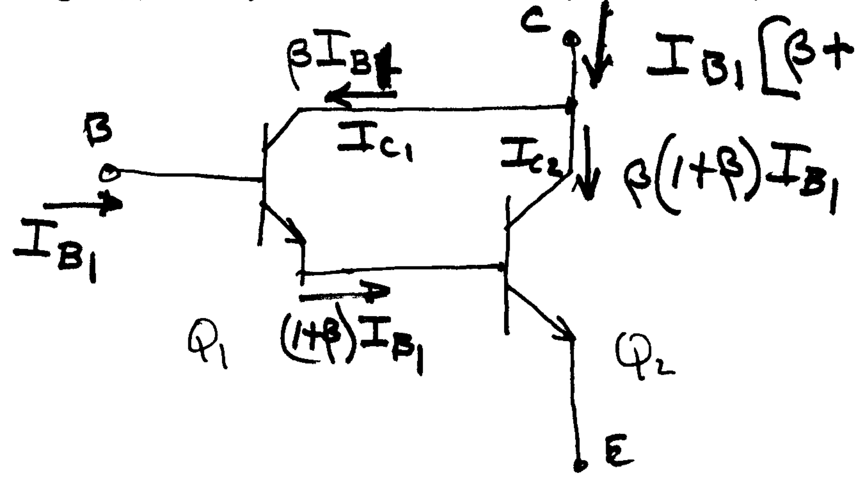
DARLINGTON CONFIGURATION

DC

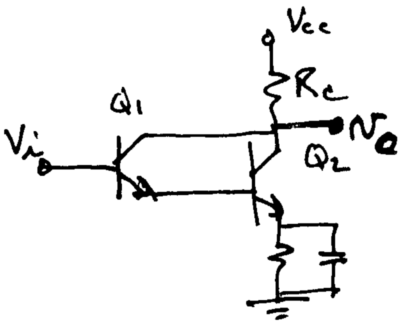


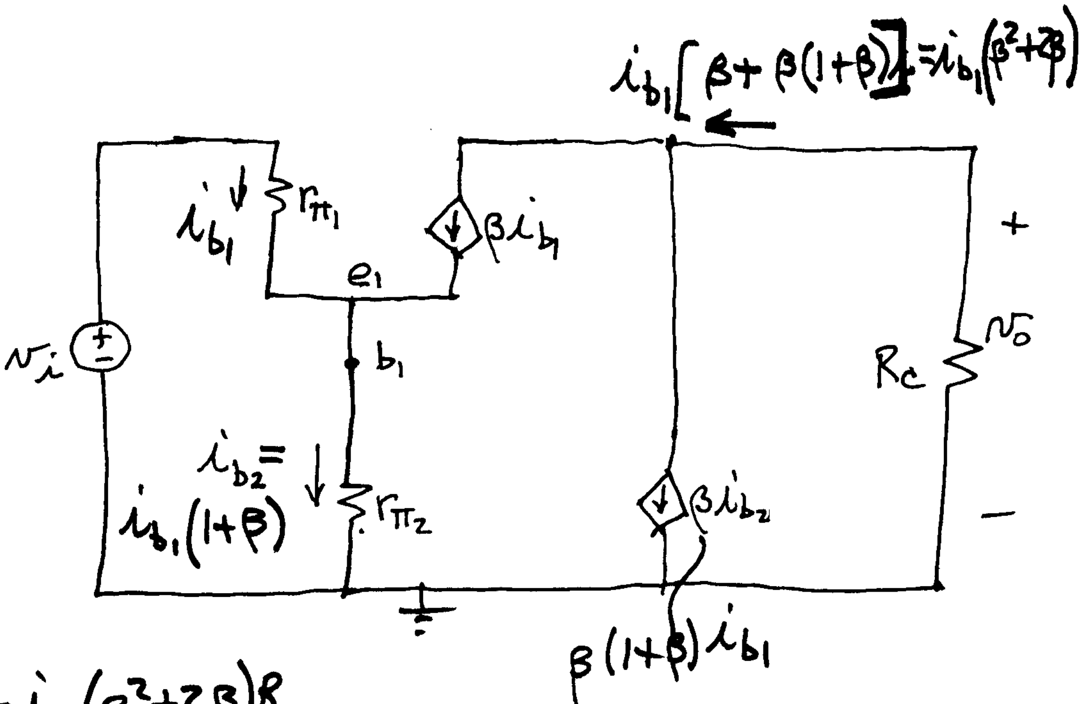
$$I_{B_1}\left[\beta+\beta(1+\beta)\right]=I_{B_1}\left[\beta^2+2\beta\right]$$

$$\frac{I_C}{I_{B_1}}=\frac{I_{B_1}\left[\beta^2+2\beta\right]}{I_{B_1}}$$

$$\beta_{equiv.}=\beta^2+2\beta \simeq \beta^2$$

SMALL-SIGNAL





$$v_o=-i_{b_1}(\beta^2+2\beta)R_C$$

$$v_i=i_{b_1}r_{\pi_1}+i_{b_1}(1+\beta)r_{\pi_2}$$

$$A_v=+\frac{v_o}{v_i}=\frac{-(\beta^2+2\beta)R_C}{r_{\pi_1}+(1+\beta)r_{\pi_2}}=-\frac{(\beta^2+2\beta)R_C}{2(1+\beta)r_{\pi_2}}$$

$$I_{c_1}=\frac{I_{c_2}}{1+\beta}$$

$$r_{\pi_1}=\frac{\beta V_T}{I_{c_1}} \qquad r_{\pi_2}=\frac{\beta V_T}{I_{c_2}}$$

$$r_{\pi_1}=\frac{\beta V_T}{I_{c_2}/(1+\beta)}=(1+\beta)\frac{\beta V_T}{I_{c_2}}=(1+\beta)r_{\pi_2}$$

$$A_v = \frac{v_o}{v_i} \simeq -\frac{\beta^2 R_c}{2\beta r_{\pi_2}} = -\frac{\beta R_c}{2 r_{\pi_2}}$$

$$r_{\pi_2} = \frac{\beta V_T}{I_{c2}}$$

$$A_v = -\frac{\beta R_c}{2\left[\frac{\beta V_T}{I_{c2}}\right]} = -\frac{I_{c2} R_c}{2 V_T}$$

$$\boxed{A_v = \frac{v_o}{v_i} \simeq -\frac{I_c R_c}{2 V_T}}$$

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