BJT Configuration

The current Amplification Factors

There are two current amplification factors in transistors.

1) α factor
2) β factor.

1) current amplification factor α

It is the ratio of collector current (I_C) and Emitter current (I_E)

$$\alpha = \frac{I_C}{I_E}$$

value of $\boxed{\alpha = 0.95 \text{ to } 0.99}$

→ For Common Base Configulation:

(i) For A.c Signals $\alpha_{ac} = \frac{\Delta I_C}{\Delta I_E}$

(ii) " D.c Signals $\alpha_{dc} = \frac{I_C}{I_E}$

2) Base current amplification factor β.

It is the ratio of Collector current I_C and base current I_B.

It is also called as transport factor in common emitter configulation.

1) For A.c Signals $\beta_{ac} = \frac{\Delta I_C}{\Delta I_B}$

2) " D.C " $\beta_{dc} = \frac{I_C}{I_B}$

value of $\boxed{\beta = 20 \text{ to } 100}$

Relation Between α and β

For transistor, we know that $I_E = I_B + I_C$ — (1)

& $\beta = \frac{I_C}{I_B}$ — (2)

$\alpha = \frac{I_C}{I_E}$ — (3)

Now, 'I_B' divided by numerator & denominator of eq (3)

$$\alpha = \frac{I_C / I_B}{I_E / I_B}$$

$$\alpha = \frac{I_C / I_B}{I_E / I_B} \qquad \therefore I_E = I_C + I_B$$

$$= \frac{I_C / I_B}{(I_C + I_B)/I_B} = \frac{I_C / I_B}{\frac{I_C}{I_B} + 1}$$

$\because \beta = I_C / I_B$

$$\boxed{\alpha = \frac{\beta}{1+\beta}}$$

In term of α

$\alpha(1+\beta) = \beta$

$\alpha + \alpha\beta = \beta$

$\alpha = \beta - \alpha\beta$

$\alpha = \beta(1-\alpha)$

$\frac{\alpha}{1-\alpha} = \beta$

So

$$\boxed{\beta = \frac{\alpha}{1-\alpha}}$$