2º mini-Teste ⇒ TESIS

Versão 3

1)

$$\frac{C(s)}{R(s)} = \frac{\frac{8}{(s+1)(s+2)}}{1+\frac{8}{(s+1)(s+2)}} = \frac{8}{(s+1)(s+2)+8}$$

$x(s)$

$$s^2+3s+10$$

$$\boxed{\frac{\omega_n^2}{s^2+2\zeta\omega_n s+\omega_n^2}}$$

$$\begin{cases} 2\zeta\omega_n = 3 \\ \omega_n^2 = 10 \end{cases} \quad \begin{cases} \zeta = 0{,}47 \\ \omega_n = 3{,}16 \end{cases}$$

$$t_p = \frac{\pi}{\omega_n\sqrt{1-\zeta^2}} \Rightarrow \boxed{t_p = 1{,}12\,s}$$

$$t_s = \frac{4}{\zeta\omega_n} = \boxed{2{,}69\,s}$$

$$M_p = e^{\frac{-\zeta\pi}{\sqrt{1-\zeta^2}}} = 0{,}18 = \boxed{18\%}$$

$$\theta = \arccos(\zeta) = 1{,}08 \text{ ou } 61{,}7^\circ$$

Radianos

$$t_r = \frac{e^{\theta/\tan\theta}}{\omega_n} \Rightarrow \boxed{t_r = 0{,}56\,s}$$

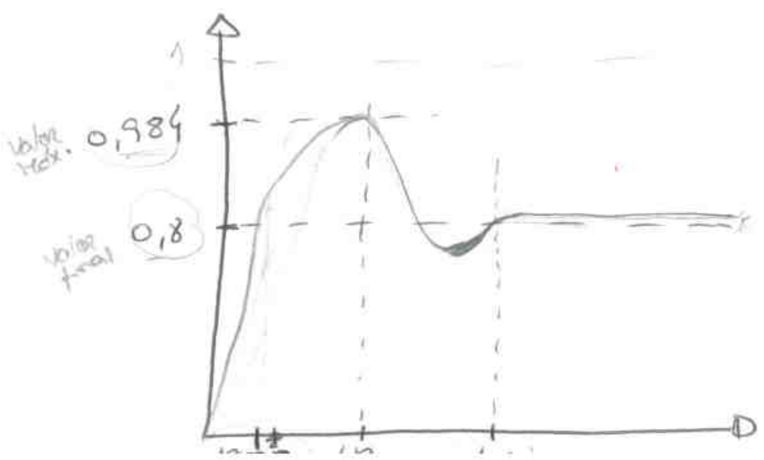
$$\text{valor final} = \lim_{t\to\infty} = \lim_{s\to 0} s\cdot x(s) = \frac{8\cdot s}{s(s^2+3s+10)} = \lim_{s\to 0}\frac{8\cancel{s}}{\cancel{s}(s^2+3s+10)} = 0{,}8$$

valor final + MP

$$\text{valor maximo} = 0{,}8 + 0{,}184 = 0{,}984$$

$$\boxed{\text{valor final} = 1 - 0{,}2 = 0{,}8}$$

degrau; erro



b) sistema do tipo zero pq não possui polos na origem

$$K_p = \lim_{s \to 0} G(s) = \lim_{s \to 0} \frac{8}{(s+1)(s+2)} = 4$$

$$e_{ss}\,(\text{degrau}) = \frac{1}{1+K_p} = \frac{1}{1+4} = \frac{1}{5} = 0{,}2$$

2)

$$s^4 + 8s^3 + 5s^2 + 5s + k = 0$$

$$\begin{array}{c|ccc} 4 & 1 & 5 & k \\ 3 & 8 & 5 & \\ 2 & a & b & \\ 1 & e & & \\ 0 & D & & \end{array}$$

$$a = -\frac{\begin{vmatrix} 1 & 5 \\ 8 & 5 \end{vmatrix}}{8} = 4{,}375$$

$$b = -\frac{\begin{vmatrix} 1 & k \\ 8 & 0 \end{vmatrix}}{8} = k$$

$$e = -\frac{\begin{vmatrix} 8 & 5 \\ 4{,}375 & k \end{vmatrix}}{4{,}375} = -1{,}83k + 5$$

$$D = -\frac{\begin{vmatrix} 4{,}375 & k \\ -1{,}83k+5 & 0 \end{vmatrix}}{-1{,}83k+5} = k$$

$$\begin{cases} -1{,}83k + 5 > 0 \\ k > 0 \end{cases} \Leftrightarrow \begin{cases} k < 2{,}73 \\ k > 0 \end{cases}$$

$$0 < k < 2{,}73$$