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Sistemas e Controle - Roteiro 3[redacted]A

Nise - cap 2

1-

a) $u(t) \Rightarrow \mathcal{L}(u(t)) = \int_0^\infty e^{-st} \times 1 \times dt = -\frac{1}{s} e^{-st}\Big|_{t=0}^{\infty} = \frac{1}{s}$

b) $\mathcal{L}(t\,u(t)) = \mathcal{L}(t\,u(t)) = \int_0^\infty e^{-st}\, t\, dt = \frac{1}{s^2}$

c) $\mathcal{L}(\text{sen}(\omega t)\, u(t)) = \frac{\omega}{s^2+\omega^2}$

2-

a) $f(t) = e^{-at}\,\text{sen}\,\omega t\, u(t) \Rightarrow \mathcal{L}(f(t)) = \frac{\omega}{(s+a)^2-\omega^2}$

b) $g(t) = e^{-at}\cos\omega t\, u(t) \Rightarrow \mathcal{L}(g(t)) = \frac{s+a}{(s+a)^2-\omega^2}$

8- $y''' + 3y'' + 5y' + y = x''' + 4x'' + 6x' + 8y$

Aplicando Laplace:

$(s^3+3s^2+5s+1)Y(s) = (s^3+4s^2+6s+8)X(s)$

$\frac{Y(s)}{X(s)} = \frac{s^3+4s^2+6s+8}{s^3+3s^2+5s+1}$

9-

a) $\frac{X(s)}{F(s)} = \frac{7}{s^2+5s+10} \Rightarrow (s^2+5s+10)X(s) = 7F(s)$

$\Downarrow$

$x'' + 5x' + 10x = 7f$

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11 - $R(s) \rightarrow \boxed{\dfrac{s^4+2s^3+5s^2+s+1}{s^5+3s^4+2s^3+4s^2+5s+2}} \; C(s) \rightarrow$, $r(t) = 3t^2$

$(s^5+3s^4+2s^3+4s^2+5s+2)\,C(s) = (s^4+2s^3+5s^2+s+1)\,R(s)$

$\dfrac{d^5c}{dt^5} + 3\dfrac{d^4 c}{dt^4} + 2\dfrac{d^3c}{dt^3} + 4\dfrac{d^2c}{dt^2} + 5\dfrac{dc}{dt} + 2c = \dfrac{d^4r}{dt^4} + 2\dfrac{d^3r}{dt^3} + 5\dfrac{d^2r}{dt^2} + \dfrac{dr}{dt} + r$

substituindo $r(t) = t^3 \Rightarrow 18\,\delta(t) + (36 - 90t + 9t^2 - 3t^3)\,u(t)$

Franklin - cap 3

3.2 - b) $3 + 7t + t^2 + \delta(t) = f(t)$

$\mathcal{L}(f(t)) = \frac{3}{s} + \frac{7}{s^2} + \frac{2}{s^3} + 1$

3.3 - c) $f(t) = t^2 + e^{-2t}\,\text{sen}\,3t$

$\mathcal{L}(f(t)) = \frac{2}{s^3} + \frac{3}{(s+2)^2+9}$

3.5 - a) $f(t) = \text{sen}\,t \cdot \text{sen}\,3t \Rightarrow \frac{1}{2}(-\cos(t+3t) + \cos(t-3t))$

$\mathcal{L}(f(t)) = -\frac{1}{2}\mathcal{L}(\cos 4t) + \frac{1}{2}\mathcal{L}(\cos -2t)$

$\mathcal{L}(f(t)) = -\frac{1}{2}\frac{s}{s^2+16} + \frac{1}{2}\frac{s}{s^2+4} = \frac{6s}{(s^2+4)(s^2+16)}$ //

3.7 - a) $\frac{2}{s(s+2)} = \frac{A}{s} + \frac{B}{s+2}$

$A(s+2) + Bs = 2 \quad , s=0$
$2A = 2 \Rightarrow A = 1$
$s = -2$
$-2B = 2 \quad B = -1$

$\mathcal{L}^{-1}\left(\frac{2}{s(s+2)}\right) = \mathcal{L}^{-1}\left(\frac{1}{s}\right) - \mathcal{L}^{-1}\left(\frac{1}{s+2}\right)$

$\mathcal{L}^{-1}\left(\frac{2}{s(s+2)}\right) = 1 - e^{-2t}$ //

3.9 - e) $y'' + 2y' = e^t \quad y(0) = 1 \quad y'(0) = 2$

$s^2 Y(s) - s1 - 2 + 2(sY(s) - 1) = \frac{1}{s-1}$

$Y(s) = \frac{s^2 + 3s + 2}{s(s-1)(s+2)}$ - Por frações parciais

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

$\mathcal{L}^{-1}(Y(s)) = \mathcal{L}^{-1}\left(\frac{1}{3(s-1)} + \frac{3}{2s} - \frac{5}{6(s+2)}\right)$

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