Laplace Transform Formulas
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Name	$f(t)$	$F(s)$
Definition	$\int_0^\infty e^{-st} f(t) dt$	$F(s)$
Unit Impulse	$\delta(t)$	1
Unit Step	$u(t) = 1$	$\frac{1}{s}$
Unit Ramp	$r(t) = t$	$\frac{1}{s^2}$
Power	$t^n \quad (n = 0, 1, \dots)$	$\frac{n!}{s^{n+1}}$
Exponential	e^{-at}	$\frac{1}{s+a}$
Time multiplied Exp.	te^{-at}	$\frac{1}{(s+a)^2}$
Repeated Root Factor	$\frac{t^{n-1}e^{-at}}{(n-1)!} \quad (n = 1, 2, \dots)$	$\frac{1}{(s+a)^n}$
Asymptotic Exponential	$\frac{1}{a}(1 - e^{-at})$	$\frac{1}{s(s+a)}$
Dual Exponential	$\frac{1}{b-a}(e^{-at} - e^{-bt})$	$\frac{1}{(s+a)(s+b)}$
Asymptotic Dual Exp.	$\frac{1}{ab}\left[1 + \frac{be^{-at} - ae^{-bt}}{a-b}\right]$	$\frac{1}{s(s+a)(s+b)}$
Sine	$\sin(\omega t)$	$\frac{\omega}{s^2+\omega^2}$
Cosine	$\cos(\omega t)$	$\frac{s}{s^2+\omega^2}$
Decaying Sine	$e^{-at}\sin(\omega t)$	$\frac{\omega}{(s+a)^2+\omega^2}$
Decaying Cosine	$e^{-at}\cos(\omega t)$	$\frac{s+a}{(s+a)^2+\omega^2}$
Generic Oscillatory Decay	$e^{-at}\left[B\cos(\omega_d t) + \frac{C-aB}{\omega_d}\sin(\omega_d t)\right]$	$\frac{Bs+C}{(s+a)^2+\omega_d^2}$
Prototype 2nd Order (Impulse Resp.)	$\frac{\omega_n}{\sqrt{1-\zeta^2}}e^{-\zeta\omega_n t}\sin(\omega_n\sqrt{1-\zeta^2}t)$	$\frac{\omega_n^2}{s^2+2\zeta\omega_n s+\omega_n^2}$
Prototype 2nd Order (Step Resp.)	$1 - \frac{e^{-\zeta\omega_n t}}{\sqrt{1-\zeta^2}}\sin(\omega_n\sqrt{1-\zeta^2}t + \phi)$	$\frac{\omega_n^2}{s(s^2+2\zeta\omega_n s+\omega_n^2)}$
where $\phi = \arctan\left(\frac{\sqrt{1-\zeta^2}}{\zeta}\right)$		

Laplace Transform Properties

Name	Time Domain	Laplace Domain
Linearity (A, B: real constants)	$Af(t) + Bg(t)$	$AF(s) + BG(s)$
First Derivative	$\frac{df(t)}{dt}$	$sF(s) - f(0^-)$
Second Derivative	$\frac{d^2 f(t)}{dt^2}$	$s^2F(s) - sf(0^-) - f'(0^-)$
nth Derivative	$\frac{d^n f(t)}{dt^n}$	$s^nF(s) - \sum_{k=1}^{n} s^{n-k} f^{(k-1)}(0^-)$
Integral	$\int_0^t f(\lambda)d\lambda$	$\frac{F(s)}{s}$
Time Multiplication	$tf(t)$	$-\frac{dF(s)}{ds}$
Time Multiplication t^n	$t^n f(t)$	$(-1)^n \frac{d^n F(s)}{ds^n}$
Time Delay	$f(t-a)u(t-a)$	$e^{-as}F(s)$
Complex Shift (s-Shift)	$e^{-at}f(t)$	$F(s+a)$
Scaling	$f(t/a)$	$aF(as)$

Laplace Transform Theorems

Name	Time Domain	Laplace Domain
Convolution Property	$f * g = \int_0^t f(\tau)g(t-\tau)d\tau$	$F(s)G(s)$
Initial Value Theorem	$\lim_{t\to 0^+} f(t)$	$\lim_{s\to\infty} sF(s)$
Final Value Theorem	$\lim_{t\to\infty} f(t)$	$\lim_{s\to 0} sF(s)$

*FVT requires poles of $sF(s)$ to be in the Left Half-Plane (negative real parts), except possibly a single pole at s=0.

Laplace Dönüşümü konu anlatımı ve soru çözümleri için QR'ı okut.

Buraya tıkla, konu anlatımı ve soru çözümlerini izle.

Ya da buraya tıkla ve interaktif formül sayfasına git.