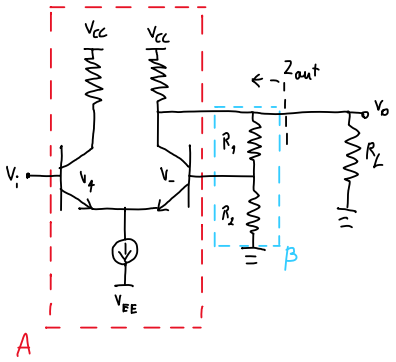
a)



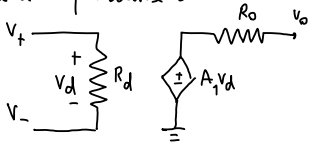
→ Malha à entrada

→ Na à saída

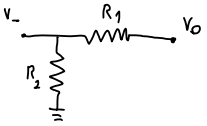
⇒ Série - Paralelo → Tensão - Tensão

Matriz H: $\begin{bmatrix} V_1 \\ I_2 \end{bmatrix} = \begin{bmatrix} h_{11} & h_{12} \\ h_{21} & h_{22} \end{bmatrix} \begin{bmatrix} I_1 \\ V_2 \end{bmatrix}$

Esquema equivalente de A



Esquema equivalente de β

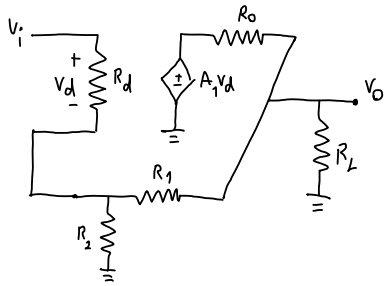


$A_1 = 8000$ $R_L = 100\,K\Omega$

$R_d = 10K\Omega$ $R_1 = 40\,K\Omega$

$R_o = 5\,K\Omega$ $R_2 = 10\,K\Omega$

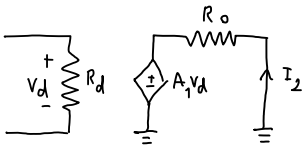
Circuito total



b) A:

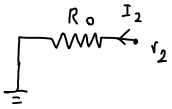
$h_{11} = \left.\frac{V_1}{I_1}\right|_{V_2=0} = R_d$

$h_{21} = \left.\frac{I_2}{I_1}\right|_{V_2=0} = \frac{A_1 V_d}{R_o} \cdot \frac{R_d}{V_d} = \frac{A_1 R_d}{R_o}$



$h_{12} = \left.\frac{V_1}{V_2}\right|_{I_1=0} = 0$

$h_{22} = \left.\frac{I_2}{V_2}\right|_{I_1=0} = \frac{1}{R_o}$

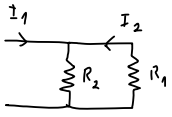


$H_A = \begin{bmatrix} R_d & 0 \\ \frac{A_1 R_d}{R_o} & \frac{1}{R_o} \end{bmatrix} = \begin{bmatrix} 10\,K\Omega & 0 \\ -16\,K & 0.2\,mS \end{bmatrix}$

β:

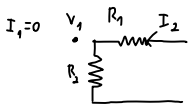
$h_{11} = \left.\frac{V_1}{I_1}\right|_{V_2=0} = R_2 // R_1$

$h_{21} = \left.\frac{I_2}{I_1}\right|_{V_2=0} = -\frac{R_2}{R_2 + R_1}$



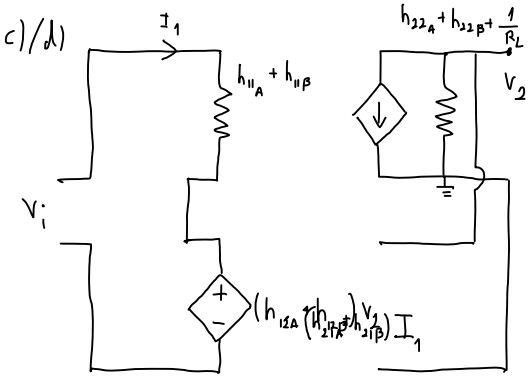
$h_{12} = \left.\frac{V_1}{V_2}\right|_{I_1=0} = \frac{R_2}{R_2 + R_1}$

$h_{22} = \left.\frac{I_2}{V_2}\right|_{I_1=0} = \frac{1}{R_2 + R_1}$



$H_\beta = \begin{bmatrix} R_2 // R_1 & \frac{R_2}{R_2+R_1} \\ -\frac{R_2}{R_2+R_1} & \frac{1}{R_1+R_2} \end{bmatrix} = \begin{bmatrix} 8K\Omega & 0.2 \\ -0.2 & 20\,\mu S \end{bmatrix}$

c)/d)



$A' = \frac{V_2}{V_{1A}} = -\frac{h_{21A} + h_{21\beta}}{(h_{11A} + h_{11\beta})\left(h_{22A} + h_{22\beta} + \frac{1}{R_L}\right)} = 3865$

$A_f = \frac{V_2}{V_1} = \frac{A'}{1 + A'\beta'} =$

$= 4.99 \approx 5$

$\beta' = h_{12A} + h_{12\beta} = 0.2$

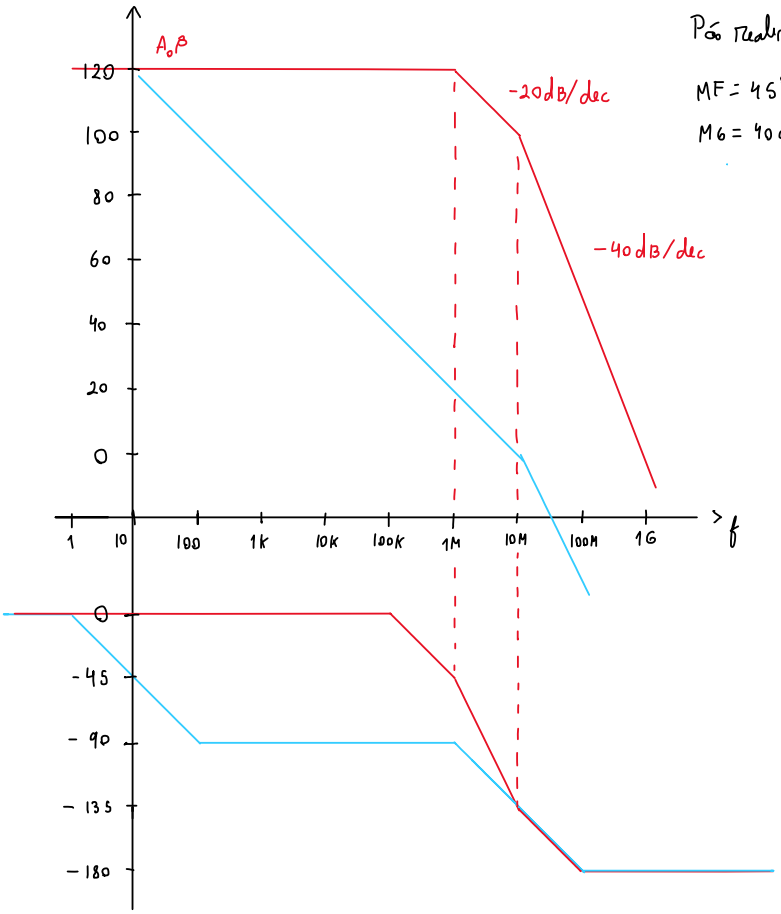
$Z_{0A'} = \frac{1}{h_{22A} + h_{22\beta} + \frac{1}{R_L}}$ $Z_{0f} = \frac{Z_{0A'}}{1 + \beta' A'}$ $Z_{out} = \frac{1}{\frac{1}{Z_{0f}} - \frac{1}{R_L}}$

$Z_{0A'} = 4.35\,k\Omega$ $Z_{0f} = 5.6\,\Omega$ $Z_{out} = 5.6\,\Omega$

l) $A_0 = 134\,dB$

$\beta = 0{,}2 \Rightarrow -14\,dB$

$A_0\beta = 120\,dB$



Antes realimentação

MF = 0

MG = -60 dB

Pós realimentação

MF = 45°

MG = 40 dB