* **라플라스변환에 대한 기본적인 일반식**

공　　식	명명법, 설명
$F(s)=\mathcal{L}\{f(t)\}=\int_0^\infty e^{-st}f(t)dt$ $f(t)=\mathcal{L}^{-1}\{F(s)\}$	변환의 정의, 역변환
$\mathcal{L}\{af(t)+bg(t)\}=a\mathcal{L}\{f(t)\}+b\mathcal{L}\{g(t)\}$	선형
$\mathcal{L}(f')=s\mathcal{L}(f)-f(0)$ $\mathcal{L}(f'')=s^2\mathcal{L}(f)-sf(0)-f'(0)$ $\mathcal{L}(f^{(n)})=s^n\mathcal{L}(f)-s^{n-1}f(0)-\cdots-f^{(n-1)}(0)$ $\mathcal{L}\left\{\int_0^t f(\tau)d\tau\right\}=\frac{1}{s}\mathcal{L}(f)$	함수의 미분 함수의 적분
$\mathcal{L}(e^{at}f(t))=F(s-a)$ $\mathcal{L}^{-1}\{F(s-a)\}=e^{at}f(t)$	s-변위 (제1변위정리)
$\mathcal{L}\{f(t-a)u(t-a)\}=e^{-as}F(s)$ $\mathcal{L}^{-1}\{e^{-as}F(s)\}=f(t-a)u(t-a)$	변위 (제2변위정리)
$\mathcal{L}\{tf(t)\}=-F'(s)$ $\mathcal{L}\left\{\frac{f(t)}{t}\right\}=\int_s^\infty F(\hat{s})d\hat{s}$	변환의 미분 변환의 적분
$(f*g)(t)=\int_0^t f(\tau)g(t-\tau)d\tau$ $=\int_0^t f(t-\tau)g(\tau)d\tau$ $\mathcal{L}(f*g)=\mathcal{L}(f)\mathcal{L}(g)$	합성 (convolution)
$\mathcal{L}(f)=\frac{1}{1-e^{-ps}}\int_0^p e^{-st}f(t)dt$	주기 p를 가지는 주기함수 f

* Laplace변환표

$F(s)=\mathcal{L}\{f(t)\}$	$f(t)$
▶ $\frac{1}{s}$	1
▶ $\frac{1}{s^2}$	t
▶ $\frac{1}{s^n}$ $(n=1,2,\cdots)$	$\frac{t^{n-1}}{(n-1)!}$
▶ $\frac{1}{\sqrt{s}}$	$\frac{1}{\sqrt{\pi t}}$
▶ $\frac{1}{s^{3/2}}$	$2\sqrt{\frac{t}{\pi}}$
▶ $\frac{1}{s^a}$ (a>0)	$\frac{t^{a-1}}{\Gamma(a)}$: $\Gamma(n+1)=n!$
▶ $\frac{1}{s-a}$	e^{at}
▶ $\frac{1}{(s-a)^2}$	te^{at}
▶ $\frac{1}{(s-a)^n}$ $(n=1,2,\cdots)$	$\frac{1}{(n-1)!}t^{n-1}e^{at}$
▶ $\frac{1}{(s-a)^k}$ (k>0)	$\frac{1}{\Gamma(k)}t^{k-1}e^{at}$
▶ $\frac{1}{(s-a)(s-b)}$	$\frac{1}{(a-b)}(e^{at}-e^{bt})$
▶ $\frac{s}{(s-a)(s-b)}$	$\frac{1}{(a-b)}(ae^{at}-be^{bt})$
▶ $\frac{1}{s^2+w^2}$	$\frac{1}{w}\sin wt$
▶ $\frac{s}{s^2+w^2}$	$\cos wt$
▶ $\frac{1}{s^2-a^2}$	$\frac{1}{a}\sinh at$
▶ $\frac{s}{s^2-a^2}$	$\cosh at$
▶ $\frac{1}{(s-a)^2+w^2}$	$\frac{1}{w}e^{at}\sin wt$
▶ $\frac{s-a}{(s-a)^2+w^2}$	$e^{at}\cosh wt$
▶ $\frac{1}{s(s^2+w^2)}$	$\frac{1}{w^2}(1-\cos wt)$
▶ $\frac{1}{s^2(s^2+w^2)}$	$\frac{1}{w^3}(wt-\sin wt)$
▶ $\frac{1}{(s^2+w^2)^2}$	$\frac{1}{2w^3}(\sin wt-wt\cos wt)$

$F(s)=\mathcal{L}\{f(t)\}$	$f(t)$
▶ $\dfrac{s}{(s^2+w^2)^2}$	$\dfrac{1}{2w}\sin wt$
▶ $\dfrac{s^2}{(s^2+w^2)^2}$	$\dfrac{1}{2w}(\sin wt + wt\cos wt)$
▶ $\dfrac{s}{(s^2+a^2)(s^2+b^2)}$ $(a^2 \neq b^2)$	$\dfrac{1}{b^2-a^2}(\cos at - \cos bt)$
▶ $\dfrac{1}{s^4+4k^4}$	$\dfrac{1}{4k^3}(\sin kt\ \cosh kt - \cos kt\ \sinh kt)$
▶ $\dfrac{s}{s^4+4k^4}$	$\dfrac{1}{2k^2}\sin kt\ \sinh kt$
▶ $\dfrac{1}{s^4-4k^4}$	$\dfrac{1}{2k^3}(\sinh kt - \sin kt)$
▶ $\dfrac{s}{s^4-4k^4}$	$\dfrac{1}{2k^2}(\cosh kt - \cos kt)$
▶ $\sqrt{s-a}-\sqrt{s-b}$	$\dfrac{1}{2\sqrt{\pi t^3}}(e^{bt}-e^{at})$
▶ $\dfrac{1}{\sqrt{s+a}\sqrt{s+b}}$	$e^{-\frac{(a+b)}{2}t} I_o\left(\dfrac{a-b}{2}t\right)$
▶ $\dfrac{1}{\sqrt{s^2+a^2}}$	$J_0(at)$: Bessel 함수
▶ $\dfrac{s}{\sqrt{(s-a)^3}}$	$\dfrac{1}{\sqrt{\pi t}}e^{at}(1+2at)$
▶ $\dfrac{1}{(s^2-a^2)^k}$ $(k>0)$	$\dfrac{\sqrt{\pi}}{\Gamma(k)}\left(\dfrac{t}{2a}\right)^{k-1/2} I_{k-1/2}(at)$
▶ $\dfrac{e^{-as}}{s}$	$u(t-a)$
▶ e^{-as}	$\delta(t-a)$
▶ $\dfrac{1}{s}e^{-k/s}$	$J_0(2\sqrt{kt})$
▶ $\dfrac{1}{\sqrt{s}}e^{-k/s}$	$\dfrac{1}{\sqrt{\pi t}}\cos 2\sqrt{kt}$
▶ $\dfrac{1}{\sqrt{s^3}}e^{k/s}$	$\dfrac{1}{\sqrt{\pi k}}\sinh 2\sqrt{kt}$
▶ $e^{-k\sqrt{s}}$ $(k>0)$	$\dfrac{k}{2\sqrt{\pi t^3}}e^{-k^2/4t}$
▶ $\dfrac{1}{s}\ln s$	$-\ln t - \gamma$ $(\gamma \approx 0.5772)$
▶ $\ln\dfrac{s-a}{s-b}$	$\dfrac{1}{t}(e^{bt}-e^{at})$
▶ $\ln\dfrac{s^2+w^2}{s^2}$	$\dfrac{2}{t}(1-\cos wt)$
▶ $\ln\dfrac{s^2-a^2}{s^2}$	$\dfrac{2}{t}(1-\cosh at)$