

**DEPARTMENT OF
ELECTRONICS AND
COMMUNICATION ENGINEERING**

ELECTRONIC DEVICES AND CIRCUITS

**G.PULLALAH COLLEGE OF ENGINEERING
& TECHNOLOGY::KURNOOL**

UNIT-IV

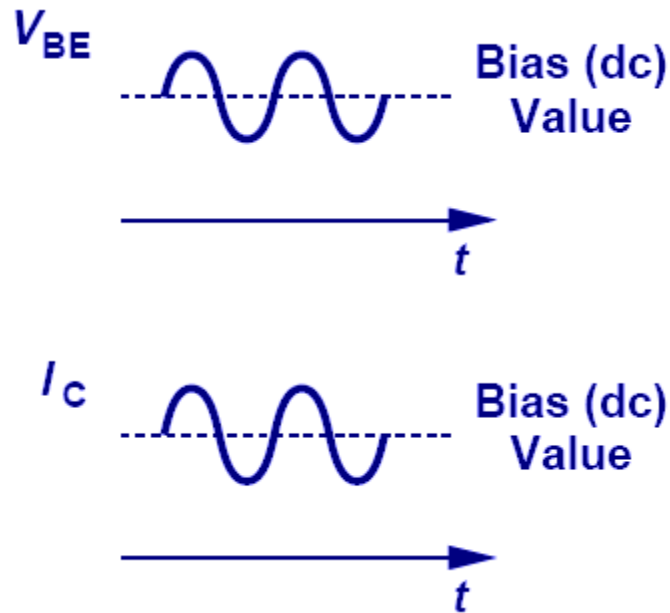
TRANSISTOR BIASING AND THERMAL STABILIZATION

CONTENT

- Need for Biasing
- Criteria for fixing operating point
- BJT biasing methods
 - Fixed Bias
 - Self Bias
 - Collector to Base Bias
- Compensation techniques
- Thermal run away
- Thermal stability

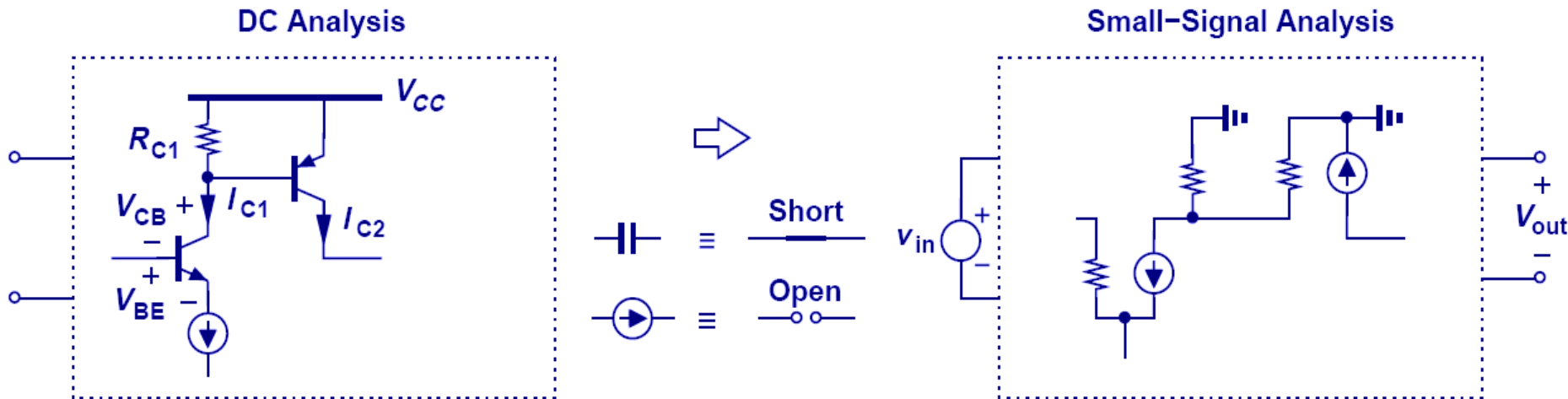
Biasing of BJT

Transistors must be biased because
They must operate in the active region, and
Their small-signal model parameters are set by the bias conditions.



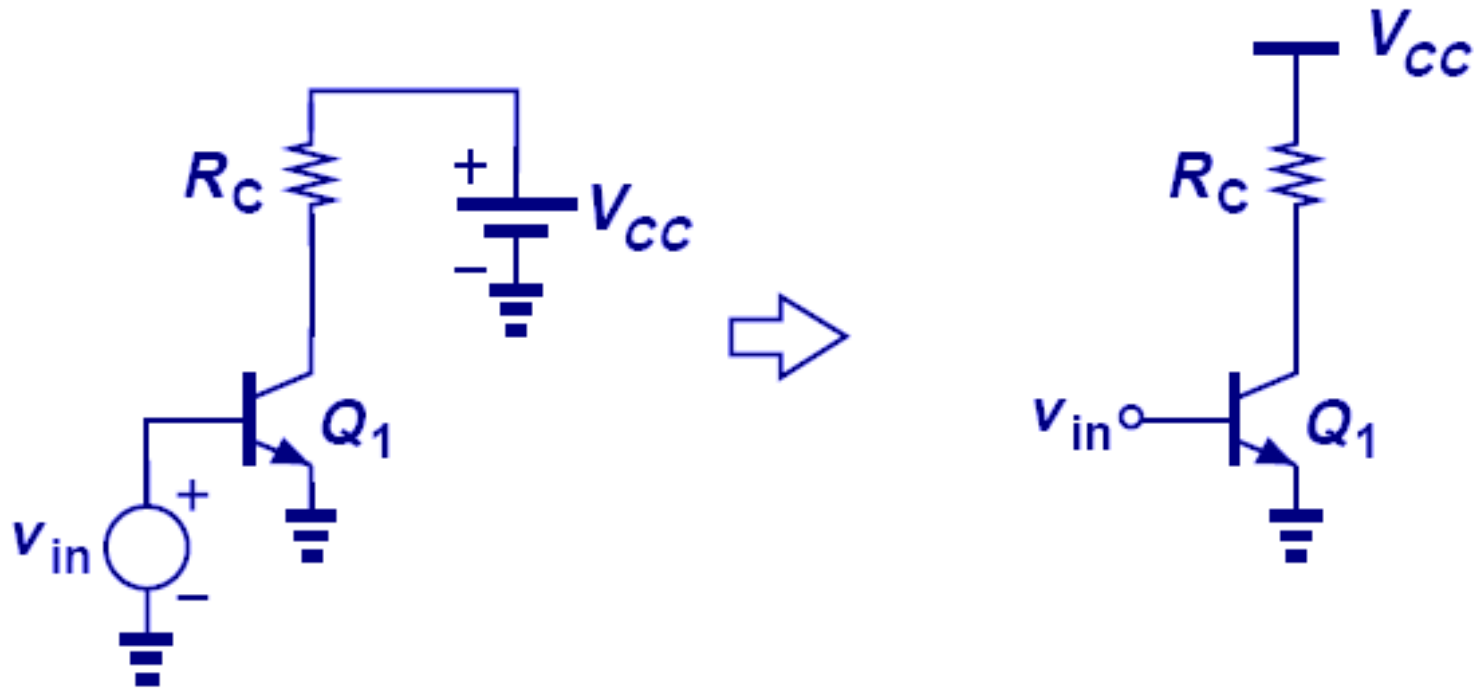
DC Analysis vs. Small-Signal Analysis

- Firstly, DC analysis is performed to determine the DC operating point and to obtain the small-signal model parameters.
- Secondly, independent sources are set to zero and the small-signal model is used.



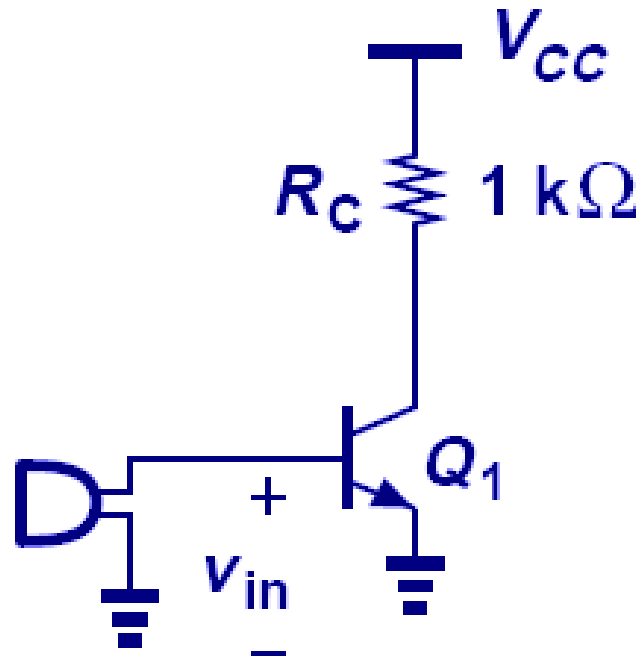
Simplified Notation

- Hereafter, the voltage source that supplies power to the circuit is replaced by a horizontal bar labeled V_{CC} , and input signal is simplified as one node labeled v_{in} .



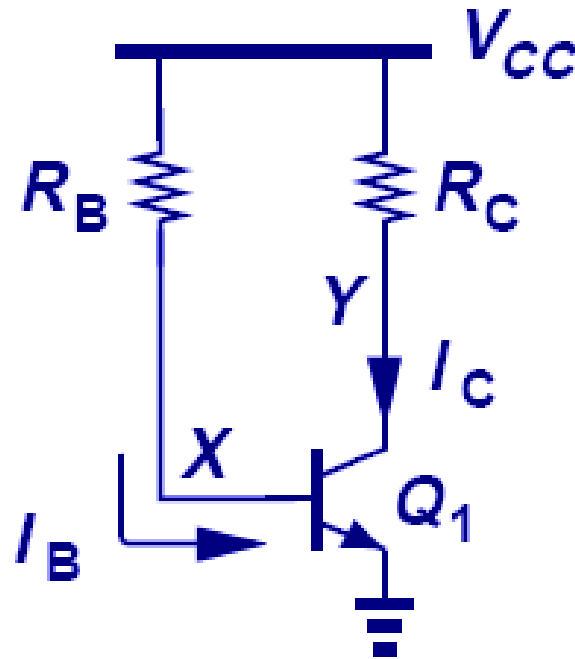
Example of Bad Biasing

- The microphone is connected to the amplifier in an attempt to amplify the small output signal of the microphone.
- Unfortunately, there is no DC bias current running through the transistor to set the transconductance.



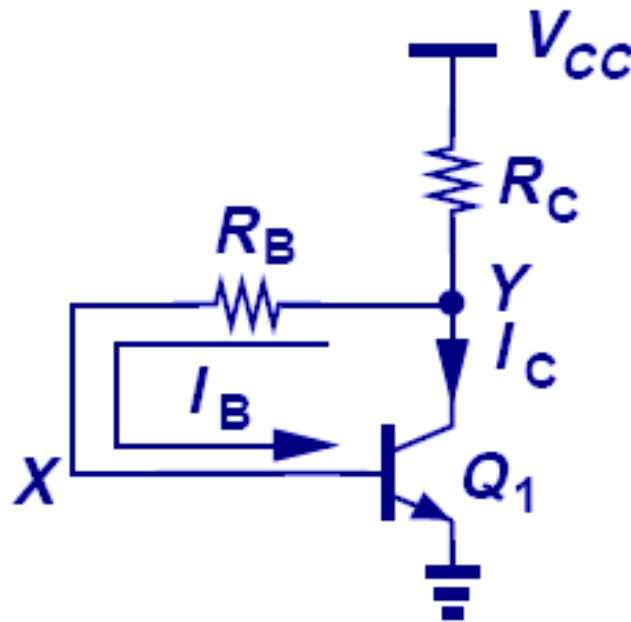
Biasing with Base Resistor

- Assuming a constant value for V_{BE} , one can solve for both I_B and I_C and determine the terminal voltages of the transistor.
- However, the bias point is sensitive to β variations.



Self-Biasing Technique

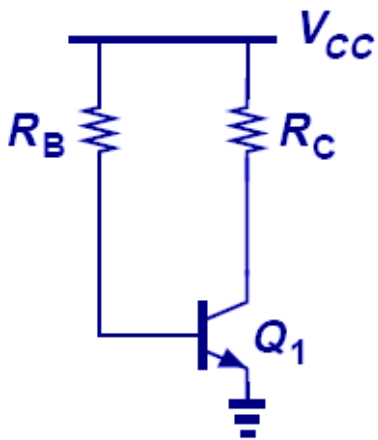
- This bias technique utilizes the collector voltage to provide the necessary V_x and I_B .
- One important characteristic of this approach is that the collector has a higher potential than the base, thus guaranteeing active-mode operation of the BJT



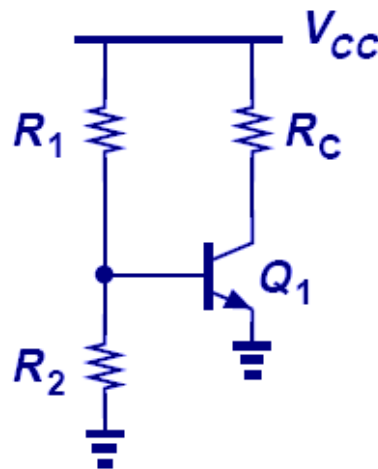
Self-Biasing Design Guidelines

- (1) provides insensitivity to β
- (2) provides insensitivity to variation in V_{BE}

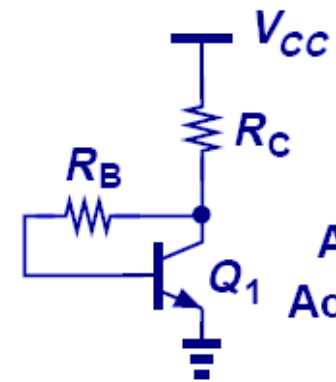
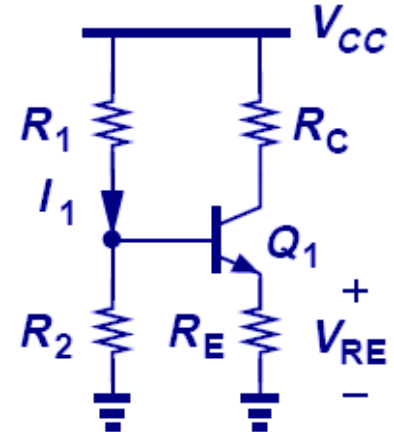
Summary of Biasing Techniques



Sensitive to β



Sensitive to Resistor Error



Always in Active Mode