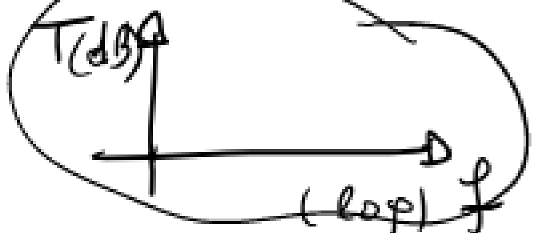
ELETTRONICA ANALOGICA 07/04/2020

ESERCIZI SIM

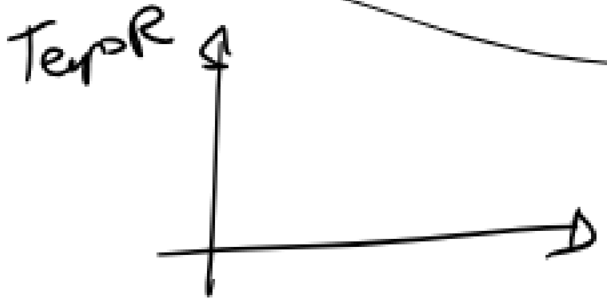
1) DAC → $V_{out} = f(V_0, V_1, V_2, V_3)$ ← schema elettronico

2) FILTRI → diagramma



3) PWM → Analogico Filtro RC $V_{RIPPLE} \approx mV$

Tempo risposta



V_{RIPPLE} (5 valori) Tempo

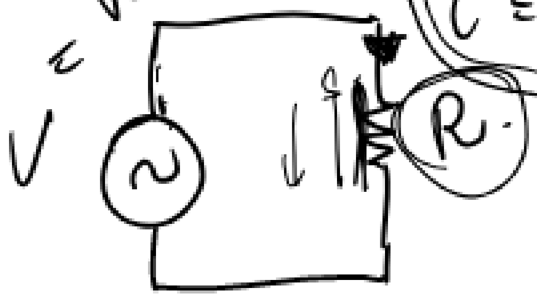
100 μV
1 mV
10 mV
50 mV
100 mV

— o —

VALORE EFFICACE

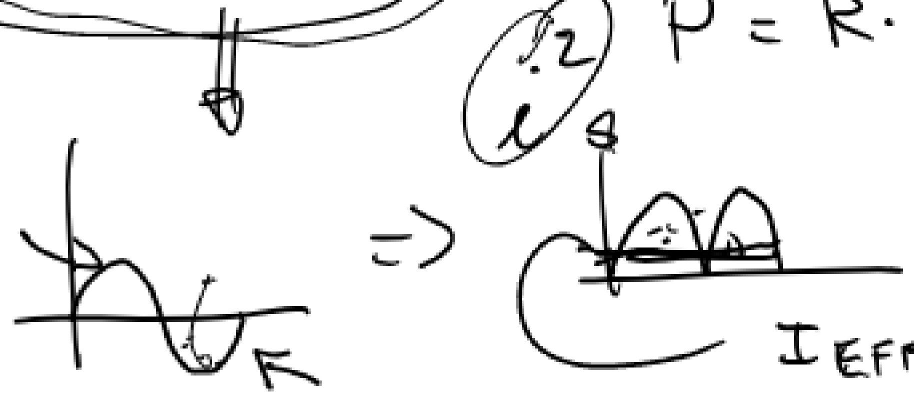
$V = V_0 \sin(\omega t)$

$i = I_0 \sin(\omega t)$



$P = R \cdot I^2$

$P = VI = RI^2$



$\int^T \sin^2(\omega t)\,dt = \frac{T}{2}$

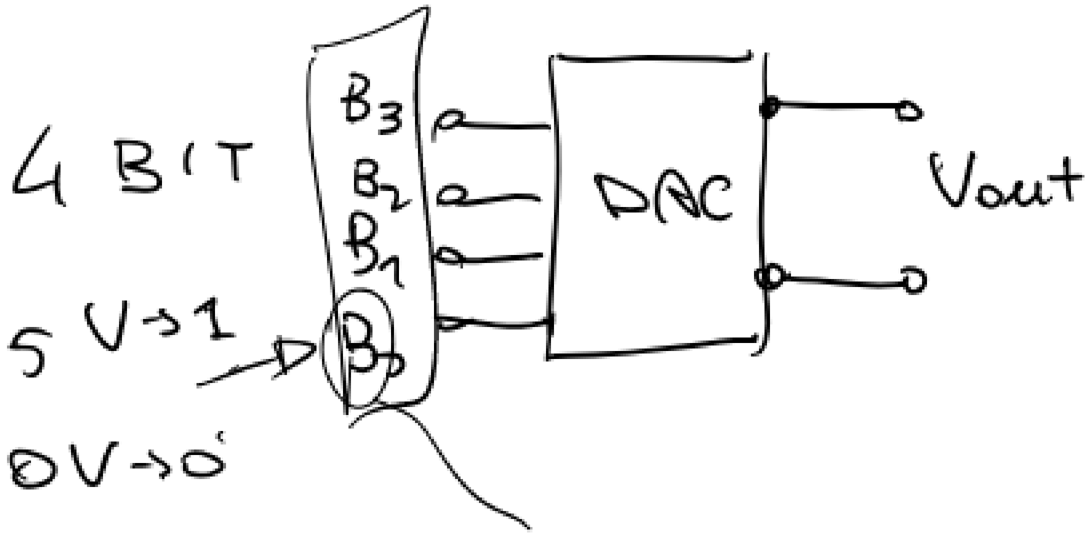
$A = A_0 \sin\omega t$

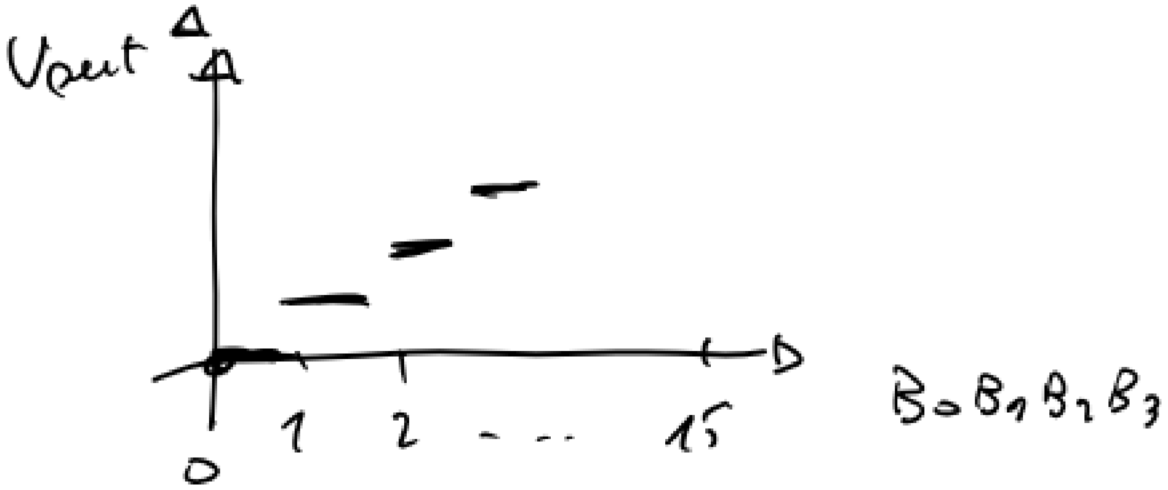
$A_{EFF} = \sqrt{\frac{1}{T}\int_0^T A^2\,dt}$

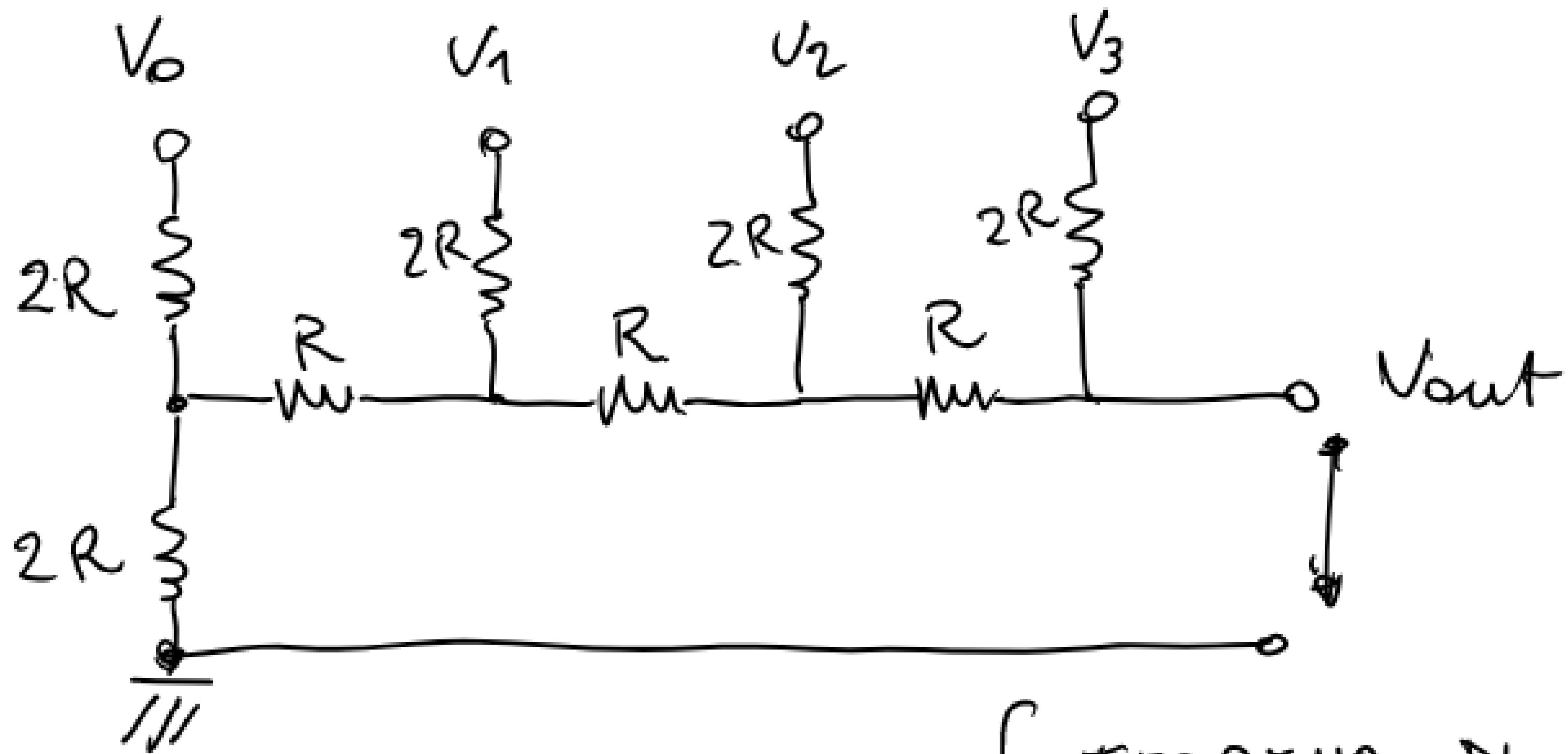
$= \sqrt{\frac{1}{T}\int_0^T A_0^2 \sin^2(\omega t)\,dt} = \frac{A_0}{\sqrt{2}}$

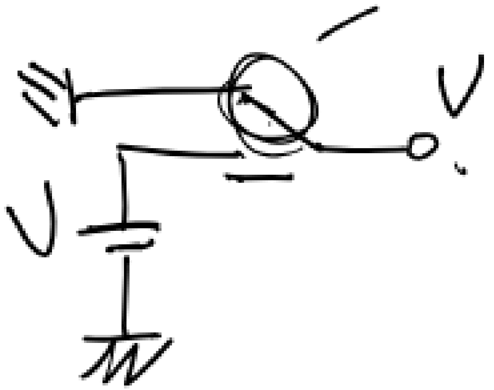
$$A_{EFF} = \frac{A_0}{\sqrt{2}}$$

DAC Digital To Analog Converter









$$V_{out} = f(V_0, V_1, V_2, V_3)$$

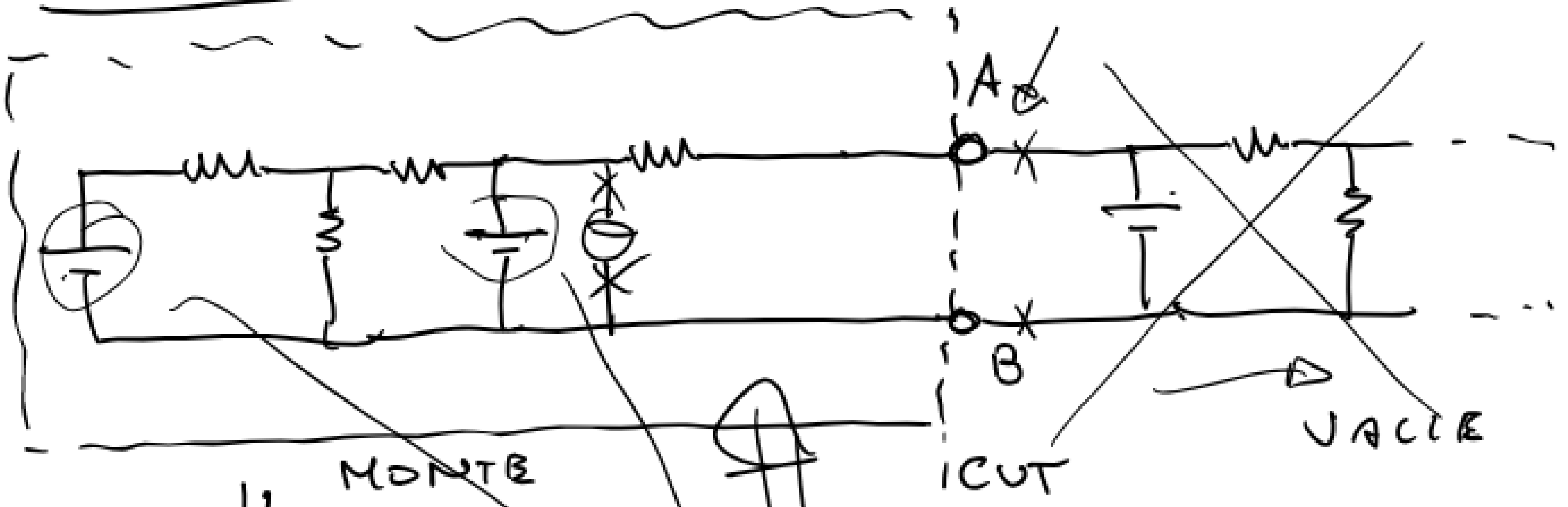
$$V_{out} = \frac{V_0}{16} + \frac{V_1}{8} + \frac{V_2}{4} + \frac{V_3}{2}$$

- TEOREMA DI THEVENIN
- PRINCIPIO DI SOVRAPPOSIZIONE

TEOREMA DI THEVENIN

Consideriamo una rete elettrica lineare

NO DISP. REATTIVI (C, L)



SCELTI DUE NODI AB

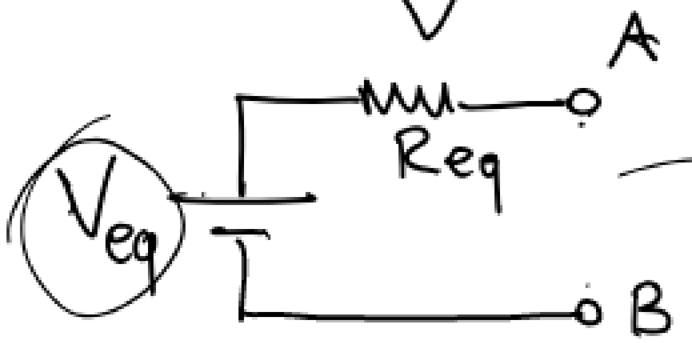
Tutto il circ. MONTE si può semplificare:

1) Gen. f.e.m. $V_{eq} = V_{AB}^{VUOTO}$ determinata a vuoto: senza circuito a VALLE.

2) Req determinata "R_{AB}" eliminando componenti attivi:

a) f.e.m ⇒ corto circuito

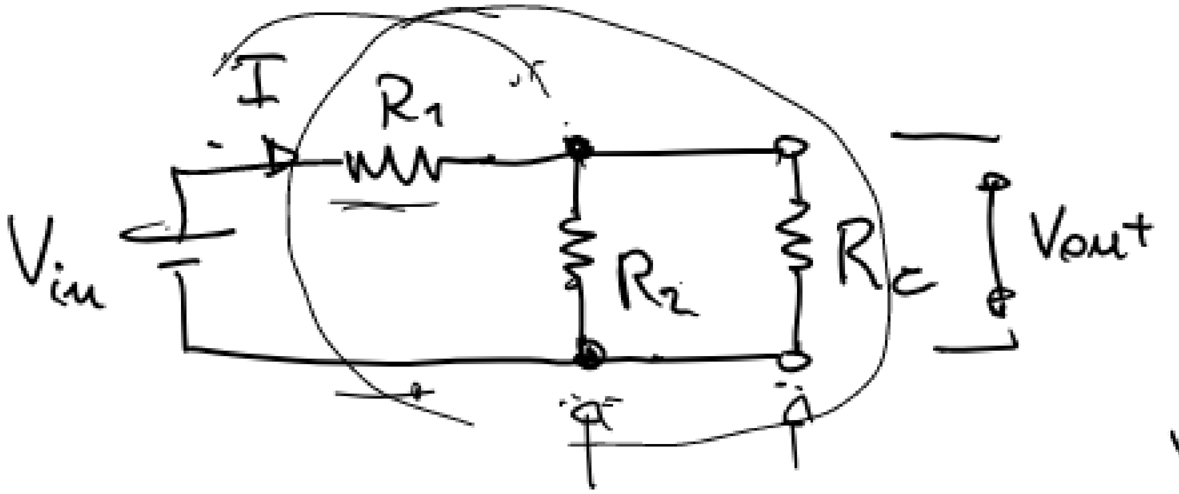
b) I_{GEN} ⇒ CIRCUITO APERTO



$V_{eq} \neq V_{AB}^{COMPLETO}$

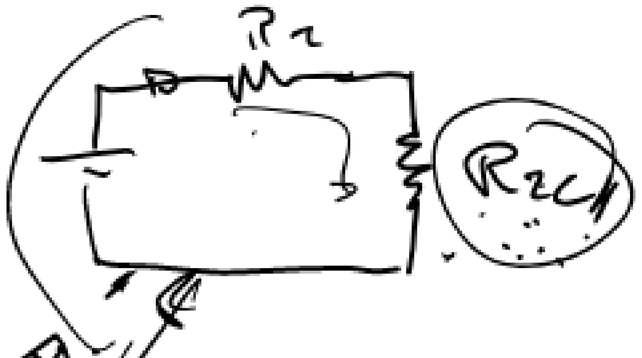
MONTE / VALLE scambiare.

ES. THEVENIN / PARTITORE CON CARICO



$V_{out} = f(V_{in}, R)$

$V_{out} = V_{in} - R_1 I \qquad I = \frac{V_{in}}{R_{TOT}}$ Parallelo



$R_{TOT} = R_1 + R_{2c}$

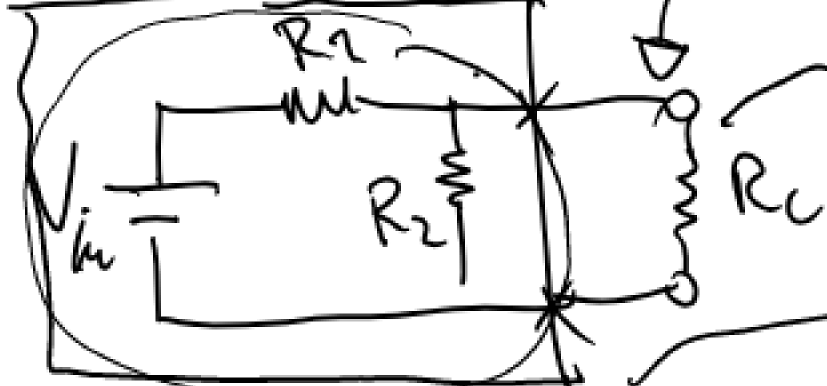
$$= V_{in} - V_{in}\frac{R_1}{R_1+R_{2c}} =$$

$$= V_{in}\left(1 - \frac{R_1}{R_1+R_{2c}}\right) = V_{in}\frac{R_{2c}}{R_1+R_{2c}}$$

$$V_{out} = V_{in}\frac{R_{2c}}{R_1+R_{2c}}$$

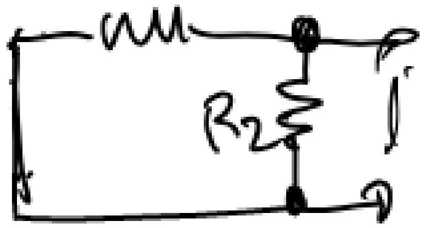
PRINC.

THEVENIN



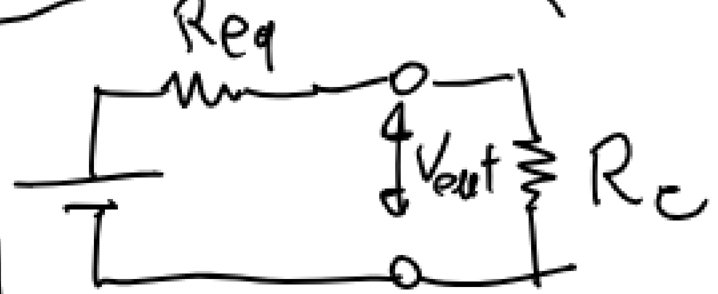
1) $V_{eq} = V_{in}\frac{R_2}{R_1+R_2}$

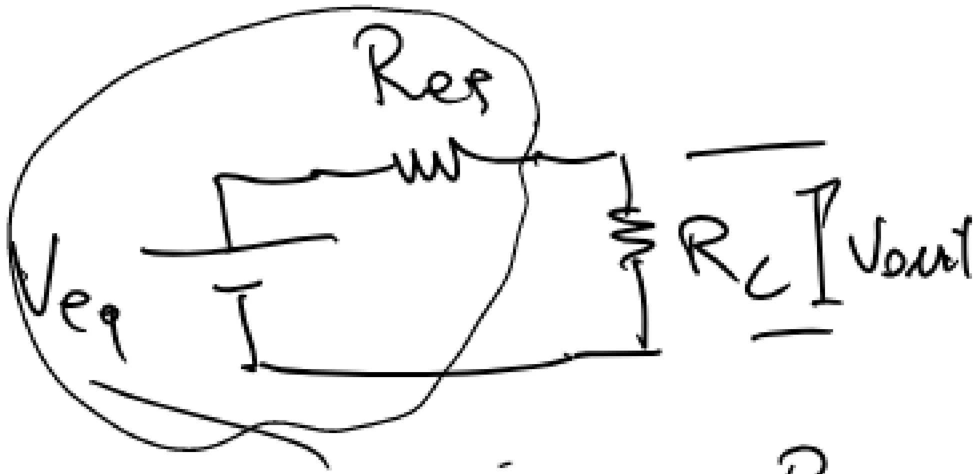
2) R_{eq}



$$R_{eq} = R_{12//} = \frac{R_1 R_2}{R_1+R_2}$$

PART. RES SENZA CARICO





$$V_{eq} = V_{in} \frac{R_2}{R_1 + R_2}$$

$$R_{eq} = \frac{R_1 R_2}{R_1 + R_2}$$

$$V_{out} = V_{in} \frac{R_{2c}}{R_1 + R_{2c}}$$?

$$V_{out} = V_{eq} \cdot \frac{R_c}{R_{eq} + R_c} = V_{in} \frac{R_2}{R_1 + R_2} \cdot \frac{R_c}{\frac{R_1 R_2}{R_1 + R_2} + R_c (R_1 + R_2)}$$

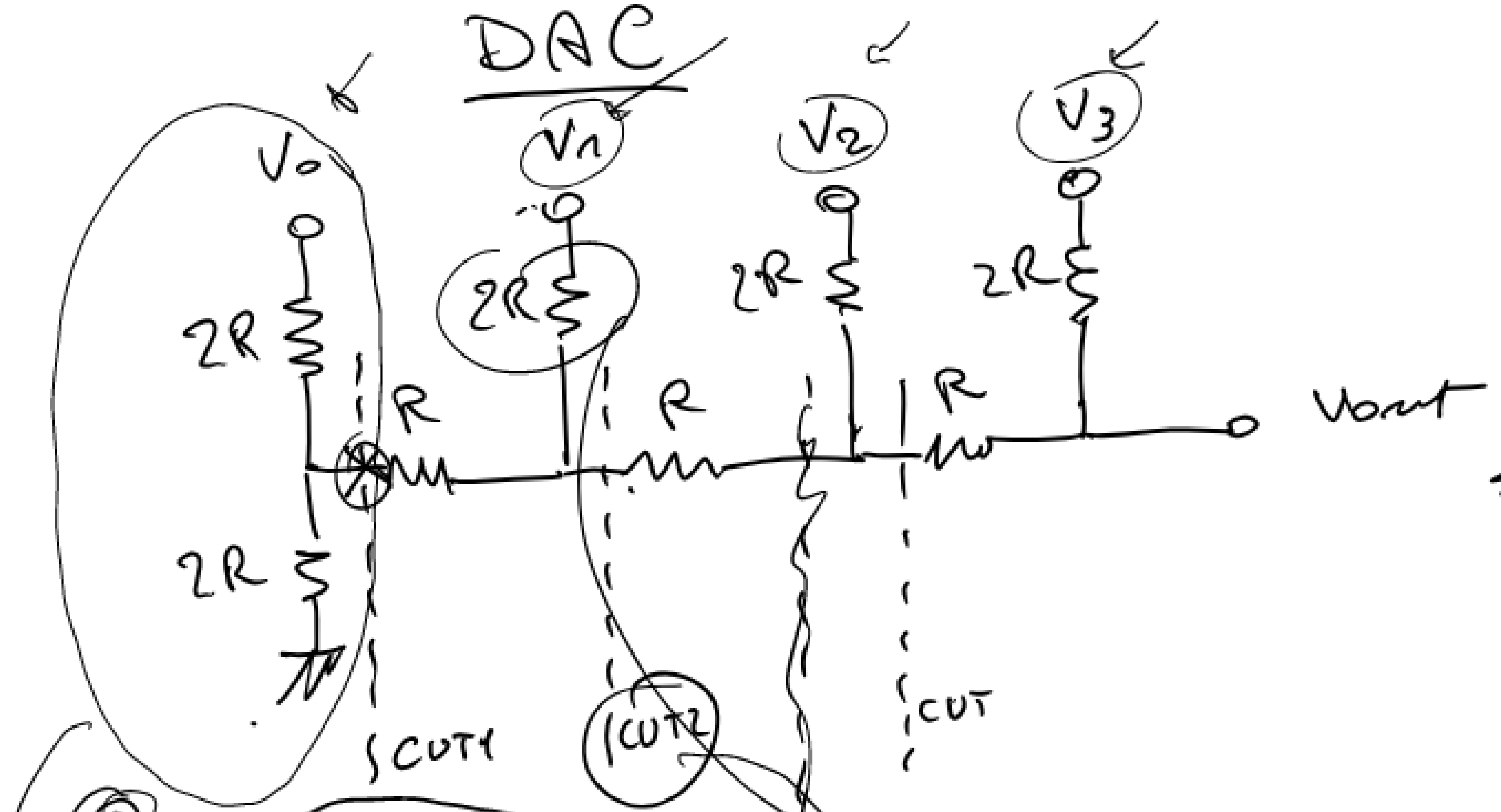
$$= V_{in} \frac{R_2 R_c}{R_1 R_2 + R_1 R_c + R_2 R_c} =$$

$$R_{2c} = \frac{R_2 \cdot R_c}{R_2 + R_c}$$

$$= V_{in} \frac{R_2 R_c / (R_2 + R_c)}{\frac{R_1 (R_2 + R_c)}{(R_2 + R_c)} + \frac{R_2 \cdot R_c}{R_2 + R_c}} = V_{in} \frac{R_{2c}}{R_1 + R_{2c}}$$

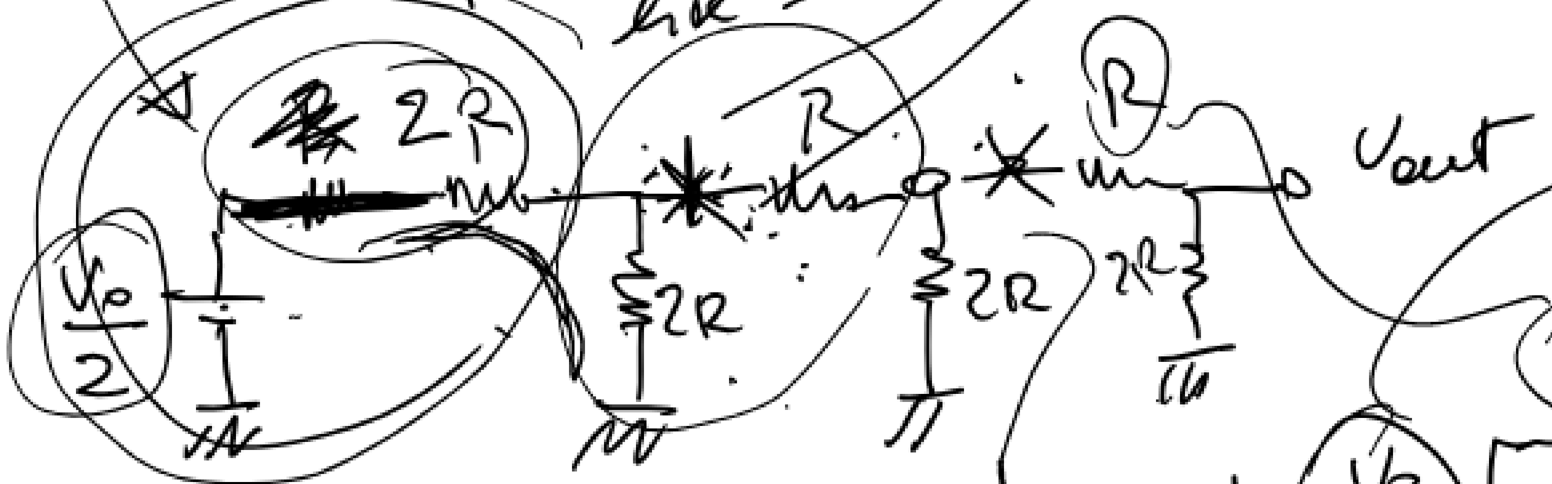
PAUSA

DAC



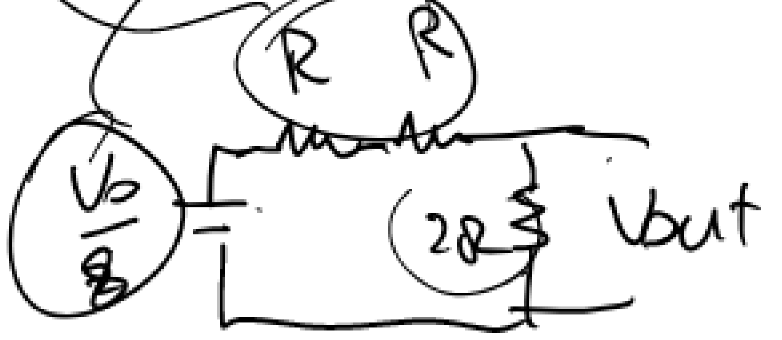
$$V_{eq}^{CUT1} = V_0 \frac{2R}{4R} = V_0/2$$

$$R_{eq} = \frac{4R^2}{4R} = R$$



$$V_{eq}^{(2)} = \frac{V_{eq}^{(1)}}{2} = \frac{V_0}{4}$$

$$V_{eq}^{CUT3} = \frac{V_0}{8}$$



$$V_{out}^{(0)} = \frac{V_0}{16}$$

PRINCIPIO DI SOVRAPPOSIZIONE

V_0 $\quad V_1, V_2, V_3 = 0$ GND

$V_{out}^{(0)} = f(V_0) \ldots$

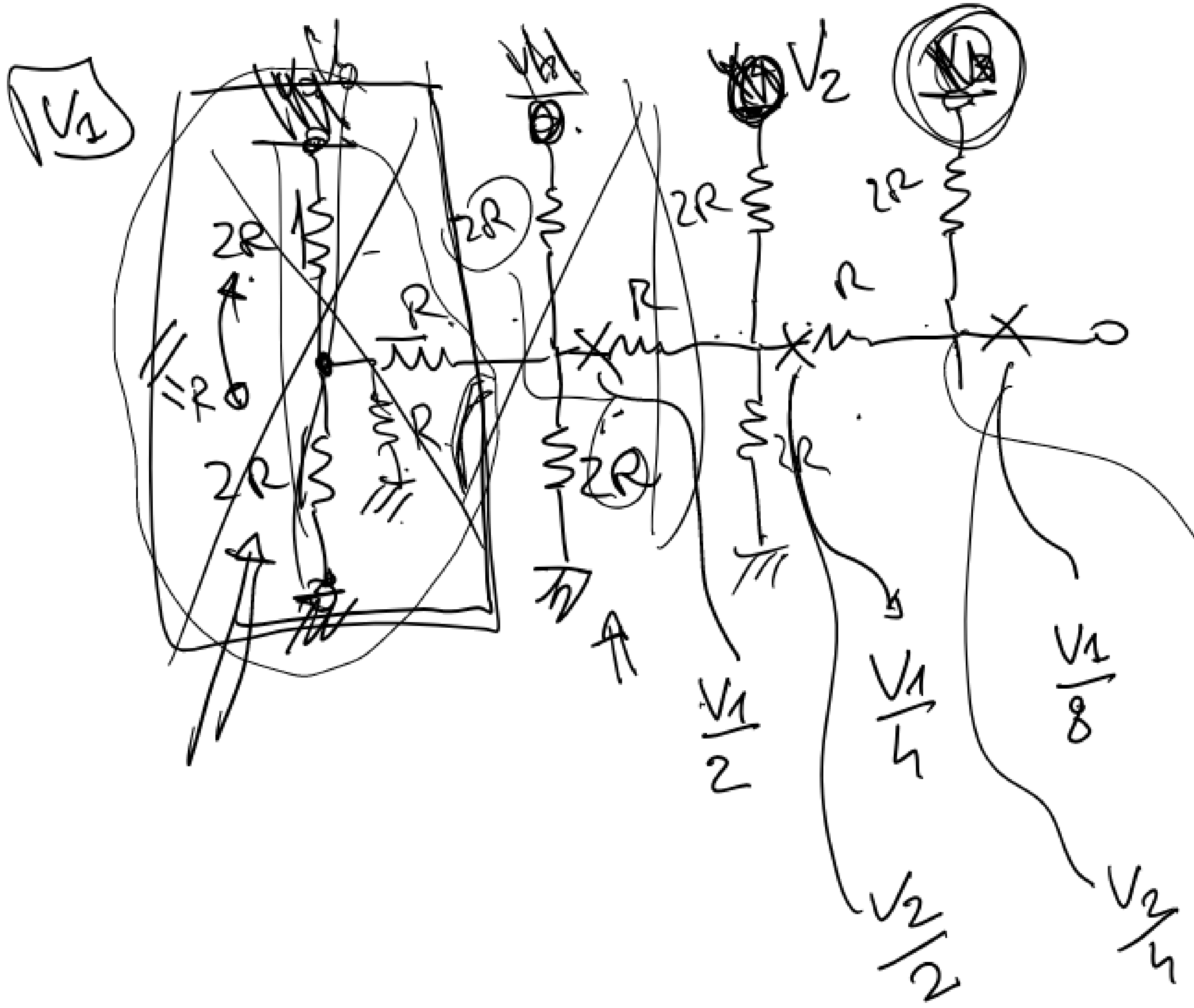
V_1 $\quad V_0, V_2, V_3 = 0$

$V_{out}^{(1)} = f(V_1)$

V_2 $\quad V_{out}^{(2)}$

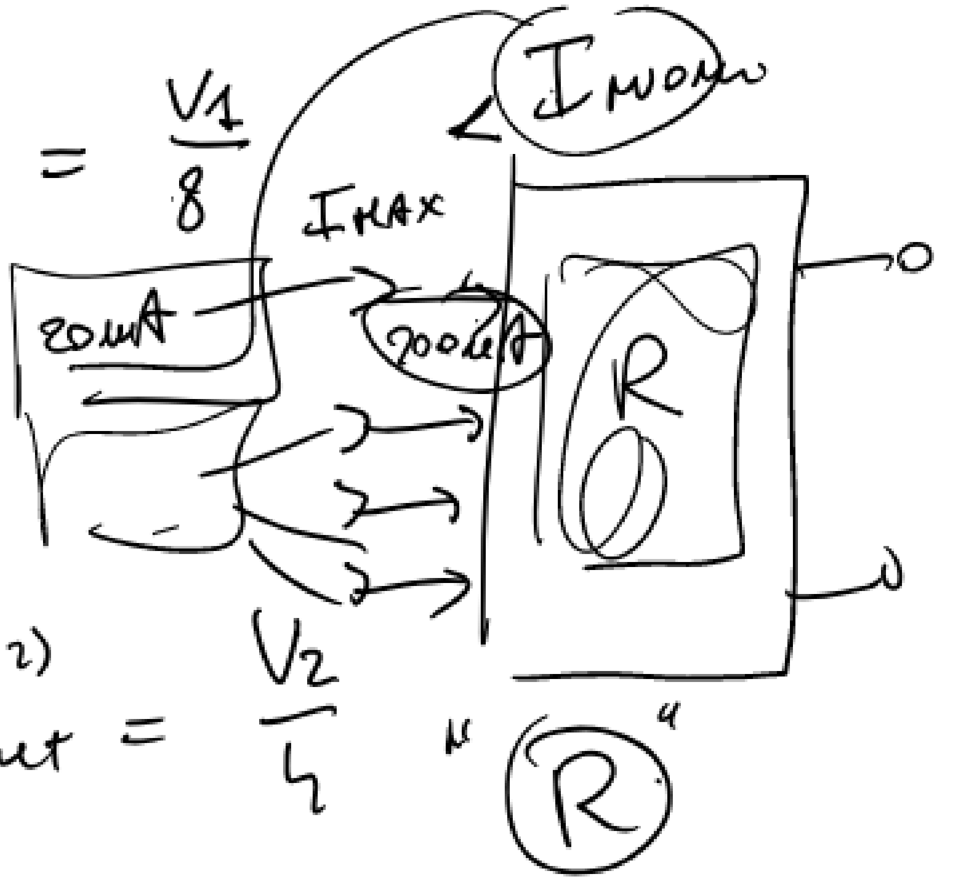
V_3 $\quad V_{out}^{(3)}$

$$V_{out} = V_{out}^{(0)} + V_{out}^{(1)} + V_{out}^{(2)} + V_{out}^{(3)}$$



$$V_{out}^{(0)} = \frac{V_0}{16}$$

$$V_{out}^{(1)} = \frac{V_1}{8}$$



$$V_{out}^{(2)} = \frac{V_2}{4}$$

"R"

$$V_{out}^{(3)} = \frac{V_3}{2}$$

$$V_{out} = \frac{V_0}{16} + \frac{V_1}{8} + \frac{V_2}{4} + \frac{V_3}{2}$$

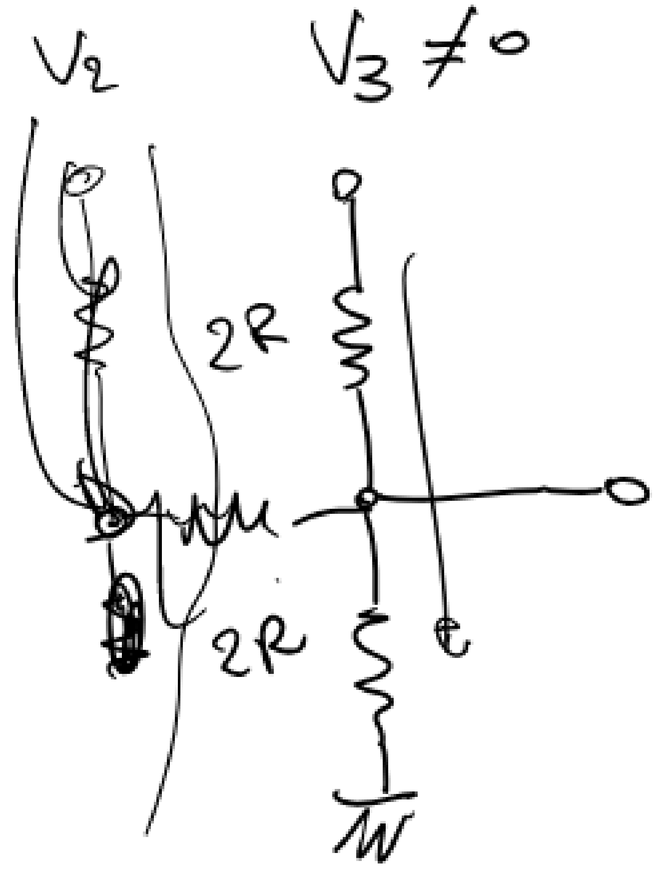
$V_{MAX} = 16$ $\quad V_i = 0$ $\quad V_{out} = 0.$

$V_i = 16$ $\quad V_{out} = 1 + 2 + 4 + 8 = 15$

Esercizio $\quad V_2 \neq 0$

$V_0, V_1, V_3 = 0$

$\rightarrow V_{out}^{(2)}$



$V_3 = 4RI$

$$I_{MAX} = \frac{V_3}{4R}$$

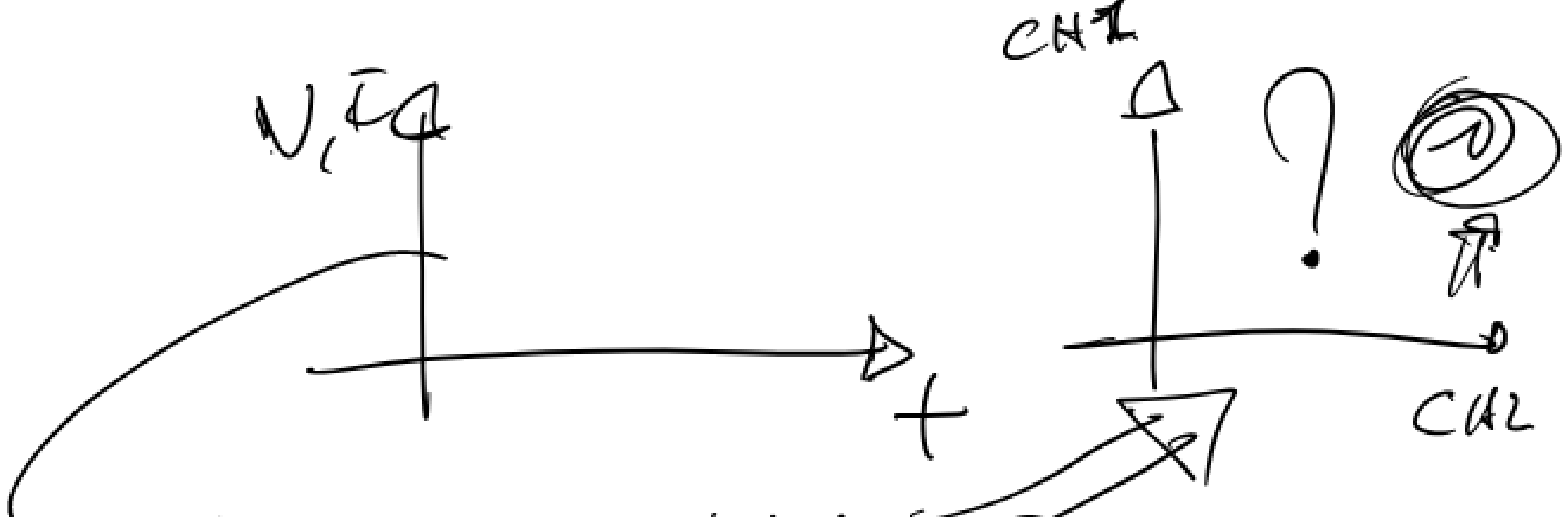
$I_{MAX} \approx 20$ mA → 2 mA

$$R = \frac{5}{4 \cdot \cancel{25}\,4 \cdot 10^{-3}} = 100\ \Omega \simeq 1.2\ k\Omega$$

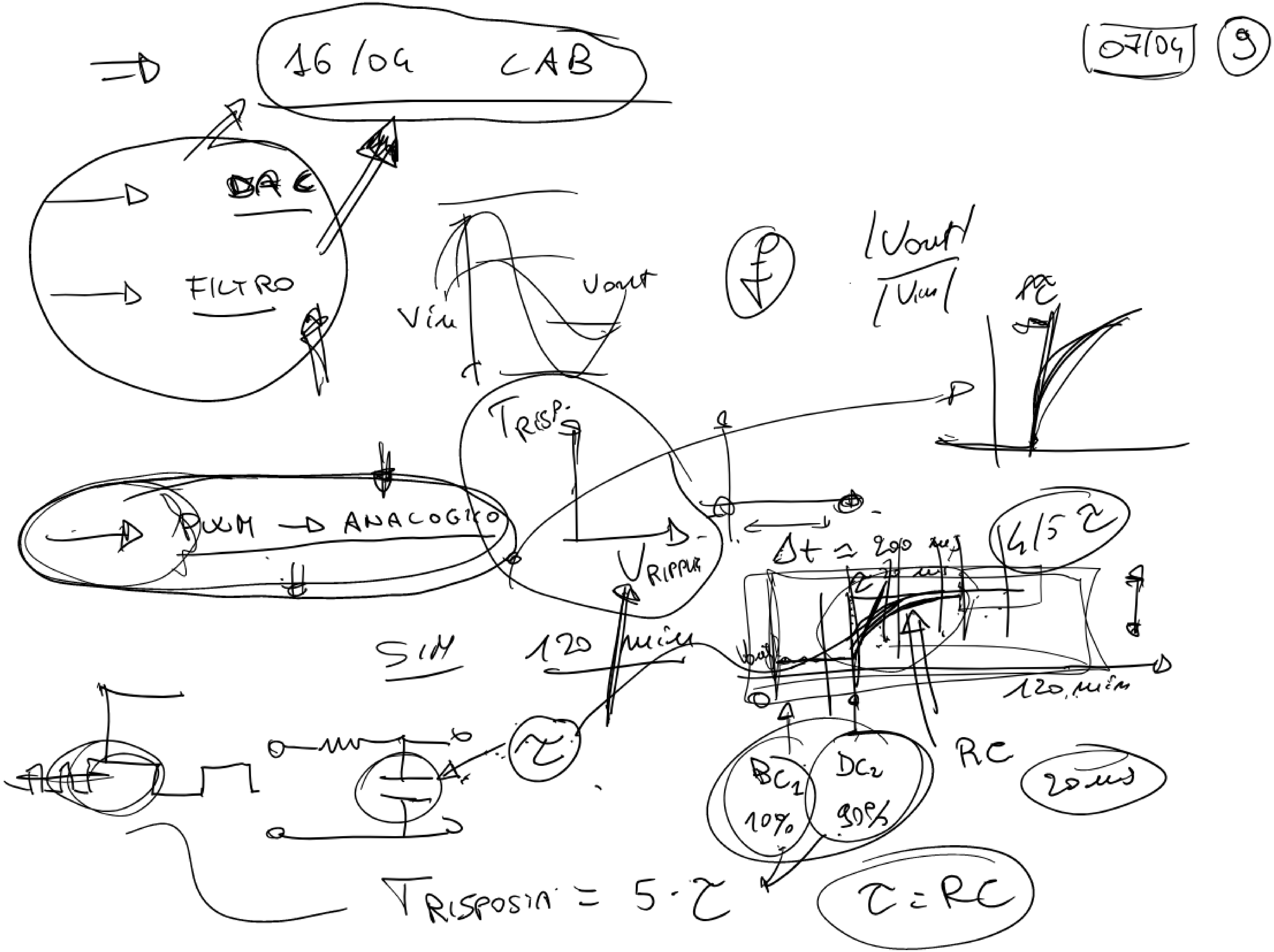
GIO 09/04
MAR 14/04] NO LEZIONE PASQUA

MULTISIM

?



esportare tabella. (2)


07/04
9
16/04 CAB
DAC
FILTRO
Vin
Vout
f
|Vout|/|Vin|
RC
PWM → ANALOGICO
TRESP
VRIPPLE
Δt ≃ 200 ms
4/5 τ
SIM
120 min
120 min
τ
DC1 10%
DC2 90%
RC
20 ms
TRISPOSTA = 5 · τ
τ = RC