Summary of DC problem

- Bias transistors so that they operate in the linear region B-E junction forward biased, C-E junction reversed biased

- Use $V_{BE} = 0.7$ (npn), $I_C \approx I_E$, $I_C = \beta I_B$

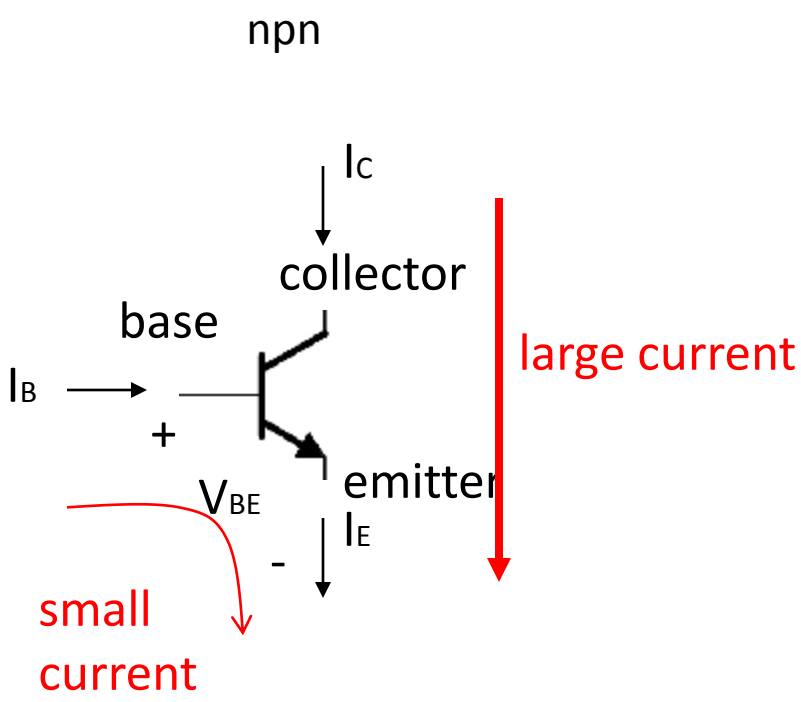
- Represent base portion of circuit by the Thevenin circuit

- Write B-E, and C-E voltage loops.

- For analysis, solve for I_C, and V_{CE}.

- For design, solve for resistor values (I_C and V_{CE} specified).

Summary of npn transistor behavior



Transistor as an amplifier

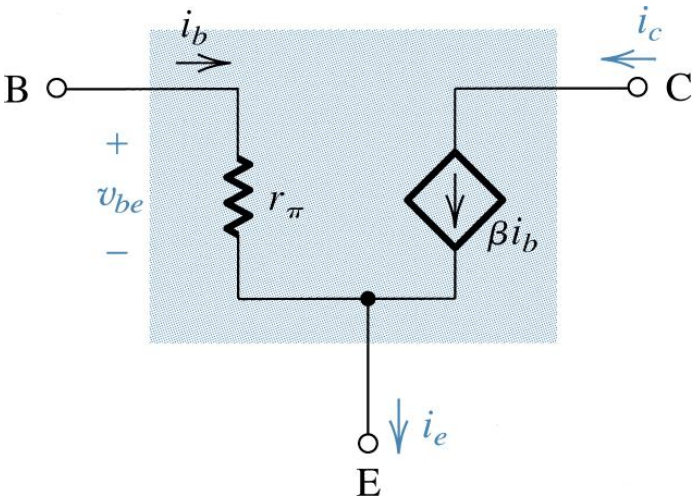
- Transistor circuits are analyzed and designed in terms of DC and ac versions of the same circuit.

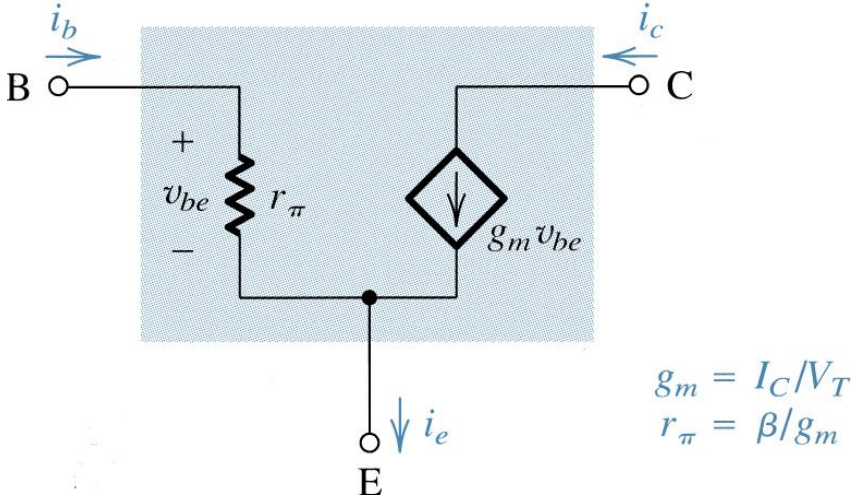
- An ac signal is usually superimposed on the DC circuit.

- The location of the operating point (values of I_C and V_{CE}) of the transistor affects the ac operation of the circuit.

- There are at least two ac parameters determined from DC quantities.

Small-signal equivalent circuit models





- ac model
- Hybrid-π model
- They are equivalent
- Works in linear region only

Steps to analyze a transistor circuit

1 DC problem

Set ac sources to zero, solve for DC quantities, I_C and V_{CE}.

2 Determine ac quantities from DC parameters

Find g_m, r_π, and r_e.

3 ac problem

Set DC sources to zero, replace transistor by hybrid-π model, find ac quantites, Rin, Rout, Av, and Ai.