

Tutorial 4

ECE 804- *Transfer Function*

1. Determine the stability of the following polynomials using the Routh-Hurwitz criterion:

a. $\varphi(s) = s^4 + s^3 + 2s^2 + 10s + 8$

b. $\varphi(s) = s^3 + 24s^2 + (100 + K)s + 25K$

2. Determine the transfer function $G(s)=Y(s)/U(s)$ of the following system, then identify the poles and zeros of the transfer function and comment about the stability. Finally, determine the $y(t)$ for input $u(t)=1(t)-1(t-0.5)$

$$\begin{cases} \dot{x}_1(t) = 2x_1(t) + 7x_2(t) \\ \dot{x}_2(t) = 4x_1(t) + 5x_2(t) + u(t) \\ \dot{x}_3(t) = -5x_3(t) \\ y(t) = -x_2(t) + x_3(t) \end{cases}$$

3. Determine the transfer function for the given system and comment about stability:

$$\dot{\mathbf{x}} = \begin{pmatrix} 2 & 1 \\ 0 & -2 \end{pmatrix} \mathbf{x} + \begin{pmatrix} 0 \\ 1 \end{pmatrix} u$$

$$y = (0 \quad 1) \mathbf{x}$$

4. For the given transfer function determine the parameters a and b in order $\zeta=0.707$ and $\omega_n=10 \text{ rad/s}$

$$G(s) = \frac{1/100}{as^2 + bs + 1}$$