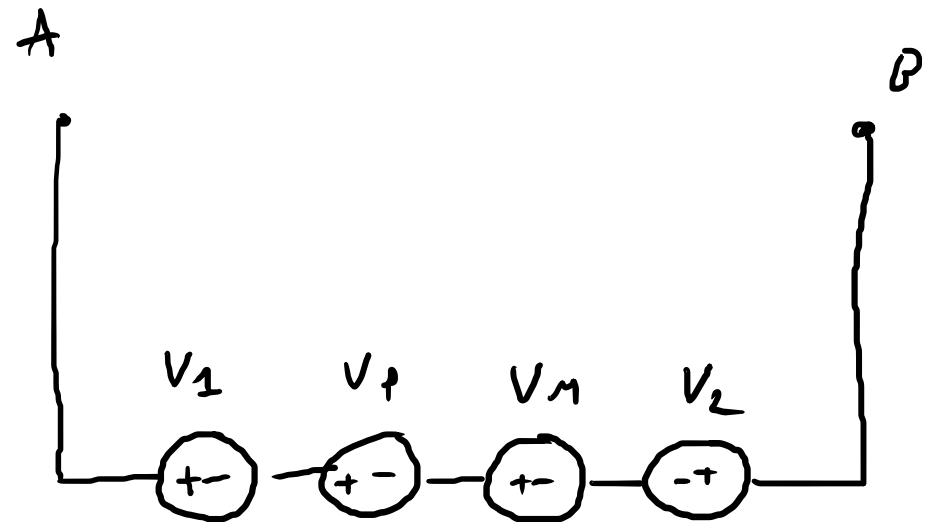
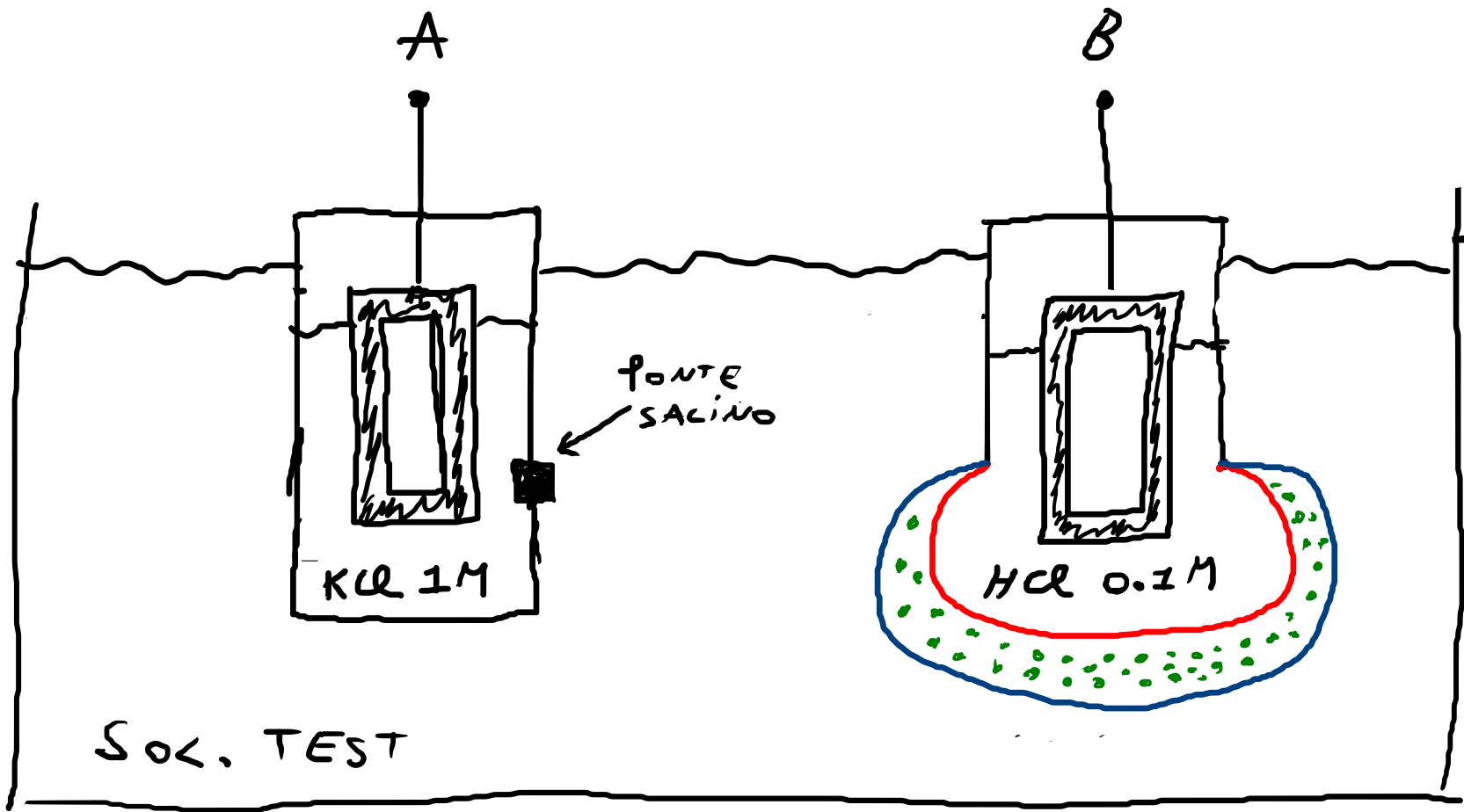


PUNTO 1



$$V_{AB} = V_1 + V_p + V_M - V_2$$

$V_p \rightarrow$ TRASCURABILE (PONTE SALINO)

— MEMBRANA DI VETRO

... STRATO ENZIMATICO

— MEMBRANA PER DIALISI



ELETTRODO $Ag/AgCl$

$$V_{AP} = V_1 + V_M - V_2$$

$$V_1 = E_0 - \frac{RT}{F} \ln ([Cl^-]) = E_0 = 0.22 V \quad \left(E_0: A_1/A_2 \right)$$

$$V_M = \frac{RT}{F} \ln \left(\frac{[H^+]}{0.1} \right) = \frac{RT}{F} \ln ([H^+]) - \frac{RT}{F} \ln (0.1)$$

$\hookrightarrow [HCl] = 0.1 M$

$$V_2 = E_0 - \frac{RT}{F} \ln ([Cl^-]) = E_0 - \frac{RT}{F} \ln (0.1)$$

$$V_{AP} = \cancel{E_0} + \frac{RT}{F} \ln ([H^+]) - \frac{RT}{F} \ln (0.1) - \cancel{E_0} + \frac{RT}{F} \ln (0.1)$$

$$\Rightarrow V_{AP} = \frac{RT}{F} \ln ([H^+]) \quad ([H^+] \rightarrow [P])$$

$$K_M \gg [S] \Rightarrow [P]_{x=0} = [S] \frac{D_s}{D_p} \left(1 - \frac{1}{\cosh(L\sqrt{\alpha})} \right)$$

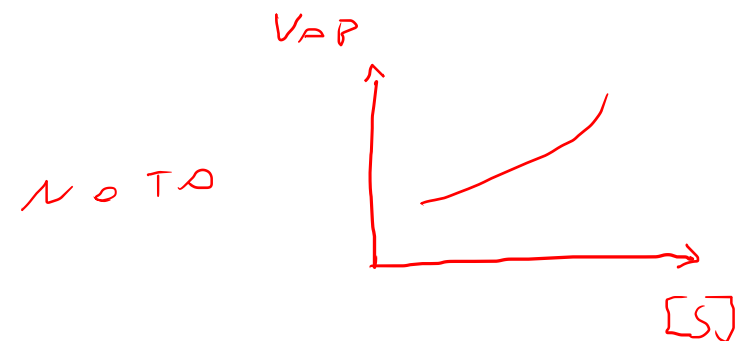
$$\alpha = \frac{k_2 [E]_0}{K_M D_s} = 3 \cdot 10^6$$

$$K^* = \frac{D_s}{D_p} \left(1 - \frac{1}{\cosh(L\sqrt{\alpha})} \right) = 0.6569$$

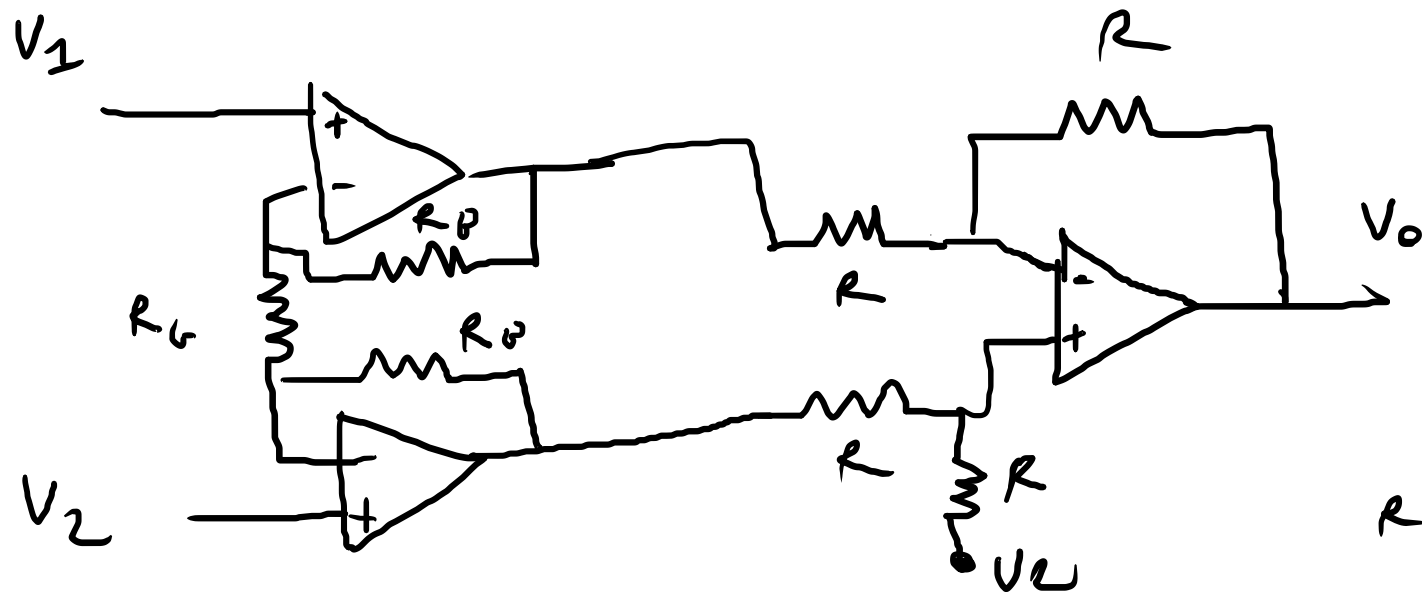
$$[P] = K^* [S]$$

$$V_{AP} = \underbrace{0.025 \text{r} \ln(K^*)}_{-0.015 \text{V}} + 0.025 \text{r} \ln([S])$$

$$\underline{V_{AP} = 0.025 \text{r} \ln([S]) - 0.015}$$



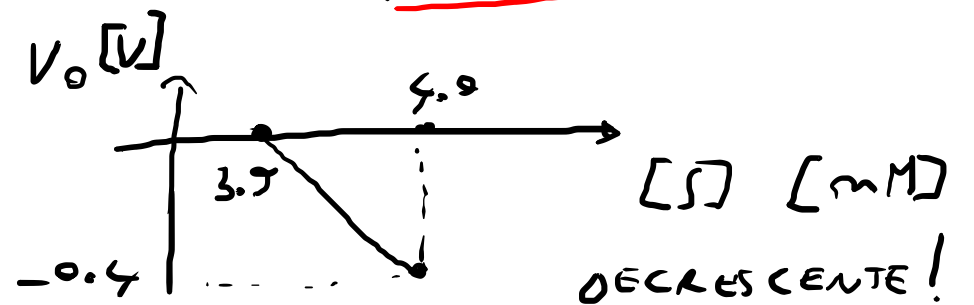
PUNTO 2



$$V_o = A(V_2 - V_1) + V_R$$

$$A = 1 + 2 \frac{R_B}{R_G}$$

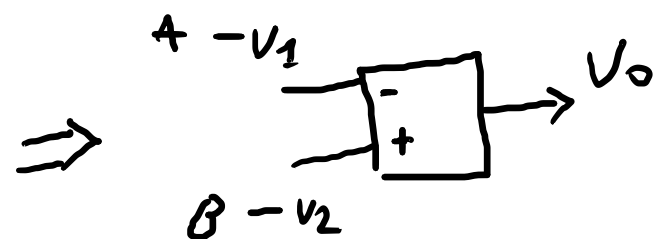
Risultazione → VEDI PAGINE FINALI



SPECIFICHE

$$\begin{cases} V_o(3.9 \text{ mm}) = 0 \\ V_o(4.9 \text{ mm}) = -0.4 \text{ V} \end{cases}$$

$V_{AO}([S]) \nearrow$
 $V_o([S]) \searrow$



$V_1 \rightarrow A$
 $V_2 \rightarrow B$

$$\begin{aligned} V_o &= A V_{PA} + V_R = \\ &= -A V_{AO} + V_R \end{aligned}$$

$$V_o = -A V_{AP} + V_R \quad V_{AP} = 0.0251 \ln([S]) + C \quad C = -0.015 [V]$$

$$\begin{cases} \textcircled{1} -A \cdot 0.0251 \ln(3.9 \cdot 10^{-3}) - A \cdot C + V_R = 0 \\ \textcircled{2} -A \cdot 0.0251 \ln(4.9 \cdot 10^{-3}) - A \cdot C + V_R = -0.4 \end{cases}$$

$$\text{SOTTRAGGO } \textcircled{1} - \textcircled{2} \quad A \cdot 0.0251 \left[\ln(4.9 \cdot 10^{-3}) - \ln(3.9 \cdot 10^{-3}) \right] = 0.4$$

$$A = \frac{0.4}{0.0251 \left[\ln(4.9 \cdot 10^{-3}) - \ln(3.9 \cdot 10^{-3}) \right]} = 68.45$$

$$\frac{1 + 2 \frac{R_P}{R_G}}{R_G} = 68.45 \quad \frac{2 R_P}{R_G} = 67.45 \quad R_P = 50 \text{ K}\Omega$$

$$R_G \cong 1.48 \text{ K}\Omega$$

$$V_R = A \cdot 0.0251 \ln(3.9 \cdot 10^{-3}) + A \cdot (-0.015) = -10.75 \checkmark$$

2 UNT03

$$V_o = -A \cdot 0.0256 \ln([S]) - A \cdot C + V_R$$

$$V_o = K_1 \ln([S]) + K_2$$

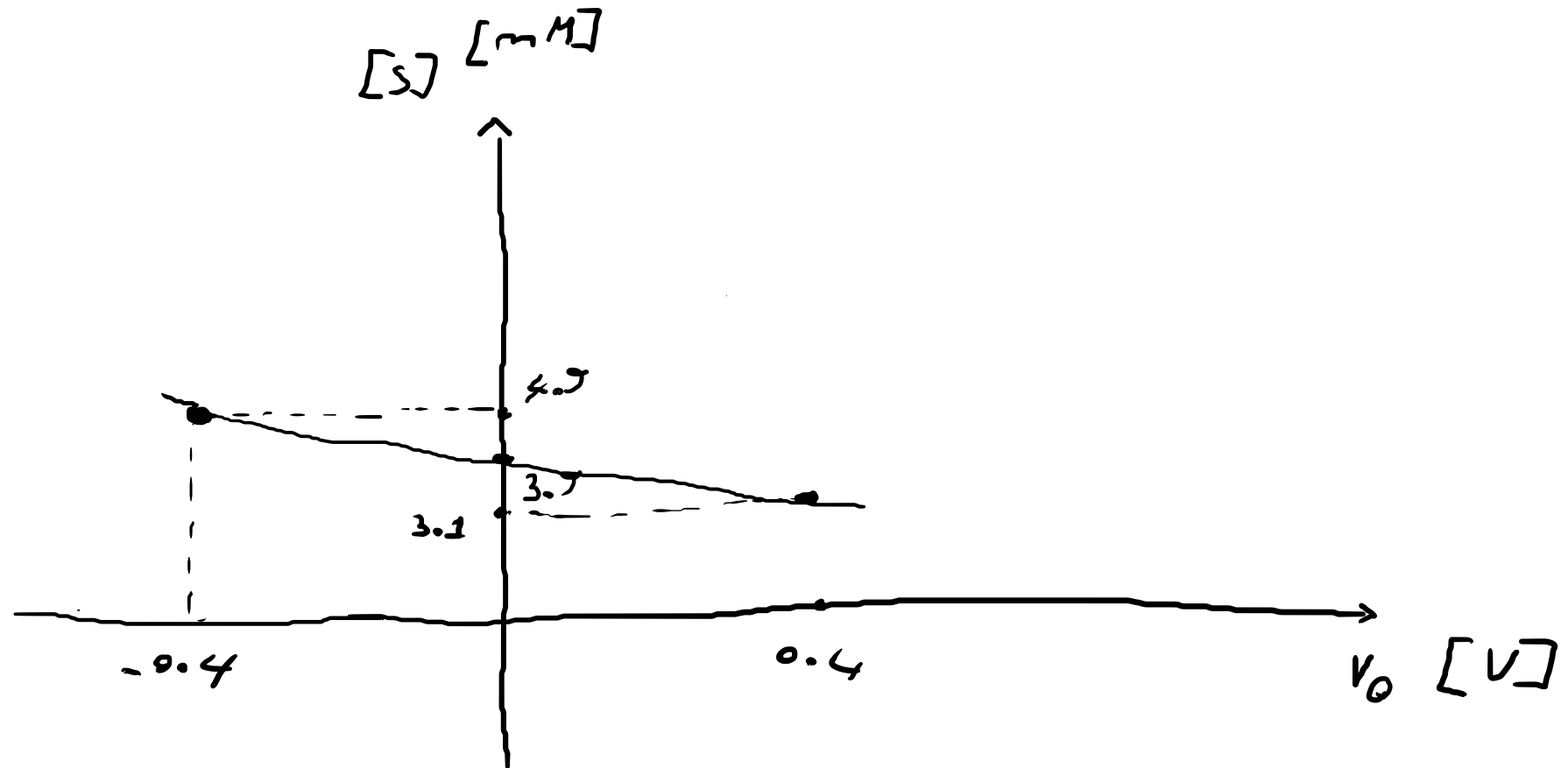
$$\ln([S]) = \frac{V_o - K_2}{K_1}$$

$$[S] = e^{\frac{V_o - K_2}{K_1}}$$

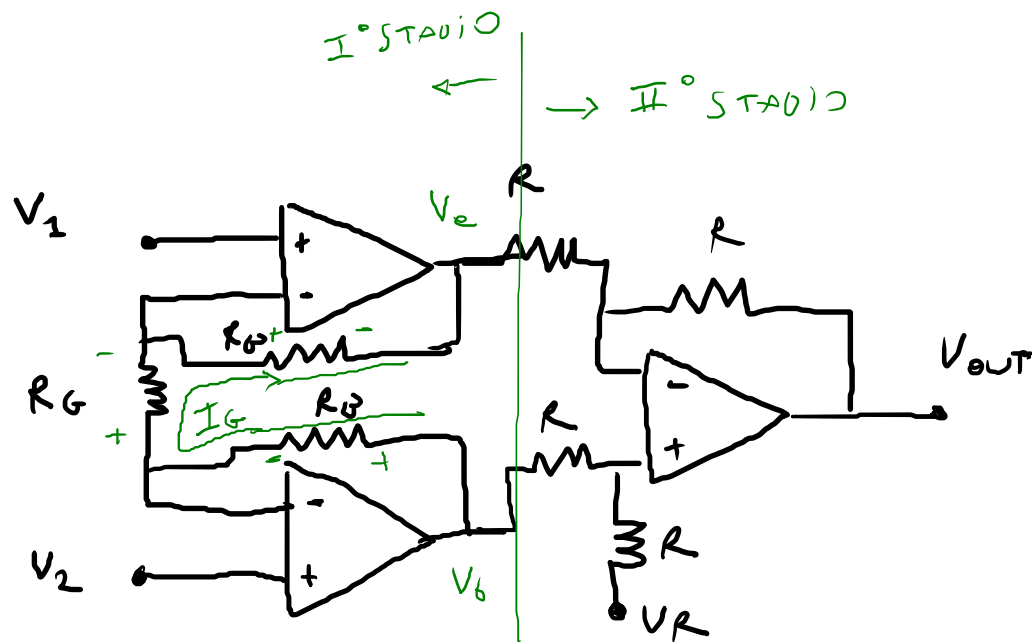
$$V_o = 0.4 \text{ V} \rightarrow [S] \hat{=} 3.1 \text{ mM}$$

$$K_1 = -A \cdot 0.0256 = -1.7523 \text{ [V]}$$

$$K_2 = -A \cdot C + V_R = -9.7233 \text{ [V]}$$



Risoluzione circuito



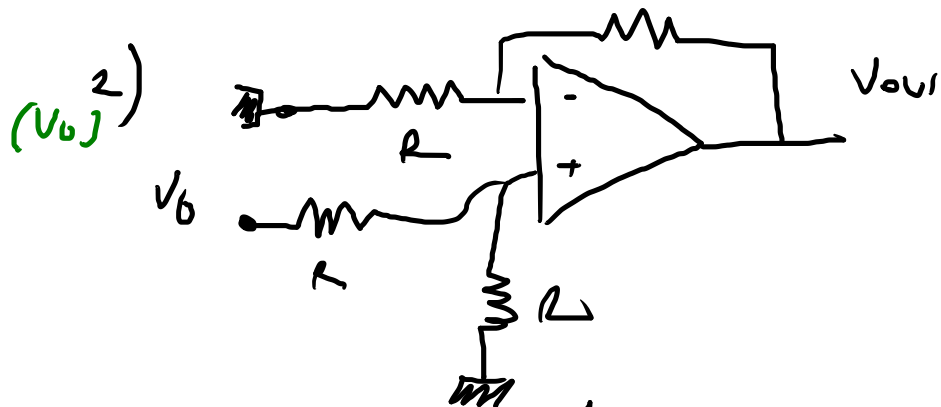
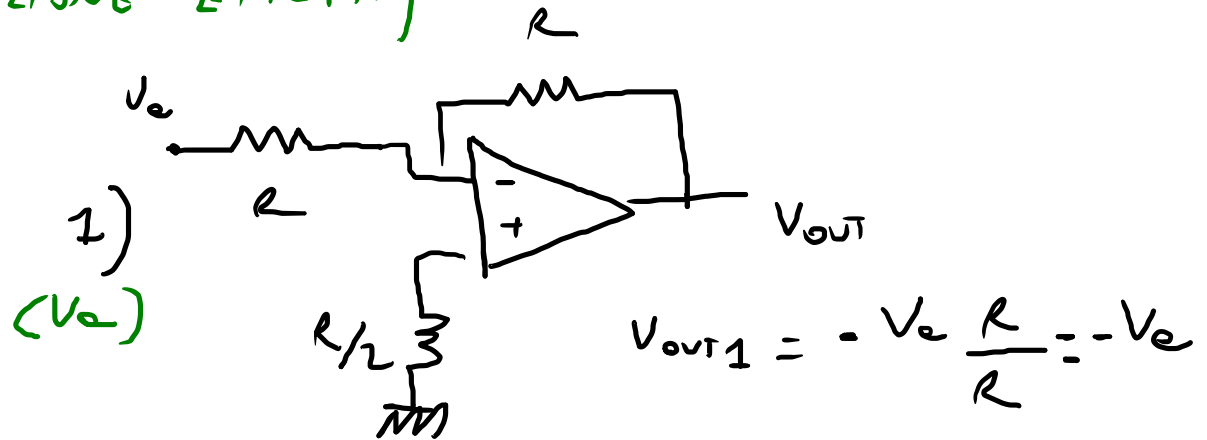
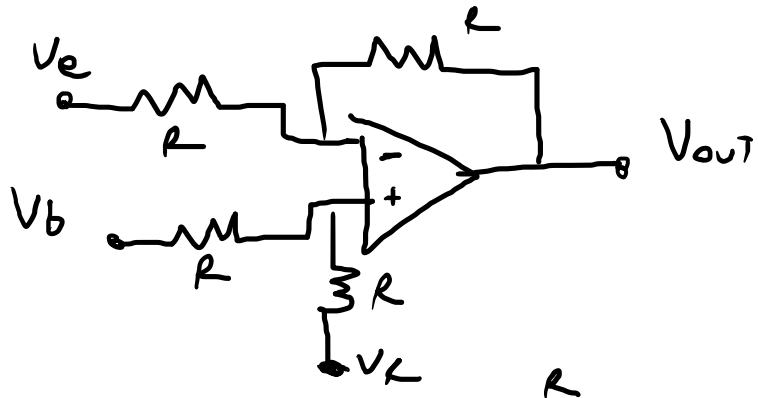
RISOLUZIONE CIRCUITO

$$\left. \begin{aligned} V_e &= V_1 - R_0 I_G \\ V_b &= V_2 + R_0 I_G \end{aligned} \right\} I^{\circ} \text{ STADIO}$$

$$I_G = \frac{V_2 - V_1}{R_G}$$

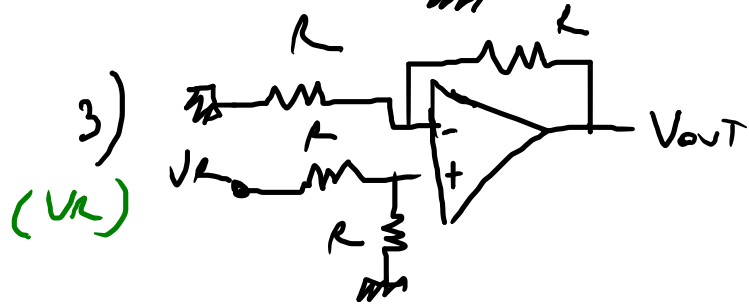
II° STADIO

(SOVRAPPOSIZIONE EFFETTI)



$$V^+ = V_b / 2$$

$$V_{OUT2} = V_b / 2 \left(1 + R / (R/2) \right) = V_b$$



$$V_{OUT3} = V_R \Rightarrow V_{OUT} = V_{OUT1} + V_{OUT2} + V_{OUT3}$$

$$\Downarrow$$

$$V_{OUT} = V_b - V_e + V_R$$

$$V_{out} = V_b - V_e + V_R \quad V_e = V_1 - R_P I_G$$

$$I_G = \frac{V_2 - V_1}{R_G} \quad V_b = V_2 + R_P I_G$$

$$V_{out} = V_2 + R_P I_G - V_1 + R_P I_G + V_R = V_2 - V_1 + 2 R_P I_G + V_R$$

$$= V_2 - V_1 + 2 R_P \frac{(V_2 - V_1)}{R_G} + V_R = (V_2 - V_1) \underbrace{\left(1 + 2 \frac{R_P}{R_G} \right)}_A + V_R$$

\Rightarrow

$$V_{out} = A (V_2 - V_1) + V_R$$

$$A = 1 + \frac{2 R_P}{R_G}$$

(NOTE: $\rightarrow A > 0$)