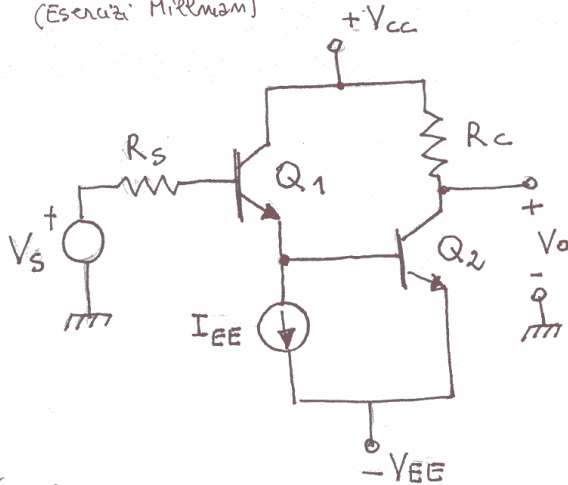


Esercizio 10-66 (Esercizio Millman)



DATI

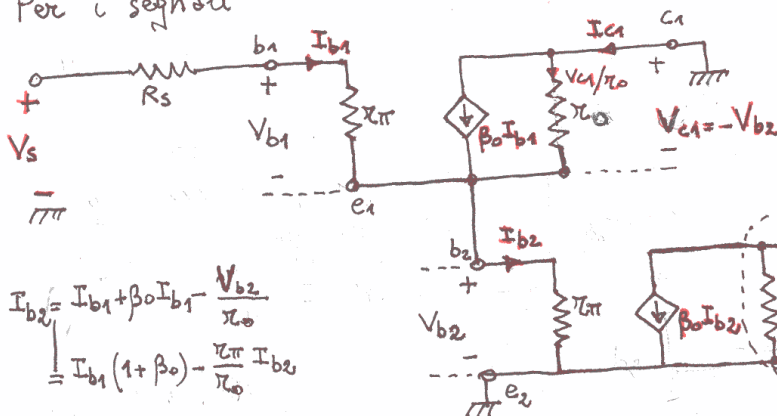
$I_{CQ} = I_{C1Q} = I_{C2Q} = 100 \mu A$
 $V_A = 130 V$ (tensione di EARLY)
 $\beta_o = 150$
 $R_s = 50 K\Omega$
 $R_c = 250 K\Omega$
 Determinare il guadagno $A_V = V_o / V_s$

SOLUZIONE

$$g_m = g_{m1} = g_{m2} = \frac{I_{CQ}}{V_T} = \frac{100 \mu A}{25 mV} = 4 mA/V ; r_{\pi} = \frac{\beta_o}{g_m} = \frac{150}{4} = 37,5 K\Omega$$

$$r_{ds} = r_{ds1} = r_{ds2} \approx \frac{V_A}{I_{CQ}} = \frac{130 V}{100 \mu A} = 1,3 M\Omega = r_o$$

Per i segnali



$$R_L = \frac{r_o \cdot R_c}{r_o + R_c} = \frac{1300 \cdot 250}{1300 + 250} \approx 210 K\Omega$$

$$I_{b2} = I_{b1} + \beta_o I_{b1} \frac{V_{b2}}{r_o}$$

$$= I_{b1} (1 + \beta_o) - \frac{r_{\pi}}{r_o} I_{b2}$$

$$I_{b1} = \left(1 + \frac{r_{\pi}}{r_o}\right) \frac{I_{b2}}{1 + \beta_o}$$

$$V_s = R_s I_{b1} + V_{b1} + V_{b2} = r_{\pi} I_{b1} + r_{\pi} I_{b2} + R_s I_{b1}$$

$$I_{b2} = \frac{V_s}{(R_s + r_{\pi}) \left(1 + \frac{r_{\pi}}{r_o}\right) \frac{1}{1 + \beta_o} + r_{\pi}}$$

$$V_o = -\beta_o R_L I_{b2} = -\frac{\beta_o R_L V_s}{(R_s + r_{\pi}) \left(1 + \frac{r_{\pi}}{r_o}\right) \frac{1}{1 + \beta_o} + r_{\pi}}$$

$$A_V = \frac{V_o}{V_s} = -\frac{\beta_o R_L}{(R_s + r_{\pi}) \left(1 + \frac{r_{\pi}}{r_o}\right) \frac{1}{1 + \beta_o} + r_{\pi}}$$

$$= -\frac{150 \cdot 210}{(50 + 37,5) \left(1 + \frac{37,5}{1300}\right) \frac{1}{1 + 150} + 37,5} \approx -827$$