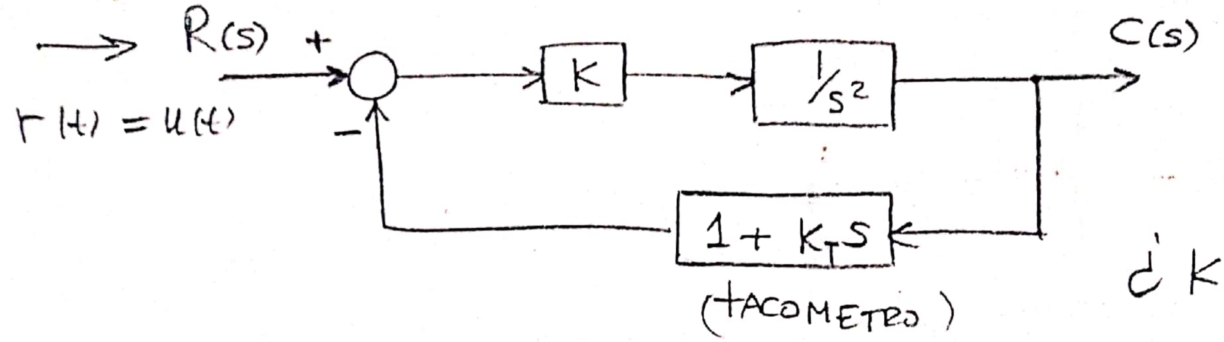
EJERCICIO : REGIMEN TRANSITORIO



¿K, K_T?

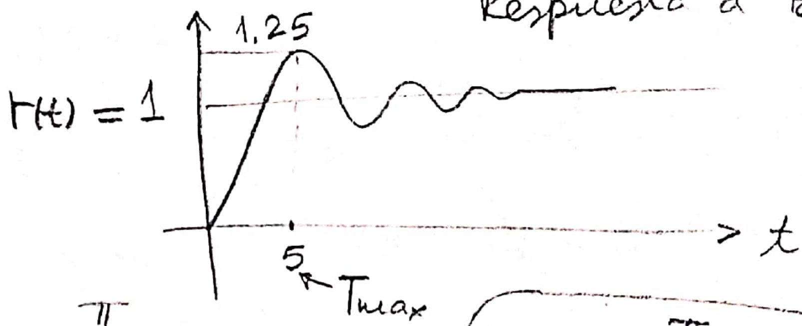
$$\frac{C(s)}{R(s)} = \frac{K/s^2}{1 + \frac{K}{s^2}(1+K_T s)} = \frac{K}{s^2 + K K_T s + K}$$

Asumiendo que el sistema es sub-amortiguado

$$s^2 + 2\xi\omega_n s + \omega_n^2 = s^2 + K K_T s + K$$

$$\boxed{\begin{aligned} 2\xi\omega_n &= K K_T \\ \omega_n^2 &= K \end{aligned}}$$

Respuesta a Escalón Unitario



$$T_{max} = 5 \text{ seg} = \frac{\pi}{\omega_d} = \frac{\pi}{\omega_n\sqrt{1-\xi^2}} \longrightarrow \boxed{\omega_n = \frac{\pi}{5\sqrt{1-\xi^2}}}$$

$$M_p = 0.25 = e^{\frac{-\xi\pi}{\sqrt{1-\xi^2}}} \Rightarrow \ln(M_p) = \ln\left(e^{-\frac{\xi\pi}{\sqrt{1-\xi^2}}}\right) = -\frac{\xi\pi}{\sqrt{1-\xi^2}}$$

$$\sqrt{1-\xi^2} = \frac{-\xi\pi}{\ln(M_p)} \Rightarrow 1-\xi^2 = \frac{\xi^2\pi^2}{(\ln M_p)^2} \Rightarrow 1 = \xi^2\left(1 + \frac{\pi^2}{(\ln M_p)^2}\right.$$

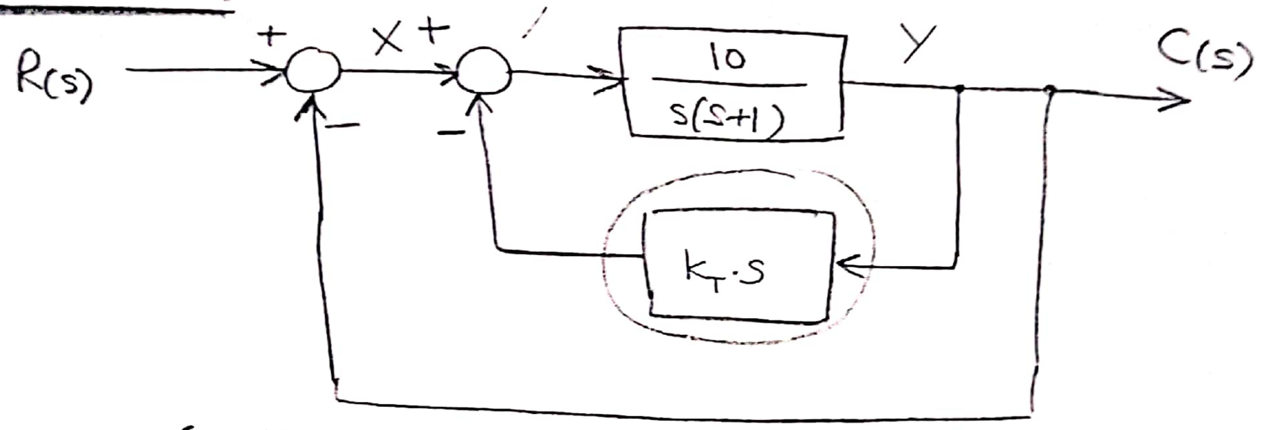
$$1 = \xi^2\left[\frac{(\ln M_p)^2 + \pi^2}{(\ln M_p)^2}\right] \Rightarrow \xi^2 = \frac{(\ln M_p)^2}{(\ln M_p)^2 + \pi^2}$$

$$\xi = \frac{\ln(M_p)}{\sqrt{\pi^2 + (\ln M_p)^2}} = \frac{\ln(0.5)}{\sqrt{\pi^2 + (\ln(0.5))^2}} \Rightarrow \boxed{\xi = 0.404}$$

$$\omega_n = \frac{\pi}{5\sqrt{1-\xi^2}} = 0.627 \Rightarrow \boxed{K = \sqrt{\omega_n}}$$

Escaneado con CamScanner

EJERCICIO



$$\frac{Y}{X} = \frac{\left(\frac{10}{s(s+1)}\right)}{1 + \frac{10 \cdot k_T \cdot s}{s(s+1)}} = \frac{10}{s(s+1) + 10 k_T \cdot s} = \frac{10}{s\left[(s+1) + 10 k_T\right]}$$

$$\frac{C}{R} = \frac{\frac{10}{s[(s+1)+10k_T]}}{1 + \frac{10}{s[(s+1)+10k_T]}} = \frac{10}{s\left[(s+1) + 10k_T\right] + 1}$$

$$\frac{C}{R} = \frac{10}{s^2 + (1 + 10k_T)s + 1}$$

$$s^2 + (1 + 10k_T)s + 1 = s^2 + 2\xi\omega_n s + \omega_n^2$$

$$\begin{cases} 1 + 10k_T = 2\xi\omega_n & \Rightarrow k_T = (2\xi\omega_n - 1) \\ \omega_n^2 = 10 & \omega_n = \sqrt{10} \end{cases}$$

Escaneado con CamScanner