Basic Properties

Linearity

$$F\left[ag(x,y)+bh(x,y)\right]=aG(k_x,k_y)+bH(k_x,k_y)$$

Scaling

$$F\left\{g(ax)\right\}=\frac{1}{|a|}G\left(\frac{k_x}{a}\right) \qquad F\left[g(ax,by)\right]=\frac{1}{|ab|}G\left(\frac{k_x}{a},\frac{k_x}{b}\right)$$

Separability

$$F\left[g(x)h(y)\right]=G\left(k_x\right)H\left(k_y\right)$$

Duality

$$F\left\{G(x)\right\}=g(-k_x)$$

Shift

$$F\left[g(x-a,y-b)\right]=G(k_x,k_y)e^{-j2\pi(k_xa+k_yb)}$$

Convolution

$$F\left[g(x,y)**h(x,y)\right]=G(k_x,k_y)H(k_x,k_y)$$

Multiplication

$$F\left[g(x,y)h(x,y)\right]=G(k_x,k_y)**H(k_x,k_y)$$

Modulation

$$F\left[g(x,y)e^{j2\pi(xa+yb)}\right]=G(k_x-a,k_y-b)$$

Transform Pairs

$$\delta(x) \leftrightarrow 1$$

$$\delta(x - x_0) \leftrightarrow e^{-j2\pi k_x x_0}$$

$$1 \leftrightarrow \delta(k_x)$$

$$rect(x) \leftrightarrow \mathrm{sinc}(k_x)$$

$$\mathrm{sinc}(x) \leftrightarrow rect(k_x)$$

$$e^{j2\pi k_0 x} \leftrightarrow \delta(k_x - k_0)$$

$$\cos 2\pi k_0 x \leftrightarrow \frac{1}{2}\left(\delta(k_x - k_0) + \delta(k_x + k_0)\right)$$

$$\sin 2\pi k_0 x \leftrightarrow \frac{1}{2j}\left(\delta(k_x - k_0) - \delta(k_x + k_0)\right)$$

$$\Pi(x)\Pi(y) \leftrightarrow \mathrm{sinc}(k_x)\mathrm{sinc}(k_y)$$

$$\Lambda(x) \leftrightarrow \mathrm{sinc}^2(k_x)$$

$$comb(x) \leftrightarrow comb(k_x)$$

Useful facts and definitions

$$\mathrm{sinc}(k_x) = \frac{\sin(\pi k_x)}{\pi k_x}$$

$$\delta(x, y) = \delta(x)\delta(y)$$

$$\mathrm{sinc}(k_x, k_y) = \mathrm{sinc}(k_x)\mathrm{sinc}(k_y)$$

$$rect(x, y) = rect(x)rect(y)$$

$$\Lambda(x) = \begin{cases} 1 - |x| & |x| < 1 \\ 0 & otherwise \end{cases}$$

$$\delta(ax) = \frac{1}{|a|}\delta(x)$$