## sum.lap Laplace transforms

Table lap.1 is a table with functions of time $f(t)$ on the left and corresponding Laplace transforms $L(s)$ on the right. Where applicable, $s = \sigma + j\omega$ is the Laplace transform variable, $T$ is the time-domain period, $\omega_0 2\pi/T$ is the corresponding angular frequency, $j = \sqrt{-1}$, $a \in \mathbb{R}^+$, and $b, t_0 \in \mathbb{R}$ are constants.

**Table lap.1:** Laplace transform identities.

| function of time t | function of Laplace s |
|---|---|
| $a_1 f_1(t) + a_2 f_2(t)$ | $a_1 F_1(s) + a_2 F_2(s)$ |
| $f(t - t_0)$ | $F(s)e^{-t_0 s}$ |
| $f'(t)$ | $sF(s) - f(0)$ |
| $\dfrac{d^n f(t)}{dt^n}$ | $s^n F(s) + s^{(n-1)} f(0) + s^{(n-2)} f'(0) + \cdots + f^{(n-1)}(0)$ |
| $\int_0^t f(\tau)d\tau$ | $\frac{1}{s}F(s)$ |
| $tf(t)$ | $-F'(s)$ |
| $f_1(t) * f_2(t) = \int_{-\infty}^{\infty} f_1(\tau) f_2(t-\tau)d\tau$ | $F_1(s)F_2(s)$ |
| $\delta(t)$ | $1$ |
| $u_s(t)$ | $1/s$ |
| $u_r(t)$ | $1/s^2$ |
| $t^{n-1}/(n-1)!$ | $1/s^n$ |
| $e^{-at}$ | $\dfrac{1}{s+a}$ |
| $te^{-at}$ | $\dfrac{1}{(s+a)^2}$ |
| $\dfrac{1}{(n-1)!} t^{n-1} e^{-at}$ | $\dfrac{1}{(s+a)^n}$ |
| $\dfrac{1}{a-b}(e^{at} - e^{bt})$ | $\dfrac{1}{(s-a)(s-b)}$ $(a \neq b)$ |
| $\dfrac{1}{a-b}(ae^{at} - be^{bt})$ | $\dfrac{s}{(s-a)(s-b)}$ $(a \neq b)$ |
| $\sin \omega t$ | $\dfrac{\omega}{s^2 + \omega^2}$ |
| $\cos \omega t$ | $\dfrac{s}{s^2 + \omega^2}$ |
| $e^{at} \sin \omega t$ | $\dfrac{\omega}{(s-a)^2 + \omega^2}$ |
| $e^{at} \cos \omega t$ | $\dfrac{s-a}{(s-a)^2 + \omega^2}$ |

$u_s(t)\, e^{-at}$

$\frac{1}{s^2} e^{-2s}$

$F(s) = \frac{1}{s^2}$ $t_0 = 2$

$f(t) = u_r(t)$

$u_r(t - t_0) = u_r(t-2)$