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5C

Análisis de señales

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Transformada de Laplace

$$1) \mathcal{L}\{3\cos(5t)\}$$

$$3\mathcal{L}\{\cos(5t)u(t)\}$$

$$3 \frac{s}{s^2+25} = \frac{3s}{s^2+25}$$

$$\cos(\omega t) = \frac{s}{s^2+\omega^2}$$

$$R = \frac{3s}{s^2+25}$$

$$\bullet \mathcal{L}\{10\sin(6t)\}$$

$$10\mathcal{L}\{\sin(6t)u(t)\}$$

$$10 \frac{6}{s^2+36} = \frac{60}{s^2+36}$$

$$R = \frac{60}{s^2+36}$$

$$\bullet \mathcal{L}\{6\sin(2t) - 5\cos(2t)\}$$

$$6\mathcal{L}\{\sin(2t)u(t)\} - 5\mathcal{L}\{\cos(2t)u(t)\}$$

$$6 \frac{2}{s^2+4} - 5 \frac{s}{s^2+4} = \frac{12}{s^2+4} - \frac{5s}{s^2+4}$$

$$R = \frac{12}{s^2+4} - \frac{5s}{s^2+4}$$

$$\bullet \mathcal{L}\{2\sin(t) + 3\cos(2t)\}$$

$$2\mathcal{L}\{\sin(t)u(t)\} + 3\mathcal{L}\{\cos(2t)u(t)\}$$

$$2 \frac{1}{s^2+1} + 3 \frac{s}{s^2+4} = \frac{2}{s^2+1} + \frac{3s}{s^2+4}$$

$$R = \frac{2}{s^2+1} + \frac{3s}{s^2+4}$$

$$\cdot \mathcal{L}\{e^{-t} \cos(2t)\}$$

$$\mathcal{L}\{\cos(2t)u(t)\} \quad s = s+1$$

$$= \frac{s}{s^2+4} \quad s = s+1 = \frac{s+1}{(s+1)^2+4}$$

$$R = \frac{s+1}{(s+1)^2+4}$$

$$\cdot \mathcal{L}\{2e^{3t} \sin(4t)\}$$

$$2\mathcal{L}\{\sin(4t)u(t)\} \quad s = s-3$$

$$= 2 \cdot \frac{4}{s^2+16} \quad s = s-3 = \frac{8}{(s-3)^2+16}$$

$$R = \frac{8}{(s-3)^2+16}$$

$$\cdot \mathcal{L}\{5t-3\}$$

$$5\mathcal{L}\{t-3\}u(t)$$

$$5e^{-3s} = 5e^{-3s}$$

$$R = 5e^{-3s}$$

$$\mathcal{L}\{2t^2 - e^{-t}\}$$

$$2\mathcal{L}\{t^2 u(t)\} s = s+1$$

$$2\left\{ \frac{2}{s^3} - \frac{1}{s} \right\} \Big|_{s=s+1}$$

$$\frac{n!}{s^{n+1}} = \frac{2!}{s^{2+1}}$$

$$\frac{1}{s} = \frac{1}{s+1}$$

$$\rightarrow \frac{2}{(s+1)^3} - \frac{1}{s+1} \rightarrow \frac{4}{(s+1)^3} - \frac{1}{s+1}$$

$$R = \frac{4}{(s+1)^3} - \frac{1}{s+1}$$

$$\mathcal{L}\{2e^{4t}\}$$

$$2\mathcal{L}\{e^{4t} u(t)\} s = s-4 \rightarrow 2s-4$$

$$R = 2s-4$$

Laplace inverse

$$\mathcal{L}^{-1}\left\{ \frac{e^{-3s}}{s^2+1} \right\} = \mathcal{L}^{-1}\left\{ \frac{1}{s^2+1} \right\} \Big|_{t=t-3} = \text{Sen}(t) u(t)$$

$$= \text{Sen}(t-3) u(t-3)$$

$$R = \text{Sen}(t-3) u(t-3)$$

$$\mathcal{L}^{-1}\left\{ \frac{e^{-\pi s}}{s^2+1} \right\} = \mathcal{L}^{-1}\left\{ \frac{1}{s^2+1} \right\} \Big|_{t=t-\pi} = \text{Sen}(t) u(t)$$

$$= \text{Sen}(t-\pi) u(t-\pi)$$

$$R = \text{Sen}(t-\pi) u(t-\pi)$$

$$\cdot \mathcal{L}^{-1} \left\{ \frac{e^{-s}}{s(s+1)} \right\} \quad f(s) = \frac{1}{s(s+1)} \quad \mathcal{L}^{-1} \left\{ \frac{1}{s(s+1)} \right\} \quad t = t-s$$

$$\text{Por } \frac{1}{s(s+1)} = \frac{A}{s} + \frac{B}{s+1}$$

$$\frac{1}{s(s+1)} = \frac{A(s+1) + B(s)}{s(s+1)} = \frac{1}{s(s+1)} = \frac{A(s+1) + B(s)}{s(s+1)}$$

$$s=0 \Rightarrow A(0+1) + B(0) = 1 \Rightarrow A = 1$$

$$s=-1 \Rightarrow A(-1+1) + B(-1) = 1 \Rightarrow B = -1$$

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

$$R = \frac{1}{s(s+1)} = \frac{1}{s} - \frac{1}{s+1}$$

$$\mathcal{L}^{-1} \left\{ \frac{4}{s(s^2+4)} \right\} = \frac{4}{s} - \mathcal{L}^{-1} \left\{ \frac{4}{s(s^2+4)} \right\}$$

$$= \frac{4}{s} - \frac{4}{2} \mathcal{L}^{-1} \left\{ \frac{2}{s(s^2+4)} \right\} = \frac{4}{s} - \frac{4}{2} \mathcal{L}^{-1} \left\{ \frac{2}{s(s^2+4)} \right\}$$

$$= \frac{4}{s} - \frac{4}{2} [1 - \cos(2t)]$$

$$R = \frac{4}{s} [1 - \cos(2t)] u(t) = (-\cos(2t) u(t))$$

Nota: No puse el $\frac{4}{s}$ a 1 porque no se si de el mismo resultado pero si se que se iguala a 1, o sea

$[u(t) - \cos(2t)] u(t)$, así quedaría sustituido