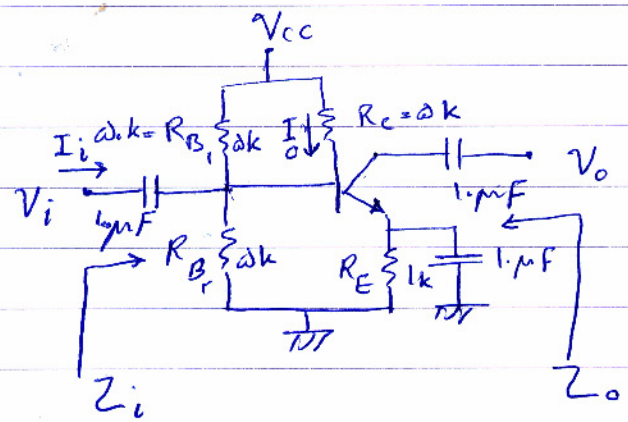
مثال: تحلیل ac کنید.

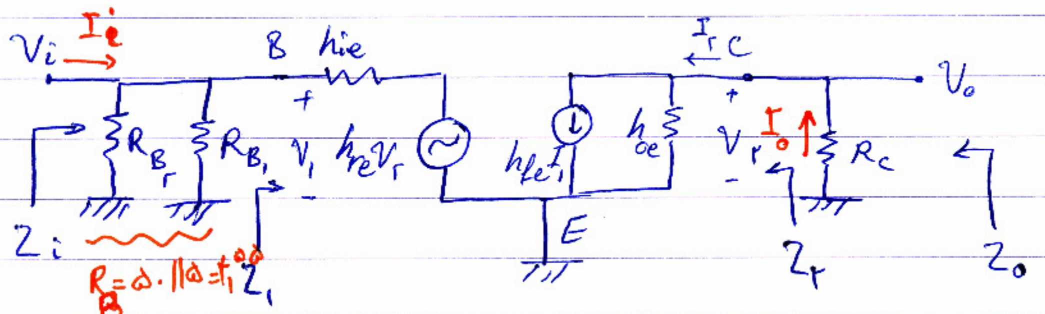


h_{ie} = ۱٫۵k

h_{re} = ۲×۱۰⁻۴

h_{fe} = ۸۰

h_{oe} = ۲۰ μA/V



$$A_V = \frac{V_o}{V_i} = \frac{V_2}{V_1} = \frac{-h_{fe}R_c}{h_{ie}+(h_{ie}h_{oe}-h_{re}h_{fe})R_c} = -۲۷۱٫۴۴$$

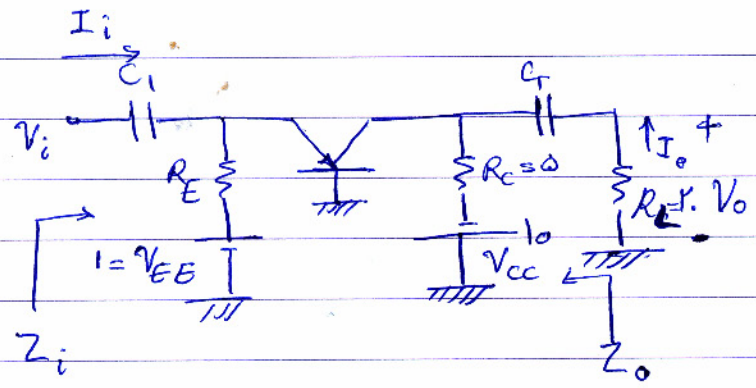
$$Z_1 = h_{ie} - \frac{h_{fe}h_{re}R_c}{1+h_{oe}R_c} = ۱۳۹۱\ \Omega$$

تقسیم جریان

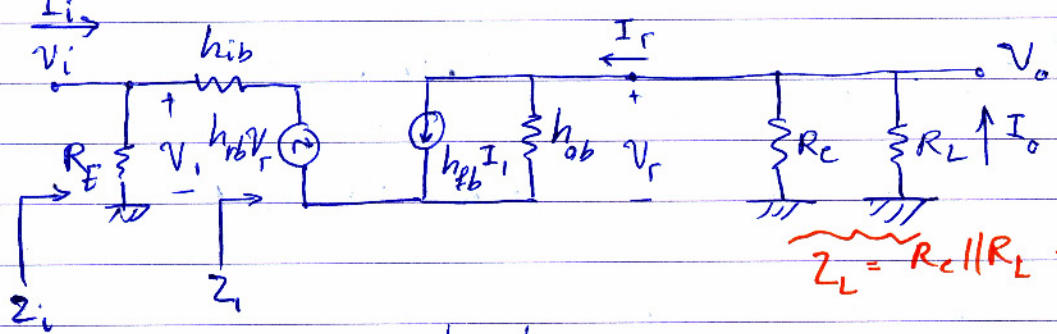
$$A_i = \frac{I_o}{I_i} = \frac{I_2}{I_i} \times \frac{I_1}{I_1} = \frac{I_2}{I_1} \times \frac{I_1}{I_i} = \frac{h_{fe}}{1+h_{oe}R_c} \times \frac{R_B}{R_B+Z_1} = ۵۵٫۷۱$$

$$Z_i = R_B || Z_1 = ۱٫۰۹۵\ k\Omega$$

$$Z_2 = \frac{1}{h_{oe} - \frac{h_{fe}h_{re}}{h_{ie}+R_s}} = ۲۵۰\ k\Omega \qquad Z_o = R_c || Z_2 = ۴٫۹\ k\Omega$$



$$\begin{cases} h_{ib} = 25\ \Omega \\ h_{rb} = 3 \times 10^{-4} \\ h_{ob} = 0.25\ \mu\frac{A}{V} \\ h_{fb} = -0.98 \end{cases}$$



$$Z_L = R_c \| R_L = \infty \| 2 = 2\ k\Omega$$

$$Z_1 = h_{ib} - \frac{h_{fb} h_{rb} Z_L}{1 + h_{ob} Z_L} = 25.1\ \Omega$$

$$Z_i = R_E \| Z_1 = 24.6\ \Omega$$

$$A_I = \frac{I_o}{I_i} \times \frac{I_1}{I_1} \times \frac{I_r}{I_r} = \frac{I_1}{I_i} \times \frac{I_r}{I_1} \times \frac{I_o}{I_r} = \frac{R_E}{R_E + Z_1} \times \frac{R_c}{R_c + R_L} \times \frac{h_{fb}}{1 + h_{ob} Z_L}$$

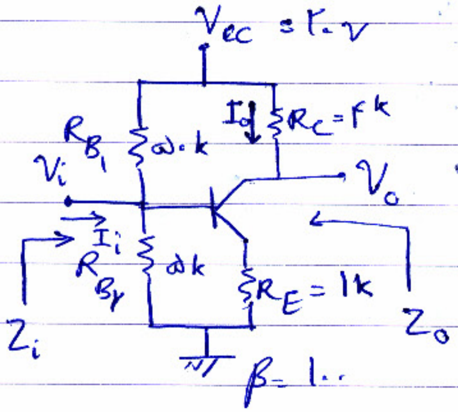
$$\Rightarrow \boxed{A_I = -0.11}$$

$$A_V = \frac{V_o}{V_i} = \frac{V_r}{V_1} = \frac{-h_{fb} Z_L}{h_{ib} + (h_{ib} h_{ob} - h_{rb} h_{fb}) Z_L} = \boxed{94}$$

$$Z_r = \frac{1}{h_{ob} - \frac{h_{fb} h_{rb}}{h_{ib} + \infty}} = 4 \text{ M}\Omega$$

$$Z_o = \infty^k \| Z_r = \boxed{2.5\ k\Omega}$$

مثال : مدار زیر را در نظر گرفته ابتدا با تحلیل dc ، Q را به دست آورده سپس تحلیل ac کنید.



با توجه به این که $(\beta+1) R_E >>> R_{B_2}$ می توان گفت :

$$V_B = \frac{5}{5+50} \times 20 = 1.818\ v$$

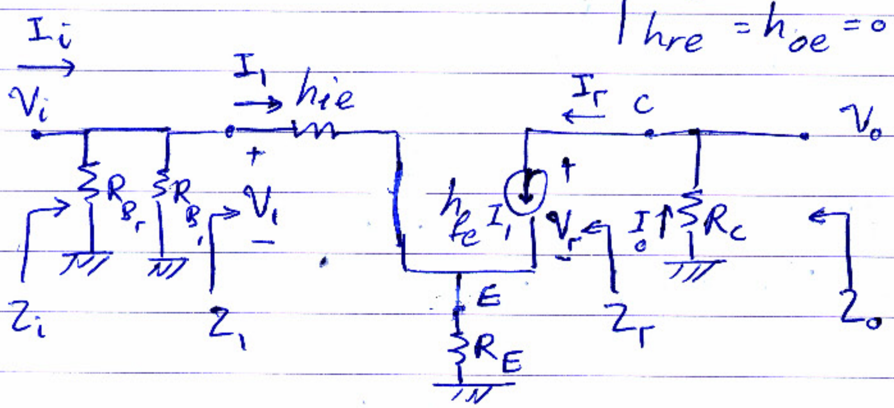
$$V_E = V_B - 0.7V = 1.818 - 0.7V = 1.118$$

$$\Rightarrow I_E = \frac{V_E}{R_E} = 1.118\ mA = I_C$$

$$-V_{cc} + R_C I_C + V_{CE} + R_E I_E = 0$$

$$\Rightarrow V_{CE} = 14.41\ v$$

$$\begin{cases} h_{ie} = \frac{26}{I_C} \times \beta = 2325\ \Omega \\ h_{fe} \approx 100 \\ h_{re} = h_{oe} = 0 \end{cases}$$



$$Z_1 = h_{ie} + (1+\beta) R_E = 2.325 + 101 \times 1 = 103.325\ k\Omega$$

$$Z_i = 4.5 \| 103.325 = 4.5\ k\Omega$$

$$A_V = \frac{V_o}{V_i} = ? \qquad V_o = -I_o R_C = -h_{fe} I_1 R_C$$

$$-V_i + h_{ie} I_1 + (I_1 + h_{fe} I_1) R_E = 0$$

$$I_1 = \frac{V_i}{h_{ie} + (h_{fe}+1) R_E} \Rightarrow V_o = -h_{fe} R_C \times \frac{V_i}{h_{ie} + (h_{fe}+1) R_E}$$

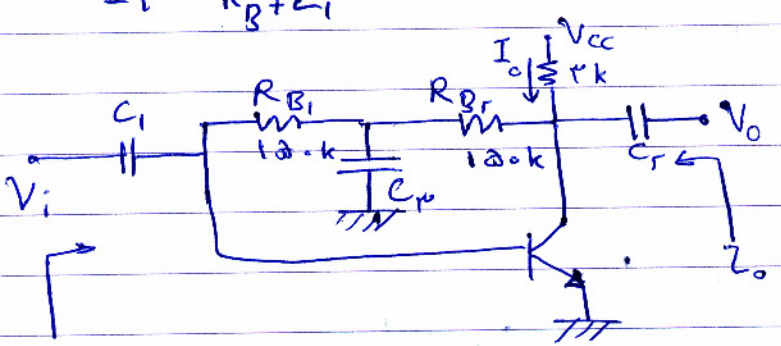
$$\Rightarrow A_V = \frac{V_o}{V_i} = \frac{-h_{fe} R_C}{h_{ie} + (h_{fe}+1) R_E} =$$

$$A_I = \frac{I_o}{I_i} = ? \qquad I_o = I_r = h_{fe} I_1 \Rightarrow \frac{I_r}{I_1} = h_{fe}$$

$$= \frac{I_r}{I_1} \times \frac{I_1}{I_i}$$

$$\frac{I_1}{I_i} = \frac{R_B}{R_B + Z_1} \Rightarrow A_I = h_{fe} \times \frac{R_B}{R_B + Z_1}$$

مدل مداری زیر را در نظر بگیرید



$$\begin{cases} h_{fe} = 50 \\ h_{ie} = 1k \end{cases}$$