

$$\text{Current Gain : } A_I = \frac{I_o}{I_b} = \frac{-I_e}{I_b} = 1 + h_{fe}$$

Input Resistance :

Applying KVL to the outer loop of Fig. 6.6.4 we have,

$$V_b - I_b h_{ie} - I_o R_L = 0$$

$$V_b = I_b h_{ie} + I_o R_L$$

$$\frac{V_b}{I_b} = h_{ie} + \frac{I_o}{I_b} R_L$$

$$R_i = \frac{V_b}{I_b} = h_{ie} + (1 + h_{fe}) R_L$$

$$\therefore \frac{I_o}{I_b} = \frac{-I_e}{I_b} = 1 + h_{fe}$$

### Important Concept

The above equation shows that input impedance of CC is higher than the CE configuration.

$$\text{Voltage Gain (A}_V\text{): } A_V = \frac{V_o}{V_b} = \frac{I_o R_L}{I_b R_i} = \frac{A_I R_L}{R_i} \quad \therefore A_I = \frac{I_o}{I_b} = \frac{-I_e}{I_b}$$

Substituting values of  $A_I$  and  $R_i$  we get,

$$A_V = \frac{(1 + h_{fe}) R_L}{h_{ie} + (1 + h_{fe}) R_L} \cong 1 \text{ but always less than 1}$$

$$\therefore (1 + h_{fe}) R_L \gg h_{ie} \dots (6.6.9)$$

Output Resistance  $R_o$  : It is the ratio of output voltage  $V_o$  to output current  $I_e$  with  $V_s = 0$

$$R_o = \left. \frac{V_o}{I_e} \right|_{V_s=0}$$

Applying KVL to the outer loop of Fig. 6.6.4 we have,

$$V_s - I_b R_s - I_b h_{ie} - V_o = 0$$

$$V_o = -I_b R_s - I_b h_{ie} \quad \therefore V_s = 0 = -I_b (R_s + h_{ie})$$

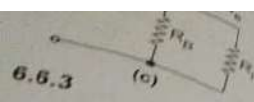
$$I_e = -(1 + h_{fe}) I_b$$

$$\frac{V_o}{I_e} = \frac{-I_b (R_s + h_{ie})}{-(1 + h_{fe}) I_b}$$

$$R_o = \frac{V_o}{I_e} = \frac{R_s + h_{ie}}{1 + h_{fe}}$$

The output resistance  $R'_o$  of the stage, taking the load into account is given as

$$R'_o = R_o \parallel R_L$$



6.6.3  
 $R_E, h_{fe} = 50,$   
 $R_2 = 1.6 \text{ k}\Omega,$   
 which is less

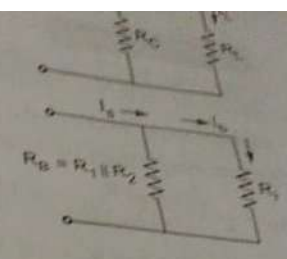
$$I_b = h_{fe} = 50$$

$$\frac{I_b}{I_s} = \frac{R_B}{R_B + R_1} = \frac{(8.2 || 1.6)}{(8.2 || 1.6) + 1.1}$$

$$= 0.549$$

$$A_{I_s} = \frac{I_L}{I_s} = -0.242 \times 50 \times 0.549$$

$$= -6.643$$



**6.6.2 Analysis of CC Amplifier using Simplified Hybrid Model**

- We have seen the simplified CE model, in which input is applied to base and output is taken from collector, and emitter is common between input and output.
- The same simplified model can be modified to get simplified CC model. For simplified CC model, we have to make collector common and take the output from emitter, as shown in the Fig. 6.6.4.
- The  $h_{fe} I_b$  current direction is now exactly opposite that of CE model because the current  $h_{fe} I_b$  always points towards emitter.

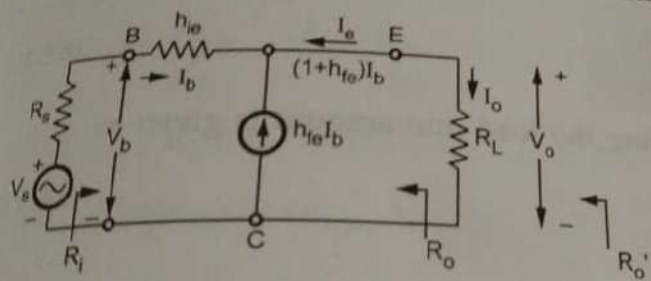


Fig. 6.6.4 Simplified CC model

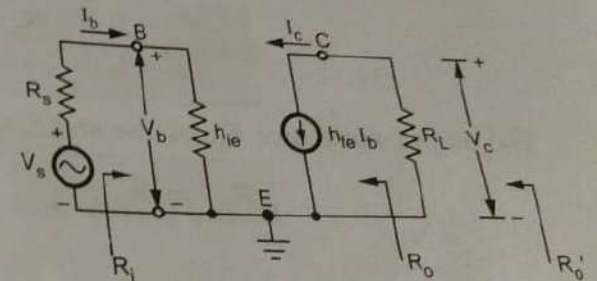


Fig. 6.6.5 Approximate CE model