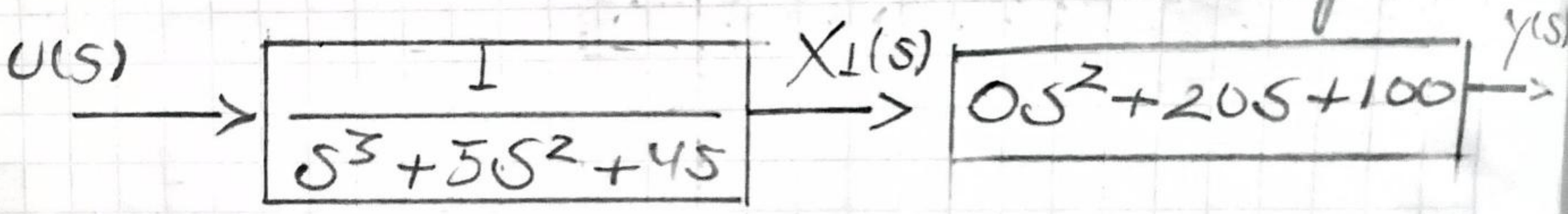
Tarea Video #1

Ejercicio 12.1 ->

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

$OS\% = 9,5\%$

$t_s = 0,74 seg$




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

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

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

$\dddot{x} \rightarrow \dot{x}_3$ $\quad \ddot{x} \rightarrow x_3$ $\quad \dot{x} \rightarrow x_2$

$$X_1 = X_1$$

$$X_2 = \dot{X}_1$$

$$X_3 = \dot{X}_2 = \ddot{X}_1$$

$$\dot{X}_3 = \ddot{X}_2 = \dddot{X}_1$$

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

$$y(s) = (b_2s^2 + b_1s + b_0)X_1(s) \rightarrow$$

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

Aplicando Transformada inversa de Laplase $-1$

$$y = 20\dot{X}_1 + 100X_1 \rightarrow y = 20X_2 + 100X_1 \quad (2)$$

$\dot{X}_1 \rightarrow X_2$ $\quad X_1 \rightarrow X_1$

Espacio de estados ->

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

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

Teniendo que ->

$$\%.05 = e^{-(\xi\pi/\sqrt{1-\xi^2})} \rightarrow$$

$$\ln(0,095) = \frac{-\xi\pi}{\sqrt{1-\xi^2}} \rightarrow$$

$$-2,3539 = \frac{-\xi\pi}{\sqrt{1-\xi^2}} \rightarrow$$

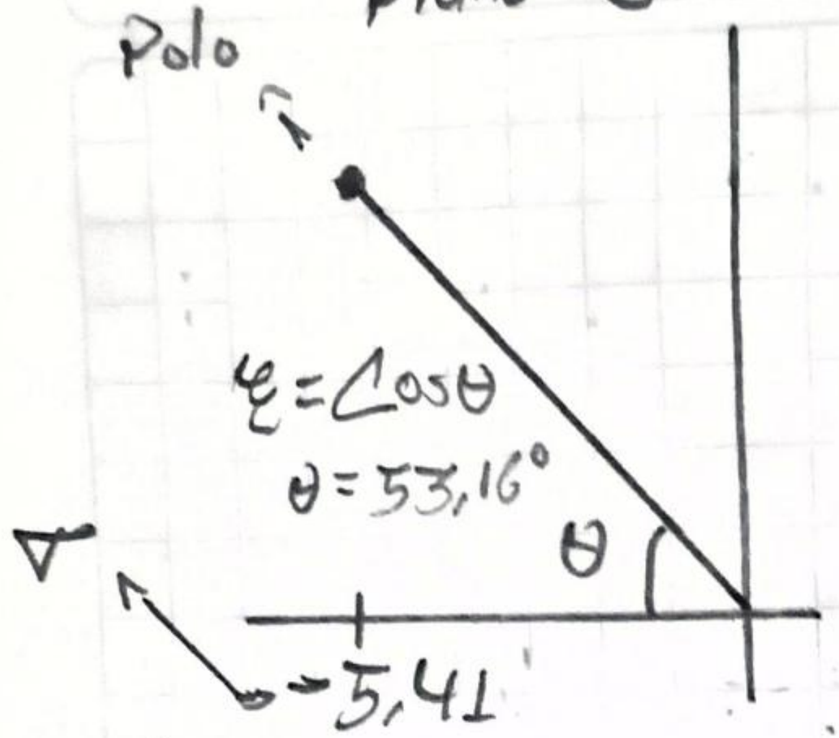
$$(I - 2,35397 I\sqrt{1-\xi^2}\,I)^2 = (-\xi\pi)^2 \rightarrow$$

$$5,5407(1-\xi^2) = \xi^2\pi^2 \rightarrow$$

$$5,5407 - 5,5407\xi^2 = \xi^2\pi \rightarrow$$

$$5,5407 = \xi^2\pi + 5,5407\xi^2 \rightarrow$$

$$\xi^2 = \frac{5,5407}{\pi + 5,5407}; \quad \xi = 0,5496$$




$\xi w_n$

$S = \nabla + j w_d$ ; $S = \xi w_n + j w_d$

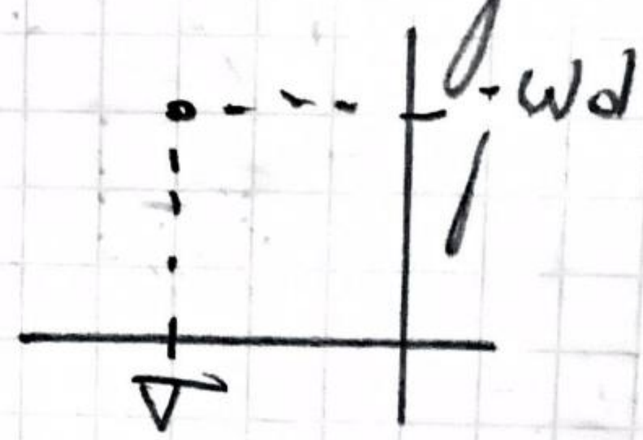
$\theta = \cos^{-1}(0,5996)$

teniendo que -> $t_s = \frac{4}{\nabla}$ ; $0,74 = \frac{4}{\nabla}$

$\nabla = \frac{4}{0,74} = 5,405$ ; $S = \nabla + j w_d$

$5,405 = \nabla = 0,5976\, w_n$

$\rightarrow w_n = \frac{5,405}{0,5976} = 9,02$ rad/s




Calculo de $w_d$ ->

$w_d = w_n\sqrt{1-\xi^2}$ ; $\tan\theta = \frac{w_d}{\nabla}$

1 2

Con 1 -> $w_d \cong 7,21$ ; Con 2 = $w_d \cong 7,22$