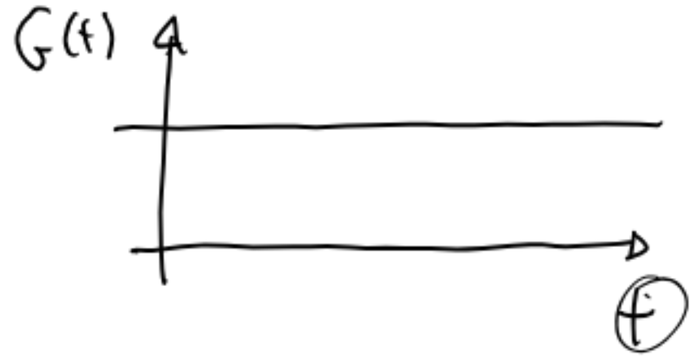
4 TIPI DI PENDENTE TEMPORALE $G(t)$

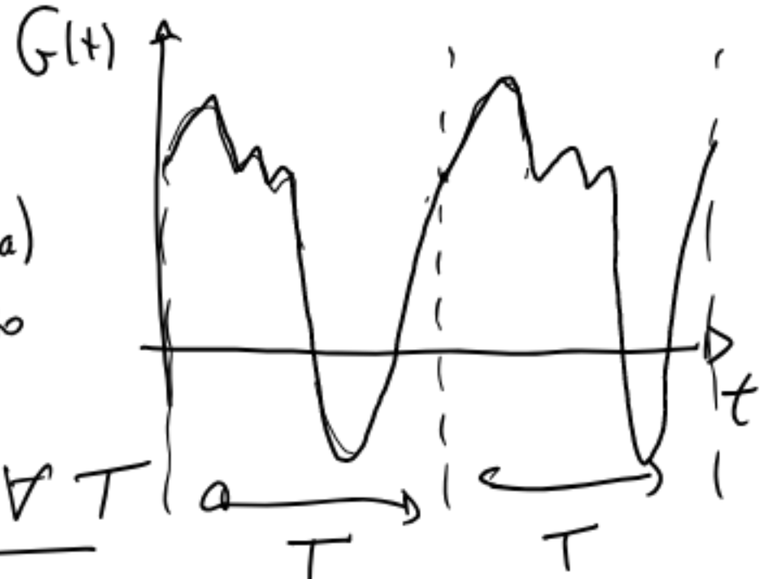
1) COSTANTE



2) PERIODICA

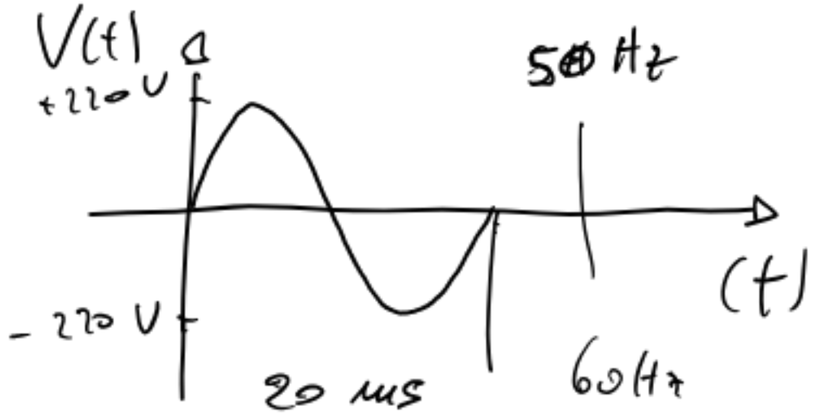
Particolare forma (d'onda) in un intervallo T definito e costante PERIODO

RIPETE IDENTICA $\forall T$



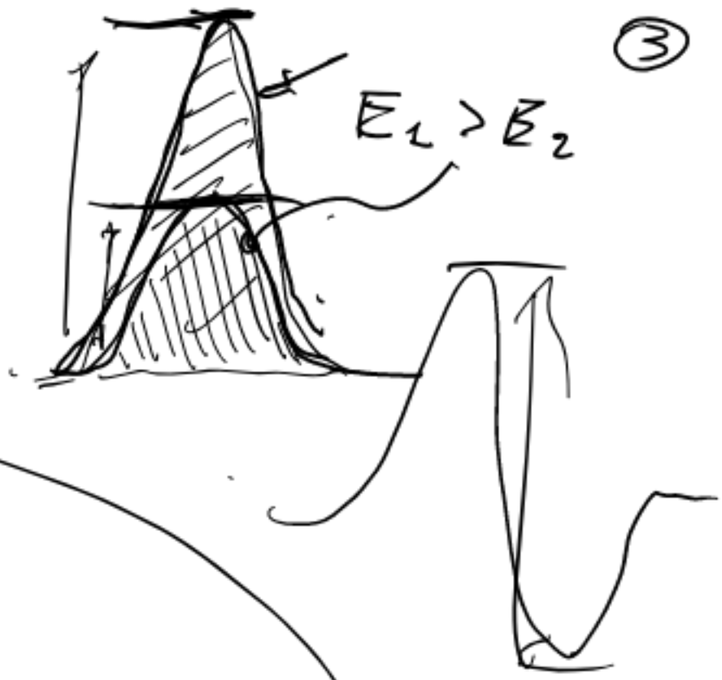
$$G(t+T) = G(t)$$

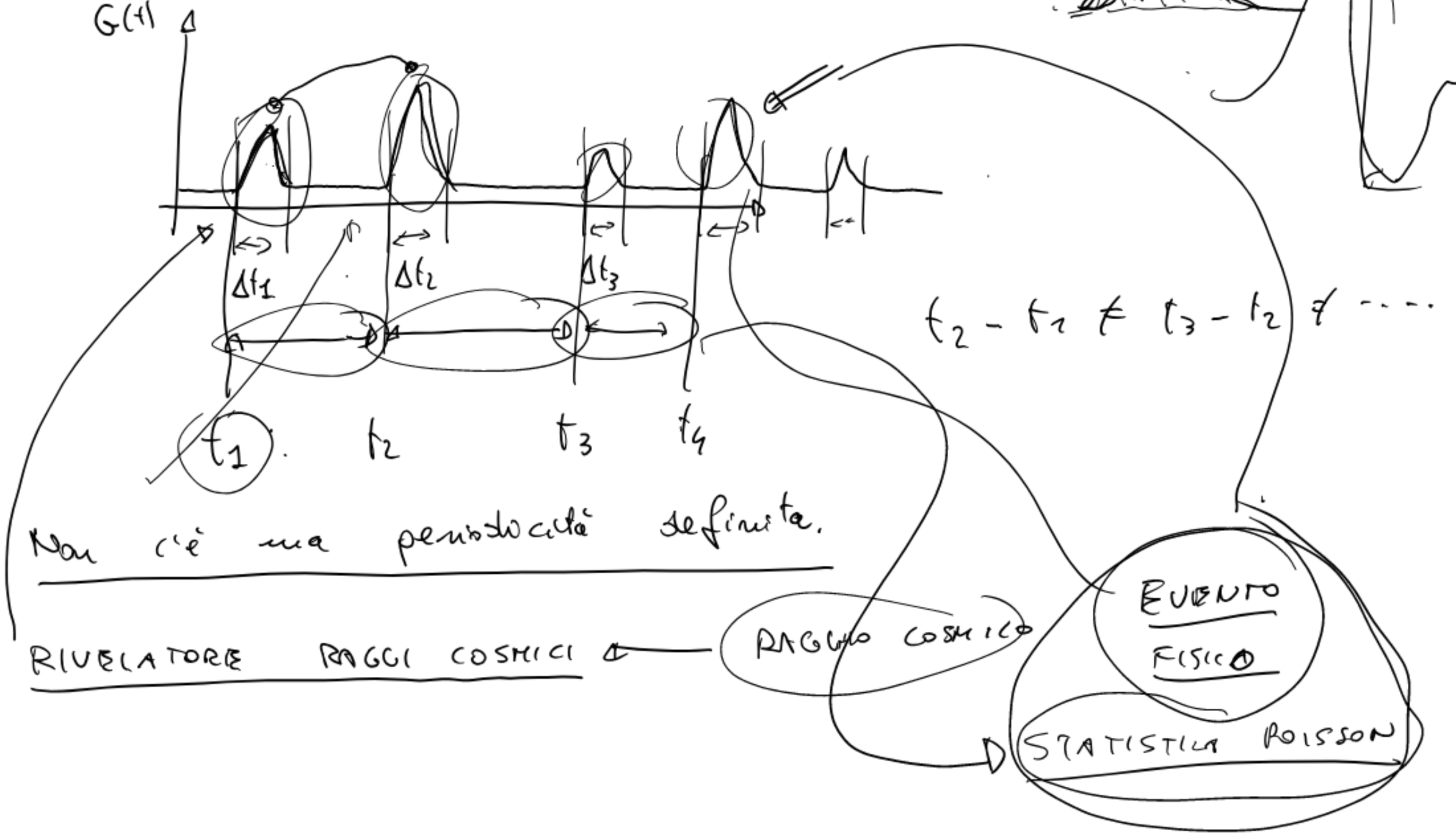
PERIODO



③ TRANSITORIA o IMPULSIVA

$G(t) \neq 0 \quad t_1 \leq t_i \leq t_2$ $\qquad \Delta t_i \neq \Delta t_j$





4) CASUALI

100 V

0

1 MIN

4

RUMORE ELETTRONICO

SPETTRO AMPIEZZA

0 100 V

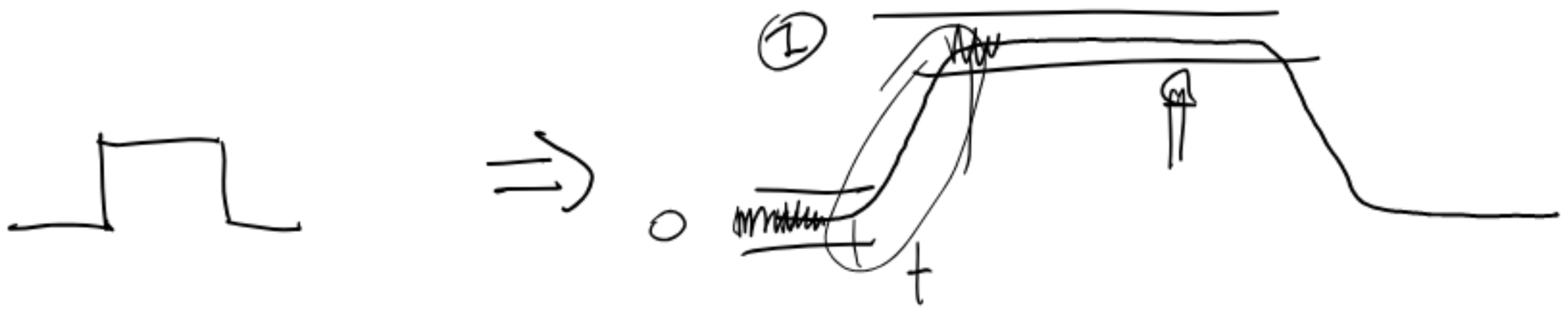
R(t)

t

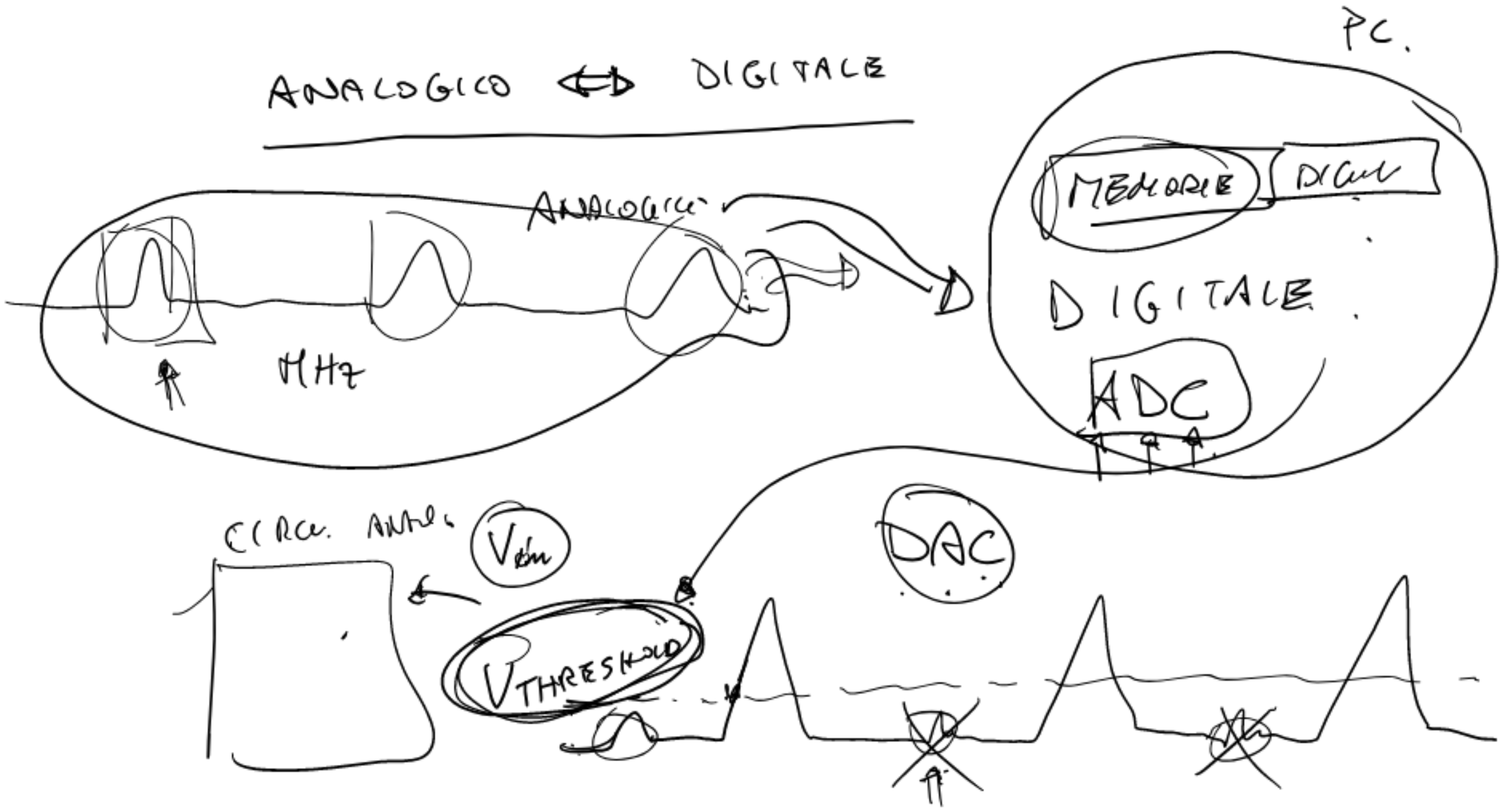
Ampiezza

Frequenza

5) (1) + (2) + (3) + (4) = + rumore



ANALOGICO ⟷ DIGITALE



DISPOSITIVI SEMICONDUTTORI

- DIODO
- TRANSISTOR

⇒ PORTE LOGICHE

Dispositivo analogico

Amplificatore

TRASDUTTORE

- SEMI CONDUTT.
- NON-SEM COND.

GRANDEZZA FISICA (G)

SEGNALE ELETTR.

V(G)

TEMPERATURA

TERMOCOPPIA

V(T)

DTA

Conduttore

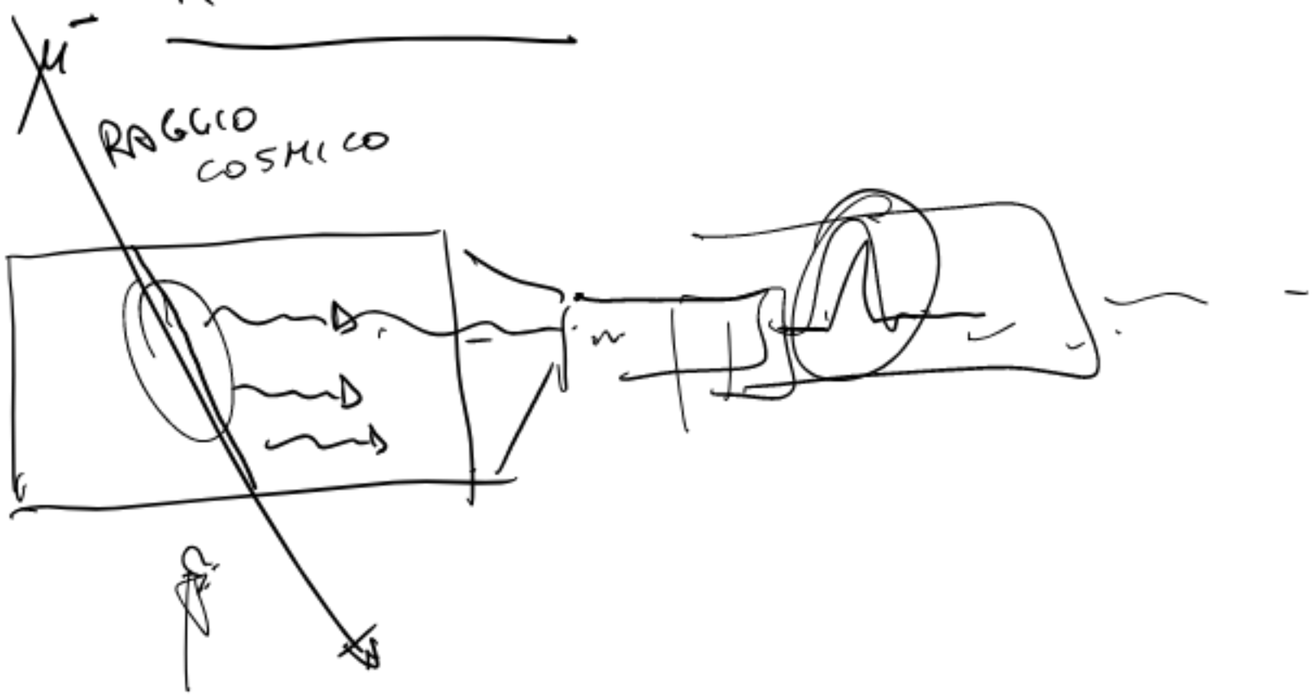
$R(T) = R(T_0)\left[1 + \alpha(T - T_0)\right]$

R_T → T

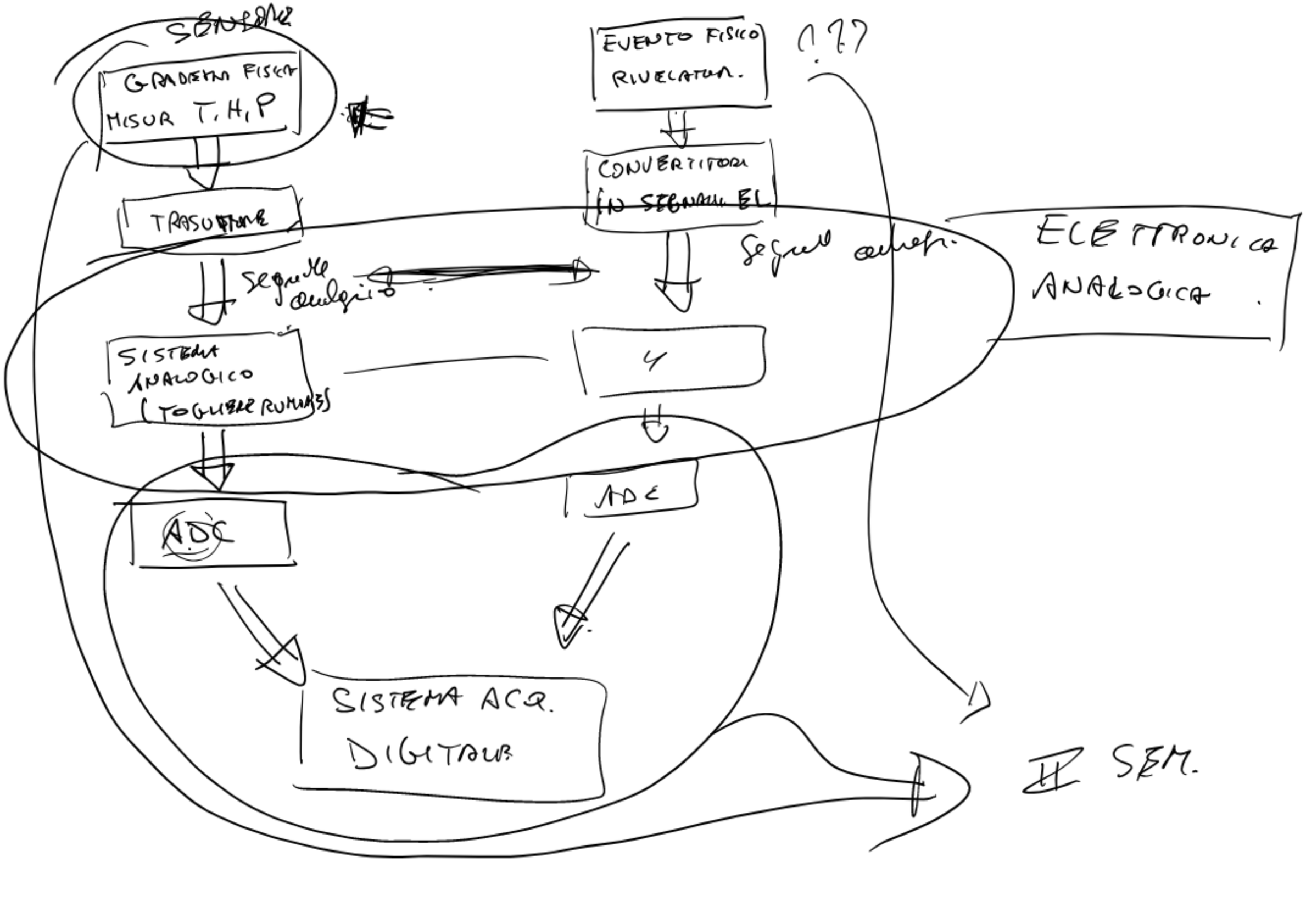
PT100

1000

RIVELATORI



ELETTRONICA PER LA FISICA



STRUMENTI UTILI PER ELETTRONICA ANALOGICA

1) NUMERI COMPLESSI → GRAND. EL. SINUSOIDALI

2) SVILUPPO SERIE DI FOURIER → strutture grand. PERIODICHE.

$\sum \sin + \sum \cos$

3) GRANDEZZE ELETTRICHE V, I, P

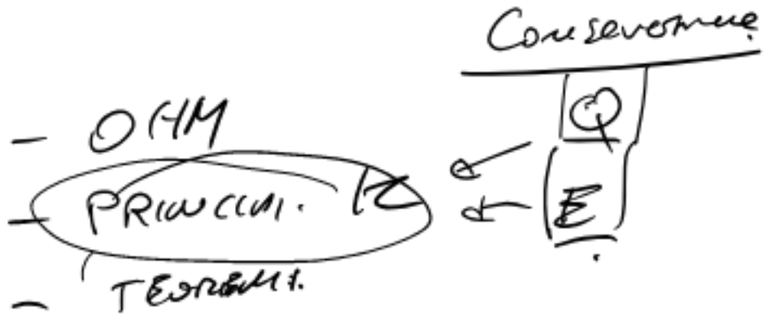
4) ELEMENTI CIRCUITALI "CONDUTTIVI" [tutto quello dei SEMICONDUTTORI]

R, L, C

5) LEGGI E PRINCIPI RETI ELETTRICHE

CORRENTE CONTINUA ⇐ R

REGIME SINUSOIDALE ⇐ Z



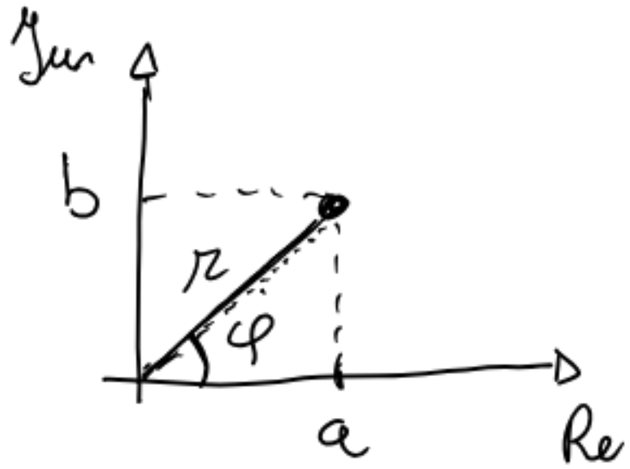
1 NUMERI COMPLESSI $\mathbb{C}$

z = Reale + IMMAGINARIO

$$z = a + jb$$

a = reale, b = immaginario

$$j^2 = -1$$ Def. unità immaginaria



-) Rapp. Cartesiana $z = a + jb$
-) Rapp. trigonometrica $z = r(\cos\varphi + j \sin\varphi)$

$a = r\cos\varphi$

$b = r\sin\varphi$

Modulo $r = \sqrt{a^2+b^2}$

Angolo $\varphi = \text{arctg}\,\frac{b}{a}$

Rapp. esponenziale

Formula di EULERO

$e^{j\varphi} = \cos\varphi + j\sin\varphi$

$$z = r \cdot e^{j\varphi}$$

Algebra in $\mathbb{C}$

$$z_1 = a + jb = r_1 e^{j\varphi_1}$$
$$z_2 = c + jd = r_2 e^{j\varphi_2}$$

Complesso CONIUGATO $\quad z = a + jb \quad z^* = a - jb$

SOMMA / SOTTRAZIONE

$$z_1 \pm z_2 = (a + jb) \pm (c + jd) = \underbrace{(a \pm c)}_{Re} + j\underbrace{(b \pm d)}_{Im}$$

Prodotto

$$z_1 \cdot z_2 = (a + jb)(c + jd) = ac + jad + jbc + j^2 bd$$
$$= (ac - bd) + j(ad + bc)$$

$$z_1 \cdot z_2 = r_1 e^{j\varphi_1} \cdot r_2 e^{j\varphi_2} = r_1 \cdot r_2 \cdot e^{j(\varphi_1 + \varphi_2)}$$

$$\boxed{r = |z| = \sqrt{z \cdot z^*}}$$

$$z \cdot z^* = (a + jb)(a - jb) = a^2 - j^2 b^2 = a^2 + b^2 = |z|^2 = r^2$$

Reciproco

$$\frac{1}{z} = \frac{1}{(a+jb)(a-jb)}(a-jb) = \frac{a-jb}{a^2+b^2} = \frac{z^*}{|z|^2}$$

$$\boxed{\frac{1}{z} = \frac{z^*}{|z|^2}}$$

$$\frac{1}{z} = \frac{1}{re^{j\varphi}} = \frac{1}{r}e^{-j\varphi}$$

Quoziente

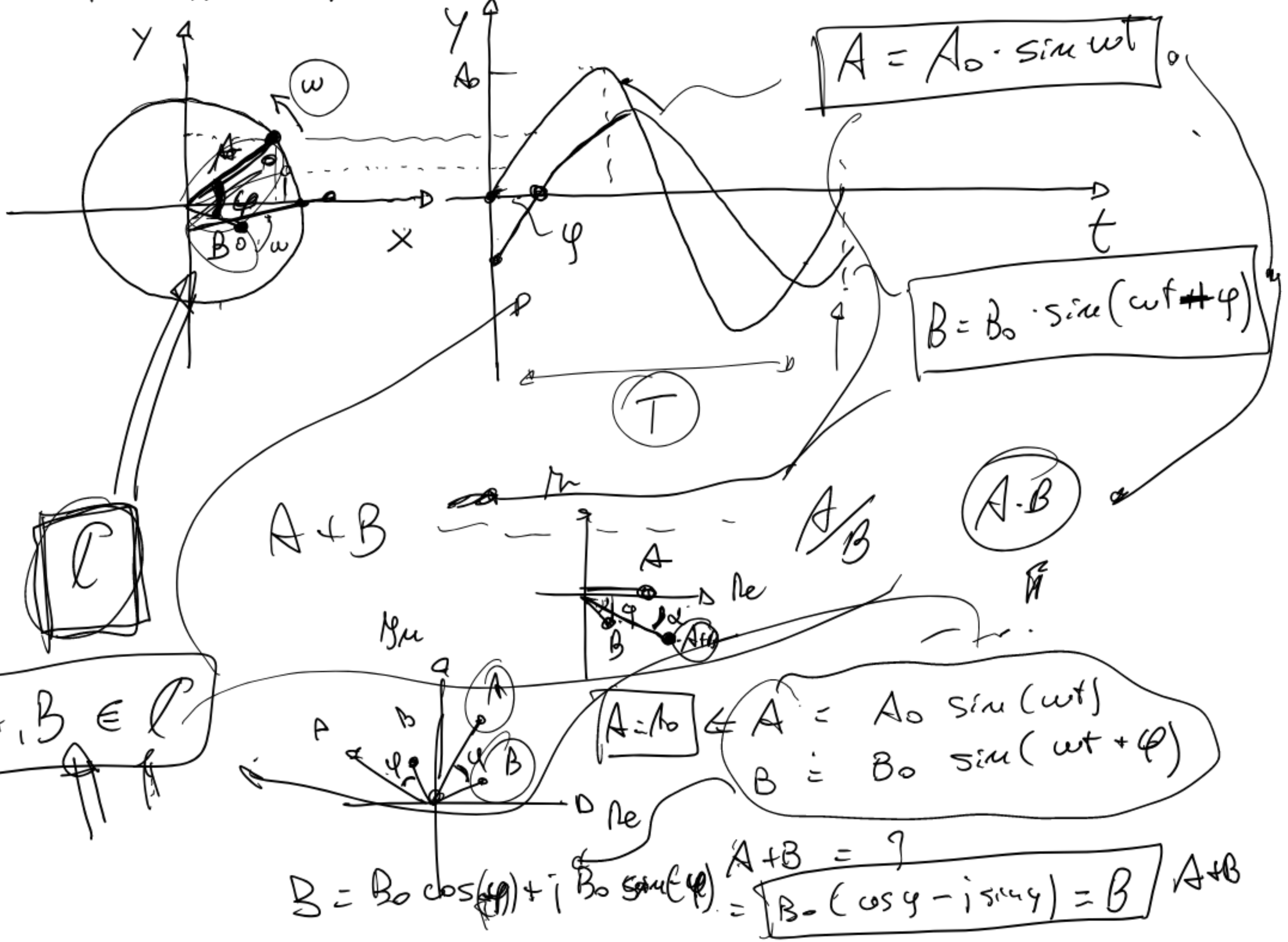
$$\frac{z_1}{z_2} = z_1 \frac{z_2^*}{|z_2|^2} = \frac{z_1 \cdot z_2^*}{|z_2|^2}$$

$$\frac{z_1}{z_2} = \frac{r_1 e^{j\varphi_1}}{r_2 e^{j\varphi_2}} = \frac{r_1}{r_2} e^{j(\varphi_1 - \varphi_2)}$$

Potenze

$$z^n = (a+jb)^n = r^n e^{jn\varphi}$$

NUMERI COMPLESSI ⟷ GRAND. SINUSOIDALI.



SIN ! GRANDEZZA Periodica = $\sum$ sin + $\sum$ cos.

SVILUPPO SERIE DI FOURIER

$f(t) = f(t+T)$ INTEGRABILE

$$f(t) = \boxed{a_0} + \sum_{M=1}^{+\infty} a_M \cos(M\omega_0 t) + \sum_{M=1}^{+\infty} b_M \sin(M\omega_0 t)$$

$\boxed{\omega_0}$: Pulsazione dell'armonica fondamentale $\omega_0 = \frac{2\pi}{T}$

$2\pi f = \frac{1}{T} 2\pi = \omega_0$

$M=1 \Rightarrow \cos(\omega_0 t)$

$\sin(\omega_0 t)$

$M>1 \Rightarrow \cos(M\omega_0 t)$

$\sin(M\omega_0 t)$

ARMONICHE DI ORDINE SUPERIORE

$$a_0 = \frac{1}{T}\int_0^{T/2} f(t)\,dt$$

OFFSET

VALOR MEDIO $f(t)$ sul T

$$a_n = \frac{2}{T} \int_{-T/2}^{T/2} f(t) \cdot \cos(n\omega_0 t)\, dt$$

$$b_n = \frac{2}{T} \int_{-T/2}^{T/2} f(t) \sin(n\omega_0 t)\, dt$$

Ampiezze delle armoniche. ⇒