Aula 22/10

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1) $2\ddot{x} + 7\dot{x} + 3x = 0 \qquad x(0) = x_0 \qquad \dot{x}(0) = 0$

$2\ddot{x} \Rightarrow 2[s^2 X(s) - sx(0) - \dot{x}(0)] = 2[s^2 X(s) - sx_0]$

$7\dot{x} \Rightarrow 7[s\,X(s) - x(0)] = 7[s\,X(s) - x_0]$

$3x \Rightarrow 3\,X(s)$

$(2s^2 + 7s + 3)X(s) - (2s + 7)x_0 = 0$

$X(s) = \dfrac{(2s+7)x_0}{(2s^2+7s+3)}$, $G(s) = \dfrac{X(s)}{U(s)}$ $G(s) = 0 \rightarrow$ não há entrada

Cálculo dos Polos: $2s^2 + 7s + 3 = 0 \rightarrow s = -0{,}5 \; ; \; s = -3$

Transformada inversa: $X(s) = \dfrac{(2s+7)x_0}{2(s+0{,}5)(s+3)} = \left(\dfrac{\alpha_1}{s+0{,}5} + \dfrac{\alpha_2}{s+3}\right)\dfrac{x_0}{2}$

$\alpha_1 = 2{,}4$

$\alpha_2 = -0{,}4$

$\therefore X(s) = \left(\dfrac{1{,}2}{s+0{,}5} \; \dfrac{-0{,}2}{s+3}\right)x_0 \xrightarrow{\mathcal{L}^{-1}} x(t) = 1{,}2\,x_0 e^{-0{,}5t} - 0{,}2e^{-3t}$

2) $\dddot{x} + 2\ddot{x} + 7\dot{x} = \ddot{u} + 7\dot{u} + 5u$

① ② ③ ④ ⑤ ⑥

① → $s^3 X(s) - s^2 x(0) - s\dot{x}(0) - \ddot{x}(0) = s^3 X(s) - 9s^2 - s - 2$

② → $2(s^2 X(s) - s\,x(0) - \dot{x}(0)) = 2(s^2 X(s) - 9s - 1)$

③ → $7(s\,X(s) - x(0)) = 7(s\,X(s) - 9)$

④ → $s^2 U(s) - s\,u(0) - \dot{u}(0) = s^2 U(s) - s$

⑤ → $7(s\,U(s) - u(0)) = 7(s\,U(s) - 1)$

⑥ → $5U(s)$

$\therefore (s^3 + 2s^2 + 7s)X(s) = (s^2 + 7s + 5)U(s) + 9s^2 + 18s + 60$

$X(s) = \dfrac{(s^2 + 7s + 5)U(s)}{s^3 + 2s^2 + 7s} + \dfrac{(9s^2 + 18s + 60)}{s^3 + 2s^2 + 7s}$

$G(s) = \dfrac{s^2 + 7s + 5}{s^3 + 2s^2 + 7s}$

$$T_e = 1,5p\left((L_{ds} - L_{is})\, i_d i_q + i_q \psi_f\right)$$

$$\frac{\partial T_e}{\partial i_d} = 1,5p(L_{ds} - L_{is})\, i_q \longrightarrow i_{qq} = 0$$

$$\frac{\partial T_e}{\partial i_q} = 1,5p(L_{ds} - L_{is})\, i_d + 1,5p\,\psi_f \rightarrow i_{dq} = \frac{-\psi_f}{L_{ds} - L_{is}}$$

$$T_e = 1,5p(L_{ds} - L_{is})\, i_{qq}(i_d - i_{dq}) + 1,5p\underbrace{\left[(L_{ds} - L_{is})\, i_{dq} + \psi_f\right]}_{(i_q - i_{qq})}$$