$$\mathcal{L}\{\delta(t)\}=1$$

$$\mathcal{L}\{u(t)\}=\frac{1}{s}$$

$$\mathcal{L}\{tu(t)\}=\frac{1}{s^2}$$

$$\mathcal{L}\left\{\frac{t^{m-1}}{(m-1)!}u(t)\right\}=\frac{1}{s^m}$$

$$\mathcal{L}\{e^{-at}u(t)\}=\frac{1}{s+a}$$

$$\mathcal{L}\{te^{-at}u(t)\}=\frac{1}{(s+a)^2}$$

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

$$\mathcal{L}\{\cos(\omega_0 t)u(t)\}=\frac{s}{s^2+\omega_0^2}$$

$$\mathcal{L}\{\sin(\omega_0 t)u(t)\}=\frac{\omega_0}{s^2+\omega_0^2}$$

$$\mathcal{L}\{e^{-\alpha t}\cos(\omega_0 t)u(t)\}=\frac{s+\alpha}{(s+\alpha)^2+\omega_0^2}$$

$$\mathcal{L}\{e^{-\alpha t}\sin(\omega_0 t)u(t)\}=\frac{\omega_0}{(s+\alpha)^2+\omega_0^2}$$

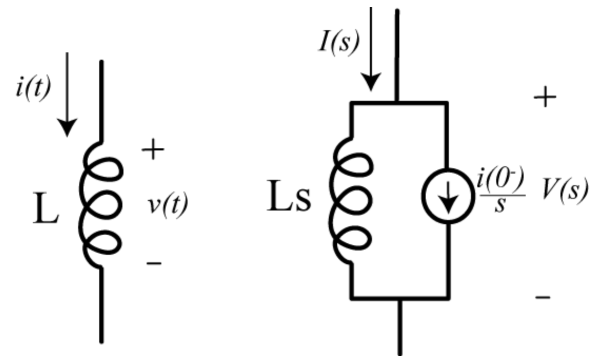
$$\mathcal{L}\left\{\frac{dx(t)}{dt}\right\}=sX(s)-x(0^-)$$

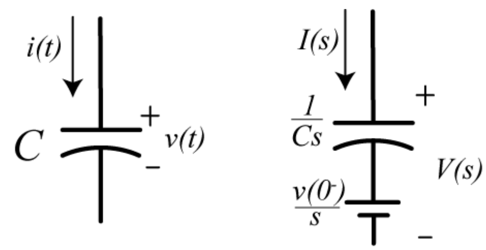
$$\mathcal{L}\left\{\frac{d^2x(t)}{dt^2}\right\}=s^2X(s)-sx(0^-)-\dot{x}(0^-)$$

$$\mathcal{L}\{x(t-a)\}=e^{-as}X(s)$$

$$\mathcal{L}\{e^{-at}x(t)\}=X(s+a)$$

$$\mathcal{L}\left\{x\left(\frac{t}{a}\right), a>0\right\}=aX(as)$$





Second Order System Properties

Percent Overshoot: $P.O.=e^{\frac{-\zeta\pi}{\sqrt{1-\zeta^2}}}\times 100\%$

If $\beta=\dfrac{PO^{max}}{100}$ then $\zeta=\dfrac{\frac{-\ln(\beta)}{\pi}}{\sqrt{1+\left(\frac{-\ln(\beta)}{\pi}\right)^2}}$,

$\theta=cos^{-1}(\zeta)$ Time to Peak:

$T_p=\dfrac{\pi}{\omega_d},\quad \omega_d=\omega_n\sqrt{1-\zeta^2}$

2% Settling Time: $T_s=\dfrac{4}{\zeta\omega_n}=4\tau$

Initial Value Theorem: If $x(t)\leftrightarrow X(s)$ $\lim_{t\to 0^+}x(t)=\lim_{s\to\infty}sX(s)$

Final Value Theorem: If $x(t)\leftrightarrow X(s)$ $\lim_{t\to\infty}x(t)=\lim_{s\to 0}sX(s)$