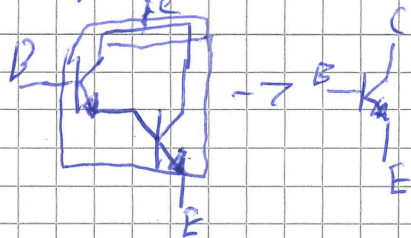
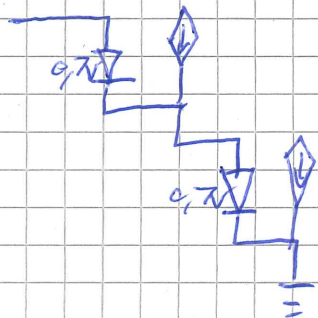


Vi ønsker å forenkle et darlingtonpar til  
modell med en transistor



### Spenningsfall:

Vi starter med spenningsfall  
over base emitter

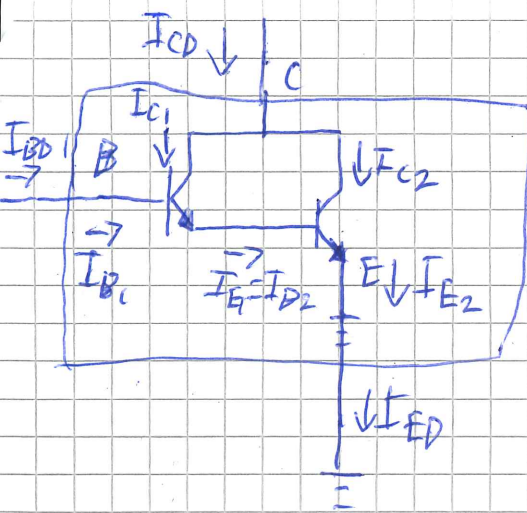


Fra en (stor) forenkling ser

vi at spenningsfall er

ca. 1,4V gitt 0,7V spenningsfall

per hver av transistorene



Förstärkning  $\beta_D$ :

$$\beta_D = \frac{I_{CD}}{I_{BD}} \quad I_{BD} = I_{B1}$$

$$I_{CD} = I_{C1} + I_{C2}$$

$$I_{B2} = I_{E1} = (\beta + 1) I_{B1}$$

$$I_{C1} = I_{B1} \cdot \beta$$

$$I_{C2} = I_{B2} \cdot \beta = (\beta + 1) \cdot I_{B1} \cdot \beta$$

$$I_{CD} = I_{C1} + I_{C2} = I_{B1} \cdot \beta + I_{B1} \cdot \beta \cdot (\beta + 1)$$

$$= I_{B1} \cdot \beta$$

$$= I_{B1} \cdot \beta + I_{B1} \cdot \beta^2 + I_{B1} \cdot \beta$$

$$= I_{B1} (\beta^2 + 2\beta)$$

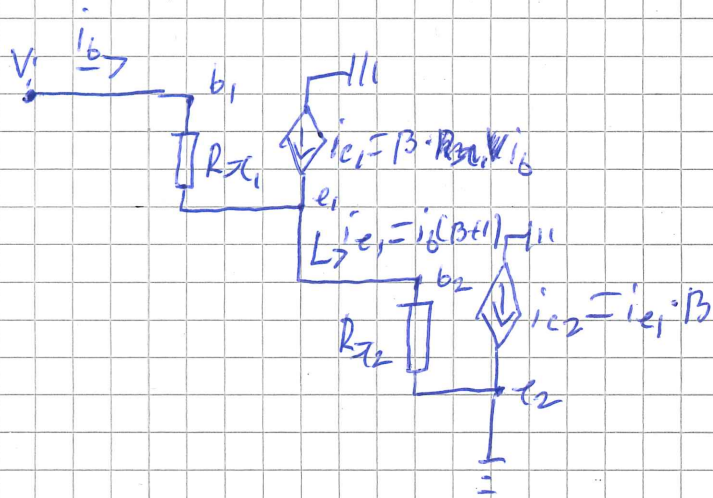
$$\beta_D = \frac{I_{CD}}{I_{BD}} = \frac{I_{B1} (\beta^2 + 2\beta)}{I_{B1}} = \beta^2 + 2\beta$$

$$\text{Siden } \beta^2 \gg 2\beta$$

$$\Rightarrow \underline{\underline{\beta_D = \beta^2}}$$

Häken K. Mikaelson

Metstand  $R_{D\pi}$



$R_{\pi}$  är en transistor  
är different ser

$$R_{\pi} = \frac{V_i}{i_{in}} = \frac{V_i}{i_b}$$

$V_i$  är summan av  
spänningarna över  $R_{\pi 1}$  och  
 $R_{\pi 2}$

gitt ved  $V_i = V_{be1} + V_{be2}$ .

$V_{be1}$  är gitt ved  $V_{be1} = i_b \cdot R_{\pi 1}$  detta gir

$i_{e1} = \frac{\beta i_b}{\beta + 1}$  som gir isjennom  $R_{\pi 2}$  dette gir

at  $V_{be2} = R_{\pi 2} \cdot i_{e1} = R_{\pi 2} (\beta + 1) \cdot i_b$   $V_i$  blir da:

$$V_i = V_{be1} + V_{be2} = R_{\pi 1} \cdot i_b + R_{\pi 2} (\beta + 1) i_b. \quad R_{\pi 1} = R_{\pi 2} = R_{\pi} \text{ her}$$

som gir  $V_i = R_{\pi} \cdot i_b (\beta + 2)$ . Fra dette gir vi at

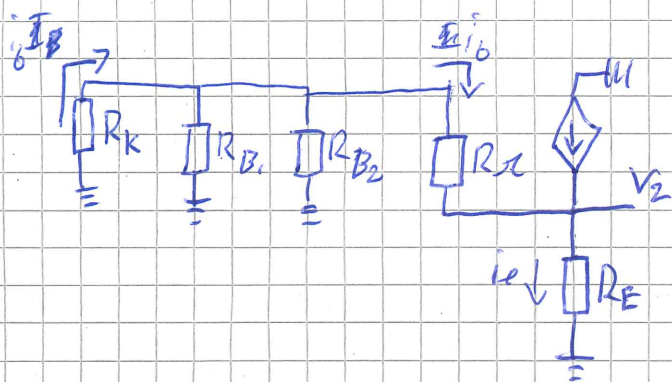
$$R_{D\pi} = R_{\pi} (\beta + 2) = \frac{V_i}{i_i} = \frac{V_i}{i_b} = \frac{R_{\pi} \cdot i_b (\beta + 2)}{i_b} = R_{\pi} (\beta + 2)$$

Siden  $\beta \gg 2$  så for vi

$$R_{D\pi} \approx \underline{\underline{R_{\pi} \cdot \beta}}$$

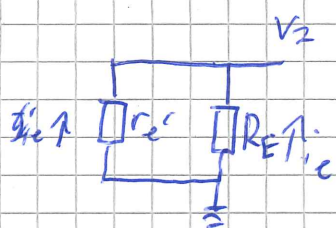
Håken K. M'kaber





$V_c$  ignorerer  $R_{D1}$  og  $R_{D2}$   
 siden  $R_k \ll R_{B1} \wedge R_{B2}$   
 slik at  
 $R_k \parallel R_{B1} \parallel R_{B2} \approx R_k$

Siden det går strøm gjennom en reflektert  
 motstand  $r_e'$  med strøm  $i_e$  sammen med



slik at  $R_o = r_e' \parallel R_E$

$$V_2 = V_{r_e'}$$

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

$$V_2 = i_e \cdot r_e'$$

$$i_b = \frac{V_2}{R_k + R_{in}}$$

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

$$V_2 = r_e' \cdot (\beta + 1) \cdot \frac{V_2}{R_k + R_{in}}$$

$$\Rightarrow r_e' = \frac{R_k + R_{in}}{\beta + 1}$$

$$R_o = R_E \parallel \frac{R_k + R_{in}}{\beta + 1}$$

Krav:

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

Håkan K. M. Karlsson