Universidad Fidélitas

Control Automático

EM-720

Tarea #4

Profesor:

Erick Salas

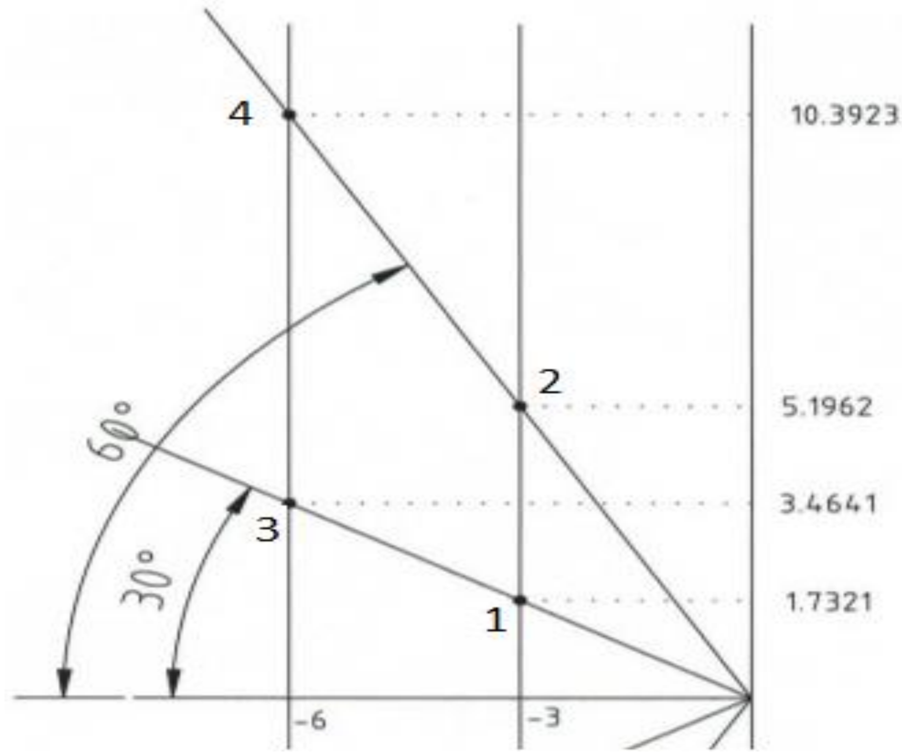
Estudiante:

Esteban Gavarrete Carballo

Segundo Cuatrimestre 2018

Del siguiente sistema encuentre:

1. Coeficiente de amortiguamiento y frecuencia natural para cada punto.
2. Mp para cada punto.
3. Proponer un sistema con retroalimentación negativa para cada punto.



1. Obtener ζ con la siguiente formula $\zeta = \cos(\theta)$

Para θ = 30°

$\zeta = \cos(\theta) \rightarrow \zeta = \cos(30) \rightarrow \zeta = \frac{\sqrt{3}}{2}$

Para θ = 60°

$\zeta = \cos(\theta) \rightarrow \zeta = \cos(60) \rightarrow \zeta = \frac{1}{2}$

2. Obtener Wn con la siguiente formula Wn = $\frac{\alpha}{\zeta}$

Para α = 3, ζ =$\frac{\sqrt{3}}{2}$

Wn =$\frac{\alpha}{\zeta}$ → Wn =$\frac{3}{\frac{\sqrt{3}}{2}}$→ Wn = $2\sqrt{3}$

Para α = 3, ζ =$\frac{1}{2}$

Wn =$\frac{\alpha}{\zeta}$ →Wn =$\frac{3}{\frac{1}{2}}$ → Wn = 6

Para α = 6, ζ =$\frac{\sqrt{3}}{2}$

Wn =$\frac{\alpha}{\zeta}$ → Wn =$\frac{6}{\frac{\sqrt{3}}{2}}$→ Wn = $4\sqrt{3}$

Para α = 6, ζ =$\frac{1}{2}$

Wn =$\frac{\alpha}{\zeta}$ →Wn =$\frac{6}{\frac{1}{2}}$ → Wn = 12

Obtener Mp con la siguiente formula $Mp = e^{-\left(\frac{\zeta \cdot \pi}{\sqrt{1-\zeta^2}}\right)}$

Para ζ =$\frac{\sqrt{3}}{2}$

$$Mp = e^{-\left(\frac{\zeta \cdot \pi}{\sqrt{1-\zeta^2}}\right)} \quad \rightarrow \quad Mp = e^{-\left(\frac{\frac{\sqrt{3}}{2} \cdot \pi}{\sqrt{1-\frac{\sqrt{3}}{2}^2}}\right)} \quad \rightarrow \quad Mp = 4{,}33x10^{-3}$$

Para ζ = $\frac{1}{2}$

$$Mp = e^{-\left(\frac{\zeta \cdot \pi}{\sqrt{1-\zeta^2}}\right)} \quad \rightarrow \quad Mp = e^{-\left(\frac{\frac{1}{2} \cdot \pi}{\sqrt{1-\frac{1}{2}^2}}\right)} \quad \rightarrow \quad Mp = \ 0{,}16$$

Obtener Ts**2% con la siguiente formula** $T_{s_{2\%}} = \frac{4}{\zeta * Wn}$

Para ζ = $\frac{\sqrt{3}}{2}$**, Wn =** $2\sqrt{3}$

$$T_{s_{2\%}} = \frac{4}{\zeta * Wn} \rightarrow T_{s_{2\%}} = \frac{4}{\frac{\sqrt{3}}{2} * 2\sqrt{3}} \rightarrow T_{s_{2\%}} = \frac{4}{3}$$

Para ζ = $\frac{\sqrt{3}}{2}$**, Wn =** $4\sqrt{3}$

$$T_{s_{2\%}} = \frac{4}{\zeta * Wn} \rightarrow T_{s_{2\%}} = \frac{4}{\frac{\sqrt{3}}{2} * 4\sqrt{3}} \rightarrow T_{s_{2\%}} = \frac{2}{3}$$

Para ζ = $\frac{1}{2}$**, Wn = 6**

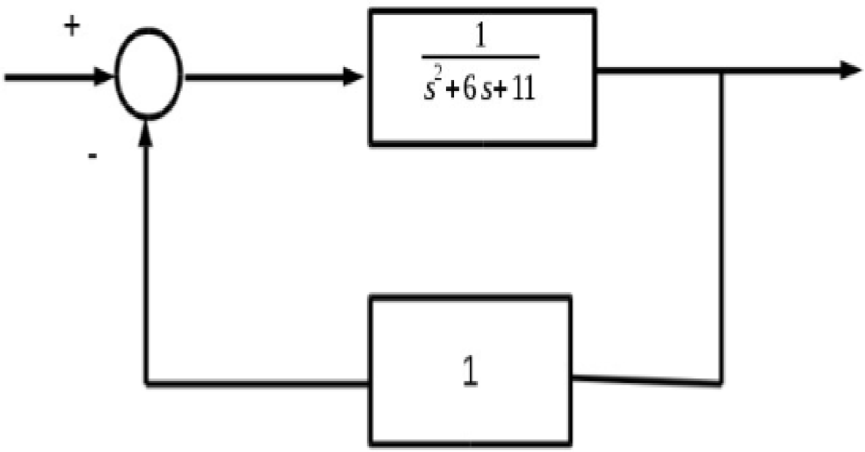
$$T_{s_{2\%}} = \frac{4}{\zeta * Wn} \rightarrow T_{s_{2\%}} = \frac{4}{\frac{1}{2} * 6} \rightarrow T_{s_{2\%}} = \frac{4}{3}$$

Para ζ = $\frac{1}{2}$**, Wn = 12**

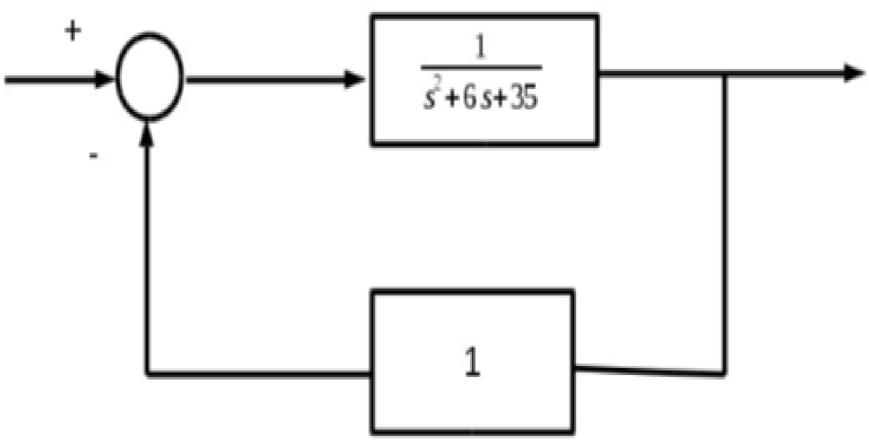
$$T_{s_{2\%}} = \frac{4}{\zeta * Wn} \rightarrow T_{s_{2\%}} = \frac{4}{\frac{1}{2} * 12} \rightarrow T_{s_{2\%}} = \frac{2}{3}$$

Función de transferencia y sistema de bloques

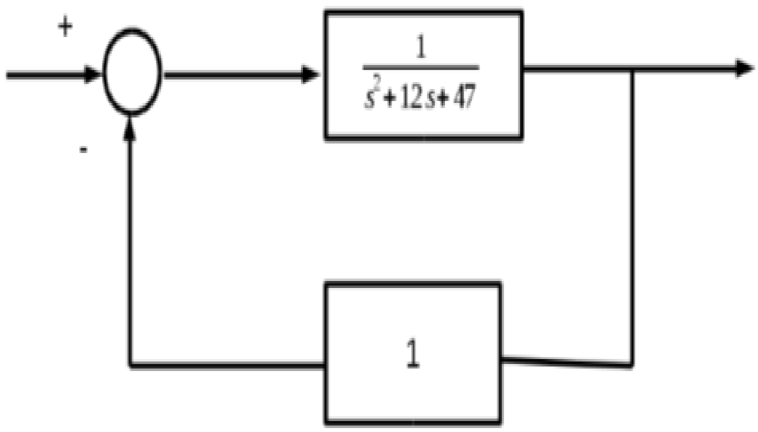
$$\frac{\omega_n^2}{s^2+2\zeta\omega_n s+\omega_n^2} \quad = \quad \frac{1}{12}\cdot\left(\frac{12}{s^2+6s+12}\right)$$



$$\frac{\omega_n^2}{s^2+2\zeta\omega_n s+\omega_n^2} \quad = \quad \frac{1}{36}\cdot\left(\frac{36}{s^2+6s+36}\right)$$



$$\frac{\omega_n^2}{s^2+2\zeta\omega_n s+\omega_n^2} = \frac{1}{48}\cdot\left(\frac{48}{s^2+12s+48}\right)$$



$$\frac{\omega_n^2}{s^2+2\zeta\omega_n s+\omega_n^2} = \frac{1}{144}\cdot\left(\frac{144}{s^2+12s+144}\right)$$