ITALO PAIVA - 10853310 - 22/10

① $G(s) = \frac{1}{(s+1)^2(s+2)} = \frac{\alpha_1}{(s+1)} + \frac{\alpha_2}{(s+1)^2} + \frac{\alpha_3}{(s+2)}$

Polo 1: multiplicidade $r=2$, $i=0:1$

Polo 2: multiplicidade $r=1$, $i=0:2$

$$\alpha_3 = \frac{1}{0!}\left[\frac{d^0}{ds^0}(s+2)^1 G(s)\right]\Big|_{s=-2} = \frac{1}{(s+1)^2}\Big|_{s=2} = 1$$

$$\alpha_2 = \frac{1}{0!}\left[\frac{d^0}{ds^0}(s+1)^2 G(s)\right]\Big|_{s=-1} = \frac{1}{s+2}\Big|_{s=-2} = 1$$

$$\alpha_1 = \frac{1}{1!}\left[\frac{d(s+1)^2 G(s)}{ds}\right]\Big|_{s=-2} = \frac{d}{dt}\left[\frac{1}{s+2}\right]\Big|_{s=-1} = \frac{-1}{(s+2)^2}\Big|_{s=-1} = -1$$

logo $G(s) = \frac{1}{(s+1)^2} + \frac{1}{(s+2)} - \frac{1}{(s+1)}$

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

$2\ddot{x} = 2(s^2 x + sx(0) - \dot{x}(0))$

$7\dot{x} = 7(sx - x(0))$

$3x = 3x$

$x(2s^2+7s+3) = -2sx(0) - 7x$

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

$x = \frac{-(2s+7)}{2s^2+7s+3} \cdot x_0$

$$X = \underbrace{\frac{-(2s+7)}{2s^2+7s+3}}_{A} X_0 \qquad \begin{matrix} \Delta = -3,5 \\ P = 1,5 \end{matrix} \Big\} \begin{matrix} s_1 = -0,5 \\ s_2 = -3 \end{matrix}$$

$$A = \frac{\alpha_1}{s+0,5} + \frac{\alpha_2}{s+3} \; ; \; (s+0,5)A = \frac{-2s+7}{s+3} \Big|_{s=-0,5}$$

$$\rightarrow \frac{-(-1+7)}{2,5} = -2,4 \; ; \; (s+3)A = \frac{-(2s+7)}{s+0,5} \Big|_{s=-3}$$

$$= \frac{-1}{2,5} = -0,4$$

$$X = \left(\frac{-2,4}{s+0,5} \; \frac{-0,4}{s+3} \right) X_0$$

$$\frac{1}{s-a} \leftarrow e^{at} \rightarrow x(t) = \left[-2,4e^{-0,5t} - 0,4e^{-3t} \right] X_0$$

$$\text{AFTfica } \frac{X}{U} = \frac{1}{2s^2+7s+3}$$

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

$$\ddot{x} = s^3 x - s^2 x_0 - s\dot{x}_0 - \ddot{x}_0 = s^3 X - 9s^2 - s - 3$$

$$7\dot{x} = 7(sX - x_0) = 7sX - 63$$

$$\ddot{u} = s^2 U - s u_0 - \dot{u}_0 = s^2 U \rightarrow 7\dot{u} = 7sU - 7u_0 = 7sU$$

$$\boxed{sU = sU} \; ; \; \ddot{x}(0) = 2, \; \dot{x}(0) = 1, \; x(0) = 3, \; u(0) = 1, \; \dot{u}(0) = 0$$

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