Semana 8 Gabriel Carneiro Gonçalves 11611ECP013

70) $0{,}2\dot{u} = -u + [45\ -5]\begin{bmatrix} e_a \\ t_e \end{bmatrix}$

$y = u$

Ke^{-5t}, $\Phi(0) = I$, $K = 1$

$y(t) = \int_0^t C\Phi(t-\tau)\cdot B u(\tau)\,d\tau = \int_0^t e^{-5(t-\tau)}(45e_a - 5t_e)\,d\tau =$

$= \int_0^t 45 e^{2} e^{-5(t-\tau)}\,d\tau - \int_4^t 5t_e e^{-5(t-\tau)}\,d\tau \quad (t > 4)$

$= 900(1 - e^{-5t}) - 10(1 - e^{-5(t-4)})$

$y(t) = \begin{cases} 900(1-e^{-5t}) & t \leq 4 \\ 890 - 900e^{-5t} + 10e^{-5(t-4)} & t \geq 4 \end{cases}$

73) $f(t) = 2x + f_v \dfrac{dx}{dt}$ $\quad F(s) = 2X(s) + f_v s X(s)$

$\dfrac{X(s)}{F(s)} = \dfrac{\frac{1}{f_v}}{s + \frac{2}{f_v}}$ $\rightarrow T_s = \dfrac{4}{a} \rightarrow a = \dfrac{2}{f_v}$ $\quad T_s = 2f_v$ ou $f_v = 0{,}5T_s$

75) $f(t) - f_v \dfrac{dx}{dt} - Kx = M\dfrac{d^2x}{dt^2}$ $\quad f(t) = f_v\dfrac{dx}{dt} + x + M\dfrac{d^2x}{dt^2}$

$F(s) = f_v sX(s) + X(s) + s^2 M X(s)$

$\dfrac{X(s)}{F(s)} = \dfrac{\frac{1}{M}}{s^2 + \frac{f_v}{M}s + \frac{1}{M}}$ $\quad e^{\frac{-\pi\delta}{\sqrt{1-\delta^2}}}\cdot 100 = 17$ $\quad T_s = \dfrac{4}{\delta\omega_n}$

$\delta = 0{,}49$

$T_s = 4s \rightarrow \delta\omega_n = 0{,}4$ $\quad \omega_n = 0{,}815$ $\quad \omega_n^2 = \dfrac{1}{M}$ ou $M = \dfrac{1}{0{,}815^2} = 1{,}51$

$2\delta\omega_n = \dfrac{f_v}{M} \rightarrow 2 \times 0{,}4 = \dfrac{f_v}{1{,}51}$ $\quad f_v = 1{,}21$ e $M = 1{,}51$

7b) $T(t) - 1\dfrac{d\theta}{dt} - k\theta = J\dfrac{d^2\theta}{dt^2}$ $T(s) = s\theta(s) + k\,\theta(s) + s^2 J\theta(s)$

$$\frac{\theta(s)}{F(s)} = \frac{\frac{1}{J}}{s^2 + \frac{1}{J^2} + \frac{k}{J}}$$

$$e^{\frac{-\pi \cdot \delta}{\sqrt{1-\delta^2}}} \cdot 100 = 30$$

$\delta = 0,358$ $2\delta\omega n = \dfrac{1}{J} \Rightarrow \delta\omega n = \dfrac{1}{2J}$

$TS = \dfrac{4}{\delta\omega n}$ $TS = 3s$ $\dfrac{4}{\delta\omega n} = \dfrac{4}{\frac{1}{2J}} = 3$ $J = \dfrac{3}{8}$

$\delta\omega n = \dfrac{4}{3}$, $\delta = 0,358$ $\omega n = 3,72$ $\omega n^2 = \dfrac{k}{J}$ ou $k = 3,72^2 \cdot \dfrac{3}{8} = 5,20$

$J = \dfrac{3}{8}$, $k = 5,20$