tempo v. indip.

$s(t)$

- tempo continuo
- tempo discreto: sequenze

  $s[n]$

- ampiezza continua
- ampiezza discreta

- segnali analogici:
  t.c. e ampiezza continua
- segnali campionati:
  t. discreto e ampiezza continua
- segnali digitali:
  segn. t. dis. e amp. dis.
- segnali quantizzati
  segn. t. cont. e amp. discreta

$s(t)$ periodico di periodo T_0

se $\forall t \quad s(t+T_0) = s(t)$

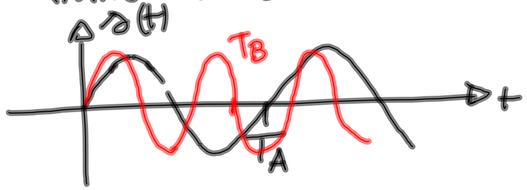
i.e.

$$s(t) = \sin\left(2\pi \frac{t}{T_A}\right)$$

$$s(t+T_A) = s(t) \quad \forall t$$

$\boxed{\text{N.B.}}$ $\quad f_A = \dfrac{1}{T_A}$

numero di oscill. al secondo



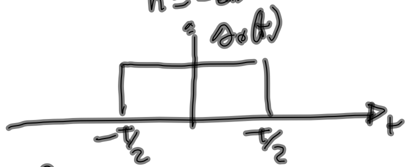
$T_B < T_A$

$f_B > f_A$

Periodicizzazione

$s_0(t) \quad , \quad T_0$

$$\sum_{n=-\infty}^{+\infty} s_0(t - nT_0) = \mathrm{rep}_{T_0}(s_0(t))$$



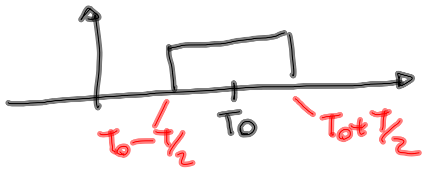
$$s_0(t) = \mathrm{rect}\left(\frac{t}{T}\right)$$

$$\sum_{n=-\infty}^{\infty} \mathrm{rect}\left(\frac{t-nT_0}{T}\right)$$

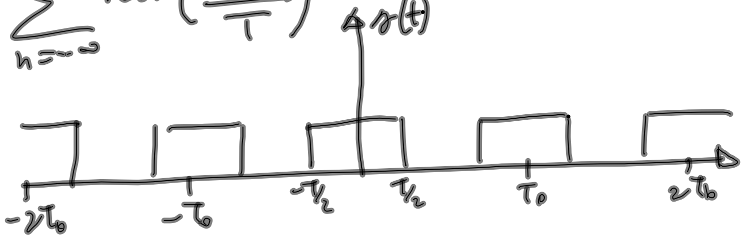
$n=1 \qquad \mathrm{rect}\left(\dfrac{t-T_0}{T}\right)$

$\mathrm{rect}\left(\frac{t-T_0}{T}\right)$

"impulso rettangolare"



$\sum_{n=-\infty}^{\infty} \mathrm{rect}\left(\frac{t-nT_0}{T}\right)$



"onda quadra"

Energia

$s(t)$ se $\exists < \infty, \neq 0$

$$E_s = \lim_{T\to\infty} \int_{-T/2}^{T/2} |s(t)|^2 dt =$$

$$= \int_{-\infty}^{+\infty} |s(t)|^2 dt \geq 0$$

Potenza media (nell'intervallo T)

$$P_s(T) \triangleq \frac{1}{T} \int_{-T/2}^{T/2} |s(t)|^2 dt$$

Potenza media finita se $\exists < \infty, \neq 0$

$$P_s = \lim_{T\to\infty} P_s(T) = \lim_{T\to\infty} \frac{1}{T} \int_{-T/2}^{T/2} |s(t)|^2 dt$$

Segnali periodici

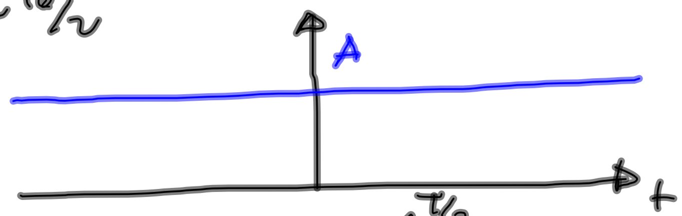
Energia infinita

Potenza finita

$$E_s = \lim_{N \to \infty} N \int_{-T_0/2}^{T_0/2} |s(t)|^2 dt$$

$$P_s = \frac{1}{T_0} \int_{-T_0/2}^{T_0/2} |s(t)|^2 dt$$

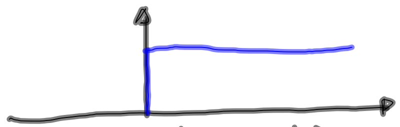
- $s(t) = A$



$$E_s = \lim_{T \to \infty} \int_{-T/2}^{T/2} |s(t)|^2 dt = \lim_{T \to \infty} \int_{-T/2}^{T/2} A^2 dt =$$

$$= \lim_{T \to \infty} A^2 T = \infty$$

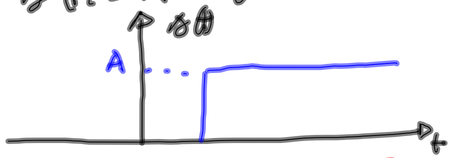
$$P_s = \lim_{T \to \infty} \frac{1}{T} \int_{-T/2}^{T/2} |s(t)|^2 dt = \lim_{T \to \infty} \frac{1}{T} A^2 T = A^2$$



$$u(t) = \begin{cases} 1 & t \geq 0 \\ 0 & t < 0 \end{cases}$$

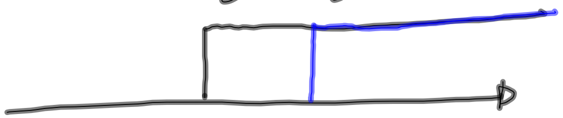
$$u(t) = \begin{cases} 0 & t < 0 \\ 1/2 & t = 0 \\ 1 & t > 0 \end{cases}$$

$$s(t) = A\, u(t - t_0)$$



$\boxed{?}$ rect da $u(t)$ $\boxed{?}$

$$\mathrm{rect}\left(\frac{t}{T}\right)$$



$$\mathrm{rect}\left(\frac{t}{T}\right) = u\left(t + T/2\right) - u\left(t - T/2\right)$$

$$E_s = \lim_{T \to \infty} \int_{-T/2}^{T/2} |s(t)|^2 dt = \lim_{T \to \infty} \int_{-T/2}^{T/2} |u(t)|^2 dt =$$

$s(t) = u(t)$

$$= \lim_{T \to \infty} \int_0^{T/2} dt = \lim_{T \to \infty} t \Big|_0^{T/2} = \lim_{T \to \infty} T/2$$