propierties.

7) $\mathcal{L}^{-1}\left\{ e^{-as} F(s) \right\} = f(t-a) \cdot u(t-a)$

8) $\mathcal{L}\left\{ e^{as} f(t) \right\} = F(s-a)$

operation convolution

9) $\mathcal{L}^{-1}\left\{ F(s) \cdot G(s) \right\} = f(t) * g(t)$

$$f(t) * g(t) = \int_0^t f(\tau) \cdot g(t-\tau)\, d\tau$$

Sectional continous functions

$$\mathcal{L}\{t^2\} = \frac{2!}{s^3} \qquad \mathcal{L}\{e^{at}f(t)\} = F(s-a)$$

$$\mathcal{L}\{t^2 e^{8t}\} = \frac{2}{(s-8)^3}$$

$$\mathcal{L}\{e^{2t}\cos(3t)\} = \frac{(s-2)}{(s-2)^2+(3)^2}$$

$$\mathcal{L}\{\cos(bt)\} = \frac{s}{s^2+b^2}$$

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

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

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

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

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

$$\mathcal{L}\left\{e^{at}f(t)\right\} = F(s-a) \qquad \left\{\begin{array}{l} \mathcal{L}\{\cos(bt)\} = \dfrac{s}{s^2+b^2} \\ \mathcal{L}\{\sin(bt)\} = \dfrac{b}{s^2+b^2} \end{array}\right\}$$

$$\mathcal{L}^{-1}\left\{\frac{e^{3s}}{s^2+9}\right\} =$$

$$\mathcal{L}^{-1}\left\{\frac{1}{s^2+9}\right\} = \frac{1}{3}\mathcal{L}^{-1}\left\{\frac{3}{s^2+9}\right\}$$

$$= \frac{1}{3}\left(\sin(3t)\right)$$

$$\mathcal{L}^{-1}\left\{\frac{e^{3s}}{s^2+9}\right\} = \frac{1}{3}\sin\left(3(t+3)\right)\cdot u\left(t+3\right)$$

$$\mathcal{L}^{-1}\left\{e^{-as}\cdot F(s)\right\} = f(t-a)\cdot u(t-a)$$

$$\mathcal{L}^{-1}\left\{\frac{s}{(s^2+16)^2}\right\} = \mathcal{L}^{-1}\left\{\frac{s}{s^2+16}\cdot\frac{1}{s^2+16}\right\}$$

$$= \frac{1}{4}\mathcal{L}^{-1}\left\{\frac{s}{s^2+16}\cdot\frac{4}{s^2+16}\right\}$$

$$\mathcal{L}^{-1}\left\{\frac{s}{s^2+16}\right\} = \cos(4t)$$

$$\mathcal{L}^{-1}\left\{\frac{4}{s^2+16}\right\} = \sin(4t)$$

$$\mathcal{L}^{-1}\left\{F(s)\cdot G(s)\right\} = f(t) * g(t)$$

$$\frac{1}{4}\mathcal{L}^{-1}\left\{\frac{s}{s^2+16}\cdot\frac{4}{s^2+16}\right\} = \cos(4t) * \sin(4t)$$

$$\frac{1}{4}\cos(4t) * \sin(4t) = \int_0^t \cos(4z)\cdot\sin(4(t-z))\,dz.$$

$$\frac{1}{4}\int_0^t \cos(4z)\left[\sin(4t)\cos(4z) - \cos(4t)\sin(4z)\right]dz.$$

$$\frac{1}{4}\left(\sin(4t)\int_0^t \cos^2(4z)\,dz - \cos(4t)\int_0^t \cos(4z)\sin(4z)\,dz\right)$$

$$\frac{1}{4}\left(\sin(4t)\int_0^t\left(\frac{1}{2}+\frac{1}{2}\cos(8z)\right)dz - \frac{\cos(4t)}{4}\int_0^t \sin(4z)\cos(4z)\,4\,dz.\right)$$

$$\frac{1}{4}\left(\frac{\sin(4t)}{2}\int_0^t dz + \frac{\sin(4t)}{16}\int \cos(8z)\,8\,dz - \frac{\cos(4t)}{4}\left(\frac{\sin^2(4z)}{2}\right)_0^t\right)$$

$$\frac{1}{4}\left(\frac{\sin(4t)}{2}\left(z\right)_0^t + \frac{\sin(4t)}{16}\left(\sin(8z)\right)_0^t - \frac{\cos(4t)}{4}\left(\frac{\sin^2(4z)}{2}\right)_0^t\right)$$

$$\frac{1}{4}\left(\frac{\sin(4t)}{2}\left[t-(0)\right] + \frac{\sin(4t)}{16}\left[\sin(8t)-(0)\right] - \frac{\cos(4t)}{4}\left[\frac{\sin^2(4t)}{2}-(0)\right]\right)$$

$$\frac{1}{4}\left(\frac{t\sin(4t)}{2} + \frac{\sin(4t)}{16}\left(2\sin(4t)\cos(4t)\right) - \frac{\cos(4t)}{8}\left(\sin^2(4t)\right)\right)$$

$$\frac{1}{4}\left(\frac{t\sin(4t)}{2} + \cancel{\frac{\sin^2(4t)\cos(4t)}{8}} - \cancel{\frac{\sin^2(4t)\cos(4t)}{8}}\right)$$

$$\mathcal{L}^{-1}\left\{\frac{s}{(s^2+16^2)^2}\right\} = \frac{t\sin(4t)}{8}$$

$$\mathcal{L}\{f(t)\} = F(s)$$

$f, t \in \mathbb{R}$

$F \in \mathbb{R}$

$s \in \mathbb{C}$

$$\mathcal{L}^{-1}\{F(s)\} = f(t)$$

$F \in \mathbb{R}$

$s \in \mathbb{C}$

$f, t \in \mathbb{R}$

$$Ecuacion := \frac{d}{dt}\, y(t) + \int_0^t y(v)\, e^{-2t+2v}\, dv = 1$$

$$\frac{dy}{dt} + \int_0^t y(z)\, e^{-2(t-z)}\, dz = 1$$

$$\mathcal{L}\left\{\frac{dy}{dt}\right\} + \mathcal{L}\{y(t)\} \cdot \mathcal{L}\{e^{-2t}\} = \mathcal{L}\{1\}$$

$$\mathcal{L}\{y(t)\} - y(0) + \mathcal{L}\{y(t)\} \cdot \left(\frac{1}{s+2}\right) = \frac{1}{s}$$

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

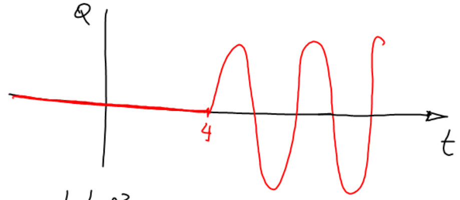
$$\mathcal{L}\{y(t)\} = \frac{\frac{1}{s} + 1}{1 + \frac{1}{s+2}}$$

$$= \frac{\frac{1+s}{s}}{\frac{s+2+1}{s+2}}$$

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

math rep. Electrical Switch

$$\frac{d^2y}{dt^2}-\frac{dy}{dt}+y=u(t-4)\cdot\sin\left(60\pi(t-4)\right)$$



$y(0)=0$

$y'(0)=1$

$$\mathcal{L}\left\{\frac{d^2y}{dt^2}\right\}-\mathcal{L}\left\{\frac{dy}{dt}\right\}+\mathcal{L}\{y\}=\mathcal{L}\left\{u(t-4)\sin\left(60\pi(t-4)\right)\right\}$$

$$\left(s^2\mathcal{L}\{y\}-s(0)-(1)\right)-\left(s\mathcal{L}\{y\}-(0)\right)+\mathcal{L}\{y\}=$$

$$=\frac{e^{-4s}\,60\pi}{s^2+3600\pi^2}$$

$$\mathcal{L}\{\sin(60\pi t)\}=\frac{60\pi}{s^2+3600\pi^2}$$

$$(s^2-s+1)\mathcal{L}\{y\}=60\pi\frac{e^{-4s}}{s^2+3600\pi^2}+1$$

$$(s^2-s+1)\mathcal{L}\{y\}=\left(\frac{s^2+3600\pi^2+60\pi e^{-4s}}{s^2+3600\pi^2}\right)$$

$$s=\frac{1\pm\sqrt{(-1)^2-4(1)(1)}}{2(1)}=\frac{1\pm\sqrt{-3}}{2}$$

$$\mathcal{L}\{y\}=\frac{s^2+\left(3600\pi^2+60\pi e^{-4s}\right)}{(s^2+3600\pi^2)(s^2-s+1)}$$

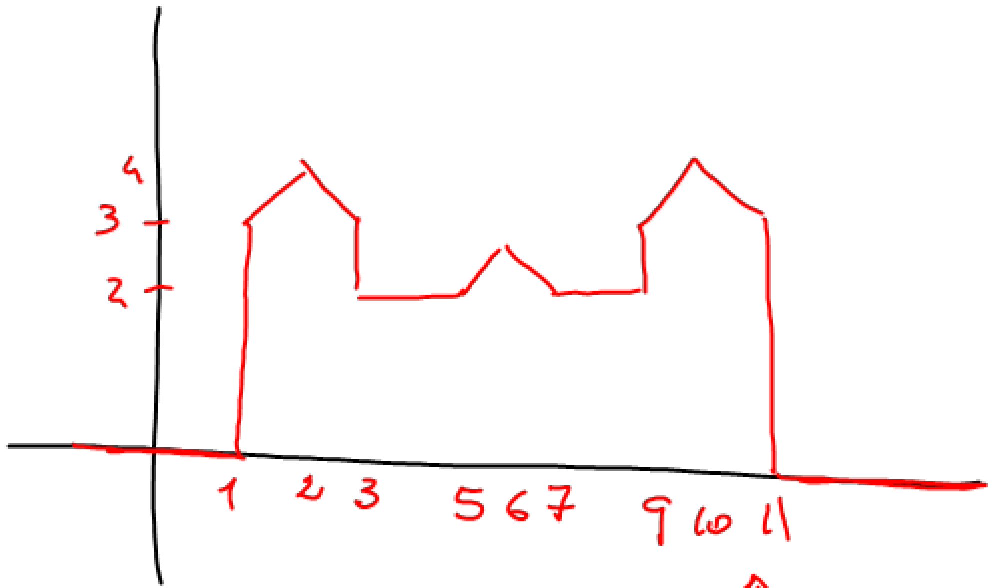
$$\frac{s^2+\left(3600\pi^2+60\pi e^{-4s}\right)}{(s^2+3600\pi^2)(s^2-s+1)}=\frac{As+B}{s^2+3600\pi^2}+\frac{Cs+D}{s^2-s+1}$$

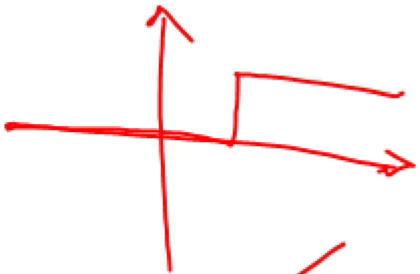
$$+\frac{Cs+D}{\left(s^2-s+\frac{1}{4}\right)+\frac{3}{4}}$$

$$+\frac{Cs+D}{\left(s-\frac{1}{2}\right)^2+\left(\frac{\sqrt{3}}{2}\right)^2}$$

$\cos(60\pi t)$ $\quad$ $\operatorname{sen}(60\pi t)$

$e^{\frac{1}{2}t}\cos\left(\frac{\sqrt{3}}{2}t\right)$ $\quad$ $e^{\frac{1}{2}t}\operatorname{sen}\left(\frac{\sqrt{3}}{2}t\right)$



$u(t-a) =$ 

$r(t-a) =$