Modelagem de Sistemas Dinâmicos

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

↳ Laplace

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

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

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

$s_1 = (-7+5)/4 = -\frac{1}{2}$

$s_2 = (-7-5)/2 = -3$

$$X(s) = \frac{(2s+7)x_0}{2(s+3)(s+\frac{1}{2})} = \left[\frac{A}{s+3} + \frac{B}{(2s+1)}\right]\frac{x_0}{2} = \left[\frac{A(2s+1) + B(s+1)}{(s+3)(2s+1)}\right]\frac{x_0}{2}$$

$$\begin{aligned} 2A + B &= 2 \\ A + 3B &= 7 \end{aligned} \Rightarrow \begin{aligned} A &= -2/5 \\ B &= 12/5 \end{aligned}$$

$$X(s) = -\frac{x_0}{5(s+3)} + \frac{6x_0}{5(s+1/2)}$$

$$\mathcal{L}^{-1}\left\{\frac{1}{s-a}\right\} = e^{at}$$

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