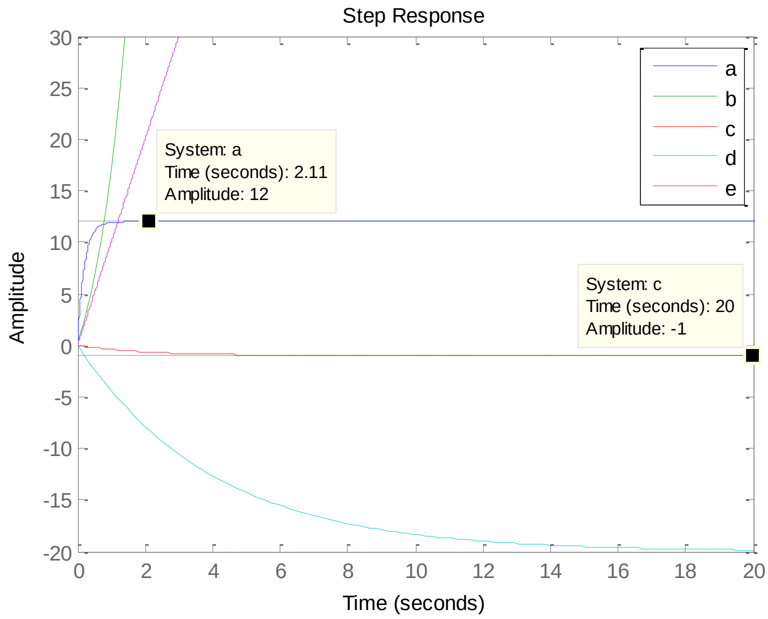
Chapter 9

9



11

$$\mathcal{L}^{-1}\left[\frac{100}{s+10}\,\frac{1}{s}\right] = 100\,\frac{1}{10}\left(1-e^{-10t}\right) = 10-10e^{-10t}$$

valor final: $10(1-0)=10$; valor inicial: $10(1-1)=0$

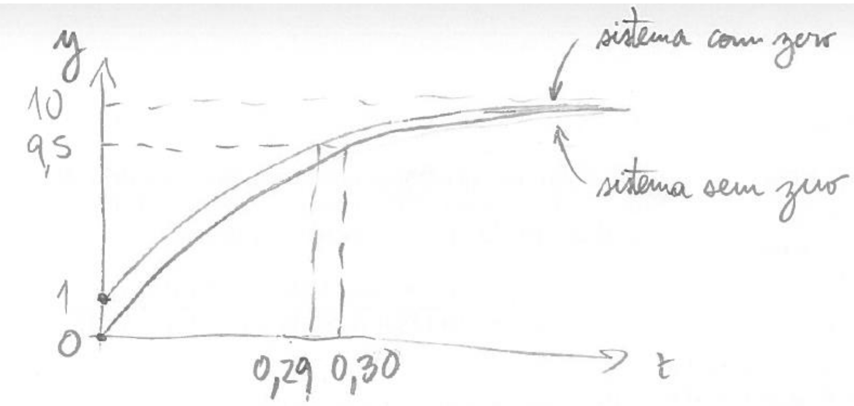
$t_{5\%}$: $10(1-e^{-10t}) = 0{,}95\times 10 \Leftrightarrow e^{-10t}=0{,}05 \Leftrightarrow t=-\frac{1}{10}\log_e 0{,}05 = 0{,}30$

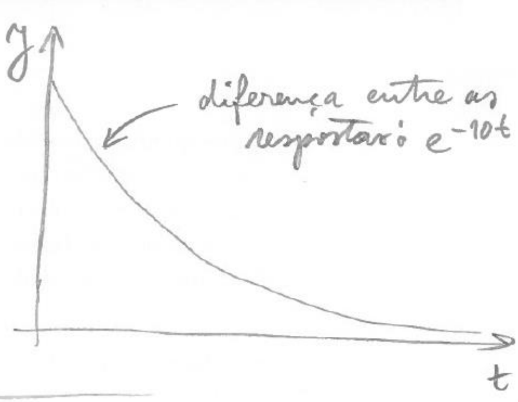
$$\mathcal{L}^{-1}\left[\frac{s+100}{s+10}\,\frac{1}{s}\right] = \mathcal{L}^{-1}\left[\frac{1}{s+10}\right] + \mathcal{L}^{-1}\left[\frac{100}{s+10}\,\frac{1}{s}\right] = e^{-10t} + 10\left(1-e^{-10t}\right) = 10-9e^{-10t}$$

valor final: 10 é a mesma ; valor inicial: $10-9=1$

$t_{5\%}$: $10-9e^{-10t} = 0{,}95\times 10 \Leftrightarrow 1-0{,}9e^{-10t} = 0{,}95 \Leftrightarrow \frac{0{,}05}{0{,}9} = e^{-10t} \Leftrightarrow$

$\Leftrightarrow t = -\frac{1}{10}\log_e \frac{0{,}05}{0{,}9} = 0{,}29$





$$\mathcal{L}^{-1}\left[\frac{8}{s+12}\,\frac{1}{s}\right] = 8\,\frac{1}{12}\left(1-e^{-12t}\right) = \frac{2}{3} - \frac{2}{3}e^{-12t}$$

valor final: $\frac{2}{3}(1-0)=\frac{2}{3}$; valor inicial: $\frac{2}{3}(1-1)=0$

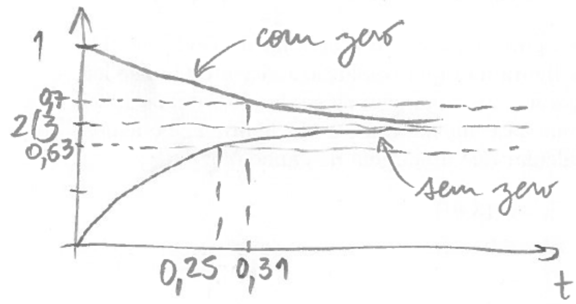
$t_{5\%}$: $\frac{2}{3}\left(1-e^{-12t}\right) = 0{,}95\times\frac{2}{3} \Leftrightarrow 0{,}05 = e^{-12t} \Leftrightarrow t = -\frac{1}{12}\log_e 0{,}05 = 0{,}25$

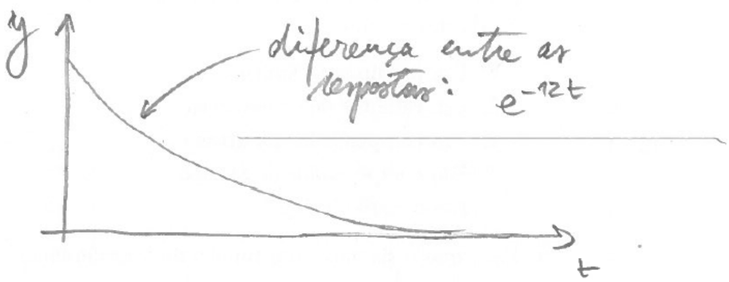
$$\mathcal{L}^{-1}\left[\frac{s+8}{s+12}\,\frac{1}{s}\right] = \underbrace{\mathcal{L}^{-1}\left[\frac{1}{s+12}\right]} + \mathcal{L}^{-1}\left[\frac{8}{s+12}\,\frac{1}{s}\right] = e^{-12t} + \frac{2}{3} - \frac{2}{3}e^{-12t} = \frac{2}{3} + \frac{1}{3}e^{-12t}$$

valor final: $\frac{2}{3}$ à mesma; valor inicial: $\frac{2}{3}+\frac{1}{3}=1$

$t_{5\%} = \frac{2}{3} + \frac{1}{3}e^{-12t} = 1{,}05\times\frac{2}{3} \Leftrightarrow \frac{1}{2}e^{-12t} = 0{,}05 \Leftrightarrow t = -\frac{1}{12}\log_e 0{,}1 = 0{,}31$

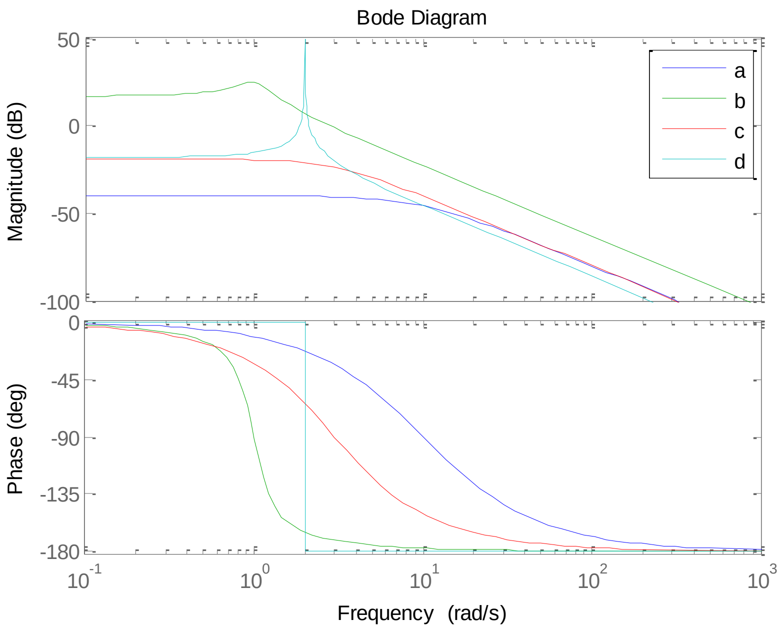
a resposta decrescente





13 1/(s+10)

16



17 a) $64.8/(s^2 + 9s + 81)$

b) $160/(s^2 + 4s + 16)$