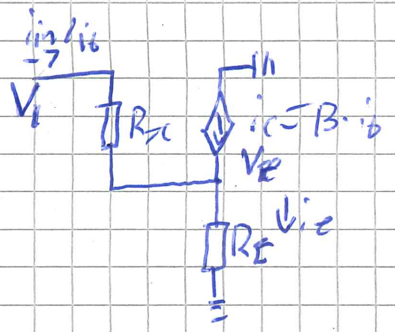


Den interne motstanden ~~inngangsmotstanden~~ er gitt som

$$R_{in} = \frac{V_i}{i_i} = \frac{V_1}{i_b}$$

Vi vet at $V_1 = V_{R\pi} + V_e$

$V_{R\pi}$ er gitt som $V_{R\pi} = i_b \cdot R_\pi$

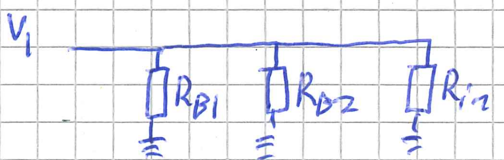
V_e er gitt som $V_e = i_e \cdot R_E$

$$= i_b(\beta+1)R_E$$

Som gir oss

$$R_{in} = \frac{V_1}{i_b} = \frac{\cancel{i_b}(R_\pi + (\beta+1)R_E)}{\cancel{i_b}} = R_\pi + (\beta+1)R_E$$

Vi tegner en modell for inngangen



Vi ser at den totale inngangsmotstanden R_i er

$$R_i = (R_{B1} \| R_{B2}) \| (R_\pi + (\beta+1)R_E)$$

Vi forenkler:

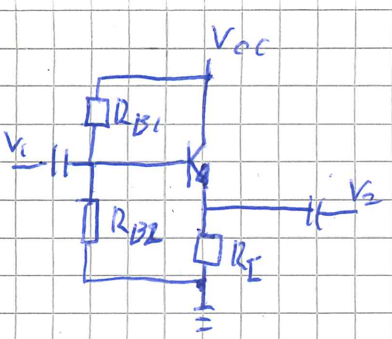
$\beta \gg 1$
$R_E\beta \gg R_\pi$

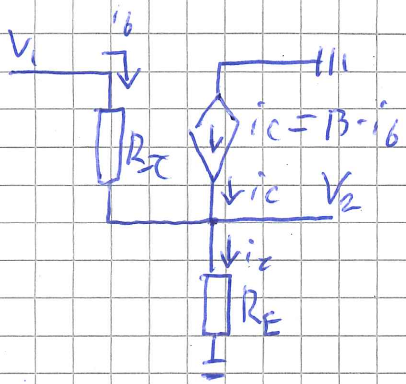
$$\Rightarrow R_i \approx \underline{\underline{R_{B1} \| R_{B2} \| R_E\beta}}$$

Krav:

$\beta \gg 1$

$R_E\beta \gg R_\pi$





$A_V = \frac{V_2}{V_1}$

$i_b = \frac{V_\pi}{R_\pi}$ $\quad i_c = \beta \cdot i_b$ $\quad i_E = i_b + i_c = i_b(\beta+1)$ $\quad V_\pi = V_1 - V_2$

$$V_2 = i_E \cdot R_E = R_E \cdot i_b(\beta+1) = R_E \cdot (i_b \cdot \beta + i_b) = R_E\left(\frac{V_\pi}{R_\pi} + \frac{\beta V_\pi}{R_\pi}\right)$$

$$= R_E \cdot V_\pi \left(\frac{1}{R_\pi} + \frac{\beta}{R_\pi}\right)$$

krav 1 $\quad \beta \gg 1 \Rightarrow \frac{\beta}{R_\pi} \gg \frac{1}{R_\pi}$

$$\Rightarrow R_E \cdot V_\pi \cdot \frac{\beta}{R_\pi}$$

$$V_2 = (V_1 - V_2) R_E \cdot \frac{\beta}{R_\pi} \Rightarrow A_V = \frac{V_2}{V_1} = \frac{\frac{R_E \beta}{R_\pi} \cdot \frac{R_\pi}{\beta}}{1 + \frac{R_E \beta}{R_\pi} \cdot \frac{R_\pi}{\beta}}$$

$$A_V = \frac{R_E}{\frac{R_\pi}{\beta} + R_E}$$

Krav 2 $\quad \frac{R_\pi}{\beta} \ll R_E$

$$A_V \approx \frac{R_E}{R_E}$$

$$\approx 1$$

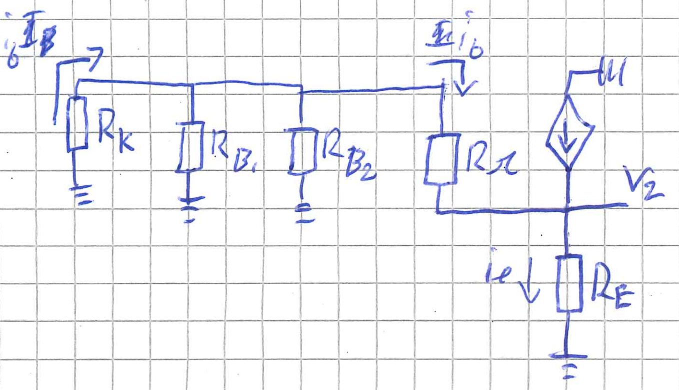
Håkon K. Mikalsen

Krav 1: $\beta \gg 1$

β er vanligvis i størrelsesorden 10^2 eller større

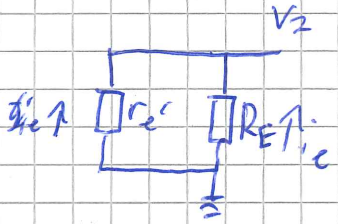
Krav 2: $\frac{R_\pi}{\beta} \ll R_E$

$\frac{R_\pi}{\beta}$ er vanligvis i størrelsesorden 10^1 eller mindre, mens R_E er i størrelsesorden 10^2 eller høyere



Vi ignorerer R_{B1} og R_{B2} siden $R_K \ll R_{B1} \wedge R_{B2}$ slik at $R_K || R_{B1} || R_{B2} \approx R_K$

Siden det går strøm dannes en reflektert ny motstand r_e' med strøm i_e igjennom seg



slik at $R_o = r_e' || R_E$.

$$V_2 = V_{r_e'}$$

$$V_2 = i_e \cdot r_e'$$

$$V_2 = r_e' \cdot (\beta+1) \cdot i_b$$

$$\cancel{V_2} = r_e' \cdot (\beta+1) \cdot \frac{\cancel{V_2}}{R_K + R_\pi}$$

$$i_e = (\beta+1) \cdot i_b$$

$$i_b = \frac{V_2}{R_K + R_\pi}$$

$$\Rightarrow \quad r_e' = \frac{R_K + R_\pi}{\beta+1}$$

$$R_o = R_E \,||\, \frac{R_K + R_\pi}{\beta + 1}$$

Krav:

$R_K \ll R_{B1} \wedge R_{B2}$

Håkon K. Mikalsen