Continuous-Time Fourier Transform

$$X(\omega)=\int_{-\infty}^{\infty} x(t)\, e^{-j\omega t}\, dt, \quad -\infty<\omega<\infty \quad \text{and} \quad x(t)=\tfrac{1}{2\pi}\int_{-\infty}^{\infty} X(\omega)\, e^{j\omega t}\, d\omega, \quad -\infty<t<\infty$$

Continuous-Time Fourier Transform Properties

Linearity	$a\,x(t)+b\,v(t)\leftrightarrow a\,X(\omega)+b\,V(\omega)$
Right/left time shift	$x(t-c)\leftrightarrow X(\omega)\,e^{-j\omega c}$
Time scaling	$x(at)\leftrightarrow \frac{1}{a}X\left(\frac{\omega}{a}\right), \quad a>0$
Time reversal	$x(-t)\leftrightarrow X(-\omega)=\overline{X(\omega)}$
Multiplication by t^n	$t^n\,x(t)\leftrightarrow (j)^n \dfrac{d^n X(\omega)}{d\omega^n}, \quad n=1,2,\ldots$
Multiplication by $e^{j\omega_0 t}$	$x(t)\,e^{j\omega_0 t}\leftrightarrow X(\omega-\omega_0), \quad \omega_0$ real
Multiplication by $\sin(\omega_0 t)$	$x(t)\sin(\omega_0 t)\leftrightarrow \frac{j}{2}\left[X(\omega+\omega_0)-X(\omega-\omega_0)\right]$
Multiplication by $\cos(\omega_0 t)$	$x(t)\cos(\omega_0 t)\leftrightarrow \frac{1}{2}\left[X(\omega+\omega_0)+X(\omega-\omega_0)\right]$
Differentiation wrt time	$\dfrac{d^n x(t)}{dt^n}\leftrightarrow (j\omega)^n X(\omega) \quad n=1,2,\ldots$
Integration	$\int_{-\infty}^{t} x(\lambda)\,d\lambda \leftrightarrow \frac{1}{j\omega}X(\omega)+\pi X(0)\,\delta(\omega)$
Convolution in time-domain	$x(t)*v(t)\leftrightarrow X(\omega)V(\omega)$
Multiplication in time-domain	$x(t)\,v(t)\leftrightarrow \frac{1}{2\pi}X(\omega)*V(\omega)$
Parseval's theorem	$\int_{-\infty}^{\infty} x(t)\,v(t)\,dt=\frac{1}{2\pi}\int_{-\infty}^{\infty}\overline{X(\omega)}\,V(\omega)\,d\omega$
Special case of Parseval's theorem	$\int_{-\infty}^{\infty} x^2(t)\,dt=\frac{1}{2\pi}\int_{-\infty}^{\infty}\lvert X(\omega)\rvert^2\,d\omega$
Duality	$X(t)\leftrightarrow 2\pi x(-\omega)$

Continuous-Time Fourier Transform pairs [i.e., $x(t)\leftrightarrow X(\omega)$]

$1, \quad -\infty<t<\infty \leftrightarrow 2\pi\delta(\omega)$	$-0.5+u(t)\leftrightarrow \dfrac{1}{j\omega}$
$u(t)\leftrightarrow \pi\,\delta(\omega)+\dfrac{1}{j\omega}$	$\delta(t)\leftrightarrow 1$
$\delta(t-c)\leftrightarrow e^{-j\omega c}, \quad c$ real	$e^{-bt}u(t)\leftrightarrow \dfrac{1}{j\omega+b}, \quad b>0$
$e^{j\omega_0 t}\leftrightarrow 2\pi\,\delta(\omega-\omega_0), \quad \omega_0$ any real number	
$p_\tau(t)\leftrightarrow \tau\,\mathrm{sinc}\left(\dfrac{\tau\omega}{2\pi}\right)$	$\tau\,\mathrm{sinc}\left(\dfrac{\tau t}{2\pi}\right)\leftrightarrow 2\pi\,p_\tau(\omega)$
$\Lambda_\tau(t)=\left(1-\dfrac{2\lvert t\rvert}{\tau}\right)p_\tau(t)\leftrightarrow \dfrac{\tau}{2}\mathrm{sinc}^2\left(\dfrac{\tau\omega}{4\pi}\right)$	$\dfrac{\tau}{2}\mathrm{sinc}^2\left(\dfrac{\tau t}{4\pi}\right)\leftrightarrow 2\pi\left(1-\dfrac{2\lvert\omega\rvert}{\tau}\right)p_\tau(\omega)=2\pi\,\Lambda_\tau(\omega)$
$\cos(\omega_0 t)\leftrightarrow \pi\left[\delta(\omega+\omega_0)+\delta(\omega-\omega_0)\right]$	$\cos(\omega_0 t+\theta)\leftrightarrow \pi\left[e^{-j\theta}\delta(\omega+\omega_0)+e^{j\theta}\delta(\omega-\omega_0)\right]$
$\sin(\omega_0 t)\leftrightarrow j\pi\left[\delta(\omega+\omega_0)-\delta(\omega-\omega_0)\right]$	$\sin(\omega_0 t+\theta)\leftrightarrow j\pi\left[e^{-j\theta}\delta(\omega+\omega_0)-e^{j\theta}\delta(\omega-\omega_0)\right]$