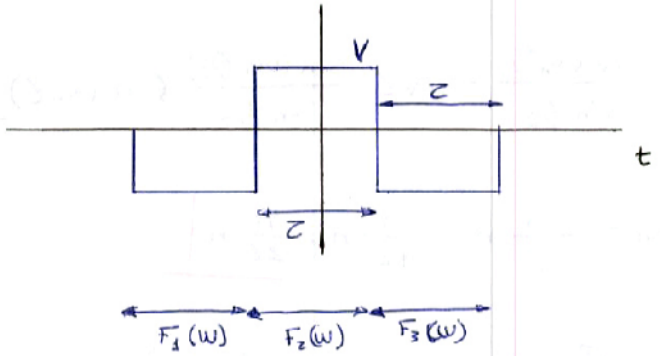
07.954.397-P JACINTO CORRAL RUEZ
(GRUPO B)

① Calcular la integral de Fourier de la siguiente señal:



$F_1(w) = V\tau \dfrac{\text{Sen}(w\,\tau/2)}{w\,\tau/2} e^{jw\tau}$ → Pulso desplazado a la izquierda.

$F_2(w) = V\tau \dfrac{\text{Sen}(w\,\tau/2)}{w\,\tau/2}$ → Pulso centrado en el origen

$F_3(w) = V\tau \dfrac{\text{Sen}(w\,\tau/2)}{w\,\tau/2} e^{-jw\tau}$ → Pulso desplazado a la derecha.

$$F(w) = F_2(w) - F_1(w) - F_3(w)$$

$$F(w) = V\tau \frac{\text{Sen}(w\,\tau/2)}{w\,\tau/2}\left(1 - e^{jw\tau} - e^{-jw\tau}\right)$$

$$F(w) = V\tau \frac{\text{Sen}(w\,\tau/2)}{w\,\tau/2} - 2V\tau \frac{\text{Sen}(w\,\tau/2)}{w\,\tau/2}\,\text{Sen}(w\tau)$$

② Calcular los coeficientes de la serie de Fourier.

$$C_n = V2\,\frac{\operatorname{Sen}(\omega_n 2/2)}{\omega_n\, 2/2} - 2V2\,\frac{\operatorname{Sen}(\omega_n 2/2)}{\omega_n\, 2/2}\,\operatorname{Sen}(\omega_n 2)\,\hat{j}$$

$$\omega_n = \frac{2\pi}{T}\,n = \frac{2\pi}{4\cdot 2}\,n = \frac{\pi}{2\cdot 2}\,n$$

$$C_n = V2\,\frac{\operatorname{Sen}\left(\frac{\pi}{2\cdot 2}\,2/2\,n\right)}{\frac{\pi}{2\cdot 2}\,2/2\cdot n} - 2V2\,\frac{\operatorname{Sen}\left(\frac{\pi}{2\cdot 2}\,2/2\,n\right)}{\frac{\pi}{2\cdot 2}\,2/2\,n}\,\operatorname{Sen}\left(\frac{\pi}{2\cdot 2}\,2\right)\hat{j}$$

$$C_n = V2\,\frac{\operatorname{Sen}\left(\frac{\pi n}{4}\right)}{\frac{\pi n}{4}} - 2V2\,\frac{\operatorname{Sen}\left(\frac{\pi n}{4}\right)}{\frac{\pi n}{4}}\,\operatorname{Sen}\left(\frac{\pi n}{2}\right)\hat{j}$$

$$C_0 = V2\,\frac{\operatorname{Sen}\emptyset}{\emptyset} - 2V2\,\frac{\operatorname{Sen}\emptyset}{\emptyset}\,\operatorname{Sen}\emptyset\,\hat{j} = V2$$

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$$C_1 = V2\,\frac{\operatorname{Sen}\pi/4}{\pi/4} - 2V2\,\frac{\operatorname{Sen}\frac{\pi}{4}}{\pi/4}\,\operatorname{sen}\left(\frac{\pi}{2}\right)\hat{j} = V2\,\frac{\sqrt{2}/2}{\pi/4} - 2V2\,\frac{\sqrt{2}/2}{\pi/4}\,\hat{j}$$

($\operatorname{sen}(\pi/2) = 1$)

$$C_1 = V2\,\frac{2\sqrt{2}}{\pi} - V2\,\frac{4\sqrt{2}}{\pi}\,\hat{j}$$

$$C_2 = V2\,\frac{\operatorname{Sen}\frac{2\pi}{4}}{\frac{2\pi}{4}} - V2\,\frac{\operatorname{Sen}\frac{2\cdot 2}{4}}{\frac{2\cdot 2}{4}}\,\operatorname{Sen}\left(\frac{2\pi}{2}\right)\hat{j}$$

$$C_2 = V2\,\frac{\operatorname{Sen}(\pi/2)}{\pi/2} - 2V2\,\frac{\operatorname{Sen}(2/2)}{\pi/2}\,\operatorname{Sen}(\pi)\,\hat{j} = \frac{2}{\pi}\,V2$$

($\operatorname{Sen}(\pi/2) \to 1$; $\operatorname{Sen}(\pi) \to 0$)

$$C_3 = \sqrt{2}\,\frac{\operatorname{Sen}\left(\frac{3\pi}{4}\right)}{\frac{3\pi}{4}} - 2\sqrt{2}\,\frac{\operatorname{Sen}\left(\frac{3\pi}{4}\right)}{\frac{3\pi}{4}}\,\operatorname{Sen}\left(\frac{3\pi}{2}\right)j$$

$$= \sqrt{2}\,\frac{\sqrt{2}/2}{\frac{3\pi}{4}} - 2\sqrt{2}\,\frac{\sqrt{2}/2}{3\pi/4}\,\operatorname{sen}\left(\frac{3\pi}{2}\right)j$$

$$C_3 = \sqrt{2}\,\frac{2\sqrt{2}}{3\pi} - 4\sqrt{2}\,\frac{\sqrt{2}}{3\pi}\,j$$

$$C_4 = \sqrt{2}\,\frac{\operatorname{Sen}\pi}{\pi} \to 0 - 2\sqrt{2}\,\frac{\operatorname{Sen}\pi}{\pi}\,\operatorname{sen}(2\pi)j$$

$$C_4 = \emptyset$$

$$C_5 = \sqrt{2}\,\frac{\operatorname{Sen}\left(\frac{5\pi}{4}\right)}{\frac{5\pi}{4}} - 2\sqrt{2}\,\frac{\operatorname{Sen}\left(\frac{5\pi}{4}\right)}{\frac{5\pi}{4}}\,\operatorname{Sen}\left(\frac{5\pi}{2}\right)j$$

$$= \sqrt{2}\,\frac{-\sqrt{2}/2}{\frac{5\pi}{4}} - 2\sqrt{2}\,\frac{-\sqrt{2}/2}{\frac{5\pi}{4}}\,j$$

$$C_5 = -\sqrt{2}\,\frac{2\sqrt{2}}{5\pi} + \sqrt{2}\,\frac{4\sqrt{2}}{5\pi}\,j$$

$$C_6 = \sqrt{2}\,\frac{\operatorname{Sen}\left(\frac{6\pi}{4}\right)}{\frac{6\pi}{4}} \to 1^{-1} - 2\sqrt{2}\,\frac{\operatorname{Sen}\left(\frac{6\pi}{4}\right)}{\frac{6\pi}{4}}\,\operatorname{Sen}\left(\frac{6\pi}{2}\right)j \to 0$$

$$C_6 = -\frac{4\sqrt{2}}{6\pi}$$

* Para representar lo hacemos en amplitud y fase, con lo que tenemos que calcular:

$$|C_n| = \sqrt{(a_n^2 + b_n^2)} \qquad \angle C_n = \theta_n = \arctan\left(-\frac{b_n}{a_n}\right)$$

$\rightarrow |C_0| = V\tau \qquad \angle C_0 = \theta_0 = \emptyset$

$$\rightarrow |C_1| = \sqrt{\frac{4\cdot 2}{\pi^2} V^2\tau^2 + \frac{16\cdot 2}{\pi^2} V^2\tau^2} = \sqrt{\left(\frac{8}{\pi^2} + \frac{32}{\pi^2}\right) V^2\tau^2} = \frac{V\tau}{\pi}\sqrt{40}$$

$$\theta_1 = \arctan \frac{\frac{4\sqrt{2}}{\pi} V\tau}{\frac{2\sqrt{2}}{\pi} V\tau} = \arctan 2 = 1.1071 \text{ rad}$$

$$\rightarrow |C_2| = \sqrt{\frac{4}{\pi^2} V^2\tau^2} = \frac{2V\tau}{\pi} \qquad \theta_2 = \emptyset \text{ rad}$$

$$\rightarrow |C_3| = \sqrt{\frac{4\cdot 2}{9\pi^2} V^2\tau^2 + \frac{16\cdot 2}{9\pi^2} V^2\tau^2} = \sqrt{\frac{40}{9\pi^2} V^2\tau^2} = \frac{V\tau}{3\pi}\sqrt{40}$$

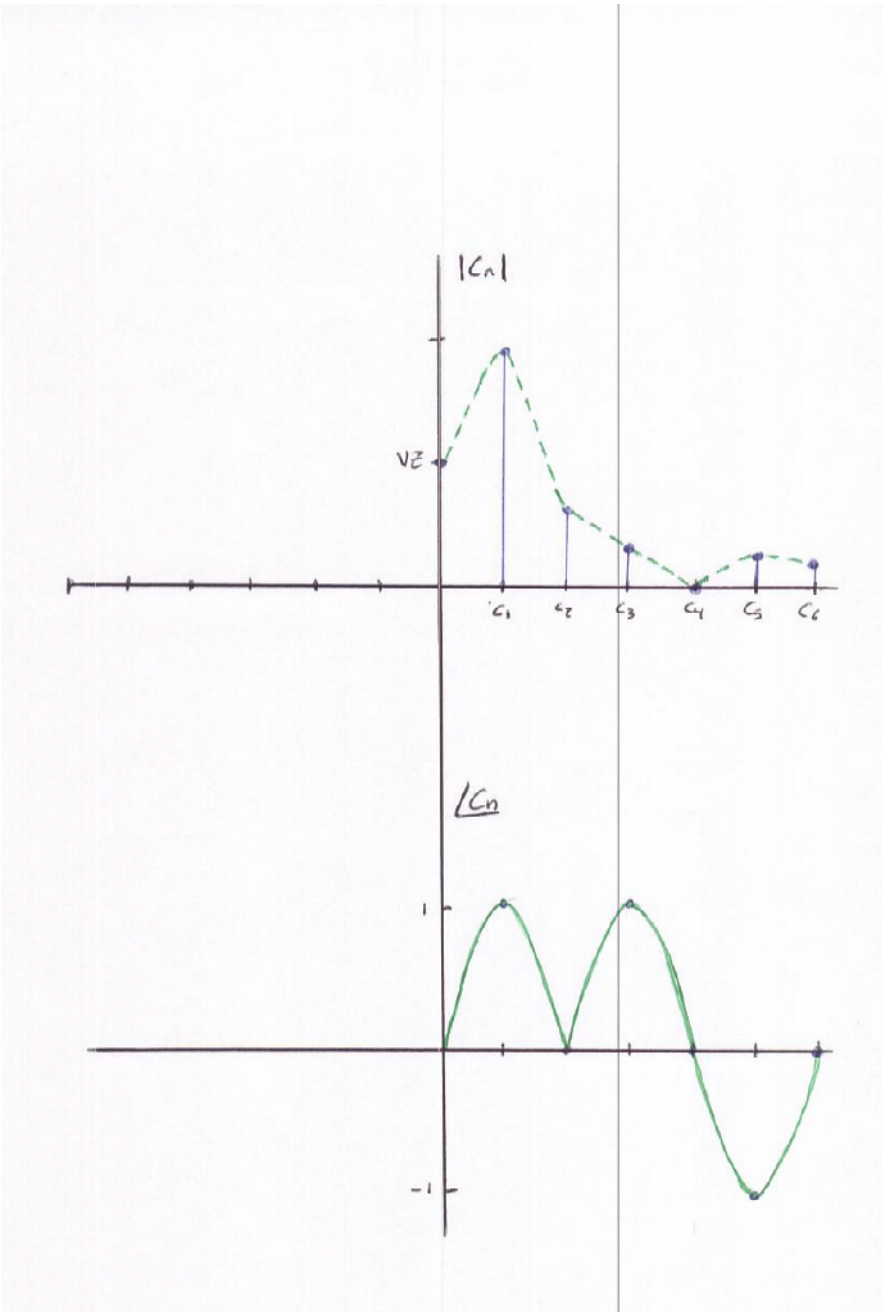
$$\theta_3 = \arctan \frac{\frac{4\sqrt{2}}{3\pi} V\tau}{\frac{2\sqrt{2}}{3\pi}} = \arctan 2 = 1.1071 \text{ rad}$$

$\rightarrow |C_4| = \emptyset \qquad \theta_4 = \emptyset$

$$\rightarrow |C_5| = \sqrt{\frac{4\cdot 2}{25\pi^2} V^2\tau^2 + \frac{16\cdot 2}{25\pi^2} V^2\tau^2} = \sqrt{\frac{40}{25\pi^2} V^2\tau^2} = \frac{V\tau}{5\pi}\sqrt{40}$$

$$\theta_5 = \arctan \frac{\frac{4\sqrt{2}}{5\pi} V\tau}{\frac{2\sqrt{2}}{5\pi} V\tau} = \arctan(-2) = -1.1071 \text{ rad}$$

$$\rightarrow |C_6| = \frac{4}{6\pi} V\tau \qquad \theta_6 = \emptyset$$


|Cn|
1/2
C1
C2
C3
C4
C5
C6
∠Cn
1
-1