



INSTITUTO POLITÉCNICO NACIONAL  
**ESCUELA SUPERIOR DE CÓMPUTO**



## **Serie Trigonométrica de Fourier**

### **Participación 1.4**

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**Asignatura:**

Teoría de Comunicaciones y Señales

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**Grupo:**

3CV17

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$$g(t) = \begin{cases} -10, & -6 < t < -3 \\ \frac{10}{3}t, & -3 < t < 3 \\ 10, & 3 < t < 6 \end{cases}$$

$$g(t) = g(t+12), \quad \omega_0 \frac{2\pi}{T} = \frac{\pi}{6}$$

$$C_n = \frac{1}{12} \int_{-6}^6 g(t) e^{-i \frac{n\pi}{6} t} dt$$

$$= \underbrace{\frac{2}{12} \int_0^3 \frac{10}{3} t e^{-i n \frac{\pi}{6} t} dt}_A + \underbrace{\frac{2}{12} \int_3^6 10 e^{-i n \frac{\pi}{6} t} dt}_B$$

$$\textcircled{A} \quad \frac{1}{6} \int_0^3 \frac{10}{3} t e^{-i n \frac{\pi}{6} t} dt =$$

$$= \frac{10}{18} \left[ \frac{-t6}{i n \pi} e^{-i n \frac{\pi}{6} t} \Big|_0^3 + \frac{6}{i n \pi} \int_0^3 e^{-i n \frac{\pi}{6} t} dt \right]$$

$$t=u \quad e^{-i n \frac{\pi}{6} t} dt = du \quad v = -\frac{6}{i n \pi} e^{-i n \frac{\pi}{6} t}$$

$$= \frac{10}{18} \left[ \frac{i t 6}{n \pi} e^{-i n \frac{\pi}{6} t} \Big|_0^3 - \frac{i 6}{n \pi} \left[ \frac{i 6}{n \pi} e^{-i n \frac{\pi}{6} t} \right]_0^3 \right]$$

$$= \frac{10}{18} \left[ \frac{i 18}{n \pi} e^{-i n \frac{\pi}{2}} + \frac{36}{n^2 \pi^2} e^{-i n \frac{\pi}{2}} - \frac{36}{n^2 \pi^2} e^{-i n \frac{\pi}{6} 0} \right]$$

$$= \frac{10}{18} \left[ \frac{i 18}{n \pi} e^{-i n \frac{\pi}{2}} + \frac{36}{n^2 \pi^2} e^{-i n \frac{\pi}{2}} - \frac{36}{n^2 \pi^2} \right]$$



$$= \frac{10i}{n\pi} e^{-in\frac{\pi}{2}} + \frac{20}{n^2\pi^2} e^{-in\frac{\pi}{2}} - \frac{20}{n^2\pi^2}$$

$$= \frac{10}{n\pi} \left[ \cos\left(\frac{n\pi}{2}\right) - i\sin\left(\frac{n\pi}{2}\right) \right] + \frac{20}{n^2\pi^2} \left[ \cos\left(\frac{n\pi}{2}\right) - i\sin\left(\frac{n\pi}{2}\right) \right] - \frac{20}{n^2\pi^2}$$

$$= \frac{10i}{n\pi} \cos\left(\frac{n\pi}{2}\right) + \frac{10}{n\pi} \sin\left(\frac{n\pi}{2}\right) + \frac{20}{n^2\pi^2} \cos\left(\frac{n\pi}{2}\right) - \frac{20i}{n^2\pi^2} \sin\left(\frac{n\pi}{2}\right)$$

$$= \frac{10}{n\pi} \sin\left(\frac{n\pi}{2}\right) + \frac{20}{n^2\pi^2} \cos\left(\frac{n\pi}{2}\right) - \frac{20}{n^2\pi^2} + \left[ \frac{10i}{n\pi} \cos\left(\frac{n\pi}{2}\right) - \frac{20i}{n^2\pi^2} \sin\left(\frac{n\pi}{2}\right) \right]$$

$$\textcircled{B} \frac{10}{6} \int_3^6 e^{-in\frac{\pi}{2}t} dt = \frac{10}{6} \left[ \frac{-6}{n\pi i} e^{-in\frac{\pi}{6}t} \right]_3^6 = \frac{10}{6} \left[ \frac{i}{n\pi} e^{-in\frac{\pi}{6}t} \right]_3^6$$

$$= \frac{10i}{n\pi} e^{-in\pi} - \frac{10i}{n\pi} e^{-in\frac{\pi}{2}}$$

$$= \frac{10i}{n\pi} \left[ \cos(n\pi) - i(\sin(n\pi)) \right] - \frac{10i}{n\pi} \left[ \cos\left(\frac{n\pi}{2}\right) - i\sin\left(\frac{n\pi}{2}\right) \right]$$

$$= \frac{10i}{n\pi} \cos(n\pi) - \frac{10i}{n\pi} \cos\left(\frac{n\pi}{2}\right) - \frac{10}{n\pi} \sin(n\pi)$$

$$= -\frac{10}{n\pi} \sin\left(\frac{n\pi}{2}\right) + i \left( \frac{10}{n\pi} (\cos(n\pi)) - \frac{10}{n\pi} \cos\left(\frac{n\pi}{2}\right) \right)$$

$$b_n = \frac{20}{n^2\pi^2} \cos\left(\frac{n\pi}{2}\right) - \frac{20}{n^2\pi^2} + i \left( \frac{10}{n\pi} \cos(n\pi) - \frac{20}{n^2\pi^2} \sin\left(\frac{n\pi}{2}\right) \right)$$

$$b_n = -2 \left\{ \ln(n) \right\} = -2 \left( \frac{10}{n\pi} \cos(n\pi) - \frac{20}{n^2\pi^2} \sin\left(\frac{n\pi}{2}\right) \right)$$

impar  $\therefore$

$$g(t) = \sum_{n=1}^{\infty} -2 \left( \frac{10}{n\pi} \cos(n\pi) - \frac{20}{n^2\pi^2} \sin\left(\frac{n\pi}{2}\right) \right)$$