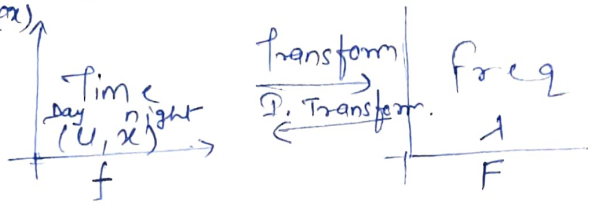
Fourier Transform → Signal

F.T $f(u) \to F(\lambda)$, $F(\lambda) \to f(x)$

$$F(\lambda) = \int f(u)\, e^{-i\lambda u}\, du$$



$f(u) \to F(\lambda) \to$ day shift

$F(\lambda) \to f(x) \to$ night shift

(1)(1)

F.T $f(u) \to F(\lambda)$

$$F(\lambda) = \int_{-\infty}^{\infty} f(u)\, e^{-i\lambda u}\, du$$

$F(\lambda) \to f(x)$

$$f(x) = \frac{1}{2\pi}\int_{-\infty}^{\infty} F(\lambda)\, e^{i\lambda x}\, d\lambda$$

FCT $f(u) \to F_c(\lambda)$

$$F_c(\lambda) = \int_0^{\infty} f(u)\cos\lambda u\, du$$

(Even)

$F_c(\lambda) \to f(x)$

$$f(x) = \frac{2}{\pi}\int_0^{\infty} F_c(\lambda)\cos\lambda x\, d\lambda$$

FST $f(u) \to F_s(\lambda)$

$$F_s(\lambda) = \int_0^{\infty} f(u)\sin\lambda u\, du$$

(odd)

$F_s(\lambda) \to f(x)$

$$f(x) = \frac{2}{\pi}\int_0^{\infty} F_s(\lambda)\sin\lambda x\, dx$$

Even function

1) $f(-x) = f(x)$
2) $\cos, x^2, |x|, K$
3) $F_c T$

Pre-Requisites

$\sin 0 = 0 \quad \cos 0 = 1$

$\sin \pi/2 = 1 \quad \cos \pi/2 = 0$

$\sin \pi = 0 \quad \cos \pi = -1$

$\sin 2\pi = 0 \quad \cos 2\pi = 1$

$e^0 = 1,\ e^{-\infty} = 0,\ e^{\infty} = \infty$

Odd function

1) $f(-x) = -f(x)$
2) $\sin, x, x^3$
3) ~~$F_c T$~~ $F_s T$

4) $\int_{-a}^{a} f(x)\,dx = \begin{cases} 0 & \text{when } f(x) \text{ is odd} \\ 2\int_0^a f(x)\,dx & \text{when } f(x) \text{ is even} \end{cases}$

1. $\int \sin \lambda u \, du = -\frac{\cos \lambda u}{\lambda}$

$\int \cos \lambda u \, du = \frac{\sin \lambda u}{\lambda}$

$\int e^{-i\lambda u} \, du = \frac{e^{-i\lambda u}}{(-i\lambda)}$

$\left\{ \frac{d}{dx} x^n \Rightarrow n x^{n-1} \right.$

$\int uv \, dx = uv_1 - u'v_2 + u''v_3 - \cdots\cdots$

$\int u \sin \lambda u \, du = \left[u\left(-\frac{\cos \lambda u}{\lambda}\right) - 1\left(-\frac{\sin \lambda u}{\lambda^2}\right) + \right] 0$

$$\int e^{au} \sin bu \, du = \frac{e^{au}}{a^2+b^2}\left(a \sin bu - b \cos bu\right)$$

$$\int e^{au} \cos bu \, du = \frac{e^{au}}{a^2+b^2}\left(a \cos bu + b \sin bu\right)$$