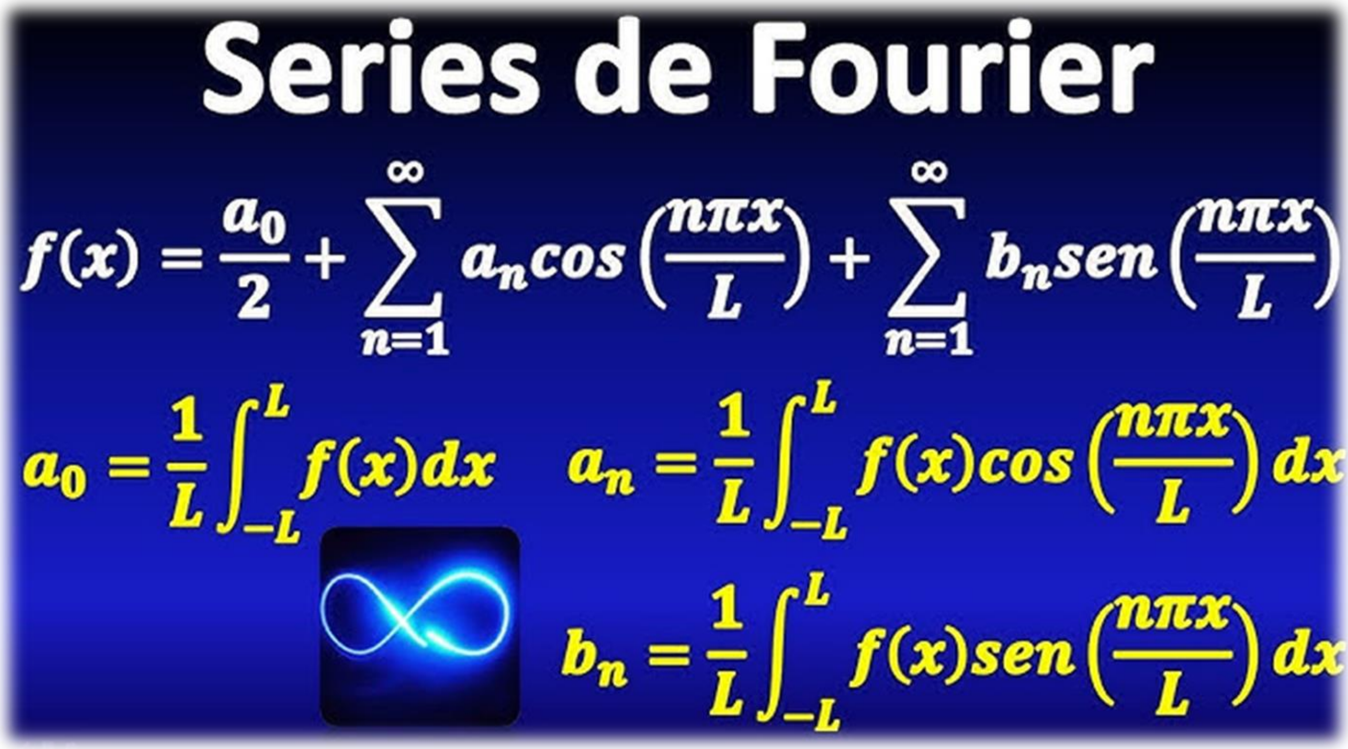
2024



Análisis de Fourier

SERIE TRIGONOMETRICA VS SERIE EXPONENCIAL

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Series de Fourier

10 03 24

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

$$P(t) = \frac{a_0}{2} + \sum_{n=1}^{\infty} \left[a_n \cos(wnt) + b_n \operatorname{Sen}(wnt) \right]$$

$$\overset{?}{=} \sum_{n=-\infty}^{\infty} C_n e^{jwnt}$$

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

$$b_n = \frac{2}{T} \int_0^T P(t) \operatorname{sen}(wnt)\,dt$$

$$C_n = \frac{1}{T} \int_0^T P(t)\, e^{-jwnt}\,dt$$

Primer armonico

$$a_1 \cos(wt) + b_1 \operatorname{sen}(wt)$$

$$C_{-1} e^{-jwt} + C_1 e^{jwt}$$

$C_{-1}\left[\cos(wt) - j\,sen(wt)\right] +$

$C_1\left[\cos(wt) + j\,sen(wt)\right] =$

$C_{-1}\cos(wt) + C_1\cos(wt) - j\,C_{-1}\,sen(wt) +$
$j\,C_1(sen(wt)) =$

$\left[C_1 + C_{-1}\right]\cos(wt) + \left[jC_1 - jC_{-1}\right]sen(wt)$

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

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

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

Forma de Euler

$$C_{-1} = \frac{1}{T}\int_0^T p(t)\left[\cos(wt)\,dt\right] + \cancel{j\frac{1}{T}\int_0^T p(t)\,\text{sen}(wt)\,dt} \rhd 0$$

$$C_1 = \frac{1}{T}\int_0^T p(t)\cos(wt)\,dt - \cancel{j\frac{1}{T}\int_0^T p(t)\,\text{sen}(wt)\,dt} \rhd 0$$

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

$$C_{-1} + C_1 = a_1$$

Entonces

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

$$a_1\cos(wt) + b_1\,\text{sen}(wt) = C_{-1}e^{-jwt} + C_1 e^{jwt}$$

$$a_2\cos(wt) + b_2\,\text{sen}(wt) = C_{-2}e^{-jwt} + C_2 e^{jwt}$$