

B.01 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
$a_1 f_1(t) + a_2 f_2(t)$	$a_1 F_1(s) + a_2 F_2(s)$
$f(t - t_0)$	$F(s)e^{-t_0 s}$
$f'(t)$	$sF(s) - f(0)$
$\frac{d^n f(t)}{dt^n}$	$s^n F(s) + s^{(n-1)}f(0) + s^{(n-2)}f'(0) + \dots + f^{(n-1)}(0)$
$\int_0^t f(\tau) d\tau$	$\frac{1}{s} F(s)$
$tf(t)$	$-F'(s)$
$f_1(t) * f_2(t) = \int_{-\infty}^{\infty} f_1(\tau) f_2(t - \tau) d\tau$	$F_1(s)F_2(s)$
$\delta(t)$	1
$u_s(t)$	$1/s$
$u_\tau(t)$	$1/s^2$
$t^{n-1}/(n-1)!$	$1/s^n$
e^{-at}	$\frac{1}{s+a}$
te^{-at}	$\frac{1}{(s+a)^2}$

$\frac{1}{(n-1)!} t^{n-1} e^{-at}$	$\frac{1}{(s+a)^n}$
$\frac{1}{a-b} (e^{at} - e^{bt})$	$\frac{1}{(s-a)(s-b)} \quad (a \neq b)$
$\frac{1}{a-b} (ae^{at} - be^{bt})$	$\frac{s}{(s-a)(s-b)} \quad (a \neq b)$
$\sin \omega t$	$\frac{\omega}{s^2 + \omega^2}$
$\cos \omega t$	$\frac{s}{s^2 + \omega^2}$
$e^{at} \sin \omega t$	$\frac{\omega}{(s-a)^2 + \omega^2}$
$e^{at} \cos \omega t$	$\frac{s-a}{(s-a)^2 + \omega^2}$
