Laplace Transform

Tristan Slater

September 26, 2022

1 Definition

$$F(s) = \mathscr{L}\{f(t)\} = \int_0^\infty e^{-st} f(t) dt \tag{1}$$

Table 1: Laplace Lookup

	$f(t) = \mathscr{L}^{-1}\{F(s)\}$	$F(s) = \mathscr{L}\{f(t)\}$
Multiplying by a Constant	$af(at)$	$aF(s)$
Time Scaling	$f(at)$	$\frac{1}{a}F\left(\frac{s}{a}\right)$
Frequency Scaling	$\frac{1}{a}f\left(\frac{t}{a}\right)$	$F(as)$
Time Shifting	$f(t-a)u(t-a)$	$e^{-at}F(s)$
Frequency Shifting	$e^{at}f(t)$	$F(s-a)$
Convolution	$(f*g)(t)$	$F(s)G(s) = G(s)F(s)$
	1	$\frac{1}{s}$
	t^n	$\frac{n!}{s^{n+1}}$
	$\sin at$	$\frac{a}{s^2+a^2}$
	$\cos at$	$\frac{s}{s^2+a^2}$
	$\sinh at$	$\frac{a}{s^2-a^2}$
	$\cosh at$	$\frac{s}{s^2-a^2}$