Table 6.1

A Short Table of (Unilateral) Laplace Transforms

	$f(t)$	$F(s)$
1	$\delta(t)$	1
2	$u(t)$	$\frac{1}{s}$
3	$tu(t)$	$\frac{1}{s^2}$
4	$t^n u(t)$	$\frac{n!}{s^{n+1}}$
5	$e^{\lambda t}u(t)$	$\frac{1}{s-\lambda}$
6	$te^{\lambda t}u(t)$	$\frac{1}{(s-\lambda)^2}$
7	$t^n e^{\lambda t}u(t)$	$\frac{n!}{(s-\lambda)^{n+1}}$
8a	$\cos bt\, u(t)$	$\frac{s}{s^2+b^2}$
8b	$\sin bt\, u(t)$	$\frac{b}{s^2+b^2}$
9a	$e^{-at}\cos bt\, u(t)$	$\frac{s+a}{(s+a)^2+b^2}$
9b	$e^{-at}\sin bt\, u(t)$	$\frac{b}{(s+a)^2+b^2}$
10a	$re^{-at}\cos(bt+\theta)\, u(t)$	$\frac{(r\cos\theta)s+(ar\cos\theta-br\sin\theta)}{s^2+2as+(a^2+b^2)}$
10b	$re^{-at}\cos(bt+\theta)\, u(t)$	$\frac{0.5re^{j\theta}}{s+a-jb}+\frac{0.5re^{-j\theta}}{s+a+jb}$
10c	$re^{-at}\cos(bt+\theta)\, u(t)$	$\frac{As+B}{s^2+2as+c}$
	$r=\sqrt{\frac{A^2c+B^2-2ABa}{c-a^2}}$, $\theta=\tan^{-1}\frac{Aa-B}{A\sqrt{c-a^2}}$	
	$b=\sqrt{c-a^2}$	
10d	$e^{-at}\left[A\cos bt+\frac{B-Aa}{b}\sin bt\right]u(t)$	$\frac{As+B}{s^2+2as+c}$
	$b=\sqrt{c-a^2}$	

Table 6.2

The Laplace Transform Properties

Operation	$f(t)$	$F(s)$
Addition	$f_1(t)+f_2(t)$	$F_1(s)+F_2(s)$
Scalar multiplication	$kf(t)$	$kF(s)$
Time differentiation	$\frac{df}{dt}$	$sF(s)-f(0^-)$
	$\frac{d^2f}{dt^2}$	$s^2F(s)-sf(0^-)-\dot{f}(0^-)$
	$\frac{d^3f}{dt^3}$	$s^3F(s)-s^2f(0^-)-s\dot{f}(0^-)-\ddot{f}(0^-)$
Time integration	$\int_{0^-}^{t} f(\tau)\,d\tau$	$\frac{1}{s}F(s)$
	$\int_{-\infty}^{t} f(\tau)\,d\tau$	$\frac{1}{s}F(s)+\frac{1}{s}\int_{-\infty}^{0^-} f(t)\,dt$
Time shift	$f(t-t_0)u(t-t_0)$	$F(s)e^{-st_0}$ $t_0\geq 0$
Frequency shift	$f(t)e^{s_0t}$	$F(s-s_0)$
Frequency differentiation	$-tf(t)$	$\frac{dF(s)}{ds}$
Frequency integration	$\frac{f(t)}{t}$	$\int_s^{\infty} F(z)\,dz$
Scaling	$f(at)$, $a\geq 0$	$\frac{1}{a}F\left(\frac{s}{a}\right)$
Time convolution	$f_1(t)*f_2(t)$	$F_1(s)F_2(s)$
Frequency convolution	$f_1(t)f_2(t)$	$\frac{1}{2\pi j}F_1(s)*F_2(s)$
Initial value	$f(0^+)$	$\lim_{s\to\infty} sF(s)$ $(n>m)$
Final value	$f(\infty)$	$\lim_{s\to 0} sF(s)$ (poles of $sF(s)$ in LHP)