Laplace transform expressions:

Definition: $F(s) = L\{f(t)\} = \int_0^\infty f(t)e^{-st}\,dt$

Laplace transformation	Time domain function
$F(s)$	$f(t)$
$C_1F_2(s) + C_2F_2(s)$	$C_1f_2(t) + C_2f_2(t)$
$F(s+a)$	$e^{-at}f(t)$
$e^{-as}F(s)$	$\begin{cases} 0, & t \le a \\ f(t-a), & t > a \end{cases}$
$\frac{1}{a}F\left(\frac{s}{a}\right)$	$f(at)$
$F_1(s)F_2(s)$	$\int_0^t f_1(\tau)f_2(t-\tau)d\tau$
$sF(s) - f(0)$	$f'(t)$
$s^nF(s) - \left[s^{n-1}f(0) + \ldots + f^{(n-1)}(0)\right]$	$f^{(n)}(t)$

Initial and final value theorems: If the limits of $f(t)$ and $F(s)$ exist and are finite, then:

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

Laplace transformations and Time domain responses

Laplace transformation	Time domain function
1	$\delta(t)$
$1 / s$	1
$1 / s^2$	t
$1 / s^{n+1}$	$t^n / n!$
$\frac{1}{s+a}$	e^{-at}
$\frac{1}{(s+a)^{n+1}}$	$\frac{t^n e^{-at}}{n!}$
$\frac{1}{s(s+a)}$	$\frac{1}{a}\left(1-e^{-at}\right)$
$\frac{1}{(s+a)(s+b)}$	$\frac{1}{a-b}\left(e^{-bt} - e^{-at}\right)$
$\frac{1}{s(s+a)(s+b)}$	$\frac{1}{ab} + \frac{1}{ab(b-a)}\left(ae^{-bt} - be^{-at}\right)$
$\frac{a}{s^2+a^2}$	$\sin(at)$
$\frac{s}{s^2+a^2}$	$\cos(at)$
$\frac{a}{(s+b)^2+a^2}$	$e^{-bt}\sin(at)$
$\frac{s+b}{(s+b)^2+a^2}$	$e^{-bt}\cos(at)$
$\frac{s+a}{s+b}$	$\delta(t)+(a-b)e^{-bt}$