sum.ft Fourier transforms

Table ft.1 is a table with functions of time $f(t)$ on the left and corresponding Fourier transforms $F(\omega)$ on the right. Where applicable, T is the time-domain period, $\omega_0 2\pi/T$ is the corresponding angular frequency, $j = \sqrt{-1}$, $a \in \mathbb{R}^+$, and $b, t_0 \in \mathbb{R}$ are constants. Furthermore, f_e and f_0 are even and odd functions of time, respectively, and it can be shown that any function f can be written as the sum $f(t) = f_e(t) + f_0(t)$. (H.P. Hsu. Fourier Analysis. Simon & Schuster, 1967. ISBN: 9780671270377)

Table ft.1: Fourier transform identities.

function of time t	function of frequency ω	
$a_1 f_1(t) + a_2 f_2(t)$	$a_1 F_1(\omega) + a_2 F_2(\omega)$	$F(f(t)) = F(\omega)$
$f(at)$	$\frac{1}{\lvert a\rvert} F(\omega/a)$	
$f(-t)$	$F(-\omega)$	
$f(t - t_0)$	$F(\omega) e^{-j\omega t_0}$	
$f(t)\cos\omega_0 t$	$\frac{1}{2}F(\omega - \omega_0) + \frac{1}{2}F(\omega + \omega_0)$	
$f(t)\sin\omega_0 t$	$\frac{1}{j2}F(\omega - \omega_0) - \frac{1}{j2}F(\omega + \omega_0)$	
$f_e(t)$	$\operatorname{Re} F(\omega)$	
$f_0(t)$	$j \operatorname{Im} F(\omega)$	
$F(t)$	$2\pi f(-\omega)$	
$f'(t)$	$j\omega F(\omega)$	
$\frac{d^n f(t)}{dt^n}$	$(j\omega)^n F(\omega)$	
$\int_{-\infty}^{t} f(\tau)\, d\tau$	$\frac{1}{j\omega} F(\omega) + \pi F(0)\delta(\omega)$	
$-jtf(t)$	$F'(\omega)$	
$(-jt)^n f(t)$	$\frac{d^n F(\omega)}{d\omega^n}$	
$f_1(t) * f_2(t) = \int_{-\infty}^{\infty} f_1(\tau) f_2(t-\tau)\, d\tau$	$F_1(\omega) F_2(\omega)$	
$f_1(t) f_2(t)$	$\frac{1}{2\pi} F_1(\omega) * F_2(\omega) = \frac{1}{2\pi}\int_{-\infty}^{\infty} F_1(\alpha) F_2(\omega - \alpha)\, d\alpha$	
$e^{-at} u_s(t)$	$\frac{1}{j\omega + a}$	
$e^{-a\lvert t\rvert}$	$\frac{2a}{a^2 + \omega^2}$	$\int_{-\infty}^{\infty} e^{-at} e^{-j\omega t}\, dt$
e^{-at^2}	$\sqrt{\pi/a}\, e^{-\omega^2/(4a)}$	
1 for $\lvert t\rvert < a/2$, else 0	$\frac{a \sin(a\omega/2)}{a\omega/2}$	
$te^{-at} u_s(t)$	$\frac{1}{(a + j\omega)^2}$	$e^{-a(-\infty)} = e^{\infty} = \infty$
$\frac{t^{n-1}}{(n-1)!} e^{-at})^n u_s(t)$	$\frac{1}{(a + j\omega)^n}$	
$\frac{1}{a^2 + t^2}$	$\frac{\pi}{a} e^{-a\lvert\omega\rvert}$	
$\delta(t)$	1	
$\delta(t - t_0)$	$e^{-j\omega t_0}$	
$u_s(t)$	$\pi\delta(\omega) + \frac{1}{j\omega}$	
$u_s(t - t_0)$	$\pi\delta(\omega) + \frac{1}{j\omega} e^{-j\omega t_0}$	
1	$2\pi\delta(\omega)$	
t	$2\pi j\delta'(\omega)$	
t^n	$2\pi j^n \frac{d^n \delta(\omega)}{d\omega^n}$	
$e^{j\omega_0 t}$	$2\pi\delta(\omega - \omega_0)$	
$\cos\omega_0 t$	$\pi\delta(\omega - \omega_0) + \pi\delta(\omega + \omega_0)$	
$\sin\omega_0 t$	$-j\pi\delta(\omega - \omega_0) + j\pi\delta(\omega + \omega_0)$	
$u_s(t)\cos\omega_0 t$	$\frac{j\omega}{\omega_0^2 - \omega^2} + \frac{\pi}{2}\delta(\omega - \omega_0) + \frac{\pi}{2}\delta(\omega + \omega_0)$	
$u_s(t)\sin\omega_0 t$	$\frac{\omega_0}{\omega_0^2 - \omega^2} + \frac{\pi}{2j}\delta(\omega - \omega_0) - \frac{\pi}{2j}\delta(\omega + \omega_0)$	
$tu_s(t)$	$j\pi\delta'(\omega) - 1/\omega^2$	
$1/t$	$\pi j - 2\pi j u_s(\omega)$	
$1/t^n$	$\frac{(-j\omega)^{n-1}}{(n-1)!}(\pi j - 2\pi j u_s(\omega))$	
$\operatorname{sgn} t$	$\frac{2}{j\omega}$	
$\sum_{n=-\infty}^{\infty} \delta(t - nT)$	$\omega_0 \sum_{n=-\infty}^{\infty} \delta(\omega - n\omega_0)$	