Transistors II: AC transistor Amplifiers

Common Emitter Amplifier Summary

**Pros:**
- Power/Current Gain.  
  ➔ Speaker got louder.
- Simple.
- Moderate input impedance.
- Does not depend on $\beta$.

**Cons:**
- Requires a DC bias.  
  ➔ Signal cannot be negative!
  ➔ Signal must larger than 0.6 V.
- Cannot provide Voltage gain.
- Significant power consumption.
The DC bias problem

There are 2 simple solutions to the DC bias problem:

- Push-Pull amplifier.
- AC-coupled biased-amplifier
Push-Pull BJT Amplifier (I)

NPN Emitter Follower
Push-Pull BJT Amplifier (I)

NPN Emitter Follower

PNP Emitter Follower
Push-Pull BJT Amplifier (II)

Combine both circuits:

Push-Pull BJT Amplifier
No DC bias required
AC-coupled Biased-Amplifier

- AC-couple the input and output signals with capacitors (i.e. high-pass RC filters)

- DC-bias the input with a voltage divider.
AC-coupled Biased-Amplifier

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![RC High-Pass Filters Diagram]
AC-coupled Biased-Amplifier

- AC-couple the input and output signals with capacitors (i.e. high-pass RC filters)

- DC-bias the input with a voltage divider.

![AC-coupled Biased-Amplifier Diagram]
4 rules:

- Choose a quiescent collector current (no load current) which is at least 10x larger than load current.

- Choose $V_{out, DC}$ in the middle of the supply voltage range for maximum signal voltage amplitude.

- Choose the DC-bias such that $V_{collector} > V_{base}$ (NPN) to avoid saturation, and $V_{base} \approx V_{emitter} + 0.6$.

- Make sure that the voltage divider DC-bias and the transistor don’t load each other (i.e. $I_{base}$ 10x smaller than $I_{voltage-divider}$).