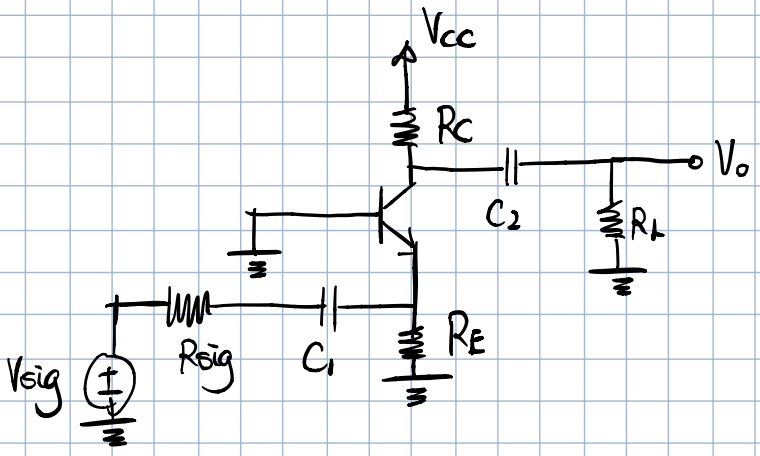
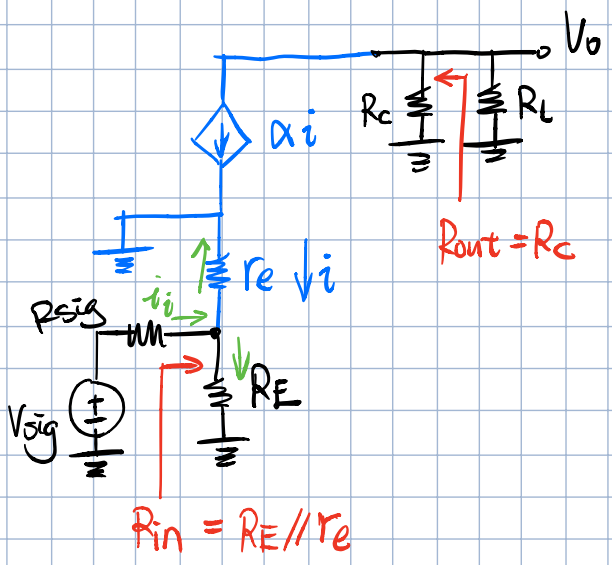
# Discrete Amplifier (CB/CC)



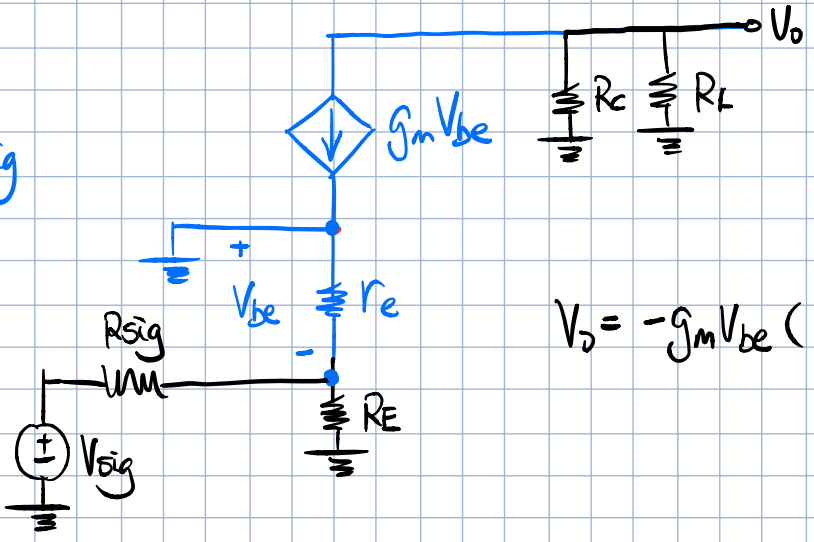

$$V_o = -\alpha i (R_c // R_L)$$

$$i_i = \frac{V_{sig}}{R_{sig}+R_{in}}$$

$$i = \frac{-R_E}{r_e+R_E} \quad i_i = \frac{-R_E}{r_e+R_E} \times \frac{V_{sig}}{R_{sig}+R_{in}}$$

$$\frac{V_o}{V_{sig}} = \alpha \frac{1}{R_{sig}+R_{in}} \cdot \frac{R_E}{r_e+R_E} (R_c // R_L)$$

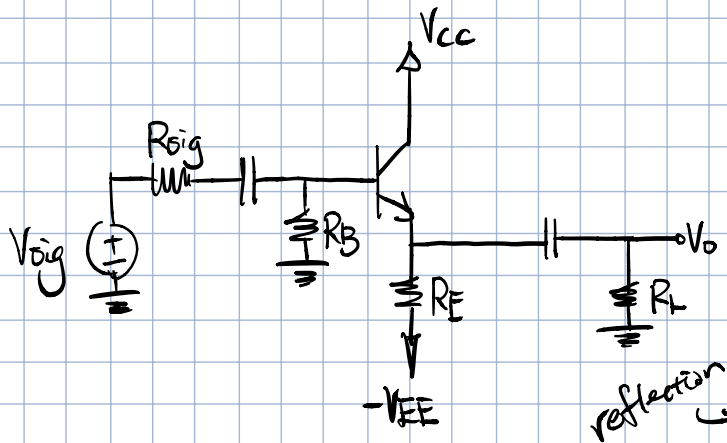
$$V_{be} = -\frac{r_e // R_E}{R_{sig}+r_e // R_E} V_{sig}$$

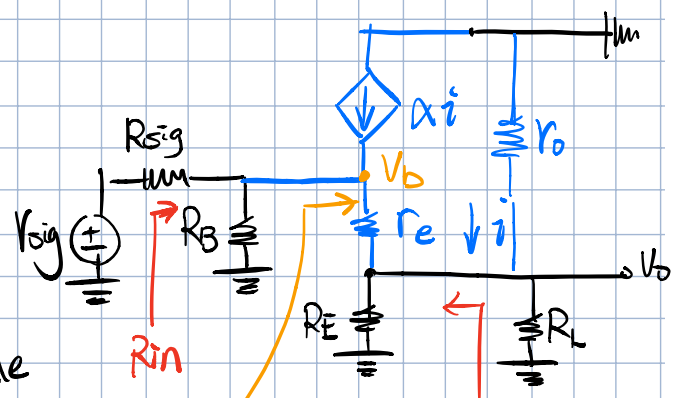



$$V_o = -g_m V_{be} (R_c // R_L)$$

$$\frac{V_o}{V_{sig}} = g_m \frac{r_e // R_E}{R_{sig}+r_e // R_E} (R_c // R_L)$$

# CC (Emitter follower)




reflection rule → $(\beta+1)\left[(R_E \,//\, r_o \,//\, R_L)+r_e\right]$

$$R_{in} = R_B \,//\, (\beta+1)\left[(R_E \,//\, r_o \,//\, R_L)+r_e\right]$$

$$R_{out} = \left(\frac{R_{sig} \,//\, R_B}{\beta+1} + r_e\right) \,//\, R_E \,//\, r_o$$

$\frac{R_{sig} \,//\, R_B}{\beta+1}$: base reflected to emitter (reflection rule)

$$V_b = \frac{R_{in}}{R_{in}+R_{sig}} V_{sig} \qquad V_o = \frac{R_E \,//\, r_o \,//\, R_L}{r_e + R_E \,//\, r_o \,//\, R_L} V_b$$

$$\text{Voltage gain} = \frac{V_o}{V_{sig}} = \frac{R_{in}}{R_{sig}+R_{in}} \frac{R_E \,//\, r_o \,//\, R_L}{r_e + R_E \,//\, r_o \,//\, R_L}$$