funzione periodica = termine costante (valore medio) + funzione sinusoidale di frequenza f (fondamentale) + infinite funzioni sinusoidali di frequenza multiple di f (armoniche).

$$f(t) = A_0 + \sum_1^{\infty} A_n \cos n\omega t + \sum_1^{\infty} B_n \sin n\omega t$$

$$\text{o } f(t) = A_0 + \sum_1^{\infty} C_n \sin(n\omega t + \varphi_n)$$

$$A_0 = \frac{1}{T}\int_0^T f(t)\,dt \qquad C_n = \sqrt{A_n^2 + B_n^2}$$

$$A_n = \frac{2}{T}\int_0^T f(t)\cos n\omega t \qquad \varphi_n = \operatorname{arctg}\frac{B_n}{A_n}$$

$$B_n = \frac{2}{T}\int_0^T f(t)\sin n\omega t \qquad T = \text{periodo}$$

- Determinazione di A_0

Integrando $f(t)$ tra 0 e T:

$$\int_0^T f(t)\,dt = \int_0^T A_0\,dt + \underbrace{\int_0^T \sum_1^{\infty} A_n \cos n\omega t\,dt}_{=0} + \underbrace{\int_0^T \sum_1^{\infty} B_n \sin n\omega t\,dt}_{=0}$$

$$\int_0^T f(t)\,dt = A_0 T \Rightarrow A_0 = \frac{1}{T}\int_0^T f(t)\,dt$$

- Determinazione di generico coefficiente A_k

$f(t) \times \cos k\omega t =$

$$= \int_0^T f(t)\cos k\omega t = \underbrace{\int_0^T A_0 \cos k\omega t\,dt}_{=0} + \int_0^T \sum_1^{\infty} A_n \cos k\omega t \cos n\omega t + \int_0^T \sum_1^{\infty} B_n \sin n\omega t \cos k\omega t\,dt = \underbrace{\int_0^T \sum_1^{\infty} A_n \frac{\cos(n+k)\omega t + \cos(n-k)\omega t}{2}\,dt}_{\frac{T}{2}A_k}$$

$$+ \underbrace{\int_0^T \sum_1^{\infty} B_n \frac{\sin(n+k)\omega t + \sin(n-k)\omega t}{2}\,dt}_{=0}$$