TRANSFORMADA DE FOURIER

Conceptos Básicos:

$$f(t) \circ\!\!-\!\!\!-\!\!\bullet F(\omega)$$

Función en el dominio del tiempo

Función en el dominio de la frecuencia

TRANSFORMACIÓN

$$F(\omega) = \mathcal{F}\{f(t)\} = \int_{-\infty}^{+\infty} f(t)e^{-j2\pi\omega t}\,dt$$

INVERSA

$$f(t) = \mathcal{F}^{-1}\{F(\omega)\} = \int_{-\infty}^{+\infty} F(\omega)e^{+j2\pi\omega t}\,d\omega$$

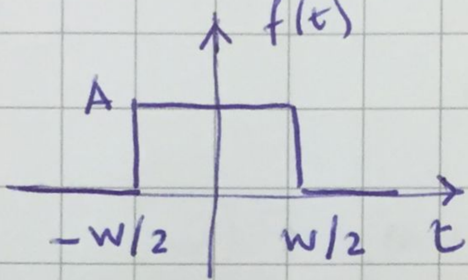
Recordar que $e^{\pm j2\pi\omega t} = \cos(2\pi\omega t) \pm \sin(2\pi\omega t)$

además:

$$\cos\theta = \frac{e^{j\theta} + e^{-j\theta}}{2}$$

$$\sin\theta = \frac{e^{j\theta} - e^{-j\theta}}{2j}$$

EJEMPLO:



$$\circ\!\!-\!\!\bullet \quad AW \frac{\sin(\pi w W)}{\pi w W}$$

$$F(w) = \int_{-\infty}^{+\infty} f(t)\, e^{-j2\pi w t}\, dt$$

$$= A \int_{-w/2}^{w/2} e^{-j2\pi w t}\, dt$$

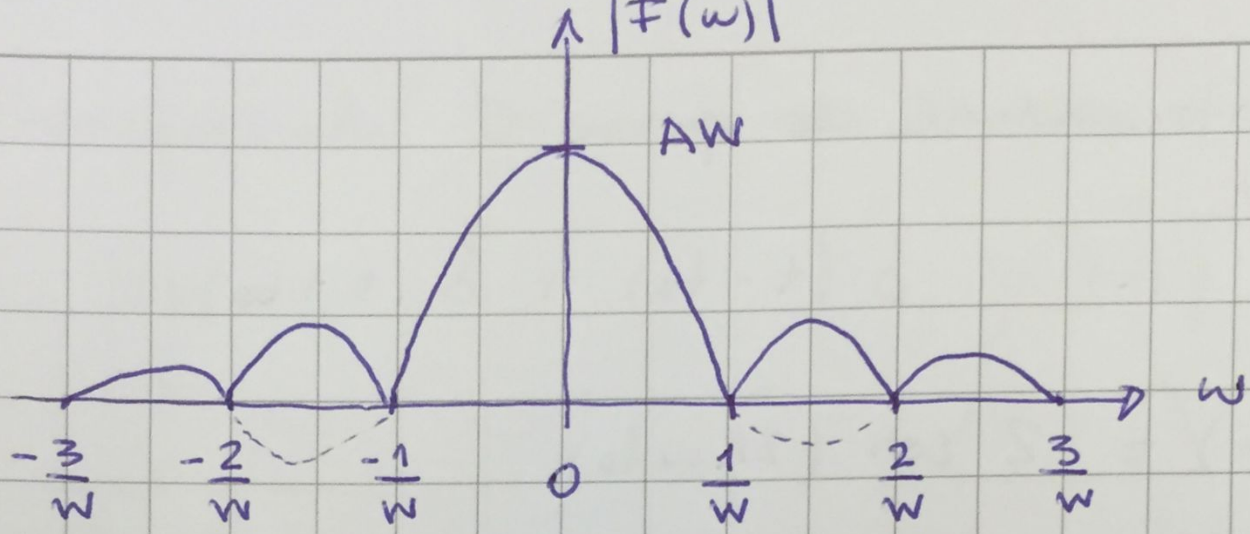
$$= \frac{A}{-j2\pi w} e^{-j2\pi w t} \Big|_{-w/2}^{w/2}$$

$$= \frac{A}{-j2\pi w} \left(e^{-j2\pi w \frac{W}{2}} - e^{+j2\pi w \frac{W}{2}} \right)$$

$$= \frac{A}{\cancel{-j2}\pi w} \cancel{(-j2)} \sin\left(\cancel{2}\pi w \frac{W}{\cancel{2}}\right)$$

$$= \frac{A}{\pi w} \sin\left(\cancel{2}\pi w \frac{W}{\cancel{2}}\right) = AW \frac{\sin(\pi w W)}{\pi w W}$$

$$= AW \operatorname{sinc}(\cancel{\pi} w W) \qquad \operatorname{sinc}(x) = \frac{\sin(\pi x)}{\pi x}$$



Transformada de Fourier de un impulso

$$f(t) = \delta(t)$$

$$F(w) = \int_{-\infty}^{+\infty} \delta(t)\, e^{-j2\pi wt}\, dt$$

$$= e^{-j2\pi w 0} = 1$$

$$\delta(t) \circ\!\!-\!\!\bullet\ 1$$

Transformada de Fourier de un impulso desplazado

$$f(t) = \delta(t - t_0)$$

$$F(w) = \int_{-\infty}^{+\infty} \delta(t - t_0)\, e^{-j2\pi wt}\, dt$$

$$= e^{-j2\pi w t_0} = \cos(2\pi w t_0) - j\sin(2\pi w t_0)$$

Transformada de dos pulsos

$$f(t) = \delta(t - t_0) + \delta(t + t_0)$$

$$F(\omega) = 2\cos(2\pi\omega t_0)$$

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