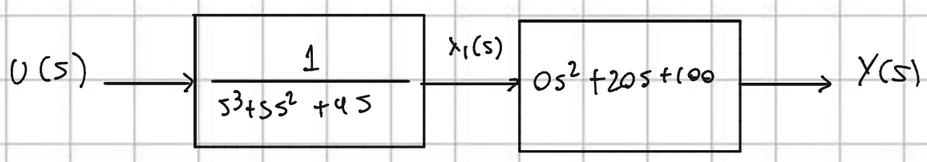
Video 1 tarea 5

$$G(s) = \frac{20(s+5)}{s(s+1)(s+4)} \quad \begin{cases} OS = 95\% \\ t_s = 0{,}74 \text{ seg} \end{cases}$$



$$\frac{X_1(s)}{U_1(s)} = \frac{1}{s^3+5s^2+4s}$$

$$(s^3+5s^2+4s)\,X_1(s) = U(s)$$

$$\dddot{x}_1 + 5\ddot{x}_1 + 4\dot{x}_1 = u$$

$$\boxed{\dot{x}_3 = -5x_3 - 4x_2 + u} \quad (1)$$

$$x_1 = x_1$$
$$x_2 = \dot{x}_1$$
$$x_3 = \dot{x}_2 = \ddot{x}_1$$
$$\dot{x}_3 = \dddot{x}_1$$

$$y(s) = (0s^2 + 20s + 100)\,X_1(s)$$

$$y(s) = 20\dot{x}_1 + 100x_1 \rightarrow \boxed{y = 20x_2 + 100x_1} \quad (2)$$

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \\ \dot{x}_3 \end{bmatrix} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & -4 & -5 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} u$$

$$y = \begin{bmatrix} 100 & 20 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}$$

$$\%OS = e^{-(\zeta\pi/\sqrt{1-\zeta^2})} \cdot 100$$

entonces

$$\frac{9{,}5}{100} = e^{-(\zeta\pi/\sqrt{1-\zeta^2})} \qquad \ln(0{,}095) = (\zeta\pi/\sqrt{1-\zeta^2})$$

$$-2{,}3539 = \frac{-\zeta\pi}{\sqrt{1-\zeta^2}} \qquad 1-\zeta^2 = (\zeta\pi/2{,}3539)^2 \qquad 1 = \zeta^2\left(1+\left(\pi/2{,}3539\right)^2\right)$$

$$\zeta = \frac{1}{\sqrt{1+\left(\frac{\pi}{2{,}3539}\right)^2}} = 0{,}5996$$

tenemos

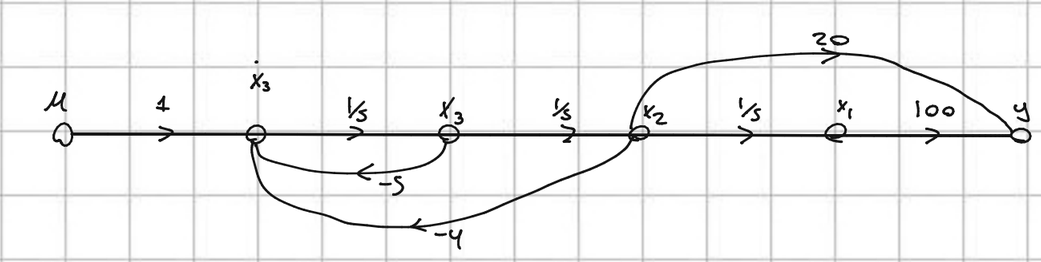
$$T_s = \frac{4}{\sigma} \qquad \sigma = \frac{4}{T_s} = 5{,}4054$$

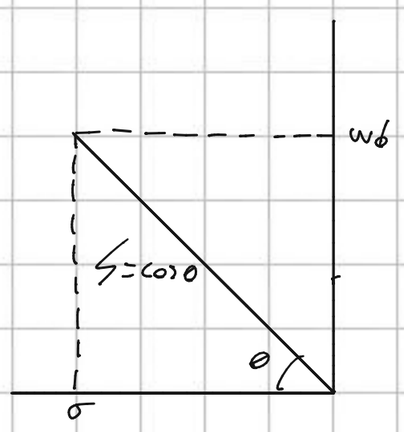
$$\sigma = \zeta\omega_n \quad y \quad \omega_d = \omega_n\sqrt{1-\zeta^2}$$

$$\omega_n = \frac{\sigma}{\zeta} = \frac{5{,}4054}{0{,}5996} = 9{,}015 \text{ rad/s}$$

$$\omega_d = 9{,}015\sqrt{1-(0{,}5996)^2} = 7{,}2147 \text{ rad/s}$$
$$\omega_d = \sigma \cdot \tan\theta = 5{,}4054 \cdot \tan(53{,}16°) = 7{,}215 \text{ rad/s}$$
} igual

$$S = 5{,}4054 + j\,7{,}2147$$





$$S = \sigma + j\omega_d = \zeta\omega_n + j\omega_d$$

$$\theta = \cos^{-1}(\zeta) = \cos^{-1}(0{,}5996)$$

$$\theta = 53{,}16°$$