



$$f(ax) \geq \frac{1}{|a|} f\left(\frac{x}{a}\right)$$

$$f(x-x_0) \geq \exp(-2\pi_j v_2) f(v)$$

$$f'(x) \geq 2\pi_j v f(v)$$

$$* \approx$$

$$, \approx *$$

Condis, disachiten

fonction échantillonnée

$$\underset{\substack{\uparrow \\ \text{continue}}}{f(x)} \cdot \underbrace{\omega_{T_e}(x)} = \text{fonction échantillonnée } (T_e)$$

fonction périodique

$$\underset{\substack{\uparrow \\ \text{continu}}}{f_0(x)} \cdot \underbrace{\omega_T(x)} = \text{fonction périodique}$$

$$\begin{array}{ccc} \text{périodique} & \Leftrightarrow & \text{échantillonnée} \\ * \omega_T(x) & & \cdot \omega_{\frac{1}{T}}(v) \text{ (série de Dirac)} \\ \text{échantillonnée} & \Leftrightarrow & \text{périodique} \\ \cdot \omega_{T_e}(x) & \Leftrightarrow & * \underbrace{\omega_{\frac{1}{T_e}}(v)}_{f_c(v)} \end{array}$$

$$\delta(v) \Leftrightarrow 1$$

$$f'(x) \Leftrightarrow 2\pi j v F(v)$$

$$f'(x) \geq 2\pi jV$$

$$f'(x) * f(x) \xrightarrow{\quad} 2\pi jV \cdot F(v)$$

$$= f'(v)$$

$$f^{(n)}(x) * f(x) = f^{(n)}(x)$$

$$\mathcal{F}[f'(x)] = 2\pi jV$$

dual

$$\mathcal{F}^{-1}[f'(v)] = -2\pi jx$$

$$f'(v) = -2\pi j \mathcal{F}(x)$$

$$x \xrightarrow{\quad} \left(\frac{f'(v)}{-2\pi j} \right) = j \frac{f'(v)}{2\pi}$$

$\mathcal{F}(x) = \frac{f'(v)}{-2\pi j}$

$$F(v) = \int_{-\infty}^{\infty} f(x) e^{-2\pi jvx} dx$$

\uparrow
 $f(x) \cdot x$

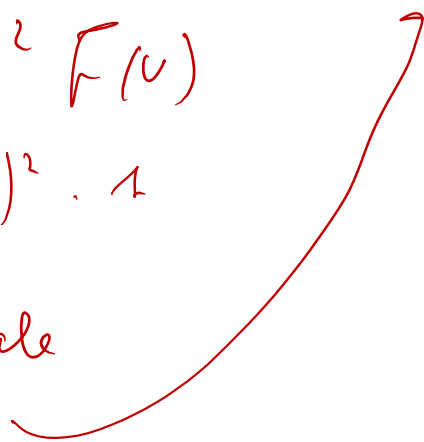
$$x \mapsto \left(\frac{1}{-2\pi j} \right) = \int \frac{1}{2\pi}$$

$$x^2 = x \cdot x \mapsto \frac{f'(v)}{-2\pi j} \neq \frac{f'(v)}{-2\pi j} = \frac{f''(v)}{-4\pi}$$

$$F[f''(x)] = (2\pi j v)^2 F(v)$$

$$F[f''(x)] = (2\pi j v)^2 \cdot 1$$

↓ dual



$$\frac{1}{f'(v)} \quad \text{let } f(v) \approx \text{WAS } f(v)$$

$$\int |x|^2 dx \neq \infty$$

$$\bullet \quad \mathcal{F} \left(\underline{x f(x)} \right) = \frac{F'(v)}{-2\pi j}$$



$$- \pi x^2 \quad - \quad (e^{-\pi v^2})'$$

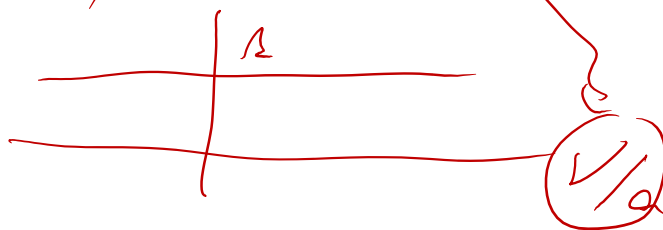
$$e^{-\pi x^2} \supseteq e^{-\pi v^2}$$

$$\underline{x e^{-\pi x^2}} \approx \frac{(e^{-\pi u^2})'}{-2\pi j}$$

$$x \cdot e^{-\pi x^2} \approx + \frac{\delta'(u)}{-2\pi j} \times e^{-\pi u^2} = \frac{(e^{-\pi u^2})'}{-2\pi j}$$

$$\boxed{\begin{aligned} f(ax) &\approx \frac{1}{|a|} f\left(\frac{x}{a}\right) \\ &= \frac{1}{|a|} \delta(u) \end{aligned}}$$

$$\approx \frac{1}{|a|} f\left(\frac{x}{a}\right)$$



$$f(ax) \approx \frac{1}{|a|} f\left(\frac{x}{a}\right)$$

$$\delta(u) \approx 1$$

$$\delta(-x) = \delta(x)$$

$$\delta'(-x)$$

$f(x)$ est pair

$f'(x)$ est impair

$$\delta(\rho(x) - 1) \approx$$

$$\tau = \dots$$

$$x \approx u$$

$$\begin{aligned} \frac{d}{dx} (f(x) * g(x)) &\approx 2\pi j \nu [F(\nu) \cdot G(\nu)] \\ &= f'(x) * g(x) \\ &= f(x) * g'(x) \end{aligned}$$

$$\begin{aligned} &= (2\pi j \nu F(\nu)) \cdot G(\nu) \\ &= F(\nu) \cdot (2\pi j \nu G(\nu)) \end{aligned}$$

$$\int_{-\infty}^{\infty} \frac{\sin \pi x}{\pi x} dx = \int_{-\infty}^{\infty} \underbrace{\frac{\sin \pi x}{\pi x}}_1 e^{-2\pi j \nu x} dx = \mathcal{F}\left[\frac{\sin \pi x}{\pi x}\right]_{\nu=0} = \Pi(\nu) = 1$$

$$\frac{\sin \pi x}{\pi x} \approx \Pi(\nu)$$

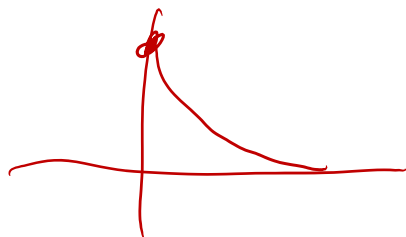


$$\frac{\sin \pi x}{\pi x} * \frac{\sin \pi x}{\pi x}$$

$$\approx \frac{\sin \pi x}{\pi x}$$

$$\Pi(\nu) * \Pi(\nu) = \Pi(\nu)$$

$$\mathcal{F}[e^{-x} u(x)]$$



$u(x); \text{ pour } x \geq 0$

$$= \int_0^{\infty} e^{-x} e^{-i\alpha_f v x} dx = \int_0^{\infty} e^{-x(1+i2\alpha_f v)} dx$$

$$= -\frac{1}{1+i2\alpha_f v} \left(e^{-x(1+i2\alpha_f v)} \right) \Big|_0^{\infty}$$

$$\boxed{e^{-x} u(x) \geq \frac{1}{1+i2\alpha_f v}}$$

$$f(x) - f''(x) = f(x)$$

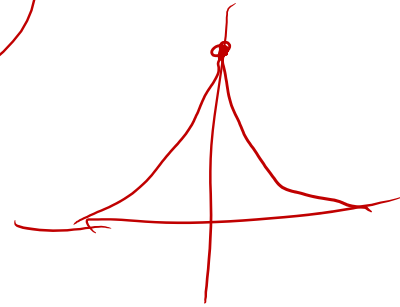
$\nabla \uparrow$

$$F(v) - (i\alpha_f v)^2 F(v) = 1$$

$$F(\nu) [1 + 4\pi^2 \nu^2] = 1$$

$$F(\nu) = \frac{1}{1 + 4\pi^2 \nu^2}$$

$$F^{-1}(F(\nu)) = \frac{1}{2} e^{-|\nu|}$$



$$f(\nu) = e^{-|\nu|} \quad \Rightarrow \quad \frac{2}{1 + 4\pi^2 \nu^2} = f(\nu)$$