EMITTER&COLLECTOR FEEDBACK BIAS

Emitter Feedback Bias:

Fig. 1, shows the emitter feedback bias circuit. In this circuit, the voltage across resistor R_E is used to offset the changes in b_{dc}. If b_{dc} increases, the collector current increases. This increases the emitter voltage which decrease the voltage across base resistor and reduces base current. The reduced base current result in less collector current, which partially offsets the original increase in b_{dc}. The feedback term is used because output current (I_C) produces a change in input current (I_B). R_E is common in input and output circuits.

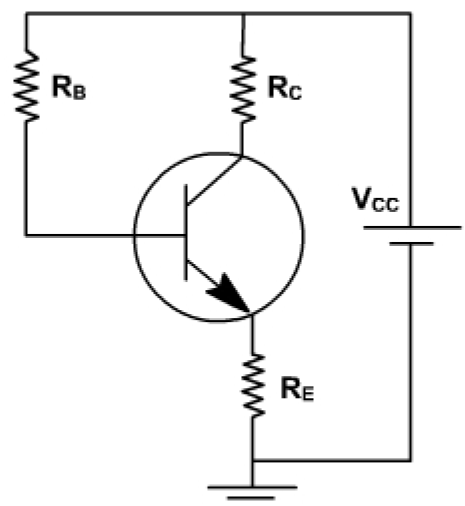

Fig. 1

In this case

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

Since $I_E = I_C + I_B$

$$\therefore \frac{\partial I_B}{\partial I_C} = -\frac{R_E}{R_B + R_E}$$

Therefore,

$$S = \frac{1+\beta_{dc}}{1+\beta_{dc}\left(\frac{R_E}{R_B+R_E}\right)} << (1+\beta_{dc})$$

In this case, S is less compared to fixed bias circuit. Thus the stability of the Q point is better.

Further,

$$I_E \approx I_C = \frac{V_{CC} - V_{BE}}{R_E + \frac{R_B}{\beta_{dc}}}$$

If I_C is to be made insensitive to β_{dc} than

$$R_E >> \frac{R_B}{\beta_{dc}}$$

R_E cannot be made large enough to swamp out the effects of β_{dc} without saturating the transistor.

Collector Feedback Bias:

In this case, the base resistor is returned back to collector as shown in **fig. 2**. If temperature increases. β_{dc} increases. This produces more collectors current. As I_C increases, collector emitter voltage decreases. It means less voltage across R_B and causes a decrease in base current this decreasing I_C, and compensating the effect of b_{dc}.

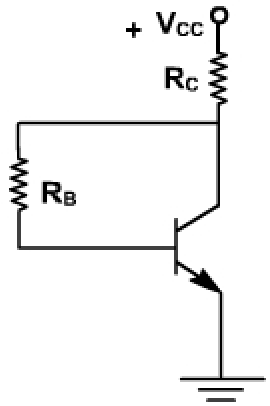

Fig. 2

In this circuit, the voltage equation is given by

$$V_{CC} = (I_B + I_C)\ R_C + I_B\ R_B + V_{BE}$$

Circuit is stiff sensitive to changes in β_{dc}. The advantage is only two resistors are used.

Then,

$$\frac{\partial I_B}{\partial I_C} = -\ \frac{R_C}{R_B + R_C}$$

Therefore,

$$S = \frac{1 + \beta_{dc}}{1 + \frac{R_C\ \beta_{dc}}{R_B + R_C}} < \frac{1 + \beta_{dc}}{1 + \beta\frac{R_E}{R_B}} < 1 + \beta_{dc}$$

It is better as compared to fixed bias circuit.

Further,

$$I_C = \frac{V_{CC} \;\; V_{BE}}{R_C + \frac{R_B}{\beta_{dc}}}$$

Circuit is still sensitive to changes in β_{dc}. The advantage is only two resistors are used.