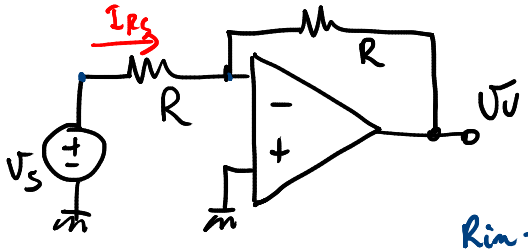
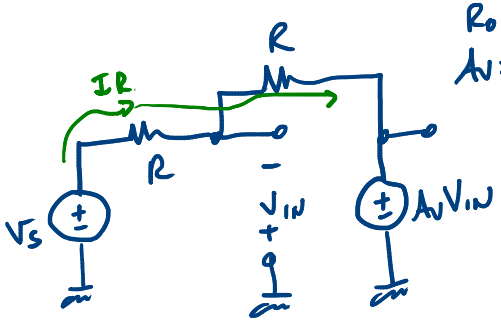


$$I_{RS} = \frac{V_S}{R} \qquad \boxed{\frac{V_S}{I_{RS}} = R}$$

$R_{in} \to \infty$
$R_o \to 0$
$A_V = \infty$

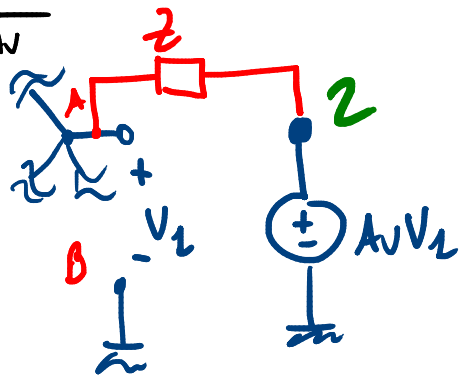


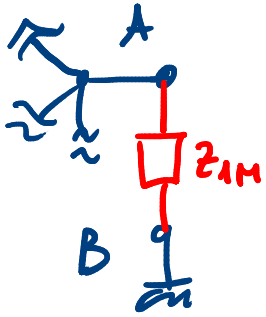
$$I_R = \frac{-V_{IN} - A_V V_{IN}}{R} = -\frac{V_{IN}}{R}(1 + A_V)$$

$$-V_{IN} = V_S - R I_R \Rightarrow I_R = \frac{V_S - R I_R (1+A_V)}{R}$$

$$R\left[1 + (1+A_V)\right] I_R = V_S (1 + A_V)$$

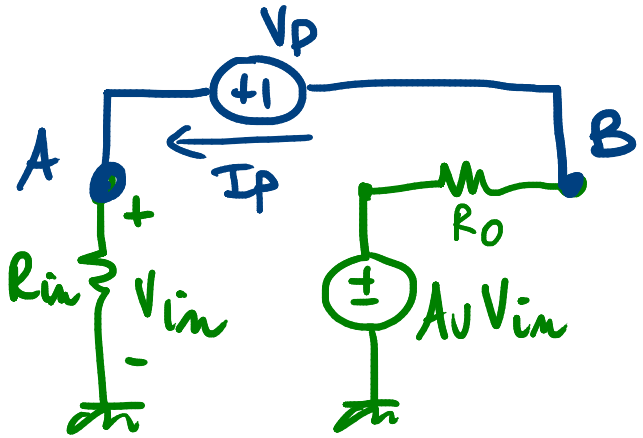
$$\frac{V_S}{I_R} = R + \frac{R}{1+A_V}$$





$$Z_{1M} = \frac{Z}{1 - A_V}$$

$$Z_{2M} = \frac{Z}{1 - 1/A_V}$$

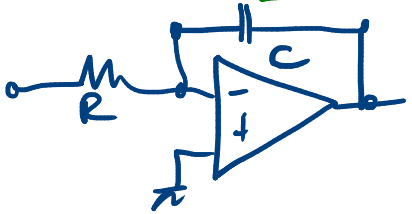


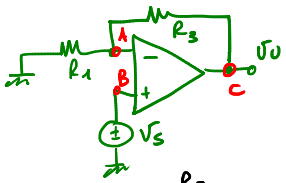
$$V_{IN} = V_p + A_u V_{IN} - R_o I_p \quad \Big\} \; R_{in} I_p = V_p + A_u R_{in} I_p - R_o I_p$$

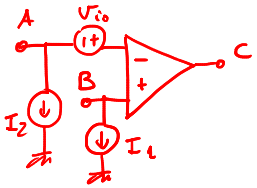
$$V_{IN} = R_{in} I_p$$

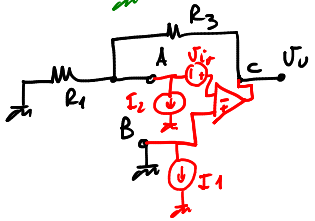
$$V_p = \left[R_{in}(1 - A_u) + R_o \right] I_p$$

$$\boxed{R_{VAB} = \frac{V_p}{I_p} = R_{in}(1 - A_u) + R_o}$$

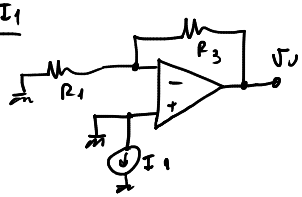






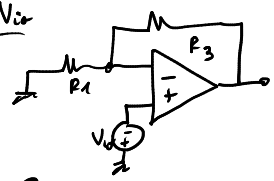


Agisce I_1



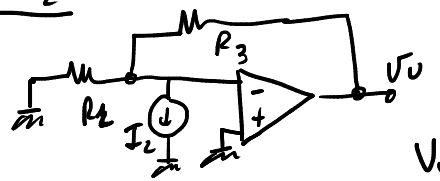
$V_{U_{I_1}} = 0$

Agisce V_{io}



$$V_{U_{V_{io}}} = -V_{io}\left(1+\frac{R_3}{R_1}\right)$$

Agisce I_2



$$V_{U_{I_2}} = R_3 I_2$$

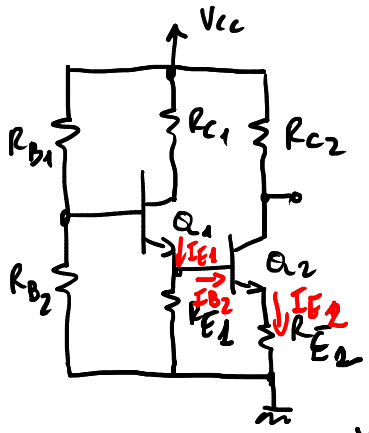
$$V_{io} \begin{cases} 5\,mV \\ -5\,mV \end{cases}$$

$$V_U = R_3 I_2 - V_{io}\left(1+\frac{R_3}{R_1}\right)$$

$$I_1 = \begin{cases} I_B + \frac{I_{io}}{2} \\ I_B - \frac{I_{io}}{2} \end{cases} \qquad I_2 = \begin{cases} I_B - \frac{I_{io}}{2} \\ I_B + \frac{I_{io}}{2} \end{cases}$$

$$I_B = \frac{I_1+I_2}{2} \qquad I_{io} = |I_1 - I_2|$$

$$V_{U_{max}} = 10{,}09\,mV \qquad \begin{cases} V_{io} = -5\,mV \\ I_2 = I_B + \frac{I_{io}}{2} = 90\,mA \end{cases}$$



$I_{E2} = (h_{FE}+1) I_{B2}$

$I_{B2} = \frac{I_{E2}}{h_{FE}+1} = I_{B1}$

$V_{B2} = V_{BEON} + R_{E2} I_{E2}$

$V_{B2} = ? = R_{C1}(I_{E1} - I_{B2})$

$R_{E2} = \frac{R_{E1}(I_{E1} - I_{B2}) - V_{BEON}}{I_{E2}} = 640\,\Omega$

$V_{B2} = V_{E1} = 1{,}98\,V$

$V_{CE2} = V_{C2} - V_{E2}$ $\qquad V_{C2} = V_{CC} - R_{C2} I_{C2} = V_{CC} - R_{C2} \frac{h_{FE} I_{E2}}{h_{FE}+1} = 3{,}09\,V$

$V_{E2} = R_{E2} I_{E2} = 1{,}28\,V$

$V_{CE2} = 1{,}81\,V$ $\qquad$ Q_2 in ZAD OK

$V_{CE1} = V_{C1} - V_{E1}$ $\qquad V_{C1} = V_{CC} - R_{C1} I_{C1} =$

$= V_{CC} - R_{C1} \frac{h_{FE}}{h_{FE}+1} I_{E1} =$

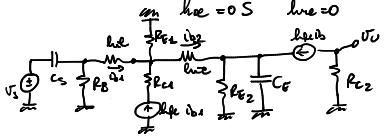
$= 6{,}059\,V$

$V_{CE1} = 4{,}079\,V$ $\qquad$ Q_1 in ZAD OK

$R_{E2} = 600\,\Omega$ $\quad h_{fe1} = h_{fe2} = h_{fe} = 300$

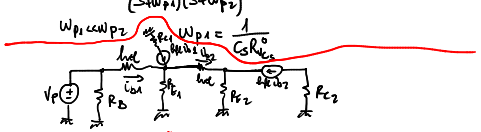
$h_{ie1} = h_{ie2} = h_{ie} = 1{,}8\,k\Omega$

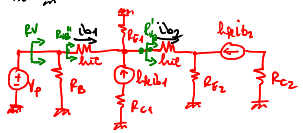
$h_{re} = 0\,S \quad h_{oe} = 0$



$$A_v(s) = \frac{A_{v0}\, s\,(s+\omega_0)}{(s+\omega_{p1})(s+\omega_{p2})}$$

$\omega_{p1} \ll \omega_{p2}$ $\quad \omega_{p1} = \dfrac{1}{C_S R_{in_c}^{0}}$





$$R_{in_B} = R_B \,//\, \left\{ h_{ie} + (h_{fe}+1)\cdot\left[R_{E1} \,//\, \left(h_{ie} + R_{E2}(h_{fe}+1)\right)\right]\right\} = 17{,}866\,k\Omega$$

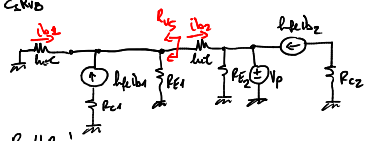
$R_{in_B}' = h_{ie} + R_{E2}(h_{fe}+1)$

$R_{in_B}'' = h_{ie} + R_{iE}(h_{fe}+1)$ $\qquad R_{iE} = R_{in_B}' \,//\, R_{E1}$

$R_{in} = R_B \,//\, R_{in_B}''$

$\omega_{p1} = \dfrac{1}{C_S R_{in}} = 55{,}97\ \text{rad/sec}$

Calcolo ω_{p2}

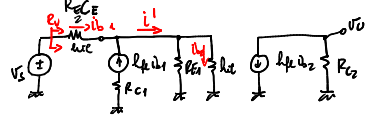


$R_{VCE} = R_E \,//\, R_{VCE}'$

$R_{VCE}' = \dfrac{h_{ie} + R_{VS}}{h_{fe}+1}$ $\qquad R_{VS} = R_{E1} \,//\, \left[\dfrac{h_{ie}}{h_{fe}+1}\right]$

$R_{VCE} = 15{,}58\,\Omega$ $\qquad \omega_{p2} = 64{,}17\ \text{Krad/sec}$

$\omega_0 = \dfrac{1}{R_E C_E} = 1667\ \text{Krad/sec}$



$V_U = -h_{fe} i_{b2} \cdot R_{C2} \qquad i_{b2} = \dfrac{R_{E1}}{R_{E1}+h_{ie}} \cdot i'$

$i' = (h_{fe}+1)\, i_{b1}$

$i_{b1} = \dfrac{V_S}{R_V} \qquad R_V = h_{ie} + (R_{E1} \,//\, h_{ie})(h_{fe}+1)$

$$A_{v0} = -h_{fe} R_{C2} \cdot \frac{R_{E1}}{R_{E1}+h_{ie}} \cdot \frac{(h_{fe}+1)}{h_{ie} + (R_{E1} \,//\, h_{ie})(h_{fe}+1)} = -275{,}9\ (48{,}82\,dB)$$