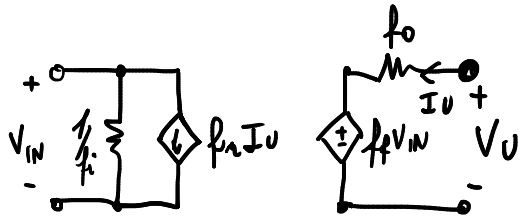
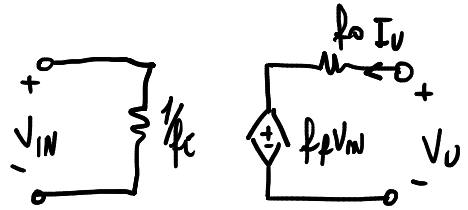
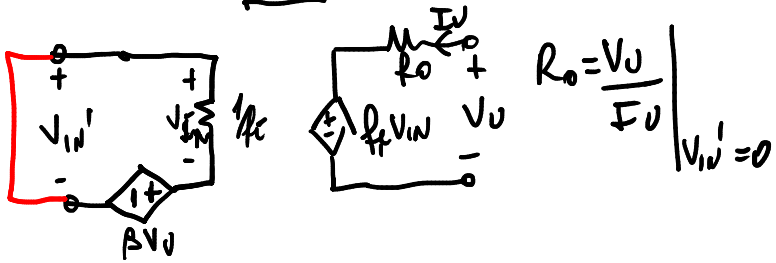


$$V_U = f_o I_U + f_f V_{IN}$$



$$R_o = \frac{V_U}{I_U}\Big|_{V_{IN}=0}$$



$$R_o = \frac{V_U}{I_U}\Big|_{V_{IN}'=0}$$

$$V_{IN} = -\beta V_U$$

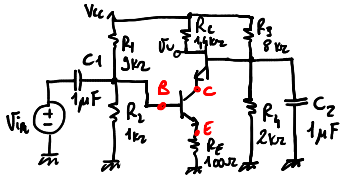
$$V_U = f_o I_U + f_f V_{IN}$$

$$V_U = f_o I_U - \beta f_f V_U$$

$$V_U [1 + \beta f_f] = f_o I_U$$

$$\frac{V_U}{I_U} = R_o = \frac{f_o}{1 + \beta f_f}$$

$$\beta = \frac{f_o - R_o}{R_o f_f} = 9,99$$



$V_{cc} = 10V$

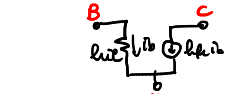
$h_{fe} = 100$

Q_1 e Q_2 uguali

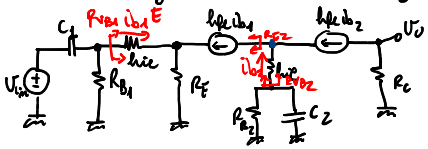
$r_{bb'} = 100\,\Omega$

$I_{C1} = 3\,mA$

$I_{C2} = 3\,mA$



$h_{ie} = r_{bb'} + \frac{V_T}{I_C} h_{fe} = 967\,\Omega$



$R_{B1} = R_1 \| R_2$

$R_{B2} = R_3 \| R_4$

$h_{fe} i_{b1} = (h_{fe}+1) i_{b2}$

$i_{b2} = \frac{h_{fe} i_{b1}}{(h_{fe}+1)}$

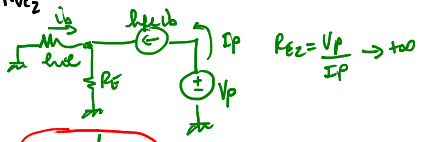
$A_v(s) = \frac{V_u}{V_{in}} = \frac{k\omega_0 (s+\omega_0)}{(s+\omega_{p1})(s+\omega_{p2})}$

$\omega_0 = \frac{1}{R_{B2} C_2}$ $\qquad \omega_{p1} = \frac{1}{C_1 R_{Vc1}}$

$R_{Vc2} = ? = R_{B1} \| R_{VB1}$ $\qquad R_{VB1} = h_{ie} + R_E (h_{fe}+1)$

$\omega_{p2} = \frac{1}{C_2 R_{Vc2}} \Rightarrow R_{Vc2} = R_{B2} \| R_{VB2}$ $\qquad R_{VB2} = h_{ie} + R_{E2}(h_{fe}+1)$

R_{E2} ?

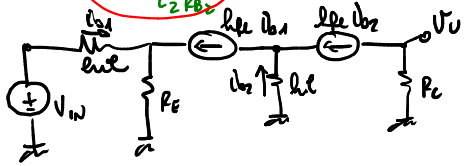


$R_{E2} = \frac{V_p}{I_p} \to \infty$

$R_{Vc2} = R_{B2}$

$\omega_{p1} = \frac{1}{C_2 R_{B2}}$

$A_{v0} \Rightarrow$



$V_u = -R_C h_{fe} i_{b2}$ $\qquad h_{fe} i_{b1} = (h_{fe}+1) i_{b2}$ $\qquad i_{b2} = \frac{h_{fe} i_{b1}}{h_{fe}+1}$

$i_{b1} = \frac{V_{IN}}{R_{VD}} = \frac{V_{IN}}{h_{ie} + R_E (h_{fe}+1)}$

$A_{v0} = -R_C h_{fe} \frac{h_{fe}}{(h_{fe}+1)} \cdot \frac{1}{h_{ie} + R_E (h_{fe}+1)} = -12{,}53\ (22\,dB)$

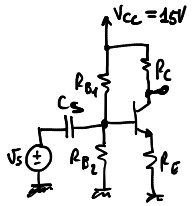
$h_{fe} = 300$
$r_{bb'} = 900\Omega$

$h_{FE} = 100$

$I_C = 2mA$

$A_{CB} \geq 10 \quad f \in [100 \div 20kHz]$

$A_{VB} = \left| -\frac{R_C h_{fe}}{h_{ie} + R_E(h_{fe}+1)} \right| \simeq \left| -\frac{R_C}{R_E} \right| \geq 10$



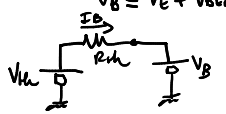
$R_C = 4k\Omega \qquad R_E = 200\Omega$

$V_C = V_{CC} - R_C I_C = 7V$

$V_E = R_E \frac{(h_{FE}+1)}{h_{FE}} I_C = 0,404V$

$V_B = V_E + V_{BE_{ON}} = 1,104V$

$\begin{cases} V_{CQ} = 6,596V \\ I_C = 2mA \\ I_B = 20\mu A \end{cases}$



$V_{th} = \frac{R_{B_2}}{R_{B_1}+R_{B_2}} V_{CC}$

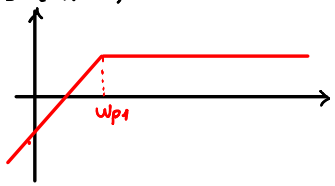
$R_{th} = R_{B_1} // R_{B_2}$

$V_{th} = R_{th} I_B + V_E$

$\frac{R_{B_2}}{R_{B_1}+R_{B_2}} V_{CC} = R_{B_1} // R_{B_2} I_B + V_E$

$\begin{cases} R_{B_2} V_{CC} = R_{B_1} R_{B_2} I_B + (R_{B_1}+R_{B_2}) V_E \\ R_{B_1}+R_{B_2} = 100k\Omega \end{cases}$

$A_{V(s)} = \frac{A_{VB}\, s}{(s+\omega_{p1})}$



$\omega_{p1} \ll G2B \ rad/sec$

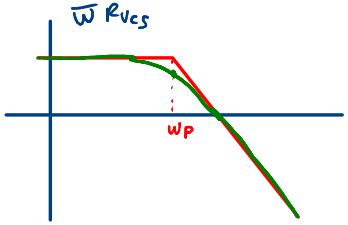
$h_{ie} = r_{bb'} + \frac{V_T}{I_C} h_{fe} = 4,8k\Omega$

$\omega_{p1} = \frac{1}{C_S R_{VCS}}$

$R_{VCS} = R_{B_1} // R_{B_2} // [h_{ie} + R_E(h_{fe}+1)]$

$\omega_p \ll G2B \ rad/sec = \overline{\omega} \qquad \frac{1}{C_S R_{VCS}} \ll \overline{\omega}$

$C_S \gg \frac{1}{\overline{\omega} R_{VCS}}$



$A(s) = \frac{A_{CB}\omega_p}{s+\omega_p}$

$|A(j\omega_p)| = \frac{A_{CB}\omega_p}{\sqrt{\omega_p^2+\omega_p^2}} =$

$\frac{A_{CB}\omega_p}{\sqrt{2}\omega_p}$