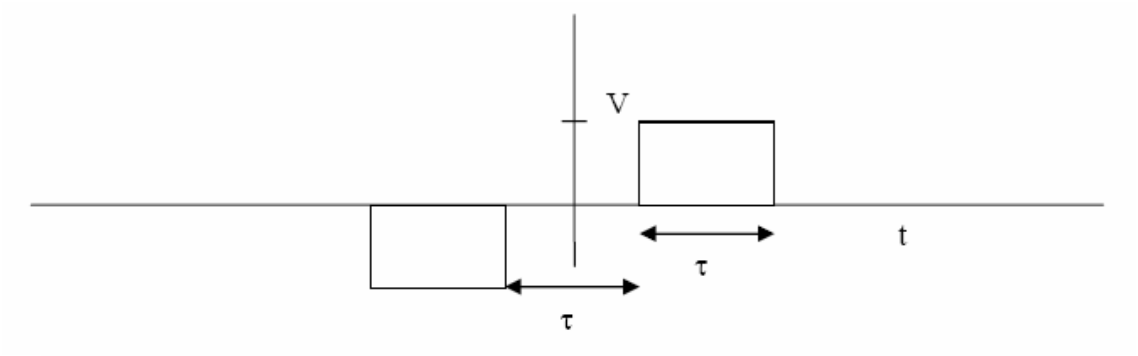
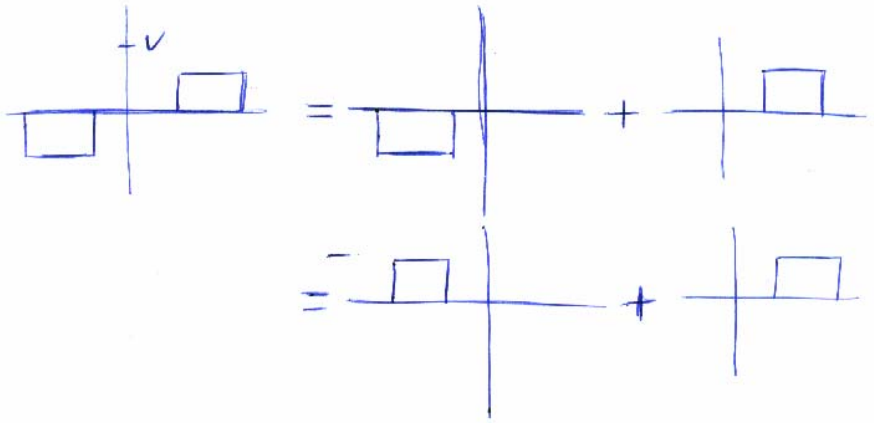
EJERCICIO 1

1.- Calcular la integral de Fourier de la siguiente señal:





$$F(\omega) = -F_1(\omega) + F_2(\omega)$$

$$F_1(\omega) = -V\tau \frac{\operatorname{sen}(\omega\tau/2)}{\omega\tau/2} e^{j\omega\tau}$$

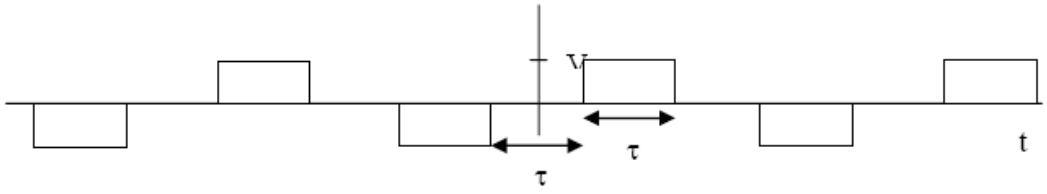
$$F_2(\omega) = V\tau \frac{\operatorname{sen}(\omega\tau/2)}{\omega\tau/2} e^{-j\omega\tau}$$

$$F(\omega) = -\left(-V\tau \frac{\operatorname{sen}(\omega\tau/2)}{\omega\tau/2} e^{j\omega\tau}\right) + V\tau \frac{\operatorname{sen}(\omega\tau/2)}{\omega\tau/2} e^{-j\omega\tau}$$

$$F(\omega) = V\tau \frac{\operatorname{sen}(\omega\tau/2)}{\omega\tau/2} \left[\underbrace{e^{j\omega\tau} + e^{-j\omega\tau}}_{2j\operatorname{sen}(\omega\tau)}\right]$$

$$F(\omega) = 2V\tau \frac{\text{sen}(\omega\tau/2)}{\omega\tau/2} \text{sen}(\omega\tau) j$$

2. Utilizando los resultados anteriores calcular los coeficientes de la serie de Fourier de la siguiente señal periódica.



Calculamos el periodo, que es:

$T = 4\tau$

$$\omega_n = \frac{2\pi}{4\tau} n = \frac{\pi}{2\tau} n$$

$$C_n = 2V\tau \frac{\text{sen}(\omega_n \tau/2)}{\omega\tau/2} \text{sen}(\omega_n \tau) j$$

$$= 2V\tau \frac{\text{sen}\left(\frac{\pi}{2\tau} n \cdot \tau/2\right)}{\frac{\pi}{2\tau} n \cdot \frac{\tau}{2}} \text{sen}\left(\frac{\pi}{2\tau} n \cdot \tau\right) j$$

$$C_n = 2V\tau \frac{\text{sen}\left(\frac{\pi}{4} n\right)}{\frac{\pi}{4} n} \text{sen}\left(\frac{\pi}{2} n\right) j$$

Calcular y representar el espectro en frecuencia par los 6 primeros coeficientes

$\omega_0 = 0$

$\omega_1 = \frac{\pi}{2\tau}$

$\omega_2 = \frac{\pi}{2\tau} \cdot 2 = \frac{\pi}{\tau}$

$\omega_3 = \frac{\pi}{2\tau} \cdot 3 = \frac{3\pi}{2\tau}$

$\omega_4 = \frac{\pi}{2\tau} \cdot 4 = \frac{2\pi}{\tau}$

$\omega_5 = \frac{\pi}{2\tau} \cdot 5 = \frac{5\pi}{2\tau}$

$\omega_6 = \frac{\pi}{2\tau} \cdot 6 = \frac{3\pi}{\tau}$

$C_0 = 0$

$C_1 = 2V\tau \frac{\sqrt{2}/2}{\pi/4} \cdot \text{sen}\left(\frac{\pi}{\tau}\right) j =$

$= 2V\tau \frac{2\sqrt{2}}{\pi} j = 4V\tau \sqrt{2}/\pi \, j$

$C_2 = 2V\tau \frac{\text{sen}(\pi/2)}{\pi/2} \text{sen}(\pi) = 0$

$C_3 = 2V\tau \frac{\text{sen}\left(\frac{\pi}{4} \cdot 3\right)}{\pi/4 \cdot 3} \text{sen}\left(\pi/2 \cdot 3\right) =$

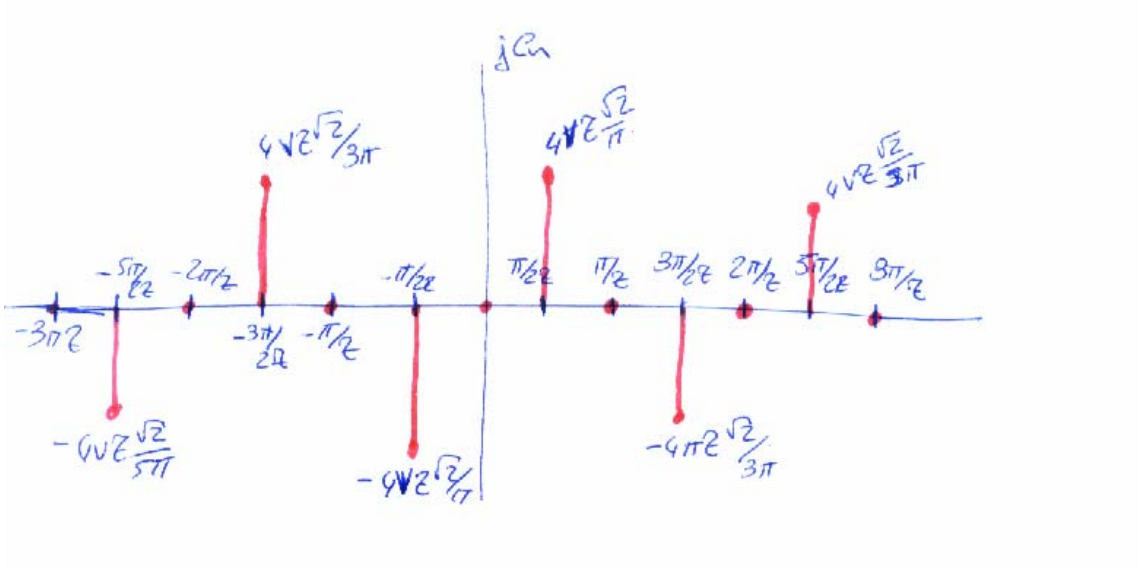
$= 2V\tau \frac{\sqrt{2}/2}{3\pi/4} \cdot -1 = -4V\tau \frac{\sqrt{2}}{3\pi} j$

$C_4 = 2V\tau \frac{\text{sen}\left(\frac{\pi}{4} \cdot 4\right)}{\pi/4 \cdot 4} \cdot \text{sen}\left(\pi/2 \cdot 4\right) = 0$ (0)

$C_5 = 2V\tau \frac{\text{sen}\left(\pi/4 \cdot 5\right)}{\pi/4 \cdot 5} \text{sen}\left(\pi/2 \cdot 5\right) =$

$= 2V\tau \frac{\sqrt{2}/2}{5\pi/4} \cdot 1 = 2V\tau \frac{2\sqrt{2}}{5\pi} j$

$C_6 = 2V\tau \frac{\text{sen}\left(\pi/4 \cdot 6\right)}{\pi/4 \cdot 6} \text{sen}\left(\pi/2 \cdot 6\right) = 0$ (0)


jCn
4√2√2/3π
4√2√2/π
4√2√2/3π
-5π/2Ω
-2π/Ω
-π/2Ω
π/2Ω
π/Ω
3π/2Ω
2π/Ω
5π/2Ω
3π/Ω
-3π/Ω
-3π/2Ω
-π/Ω
-4√2√2/5π
-4√2√2/π
-4π2√2/3π