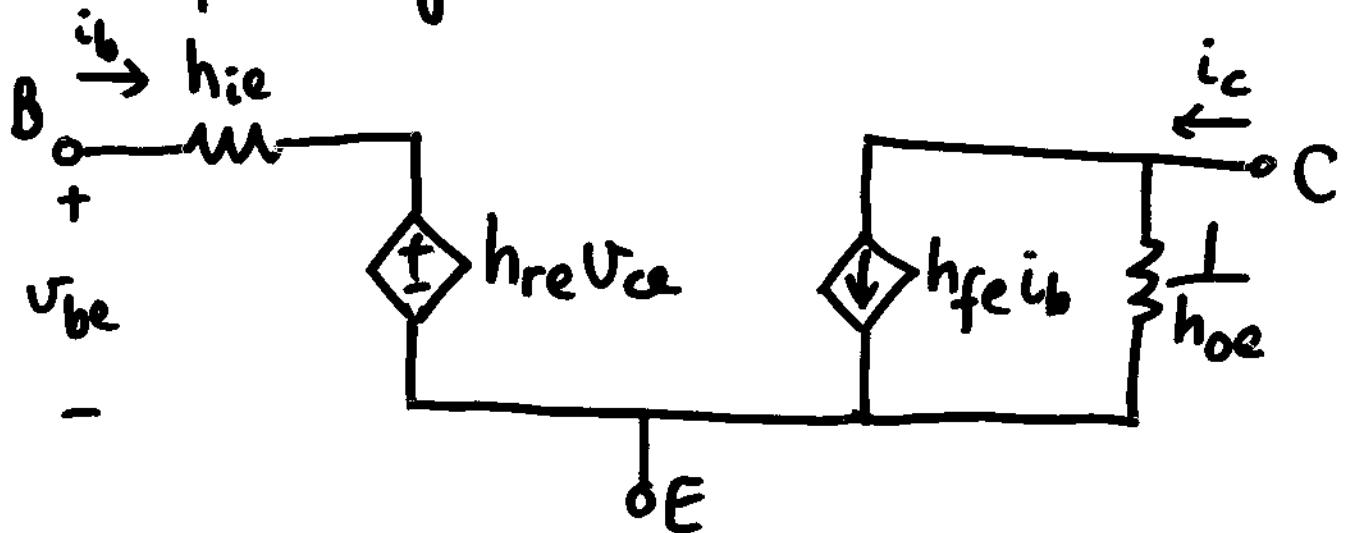


h-parameters

Two-port system



i = input

r = reverse

f = forward

o = output

$$v_{be} = h_{ie} i_b + h_{re} v_{ce}$$

$$i_c = h_{fe} i_b + h_{oe} v_{ce}$$

$$h_{ie} = \frac{v_{be}}{i_b} \Big|_{v_{ce}=0} =$$

Small signal input resistance

$$h_{re} = \frac{v_{be}}{v_{ce}} \Big|_{i_b=0} =$$

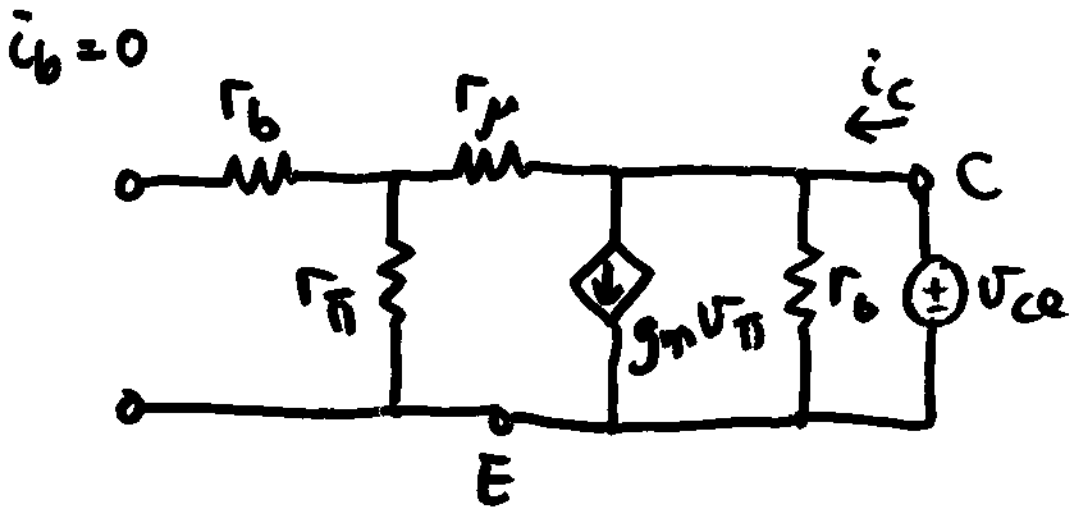
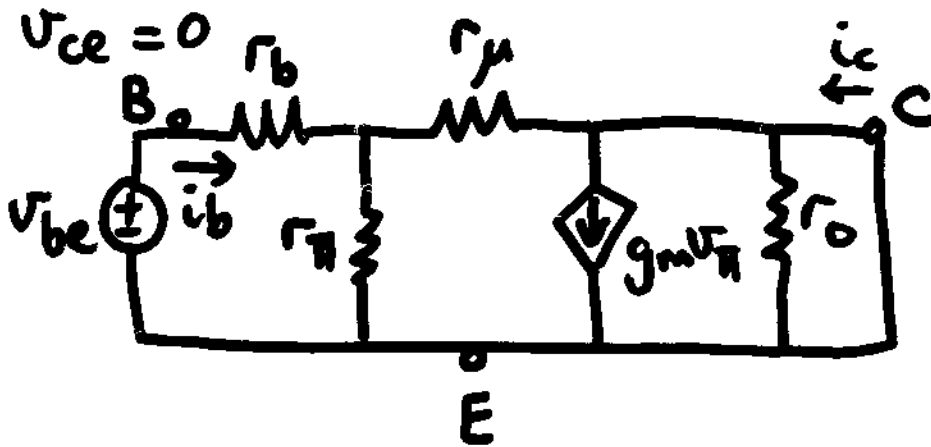
voltage feedback ratio

$$h_{fe} = \frac{i_c}{i_b} \Big|_{v_{ce}=0} =$$

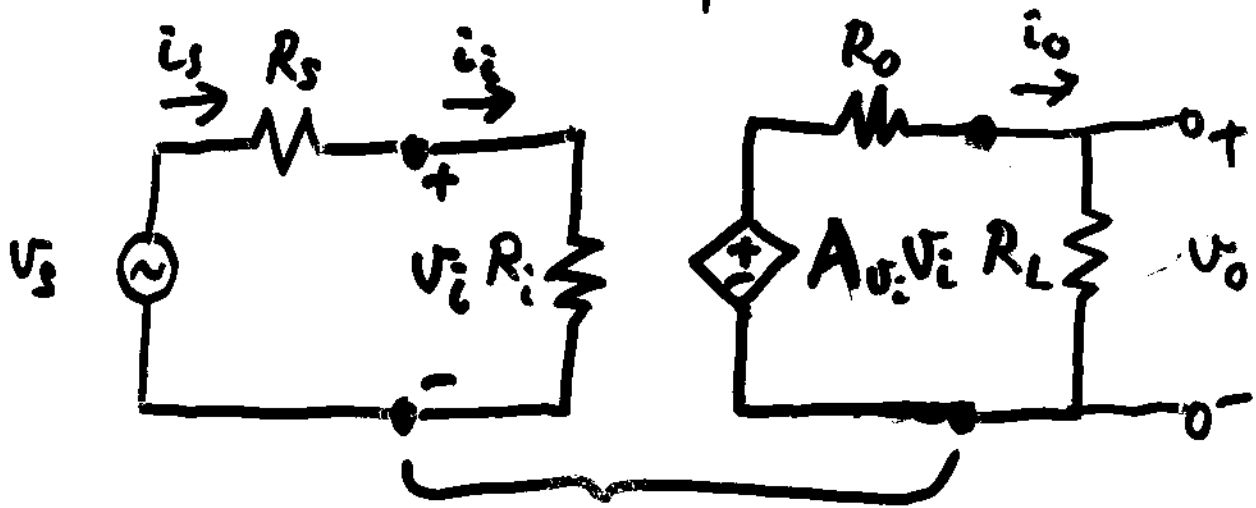
small signal current gain

$$h_{oe} = \frac{i_c}{V_{ce}} \Big|_{i_b=0} =$$

small signal output admittance



Fundamentals of Amplifiers



Amplifier ckt

A_{v_i} : intrinsic voltage gain, unloaded gain
 $R_s = 0, R_L = \infty$.

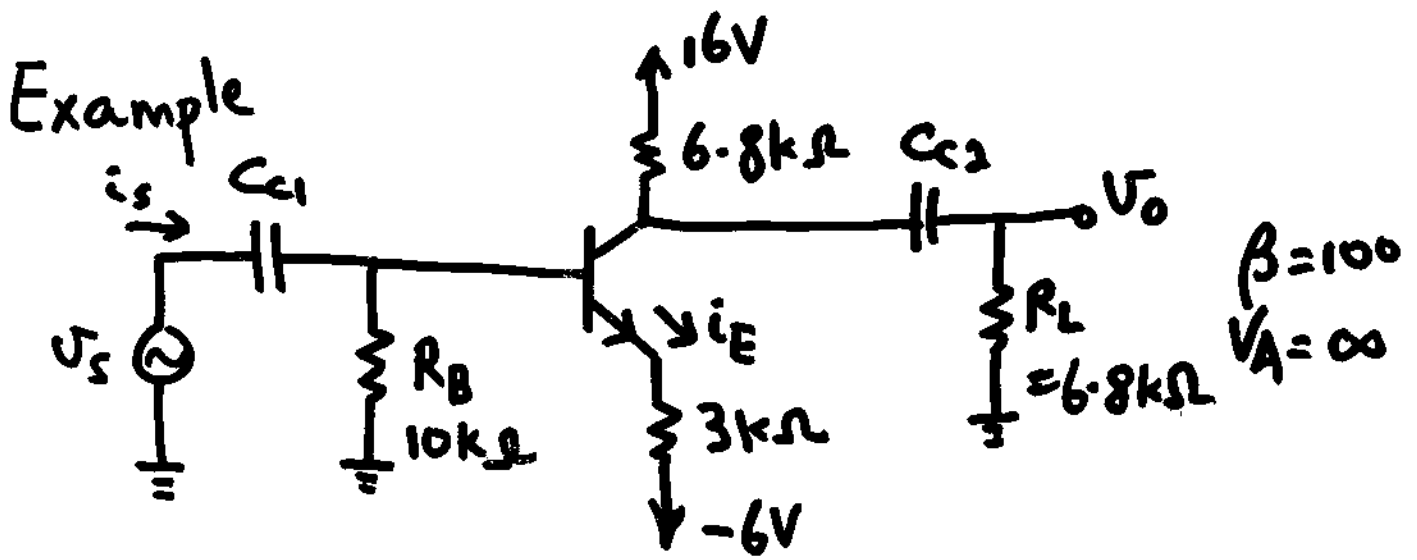
$$A_v = \frac{v_o}{v_s} = \frac{v_i}{v_s} \cdot \frac{A_{v_i} v_i}{v_i} \cdot \frac{v_o}{A_{v_i} v_i}$$

$$= \frac{R_i}{R_i + R_s} \cdot A_{v_i} \cdot \frac{R_L}{R_L + R_o}$$

$$\begin{aligned} R_i &\gg R_s \\ R_L &\gg R_o \end{aligned}$$

$$A_i = \frac{i_o}{i_s} = \frac{v_o/R_L}{v_s/(R_i + R_s)} = \frac{R_i}{R_L + R_o} A_{v_i} = \frac{R_i + R_s}{R_L} A_v$$

$$A_p = \frac{i_o v_o}{i_s v_s} = \frac{R_i + R_s}{R_L} A_v^2$$



Q-point : I_{BQ} , I_{CQ} , I_{EQ} , V_{CEQ} ?

ac parameters: g_m , r_{π} , r_o ?

$$A_v = \frac{v_o}{v_s} \quad A_i = \frac{i_o}{i_s} ?$$

R_{in} (into base) ?

R_{in} (ckt) ?

R_{out} ?

Small signal model

