Elektronika Dasar 2

Yohandri

2008

Lecrure #03 :

Common Collector

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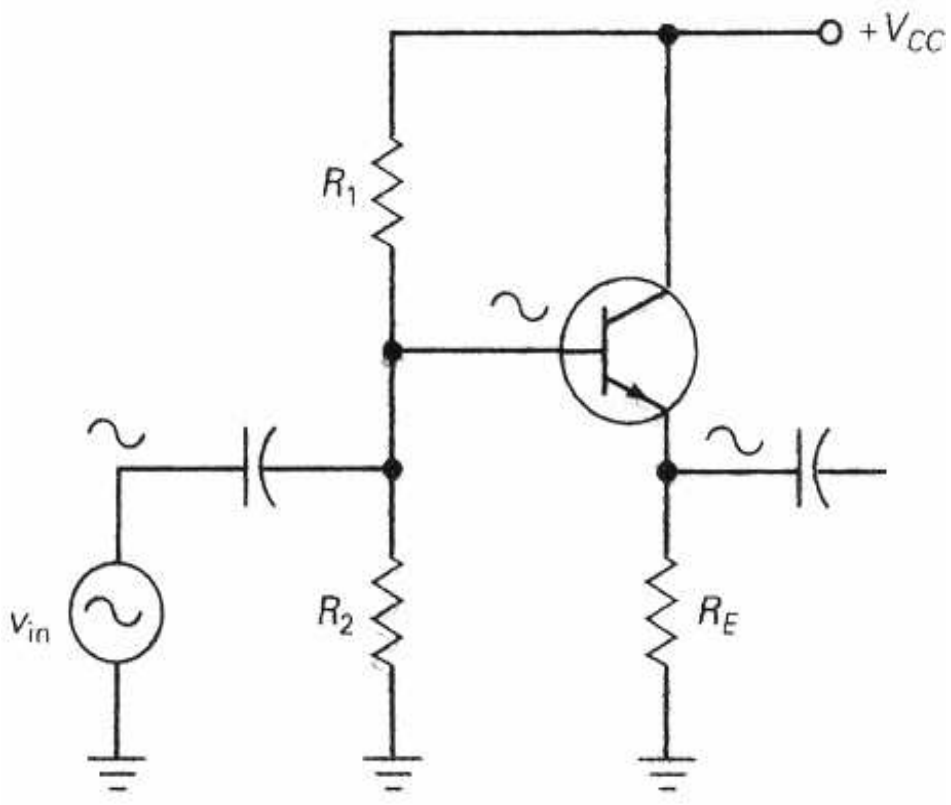
Jurusan Fisika
Universitas Negeri Padang

1. Common-Collector Amplifier

- The **common-collector** (CC) amplifier is used to provide current gain and power gain.
- The voltage gain equals approximately one, or unity.
- The collector is common to both the input and output sides of the amplifier.
- The input signal is applied to the base, while the output is taken from the emitter.
- The output signal is in phase with the input signal.
- The CC amplifier is usually referred to as an emitter follower.

CC Amplifiers Circuit

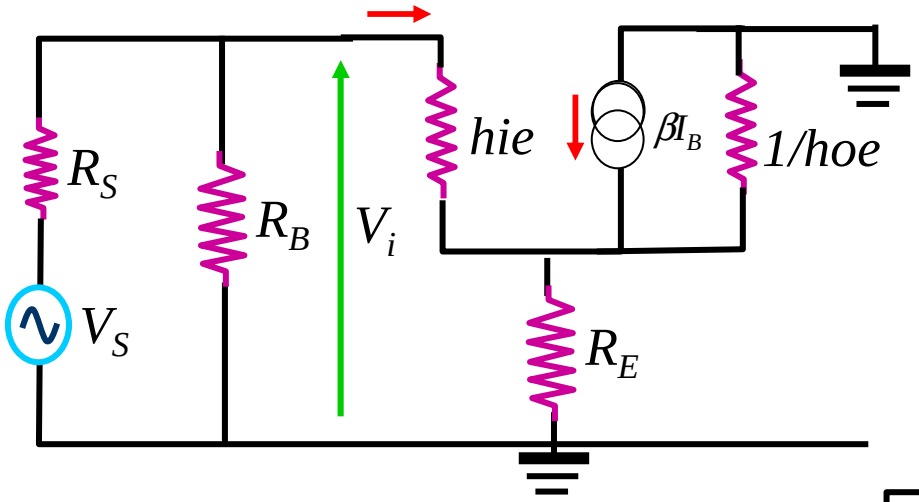
CC amplifier circuit which is also called an **emitter follower**.

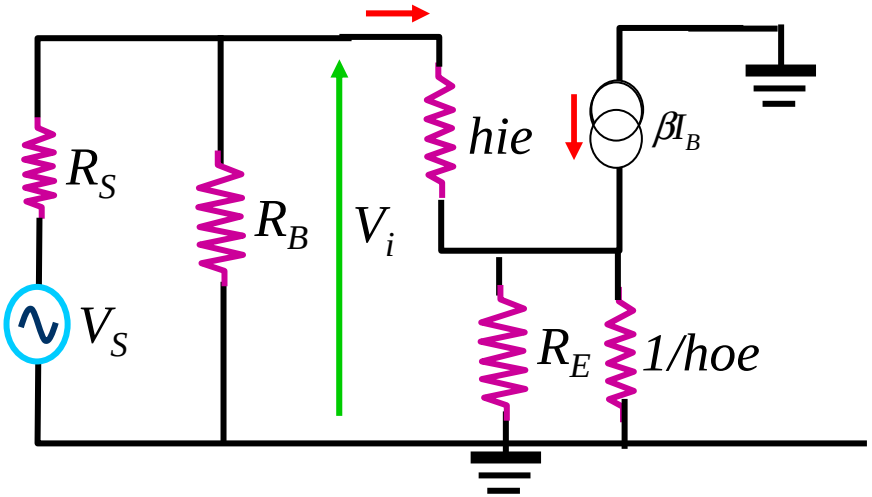


AC Analysis of an Emitter Follower

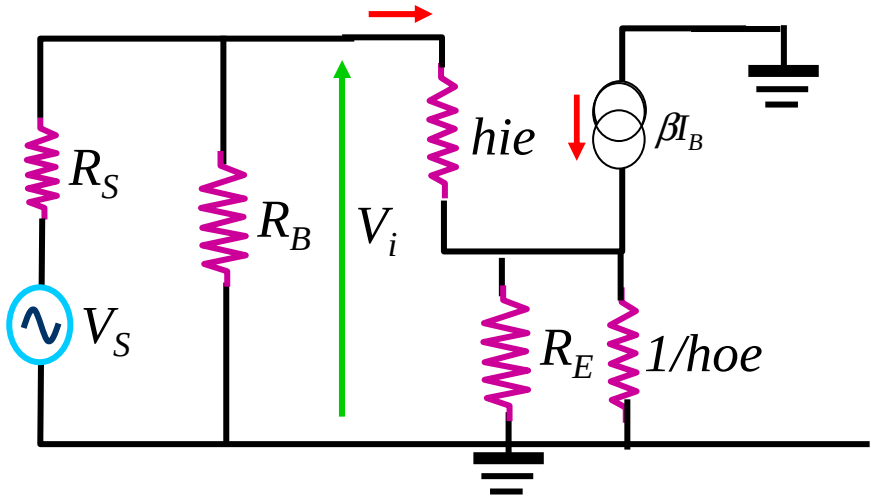
- In an **emitter follower** circuit, the input is applied to the base while the output is taken from the emitter.
- Because the collector is tied directly to the collector supply voltage, V_{CC}, no ac signal appears there.
- Because the emitter follower takes its output from the emitter, an emitter bypass capacitor is not used.
- The emitter is typically unbypassed, therefore, the swamping is heavy and the distortion in the output signal is extremely small.

Rangkaian Setara





Input Impedance



Impedansi masukan transistor (R_{it})

$$V_i = i_b h_{ie} + i_b (1+\beta)\left(R_E \,//\, \frac{1}{hoe} \right)$$

Dan $R_{it} = V_i / i_b$ sehingga

$$R_{it} = h_{ie} + (1+\beta)\left(R_E \,//\, \frac{1}{hoe} \right)$$

Misal R_E = 3K dan β = 300, maka

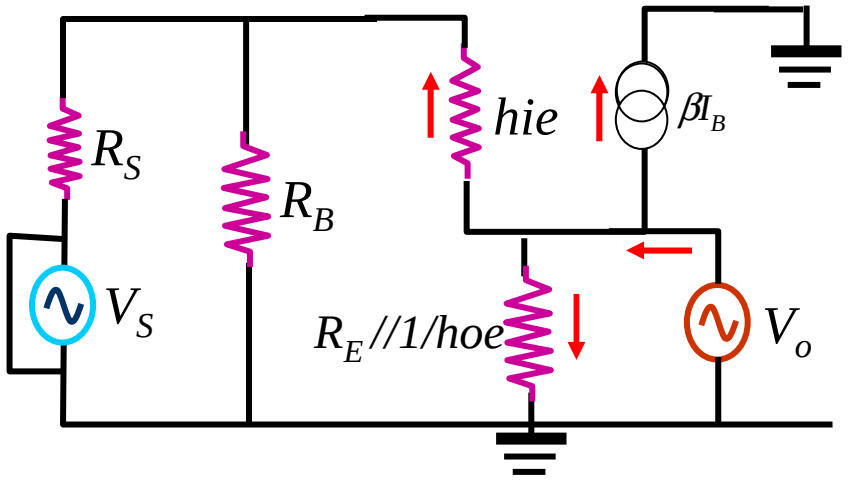
$$(1+\beta)\left(R_E \,//\, \frac{1}{hoe} \right) \cong 1\,M$$

Impedansi masukan penguat (R_i)

$$R_i = R_B \,//\, R_{it}$$

Output Impedance

Untuk menghitung impedansi masukan, sumber masukan dipandang terhubung singkat dan Vo menjadi sumber baru



$$i_o = i_b + i_e + \beta i_b$$

$$i_o = i_e + (1+\beta) i_b$$

Arus pada emitor

$$i_e = \frac{V_o}{\left(R_E // \frac{1}{hoe}\right)}$$

Arus pada basis

$$i_b = \frac{V_o}{hie + (R_B // R_S)}$$

Sehingga *Io*

$$i_o = \frac{V_o}{\left(R_E // \frac{1}{hoe}\right)} + \frac{(1+\beta)V_o}{hie + (R_B // R_S)}$$

Impedansi keluaran

$$\frac{1}{R_o}=\frac{i_o}{V_o}=\frac{1}{\left(R_E // \frac{1}{hoe}\right)}+\frac{1}{(hie+R_B // R_S)(1+\beta)}$$

atau

$$R_o=\left(R_E // \frac{1}{hoe}\right) // \frac{hie+R_B // R_S}{(1+\beta)}$$

Karena

$$\frac{hie+R_B // R_S}{(1+\beta)} \cong r_e+\frac{R_B // R_S}{(1+\beta)}=\frac{1}{40I_E}+\frac{R_B // R_S}{(1+\beta)}$$

dimana

$$\frac{1}{40I_E}+\frac{R_B // R_S}{(1+\beta)} << \left(R_E // \frac{1}{hoe}\right)$$

sehingga

$$R_o=\frac{1}{40I_E}+\frac{R_B // R_S}{(1+\beta)}$$

Dan untuk $R_B >> R_S$

$$R_o=\frac{1}{40I_E}+\frac{R_S}{(1+\beta)}$$

Penguatan

Tegangan masukan pada transistor

$$V_i = i_b h_{ie} + i_b(1+\beta)\left(R_E \,//\, \frac{1}{hoe}\right)$$

Tegangan keluaran

$$V_o = i_b(1+\beta)\left(R_E \,//\, \frac{1}{hoe}\right)$$

Penguatan Kv = Vo/Vi

$$K_V = \frac{(1+\beta)\left(R_E \,//\, \frac{1}{hoe}\right)}{h_{ie} + (1+\beta)\left(R_E \,//\, \frac{1}{hoe}\right)} \leq 1$$

Penguatan kolektor bukan penguat tegangan, melainkan penguat arus

Emitter Follower Applications

- An emitter follower has high input impedance and low output impedance.
- This makes the emitter follower ideal for **impedance matching** applications.

Emitter Follower Applications

The main purpose of the circuit in Figure is to use the emitter follower as a buffer to isolate the relatively low value of load resistance, R_L, from the high impedance collector Q_1.