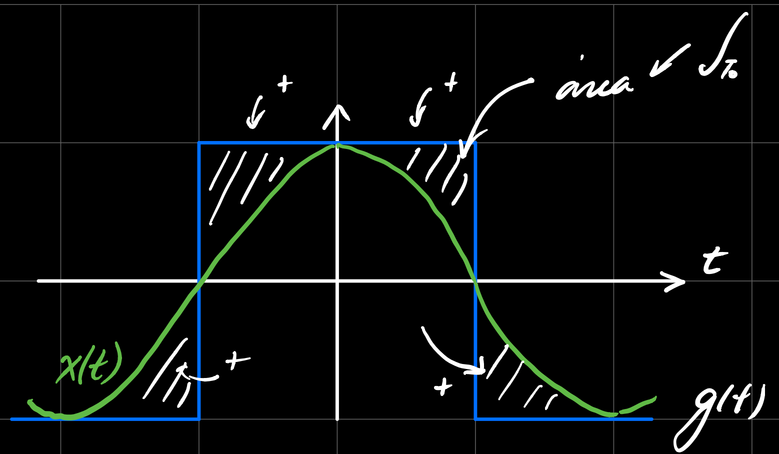


$g(t) \simeq c \cdot x(t)$

aproximação

$$\text{erro}(c) = \int_{T_0} \big(g(t) - c\,x(t)\big)^2\, dt$$

c ... variável de ajuste

OBJETIVO: $\min_{c} \ \text{erro}(c) \Rightarrow \dfrac{\partial\, \text{erro}(c)}{\partial c} = 0$

$$\text{erro}(c) = \underbrace{\overbrace{\int_{T_0} g^2(t)\, dt}^{N_1}}_{\partial/\partial c = 0} \underbrace{- 2c \overbrace{\int_{T_0} g(t)\, x(t)\, dt}^{N_2}}_{-2 \cdot c \cdot N_2} + \underbrace{c^2 \overbrace{\int_{T_0} x^2(t)\, dt}^{N_3}}$$

$\partial/\partial c = -2N_2$

$$-2\int_{T_0} g(t)\, x(t)\, dt \qquad 2c \int_{T_0} x^2(t)\, dt$$

$$-2\int_{T_0} g(t)\, x(t)\, dt + 2c \int_{T_0} x^2(t)\, dt = 0$$

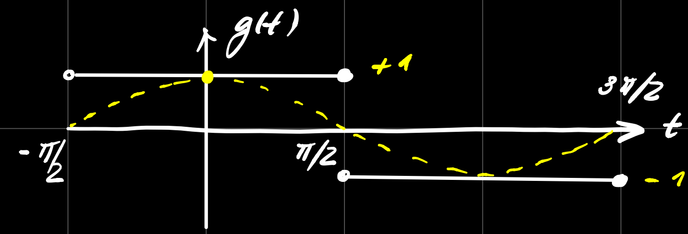
$$\underbrace{c} = \frac{\int_{T_0} g(t)\, x(t)\, dt}{\int_{T_0} x^2(t)\, dt} \quad \leftarrow$$

periódico

$g(t) \cong c\, x(t)$

$\min_{c} \ \text{erro}(c)$

EXEMPLO :



$$g(t) : \begin{cases} +1, & -\pi/2 \le t \le \pi/2 \\ -1, & \pi/2 < t \le 3\pi/2 \end{cases}$$

$$x(t) = 1\cdot\cos(\omega t) = \cos(\omega t) = \cos(1\cdot t)$$

$$\omega = \frac{2\pi}{T} \quad \therefore \quad T = \frac{3\pi}{2} + \frac{\pi}{2} = \frac{4\pi}{2} = \underbrace{2\pi\, s}$$

$$\therefore \omega = \frac{2\pi}{2\pi} = 1$$

$$x(t) = \cos(t)$$

$$C = \frac{\int_{T_0} g(t)\, x(t)\, dt}{\int_{T_0} x^2(t)\, dt} = \frac{\int_{-\pi/2}^{+\pi/2} 1\cdot\cos t\, dt - \int_{\pi/2}^{3\pi/2} 1\cdot\cos t\, dt}{\int_0^{2\pi} \underbrace{\cos^2(t)}_{\frac{1}{2} + \frac{1}{2}\cos(2t)}\, dt}$$

$$C = \frac{\operatorname{sen}(t)\Big|_{-\pi/2}^{+\pi/2} - \operatorname{sen}(t)\Big|_{\pi/2}^{3\pi/2}}{\underbrace{\int_0^{2\pi} \frac{1}{2}\cdot dt}_{\underbrace{\frac{1}{2}\cdot(2\pi - 0)}_{\pi}} + \underbrace{\frac{1}{2}\int_0^{2\pi} \cos(2t)\, dt}_{\frac{1}{2}\cdot\frac{1}{2}\cdot \underbrace{\operatorname{sen}(2t)\Big|_0^{2\pi}}_{0 - 0 = 0}}} = \frac{\overbrace{+1 + 1 + 1 + 1}^{4}}{\pi}$$

$$-1$$

$$C = \frac{4}{\pi} > 1$$

$$g(t) \cong \overset{c_1}{\frac{4}{\pi}} \cdot \cos(t)$$

(1) Onda quadrada : $g(t)$

(2) Sinal de referência : $x_1(t) = \cos(t)$

(3) $g(t) \simeq \frac{4}{\pi} \cdot \cos(t)$

$$g(t) = \frac{4}{\pi} \cdot \cos(t) + \underbrace{\boxed{\text{erro}}}_{}$$ min

$$g(t) = \frac{4}{\pi} \cdot \cos(t) + c_2 \cdot x_2(t) + \boxed{\text{erro}_2}$$

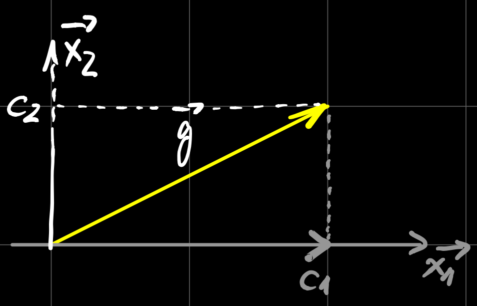
$g(t) \simeq c_1 x_1(t)$, $g(t) \simeq c_1 x_1(t) + c_2 x_2(t)$

$g(t) \simeq c_1 x_1 + c_2 x_2(t) + c_3 x_3(t)$, ...

$$g(t) = \sum_{n=1}^{\infty} c_n x_n(t) \quad , \quad \text{erro}_{n \to \infty} \to 0$$

Se $x_1(t) = \cos(t)$, $x_2(t) = ?$

$x_2(t) = \cos(\omega t)$, $\omega = ?$



$\vec{g} \simeq c_1 \vec{x_1}$

$\vec{g} = c_1 \vec{x_1} + c_2 \vec{x_2}$

$\vec{x}_1 \perp \vec{x}_2$

$c=0$

$$C = \frac{\vec{g}\odot\vec{x}}{\vec{x}\odot\vec{x}}$$

$\underbrace{x_1(t)}$ $\underbrace{x_2(t)}$

$$\int_{T_0} x_1(t)\cdot x_2(t)\cdot dt = 0$$

$$0 = \underbrace{C} = \frac{\int_{T_0} g(t)\,x(t)\,dt}{\int_{T_0} x^2(t)\,dt}$$

$$C = \frac{\vec{x}\odot\vec{x}}{\vec{x}\odot\vec{x}} = 1$$

$$|\vec{g}|\cdot|\vec{x}|\cdot\cos\theta =$$

$\vec{g} = \vec{x}$!

$$\int_{T_0} g(t)\cdot x(t)\,dt = 0$$

$$\int_{T_0} x_1(t)\cdot x_2(t)\cdot dt = 0 \quad !$$

$x_1(t) \perp x_2(t)$

Aplicando o conceito

$$\int_{T_0} \underbrace{\cos(t)}\cdot\cos(nt)\,dt = 0$$

$n = 2, 3, 4, 5, 6, 7, \ldots$

$n = 1.5,\ \int_{T_0} \neq 0$

$$g(t) = C_1\cdot x_1(t) + C_2\,x_2(t) + C_3\,x_3(t) + \ldots$$

$$= C_1\cdot \underbrace{\underbrace{\cos(t) + C_2\cos(2t)}_{\perp} + C_3\cos(3t)}_{\perp} + \ldots$$

- $g(t) = \sum_{n=1}^{\infty} C_n \cos(nt)$ ← $\underbrace{SW}$

SÍNTESE

- $C_n = \dfrac{\int_{T_0} g(t) . \cos(nt)\,dt}{\int_{T_0} \cos^2(nt)\,dt}$ ← ANÁLISE

$SF : \int_{T_0} g(t) \underbrace{e^{-jn\omega_0 t}} dt$

$F : \int_{-\infty}^{\infty} g(t) \underbrace{e^{-j\omega t}} dt$

$\mathcal{L} : \int_{-\infty}^{\infty} g(t) \underbrace{e^{-st}} dt$

$s = \sigma + j\omega$