Dr. MD. Aslam, dept.Of physics,
B.Sc. part-2 physics (Hons)
Lecture No-35

Biasing Methods and Stability Factor

The biasing in transistor circuits is done by using two DC sources V_{BB} and V_{CC}. It is economical to minimize the DC source to one supply instead of two which also makes the circuit simple.

The commonly used methods of transistor biasing are

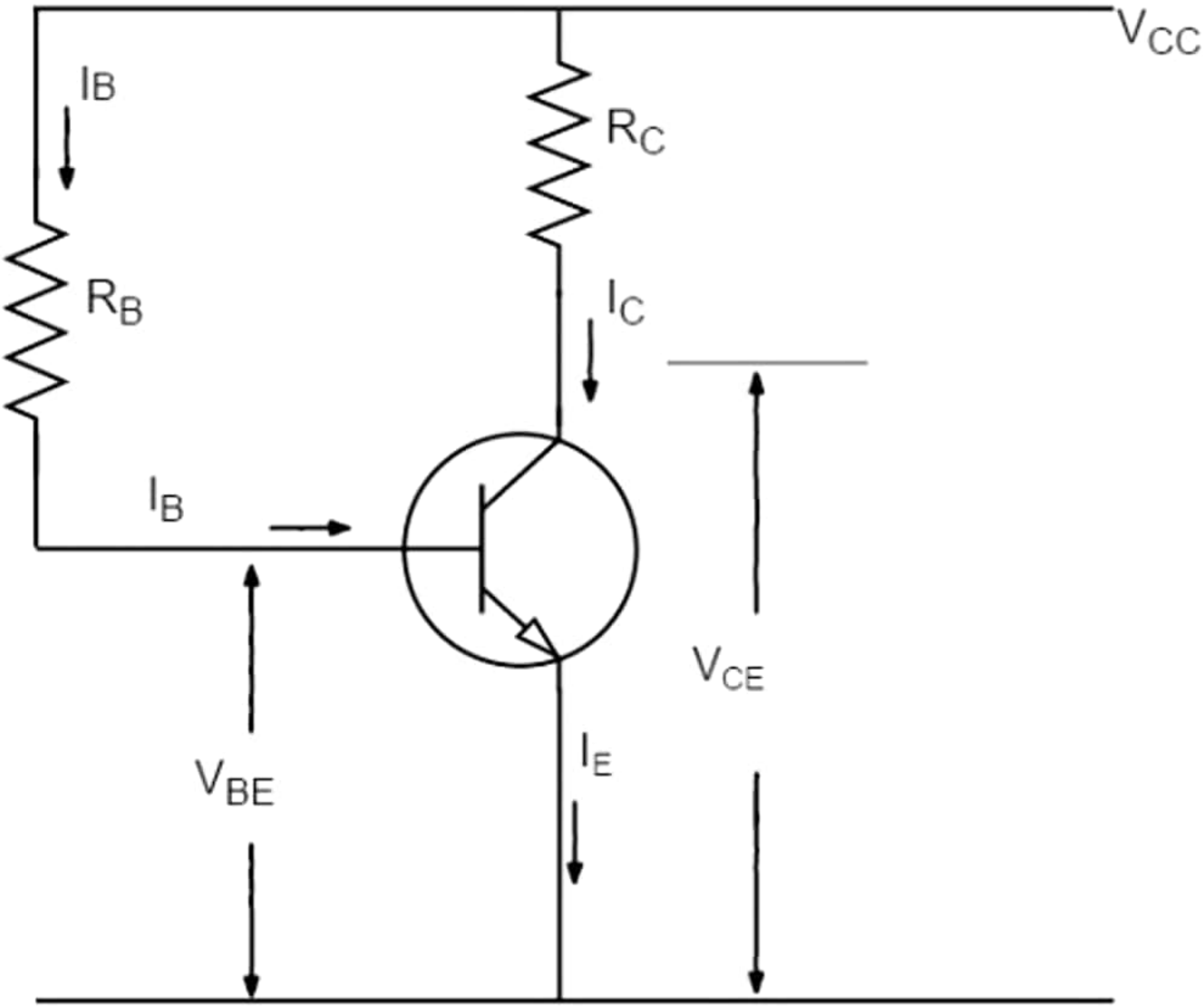
- Base Resistor method
- Collector to Base bias
- Biasing with Collector feedback resistor
- Voltage-divider bias

All of these methods have the same basic principle of obtaining the required value of I_B and I_C from V_{CC} in the zero signal conditions.

Base Resistor Method

In this method, a resistor R_B of high resistance is connected in base, as the name implies. The required zero signal base current is provided by V_{CC} which flows through R_B. The base emitter junction is forward biased, as base is positive with respect to emitter.

The required value of zero signal base current and hence the collector current (as $I_C = \beta I_B$) can be made to flow by selecting the proper value of base resistor RB. Hence the value of R_B is to be known. The figure below shows how a base resistor method of biasing circuit looks like.



Let I_C be the required zero signal collector current. Therefore,

$$I_B = \frac{I_C}{\beta}$$

Considering the closed circuit from V_{CC}, base, emitter and ground, while applying the Kirchhoff's voltage law, we get,

$$V_{CC} = I_B R_B + V_{BE}$$

Or

$$I_B R_B = V_{CC} - V_{BE}$$

Therefore

$$R_B = \frac{V_{CC} - V_{BE}}{I_B}$$

Since V_{BE} is generally quite small as compared to V_{CC}, the former can be neglected with little error. Then,

$$R_B = \frac{V_{CC}}{I_B}$$

We know that V_{CC} is a fixed known quantity and I_B is chosen at some suitable value. As

R_B can be found directly, this method is called as **fixed bias method**.

Stability factor

$$S = \frac{\beta + 1}{1 - \beta\left(\frac{dI_B}{dI_C}\right)}$$

In fixed-bias method of biasing, I_B is independent of I_C so that,

$$\frac{dI_B}{dI_C} = 0$$

Substituting the above value in the previous equation,

$$\text{Stability factor,} \quad S = \beta + 1$$

Thus the stability factor in a fixed bias is (β+1) which means that I_C changes (β+1) times as much as any change in I_{CO}.

Advantages

- The circuit is simple.
- Only one resistor R_E is required.
- Biasing conditions are set easily.
- No loading effect as no resistor is present at base-emitter junction.

Disadvantages

- The stabilization is poor as heat development can't be stopped.
- The stability factor is very high. So, there are strong chances of thermal run away.

Hence, this method is rarely employed.