**Definición**

$$\mathcal{L}[f(t)] = F(s) = \int_{0}^{\infty} e^{-st} f(t)dt$$

**Propiedades**

*1. Linealidad*

$$\mathcal{L}[a\,f(t) + b\,g(t)] = a\,\mathcal{L}[f(t)] + b\,\mathcal{L}[g(t)]$$

*2. Tranformación de funciones trasladadas*

$$\mathcal{L}[f(t-L)] = e^{-Ls}\,\mathcal{L}[f(t)]$$

*3. Tranformación de la diferenciación real*

$$\mathcal{L}\left[\frac{df(t)}{dt}\right] = s\,F(s) - f(0)$$

$$\mathcal{L}\left[\frac{d^2 f(t)}{dt^2}\right] = s^2\,F(s) - s\,f(0) - \left.\frac{df}{dt}\right|_{t=0}$$

*4. Transformación de la integral temporal*

$$\mathcal{L}\left[\int_{0}^{t} f(\tau)d\tau\right] = \frac{F(s)}{s}$$

*5. Teorema del valor inicial*

$$\lim_{t \to 0} f(t) = \lim_{s \to \infty}[sF(s)]$$

*6. Teorema del valor final*

$$\lim_{t \to \infty} f(t) = \lim_{s \to 0}[sF(s)]$$

| f(t) | F(s) |
|---|---|
| $\delta(t)$ (Impulso unitario) | $1$ |
| 1 (escalón unitario) | $\dfrac{1}{s}$ |
| t (rampa unitaria) | $\dfrac{1}{s^2}$ |
| $t^{n-1}$ | $\dfrac{(n-1)!}{s^n}$ |
| $e^{-at}$ | $\dfrac{1}{s+a}$ |
| $\dfrac{1}{\tau}e^{-t/\tau}$ | $\dfrac{1}{\tau s + 1}$ |
| $\dfrac{1}{\tau^n(n-1)!}t^{n-1}e^{-t/\tau}$ | $\dfrac{1}{(\tau s + 1)^n}$ |
| $\dfrac{1}{\tau_1 - \tau_2}(e^{-t/\tau_1} - e^{-t/\tau_2})$ | $\dfrac{1}{(\tau_1 s+1)(\tau_2 s+1)}$ |
| $1 - \dfrac{\tau_1 - \tau_3}{\tau_1 - \tau_2}e^{-t/\tau_1} + \dfrac{\tau_2 - \tau_3}{\tau_1 - \tau_2}e^{-t/\tau_2}$ | $\dfrac{\tau_3 s+1}{s(\tau_1 s+1)(\tau_2 s+1)}$ |
| $1 - e^{-t/\tau}$ | $\dfrac{1}{s(\tau s + 1)}$ |
| $1 + \dfrac{1}{\tau_1 - \tau_2}(\tau_2 e^{-t/\tau_2} - \tau_1 e^{-t/\tau_1})$ | $\dfrac{1}{s(\tau_1 s + 1)(\tau_2 s + 1)}$ |
| $1 - \dfrac{(\tau + t)}{\tau}e^{-t/\tau}$ | $\dfrac{1}{s(\tau s + 1)^2}$ |
| $\text{sen}(\omega t)$ | $\dfrac{\omega}{s^2 + \omega^2}$ |
| $\cos(\omega t)$ | $\dfrac{s}{s^2 + \omega^2}$ |
| $e^{-at}\,\text{sen}(\omega t)$ | $\dfrac{\omega}{(s+a)^2 + \omega^2}$ |

| f(t) | F(s) |
|---|---|
| $e^{-at}\cos(\omega t)$ | $\dfrac{s+a}{(s+a)^2+\omega^2}$ |
| $\dfrac{\omega_n}{\sqrt{1-\xi^2}}\,e^{-\xi\omega_n t}\,\mathrm{sen}(\omega_n\sqrt{1-\xi^2}\,t)$ | $\dfrac{1}{\dfrac{1}{\omega_n^2}s^2+\dfrac{2\xi}{\omega_n}s+1}$ |
| $1-\dfrac{1}{\sqrt{1-\xi^2}}\,e^{-\xi\omega_n t}\,sen(\omega_n\sqrt{1-\xi^2}\,t-\phi)$ <br><br> $tg\,\phi=\dfrac{\sqrt{1-\xi^2}}{-\xi}\qquad 0\le\xi<1$ | $\dfrac{1}{s\left(\dfrac{1}{\omega_n^2}s^2+\dfrac{2\xi}{\omega_n}s+1\right)}$ |
| $\tau(e^{-t/\tau}+\dfrac{t}{\tau}-1)$ | $\dfrac{1}{s^2(\tau s+1)}$ |
| $\dfrac{\omega\tau}{\tau^2\omega^2+1}e^{-t/\tau}+\dfrac{1}{\sqrt{\tau^2\omega^2+1}}sen(\omega t+\phi)$ <br><br> $tg\phi=-\tau\omega$ | $\dfrac{\omega}{(\tau s+1)(s^2+\omega^2)}$ |