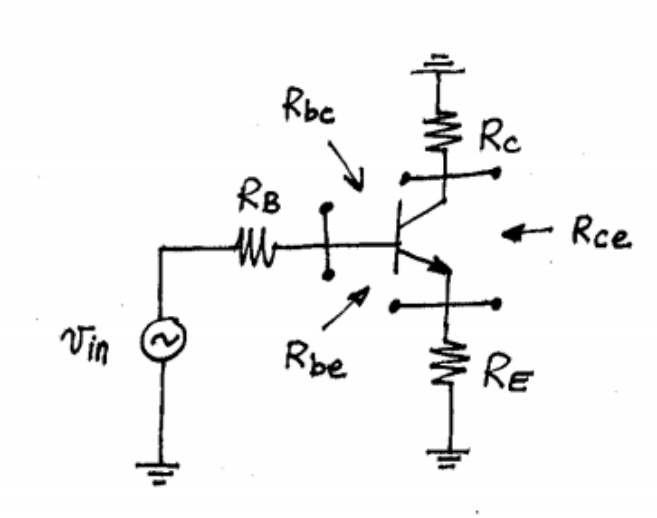
EE303 - Problem Set

Problem 1

Find the expression of the Thevenin's equivalent resistance seen between each pair of the BJT terminals. Neglect the finite ro of the BJT.



Problem 2

The cascode stage of Fig. 9.16(b) must be designed for a voltage gain of 500. If $\beta_1 = \beta_2 = 100$, determine the minimum required value of $V_{A1} = V_{A2}$. Assume $I_1 = 1$ mA.

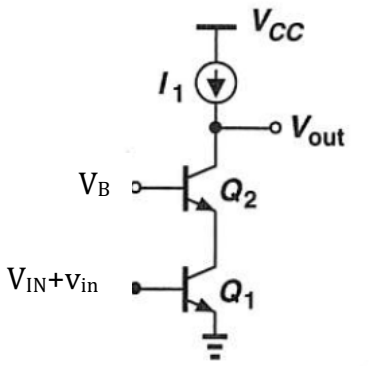


Fig. 9.16 (b)

Problem 3

Assuming Q1 and Q2 carries approximately the equal bias currents ($g_{m1} \approx g_{m2}$ and $r_{o1} \approx r_{o2}$) prove that for the circuit in fig. 9.16(b) the voltage gain reduces to:

$$A_v \approx \frac{-\beta V_A^2}{V_T(V_A + \beta V_T)}, \qquad (9.130)$$

a quantity independent of the bias current.

Problem 4

In the bipolar cascode stage of Fig. 9.2(a), $I_S = 6 \times 10^{-17}$ A and $\beta = 100$ for both transistors. Neglect the Early effect.

(a) Compute V_{b2} for a bias current of 1 mA.

(b) Noting that $V_{CE2} = V_{b1} - V_{BE1}$, determine the value of V_{b1} such that Q_2 experiences a base-collector forward bias of only 300 mV.

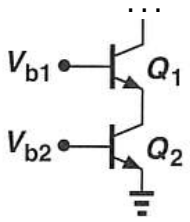


Fig 9.2 (a)