

Table of Laplace Transforms for Vibrations

This is a partial lists of important Laplace transforms for vibrations that assumes zero initial conditions, $0 < t$, and $\zeta < 1$.

$f(t)$	$\mathcal{L}[f(t)] = F(s)$		$f(t)$	$\mathcal{L}[f(t)] = F(s)$	
$\delta(t)$	1	(1)	$\frac{1}{\omega^3}(\omega t - \sin(\omega t))$	$\frac{1}{s^2(s^2 + \omega^2)}$	(17)
$\delta(t - t_0)$	e^{-st_0}	(2)	$\frac{1}{2\omega^3}(\sin(\omega t) - \omega t \cos(\omega t))$	$\frac{1}{(s^2 + \omega^2)^2}$	(18)
1	$\frac{1}{s}$	(3)	$\frac{t}{2\omega} \sin(\omega t)$	$\frac{s}{(s^2 + \omega^2)^2}$	(19)
e^{at}	$\frac{1}{s - a}$	(4)	$t \sin(\omega t)$	$\frac{2\omega s}{(s^2 + \omega^2)^2}$	(20)
$\sin(\omega t)$	$\frac{\omega}{s^2 + \omega^2}$	(5)	$t \cos(\omega t)$	$\frac{s^2 - \omega^2}{(s^2 + \omega^2)^2}$	(21)
$\cos(\omega t)$	$\frac{s}{s^2 + \omega^2}$	(6)	$e^{at} \sin(\omega t)$	$\frac{\omega}{(s - a)^2 + \omega^2}$	(22)
$\sinh(\omega t)$	$\frac{\omega}{s^2 - \omega^2}$	(7)	$e^{at} \cos(\omega t)$	$\frac{s - a}{(s - a)^2 + \omega^2}$	(23)
$\cosh(\omega t)$	$\frac{s}{s^2 - \omega^2}$	(8)	$e^{at} \sinh(\omega t)$	$\frac{\omega}{(s - a)^2 - \omega^2}$	(24)
$\frac{1}{\omega^2}(1 - \cos(\omega t))$	$\frac{1}{s(s^2 + \omega^2)}$	(9)	$e^{at} \cosh(\omega t)$	$\frac{s - a}{(s - a)^2 - \omega^2}$	(25)
$\frac{1}{\omega_d} e^{-\zeta \omega t} \sin(\omega_d t)$	$\frac{1}{s^2 + 2\zeta \omega s + \omega^2}$	(10)	$\frac{1}{\omega_2} \sin(\omega_2 t) - \frac{1}{\omega_1} \sin(\omega_1 t)$	$\frac{\omega_1^2 - \omega_2^2}{(s^2 + \omega_1^2)(s^2 + \omega_2^2)}$	(26)
$1 - \frac{\omega}{\omega_d} e^{-\zeta \omega t} \sin(\omega_d t + \phi),$ $\phi = \cos^{-1}(\zeta)$	$\frac{\omega^2}{s(s^2 + 2\zeta \omega s + \omega^2)}$	(11)	$\cos(\omega_2 t) - \cos(\omega_1 t)$	$\frac{s(\omega_1^2 - \omega_2^2)}{(s^2 + \omega_1^2)(s^2 + \omega_2^2)}$	(27)
$\frac{t^{n-1}}{(n-1)!}, n = 1, 2, \dots$	$\frac{1}{s^n}$	(12)	$e^{at} f(t)$	$F(s - a)$	(28)
$t^n, n = 1, 2, \dots$	$\frac{n!}{s^{n+1}}$	(13)	$f(t - a)\Phi(t - a)$	$e^{-as}F(s)$	(29)
$t^n e^{\omega t}, n = 1, 2, \dots$	$\frac{n!}{(s - \omega)^{n+1}}$	(14)	$\Phi(t - a)$	$\frac{e^{-as}}{s}$	(30)
$\frac{1}{\omega}(1 - e^{-\omega t})$	$\frac{1}{s(s + \omega)}$	(15)	$f'(t)$	$sF(s) - f(0)$	(31)
$\frac{1}{\omega^2}(e^{-\omega t} + \omega t - 1)$	$\frac{1}{s^2(s + \omega)}$	(16)			