



Análisis de Fourier

SERIE TRIGONOMETRICA VS SERIE EXPONENCIAL

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Series de Fourier

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Scribe

$$\omega = \frac{2\pi}{T}$$

$$P(t) = \frac{a_0}{2} + \sum_{n=1}^{\infty} \left[a_n \cos(\omega n t) + b_n \sin(\omega n t) \right]$$
$$\frac{2}{T} \sum_{n=-\infty}^{\infty} C_n e^{j\omega n t}$$

$$a_n = \frac{2}{T} \int_0^T P(t) \cos(\omega n t) dt$$

$$b_n = \frac{2}{T} \int_0^T P(t) \sin(\omega n t) dt$$

$$C_n = \frac{1}{T} \int_0^T P(t) e^{-j\omega n t} dt$$

Primer armónico

$$a_1 \cos(\omega t) + b_1 \sin(\omega t)$$

$$C_{-1} e^{-j\omega t} + C_1 e^{j\omega t}$$

$$C_{-1} [\cos(\omega t) - j \sin(\omega t)] +$$

$$C_1 [\cos(\omega t) + j \sin(\omega t)] =$$

$$C_{-1} \cos(\omega t) + C_1 \cos(\omega t) - j C_{-1} \sin(\omega t) + j C_1 \sin(\omega t) =$$

$$[C_{-1} + C_1] \cos(\omega t) + [j C_1 - j C_{-1}] \sin(\omega t)$$

$$a_1 = C_{-1} + C_1 \quad b_1 = j (C_{-1} - C_1)$$

$$C_{-1} = \frac{1}{T} \int_0^T p(t) e^{j\omega t} dt$$

$$C_1 = \frac{1}{T} \int_0^T p(t) e^{-j\omega t} dt$$

Forma de Euler

$$C_{-1} = \frac{1}{T} \int_0^T P(t) [\cos(\omega t) dt] +$$
$$\cancel{j \frac{1}{T} \int_0^T P(t) \sin(\omega t) dt} \rightarrow 0$$

$$C_1 = \frac{1}{T} \int_0^T P(t) \cos(\omega t) dt -$$
$$\cancel{j \frac{1}{T} \int_0^T P(t) \sin(\omega t) dt} \rightarrow 0$$

$$C_{-1} + C_1 = \frac{2}{T} \int_0^T P(t) \cos(\omega t) dt$$

$$C_{-1} + C_1 = a_0$$

Entonces

$$\frac{a_0}{2} = C_0$$

$$a_1 \cos(\omega t) + b_1 \sin(\omega t) = C_{-1} e^{-j\omega t} + C_1 e^{j\omega t}$$

$$a_2 \cos(\omega t) + b_2 \sin(\omega t) = C_{-2} e^{-j\omega t} + C_2 e^{j\omega t}$$