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CERTIFICATION COURSE

# APPLICATION OF MATLAB IN AUTOMATIC CONTROL

## STATE SPACE METHOD

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# PROBLEM

1. Transform the given transfer function into the state space representation using the MATLAB.

$$G(s) = \frac{10s+10}{s^3+6s^2+5s+10}$$

Ref : Katsuhiko Ogata, Modern Control Engineering, Prentice Hall, 2010



# PROBLEM

2. Generate the transfer function for the system given below and find the eigenvalues of the system:

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \\ \dot{x}_3 \end{bmatrix} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -6 & -11 & -6 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \\ 6 \end{bmatrix} u$$

$$y = \begin{bmatrix} 1 & 0 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}$$

Ref : Katsuhiko Ogata, Modern Control Engineering, Prentice Hall, 2010

## PROBLEM

3. Generate the transfer function for the system given below:

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -25 & -4 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix} \begin{bmatrix} u_1 \\ u_2 \end{bmatrix}$$

$$\begin{bmatrix} y_1 \\ y_2 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix} \begin{bmatrix} u_1 \\ u_2 \end{bmatrix}$$

Ref : Katsuhiko Ogata, Modern Control Engineering, Prentice Hall, 2010

## PROBLEM

4. Given the plant, design the phase-variable feedback gain to yield 9.5% overshoot and a settling time of 0.74 seconds.

$$G(s) = \frac{20(s+5)}{s(s+1)(s+4)}$$

Ref : Norman S. Nise, Control Systems Engineering, Wiley, 2013



## PROBLEM

5. Given the system below, determine its controllability.

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

Ref : Norman S. Nise, Control Systems Engineering, Wiley, 2013



# REFERENCE BOOKS

- Norman S. Nise, Control Systems Engineering, Wiley, 2013
- Katsuhiko Ogata, Modern Control Engineering, Prentice Hall, 2010.

