Universidad Fidélitas
Curso de control automático
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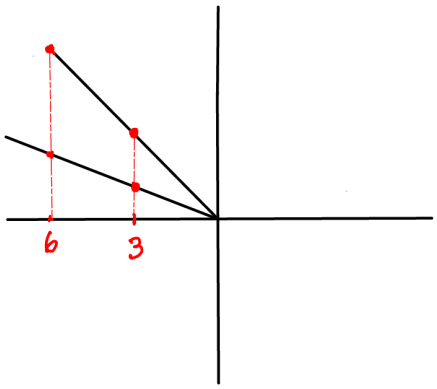
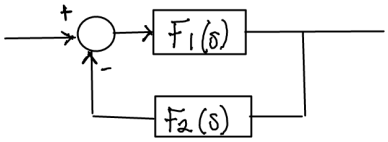
Tarea 4.



1. Encuentre el coeficiente de amortiguamiento y la frecuencia natural para cada punto.
2. encuentre el Mp para cada punto.
3. Para cada punto proponga un sistema que cumpla con el diagrama de bloques:



a) $3 \angle 30°$

$\zeta = \cos\theta$ $\quad \zeta\omega_n = 3$ $\quad M = -e^{-\left(\frac{\zeta\pi}{\sqrt{1-\zeta^2}}\right)}$

$\zeta = \cos(30°)$ $\quad \omega_n = \frac{3}{\frac{\sqrt{3}}{2}}$ $\quad M = 4.33 \times 10^{-3}$

$\zeta = \frac{\sqrt{3}}{2}$ $\quad \omega_n = 2\sqrt{3}$

Sistema de segundo orden

$$\frac{\omega_n^2}{s^2 + 2\omega_n\zeta s + \omega_n^2} \Rightarrow \frac{12}{s^2 + 6s + 12}$$

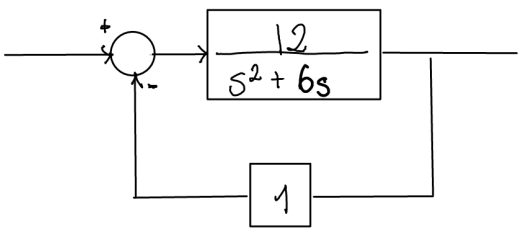
Tiempo de respuesta

$$t_{2\%} = \frac{4}{\zeta\omega_n} = \frac{4}{3}$$

Diagrama de bloques

$$\text{feedback}\left(\frac{q(s)}{p(s)}\right) = \frac{q(s)}{p(s)+q(s)}$$

$$q(s) = \frac{12}{s^2+6s} \qquad p(s) = 1$$



b) $3 \measuredangle 60°$

$\zeta = \cos\theta$ $\qquad \zeta\omega_n = 3$ $\qquad M = e^{-\left(\frac{\zeta\pi}{\sqrt{1-\zeta^2}}\right)}$

$\zeta = \cos(60°)$ $\qquad \omega_n = \frac{3}{\frac{1}{2}}$ $\qquad M = 0.163$

$\zeta = \frac{1}{2}$ $\qquad \omega_n = 6$

Sistema de segundo orden

$$\frac{\omega_n^2}{s^2 + 2\omega_n\zeta s + \omega_n^2} \Rightarrow \frac{36}{s^2 + 6s + 36}$$

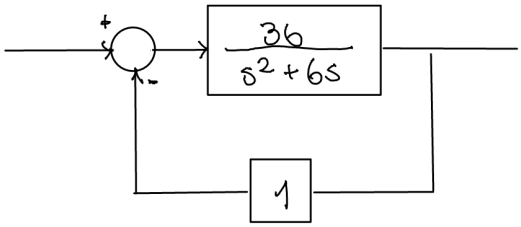
Tiempo de respuesta

$$t_{2\%} = \frac{4}{\zeta\omega_n} = \frac{4}{3}$$

Diagrama de bloques

$$\text{feedback}\left(\frac{q(s)}{p(s)}\right) = \frac{q(s)}{p(s) + q(s)}$$

$q(s) = \frac{36}{s^2 + 6s}$ $\qquad p(s) = 1$



c) $6 \measuredangle 30°$

$\zeta = \cos\theta$ $\qquad \zeta\omega_n = 6$ $\qquad M = -e^{-\left(\frac{\zeta\pi}{\sqrt{1-\zeta^2}}\right)}$

$\zeta = \cos(30°)$ $\qquad \omega_n = \frac{6}{\frac{\sqrt{3}}{2}}$ $\qquad M = 4.33 \times 10^{-3}$

$\zeta = \frac{\sqrt{3}}{2}$ $\qquad \omega_n = 4\sqrt{3}$

Sistema de segundo orden

$$\frac{\omega_n^2}{s^2 + 2\omega_n\zeta s + \omega_n^2} \Rightarrow \frac{48}{s^2 + 12s + 48}$$

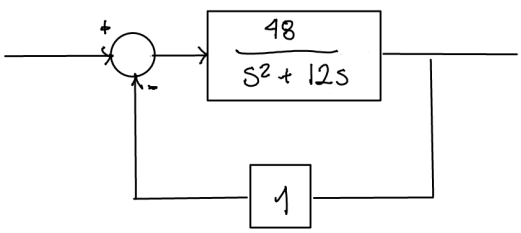
Tiempo de respuesta

$$t_{2\%} = \frac{4}{\zeta\omega_n} = \frac{4}{6}$$

Diagrama de bloques

$$\text{feedback}\left(\frac{q(s)}{p(s)}\right) = \frac{q(s)}{p(s) + q(s)}$$

$q(s) = \frac{48}{s^2 + 12s}$ $\qquad p(s) = 1$



d) $6 \measuredangle 60°$

$\zeta = \cos\theta$ $\qquad \zeta\omega_n = 6$ $\qquad M = e^{-\left(\frac{\zeta\pi}{\sqrt{1-\zeta^2}}\right)}$

$\zeta = \cos(60°)$ $\qquad \omega_n = \frac{6}{\frac{1}{2}}$ $\qquad M = 0.163$

$\zeta = \frac{1}{2}$ $\qquad \omega_n = 12$

Sistema de segundo orden

$$\frac{\omega_n^2}{s^2 + 2\omega_n\zeta s + \omega_n^2} \Rightarrow \frac{144}{s^2 + 12s + 144}$$

Tiempo de respuesta

$$t_{2\%} = \frac{4}{\zeta\omega_n} = \frac{4}{6}$$

Diagrama de bloques

$$\text{feedback}\left(\frac{q(s)}{p(s)}\right) = \frac{q(s)}{p(s)+q(s)}$$

$$q(s) = \frac{144}{s^2 + 12s} \qquad p(s) = 1$$