José Arthur [illegible] Guerreiro 10731767

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

$$2(s^2X - sx_0) + 7(sX - x_0) + 3X = 0$$

$$\Downarrow$$

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

[illegible]

$$X = \frac{x_0(2s + 7)}{2s^2 + 7s + 3} \Rightarrow \frac{x_0(2s + 7)}{2(s+3)(s+\frac{1}{2})}$$

$$X = \frac{A}{s+3} + \frac{B}{2s+1} \Rightarrow \frac{2As + A + Bs + 3B}{(s+3)(2s+1)}$$

$$\Downarrow$$

$$A = \frac{-x_0}{5} \; ; \; B = \frac{12x_0}{5}$$

$$x(t) = \frac{-x_0}{5}e^{-3t} - \frac{6x_0 e^{-\frac{t}{2}}}{5}$$

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

$u(t) = 1 \; ; \; u(0) = 0 \; ; \; x(0) = 0$

$$\Downarrow$$

$U(s) = \frac{1}{s} \; ; \; \dot{u}(0) = 0 \; ; \; \dot{x}(0) = 1$

$$\Downarrow$$

$u(1) = 1 \; ; \; \ddot{x}(0) = 2$

$\Rightarrow 2)$

$$\left(s^3X - s^2x - s\dot{x} - \ddot{x}\right) + 2\left(s^2X - sx - \dot{x}\right) + 7\left(sX - x\right) = \star$$

$$\star\ s^2U - sU(0) - \dot{U}(0) + 7\left(sU - U(0) + 5U\right)$$

$$X\left(s^3 + 2s^2 + 7s\right) = U\left(s^2 + 7s + 5\right) + 9s^2 + 19s + 67$$

$\Downarrow$

$$X = \frac{U\cdot\left(s^2+7s+5\right)}{s^3+2s^2+7s} + \frac{9s^2+19s+67}{s^3+2s^2+7s}$$

$\Downarrow$

$$G = \frac{X}{U} \Rightarrow G = \frac{s^2+7s+5}{s\left(s^2+2s+7\right)}$$

$\Downarrow$

$s_1 = 0$; $s_2 = -1 + \sqrt{5}i$; $s_3 = -1 - \sqrt{5}i$

tendo $U = \frac{1}{s}$ temos

$$X(s) = \frac{9s^3 + 20s^2 + 74s + 5}{s^2\left(s^2+2s+7\right)}$$

$\Downarrow$

$$X(s) = \frac{508}{49s} + \frac{5}{7s^2} - \frac{67s + 71}{49\left((s+1)^2+6\right)}$$

$\Downarrow$

$$X(t) = \frac{508}{49} + \frac{5t}{7} - \frac{67e^{-t}}{49}\cos(\sqrt{6}t) - \frac{4}{96\sqrt{6}} e^{-t}\operatorname{Sen}(\sqrt{6}t)$$