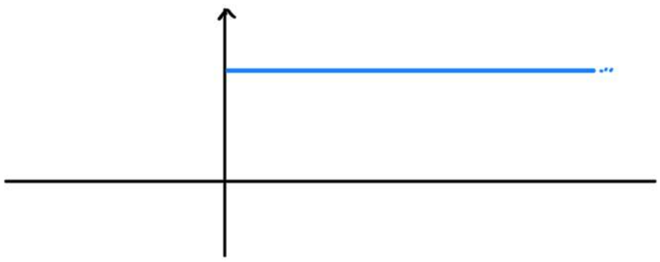
Lezione 2 - 29/02/2024

ESERCIZIO: SI CALCOLINO AREA E VALORE MEDIO DEL SEGNALE $s(t) = 1(t)$ (gradino unitario)



- $A_s = \text{area}(s) = \lim_{T \to +\infty} \int_{-T}^{T} s(t)\,dt = \lim_{T \to +\infty} \int_{-T}^{T} 1(t)\,dt$

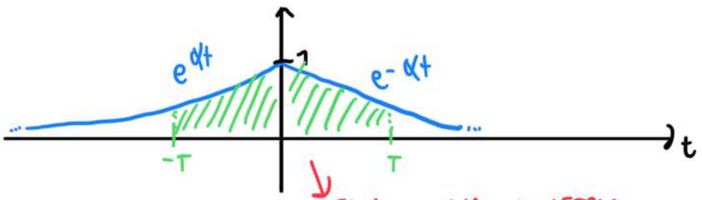
siccome per tempi negativi l'integrale è nullo:

$$\lim_{T \to +\infty} \int_{0}^{T} 1(t)\,dt = \lim_{T \to +\infty} \int_{0}^{T} 1\,dt = \lim_{T \to +\infty} T = +\infty$$

L'AREA E' INFINITA

- $m_s = \lim_{T \to +\infty} \frac{1}{2T} \underbrace{\int_{-T}^{T} s(t)\,dt}_{T} = \lim_{T \to +\infty} \frac{1}{2T} T = \frac{1}{2}$

ESERCIZIO 2: SI CALCOLINO AREA E VALORE MEDIO DEL SEGNALE $s(t) = e^{-\alpha|t|}$ $(\alpha > 0)$



SI NOTA UNA SIMMETRIA

$A_s = \lim_{T \to \infty} \int_{-T}^{T} s(t)\,dt$

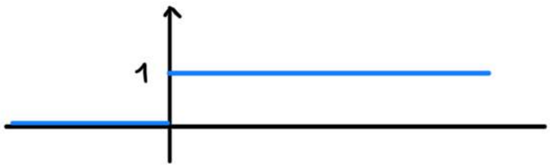
$$= \lim_{T \to +\infty} 2\int_{0}^{T} s(t)\,dt = 2\int_{0}^{T} e^{-\alpha t}\,dt = \lim_{T \to +\infty} 2 \left[\frac{e^{-\alpha t}}{-\alpha}\right]_{0}^{T} = \frac{2}{-\alpha}\left(e^{-\alpha T} - 1\right)$$

$$= \lim_{T \to +\infty} \frac{2}{\alpha}\left(1 - e^{-\alpha T}\right) = \frac{2}{\alpha}$$

- $m_s = \lim_{T \to +\infty} \frac{1}{2T} \int_{-T}^{T} s(t)\,dt = \lim_{T \to +\infty} \frac{1}{2T} \frac{2}{\alpha}\left(1 - e^{-\alpha T}\right) = \frac{1}{\underbrace{T\alpha}_{\infty}}\left(1 - \underbrace{e^{-\alpha T}}_{0}\right) = 0$

ESEMPIO: ENERGIA E POTENZA DI $s(t) = 1(t)$

$$|s(t)|^2 = \begin{cases} 1 & t > 0 \\ 0 & t < 0 \end{cases}$$



$\cong 1(t)$

a meno di $t = 0$

$$E_s = +\infty$$
$$P_s = \frac{1}{2}$$

- ENERGIA E POTENZA DI $s(t) = e^{-\alpha|t|}$ $\quad \alpha > 0$

$$|s(t)|^2 = \begin{cases} e^{-2\alpha t} & t > 0 \\ e^{2\alpha t} & t < 0 \end{cases} = e^{-2\alpha|t|} = e^{-\beta|t|}, \quad \text{DOVE } \beta = 2\alpha$$

area e v.m. del modulo quadro

$$A_y = \frac{2}{\beta} = \frac{2}{2\alpha} = \frac{1}{\alpha} \quad \rightarrow \quad E_s = \frac{1}{\alpha}$$

$$m_y = 0 \quad \rightarrow \quad P_s = 0$$