 14s^2 + 56s + 160}$$

5. Use MATLAB to find the partial-fraction expansion of the function

$$F(s) = \frac{5(s + 4)}{(s + 3)^2(s + 1)(s + 2)}$$