Transcripción del video 1

$$G(s) = \frac{20(s+5)}{s(s+1)(s+4)} \quad \left.\right\} \quad \begin{array}{l} OS = 9{,}5\% \\ t_s = 0{,}74\,s \end{array}$$

$$U(s) \rightarrow \boxed{\frac{1}{s^3+5s^2+4s}} \rightarrow X_1(s) \rightarrow \boxed{20s+100} \rightarrow Y(s)$$

$$\begin{array}{cc} 1. & 2. \end{array}$$

Para el bloque 1 $\quad U(s) = X_1(s^3+5s^2+4s) \xrightarrow{\mathcal{L}^{-1}} = \dddot{x} + 5\ddot{x} + 4\dot{x} = u$

Para el bloque 2 $\quad (20s+100)X_1(s) = Y(s) \xrightarrow{\mathcal{L}^{-1}} 20\dot{x} + 100 = y$

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

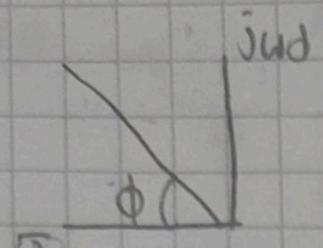
$\dot{x}_3 + 5x_3 + 4x_2 = u \rightarrow \dot{x}_3 = u - 5x_3 - 4x_2 \qquad y = 20x_2 + 100x_1$

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \\ \dot{x}_3 \end{bmatrix} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & -4 & -5 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} u \qquad y = \begin{bmatrix} 100 & 20 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} + [0]\,u$$

Considerando el amortiguamiento

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

$0{,}095 = e^{-(\zeta\pi/\sqrt{1-\zeta^2})} \cdot 100 \qquad \zeta = 0{,}5996$



$s = \sigma + j\omega_d \rightarrow \sigma = \zeta\omega_n$

$\phi = \cos^{-1}(0{,}5996) = 53{,}16°$

$t_s = \frac{4}{\sigma} \rightarrow 0{,}74 = \frac{4}{\sigma}$ $\boxed{\sigma = 5{,}41}$

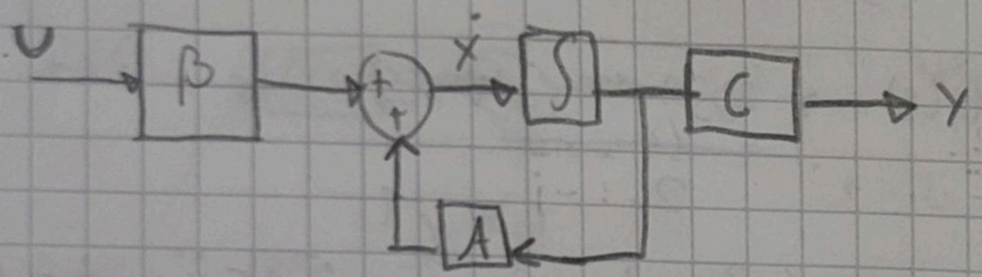
$\zeta = \cos\phi$

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

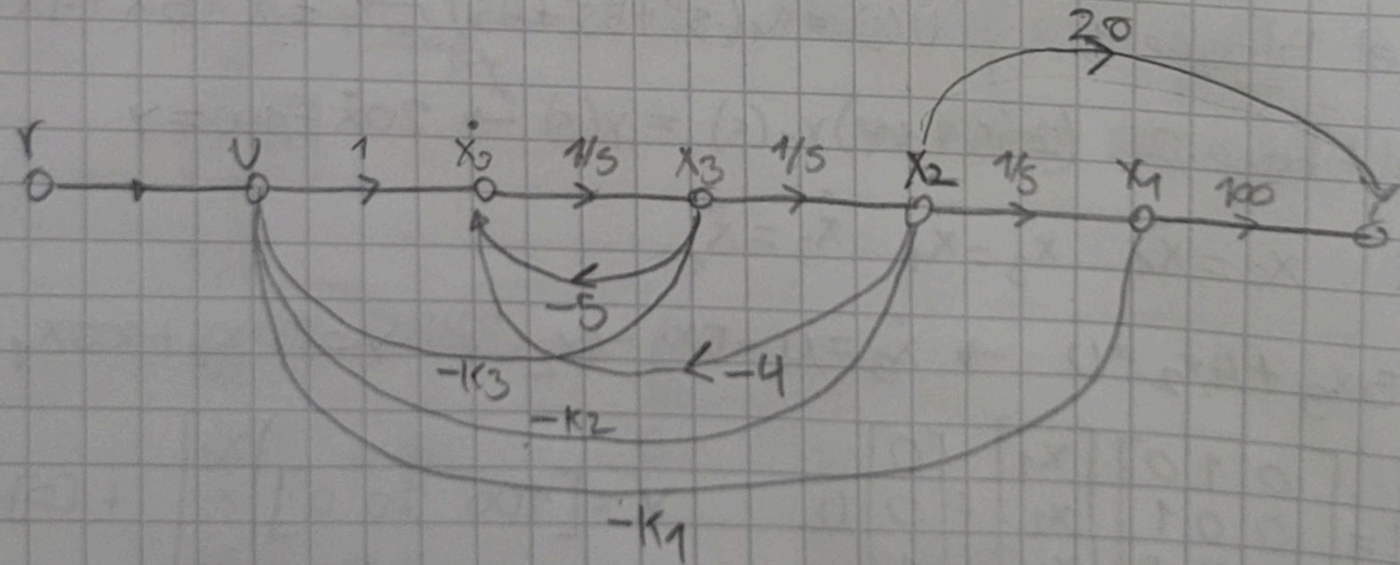
$5{,}41 = 0{,}5996\,\omega_n \rightarrow \omega_n = 9{,}02$ rad/s

$\tan(\phi) = \frac{\omega_d}{5{,}41} \quad \omega_d = \tan(53{,}16)\,5{,}41$

$\omega_d = 7{,}21$



$\dot{x} = Ax + Bu \quad Y = Cx$



$\dot{x}_3 = -4x_2 - 5x_3 + u \rightarrow \dot{x}_3 = -4x_2 - 5x_3 + (-k_3x_3 - k_2x_2 - k_1x_1) + u$

$= -k_1x_1 - (4+k_2)x_2 - (5+k_3)x_3 + u$ | $s = -5{,}4 + j7{,}21$ Pol

$$\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\\ \dot{x}_3\end{bmatrix} = \begin{bmatrix}0 & 1 & 0\\ 0 & 0 & 1\\ -k_1 & -(4+k_2) & -(5+k_3)\end{bmatrix}\begin{bmatrix}x_1\\ x_2\\ x_3\end{bmatrix} + \begin{bmatrix}0\\ 0\\ 1\end{bmatrix}U$$

$\text{Det}(sI - A) = s^3 + (5+k_3)s^2 + (4+k_2)s + k_1 = 0$

Transcripcion Video 2

$$X(s) = \frac{2s^3+8s^2+4s+8}{s(s+1)(s^2+4s+8)} = \frac{K_1}{s} + \frac{K_2}{s+1} + \frac{A}{s+2+j2} + \frac{A^*}{s+2-j2}$$

$$K_1 = sX(s)\Big|_{s=0} = \frac{s(2s^3+8s^2+4s+8)}{s(s+1)(s^2+4s+8)} = \frac{8}{8} = 1$$

$$K_2 = (s+1)X(s)\Big|_{s=-1} = \frac{(s+1)(2s^3+8s^2+4s+8)}{s(s+1)(s^2+4s+8)} = -2$$

$$A = (s+2+j2)(X(s))\Big|_{s=-2-2j} = (s+2+2j)\left[\frac{2s^3+8s^2+4s+8}{s(s+1)(s+2+j2)(s+2-j2)}\right] = \frac{3}{2} + j\frac{1}{2}$$

$$A^* = \frac{3}{2} - j\frac{1}{2}$$

$$X(s) = \frac{1}{s} - \frac{2}{s+1} + \frac{3/2+j1/2}{s+2+j2} + \frac{3/2-j1/2}{s+2-j2}$$