

Transistors II: AC transistor Amplifiers

Emitter-Follower Amplifier Summary

Pros:

- Power/Current Gain.
→ Speaker got louder.
- Simple.
- Moderate input impedance.
- Does not depend on β .

Cons:

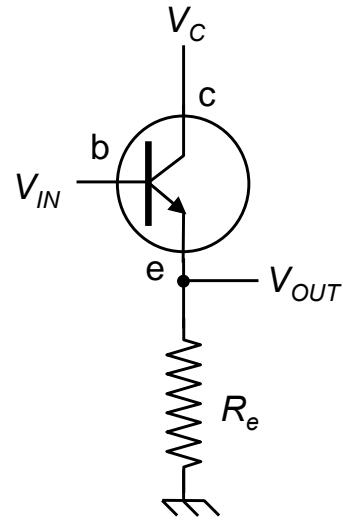
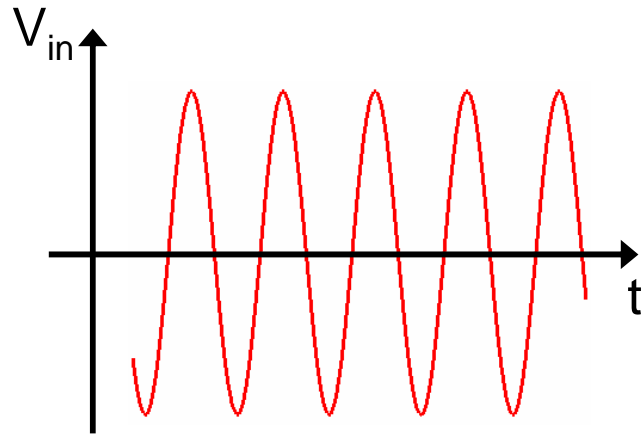
- Requires a DC bias.
→ Signal cannot be negative !
→ Signal must larger than 0.6 V.
- Cannot provide Voltage gain.
- Significant power consumption.

The DC bias problem

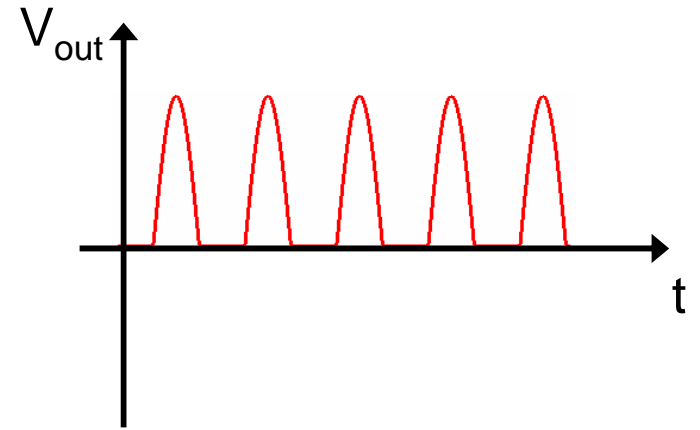
There are 2 simple solution to the DC bias problem:

- ***Push-Pull*** amplifier.
- **AC-coupled biased-amplifier**

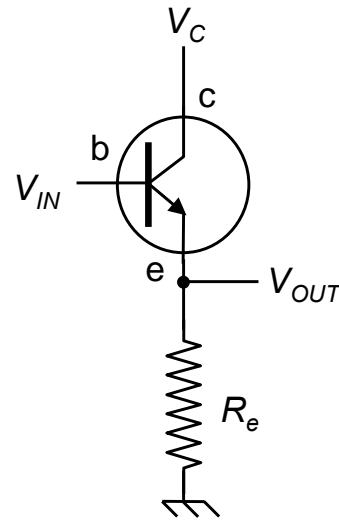
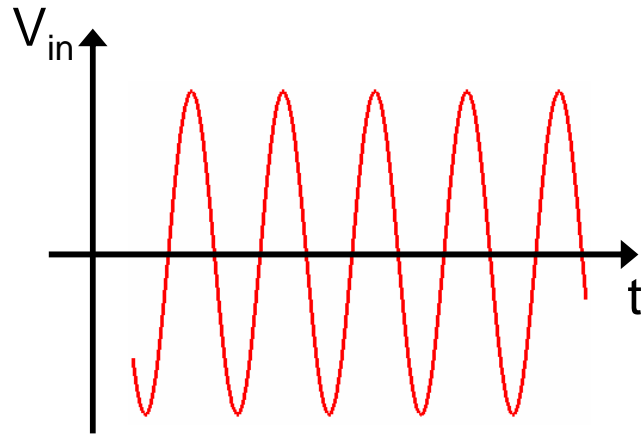
Push-Pull BJT Amplifier (I)



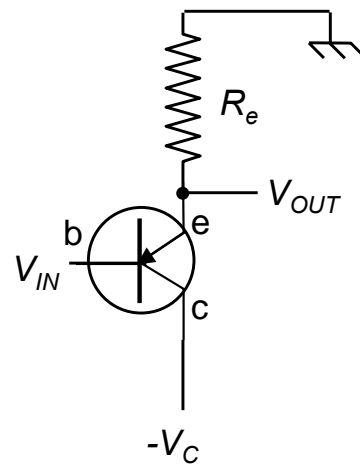
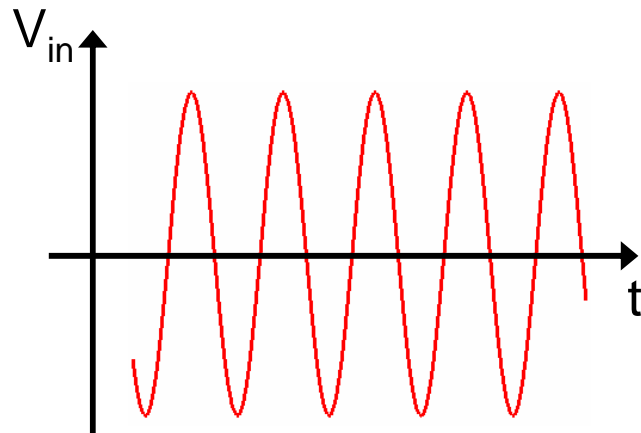
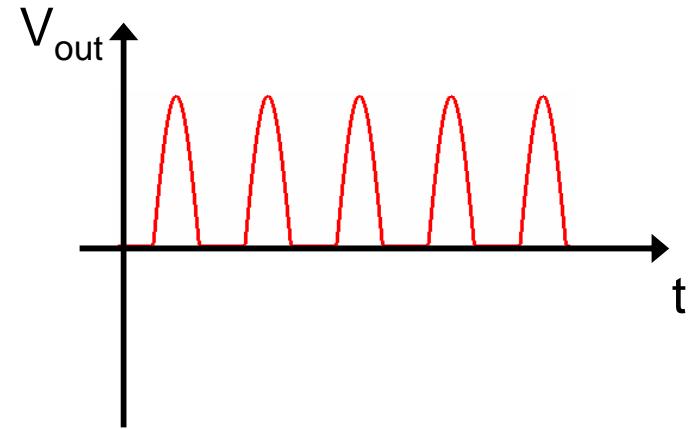
NPN Emitter Follower



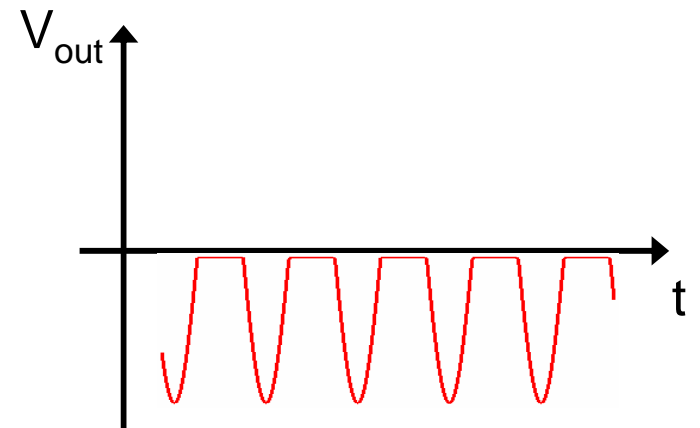
Push-Pull BJT Amplifier (I)



NPN Emitter Follower

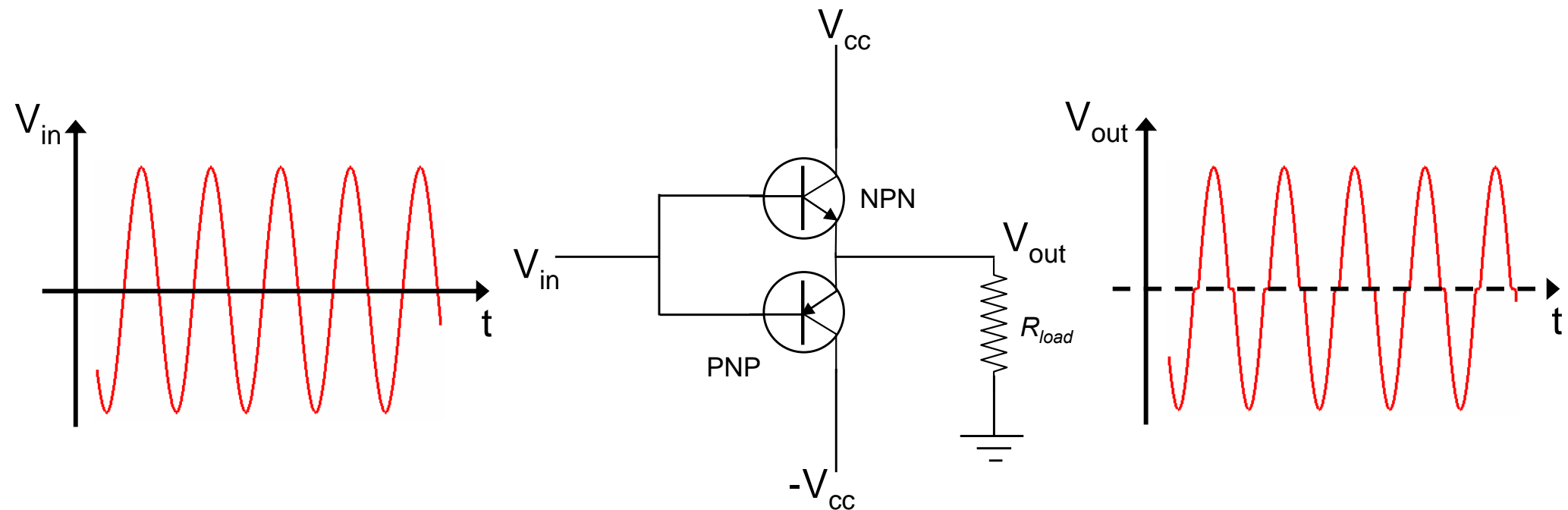


PNP Emitter Follower



Push-Pull BJT Amplifier (II)

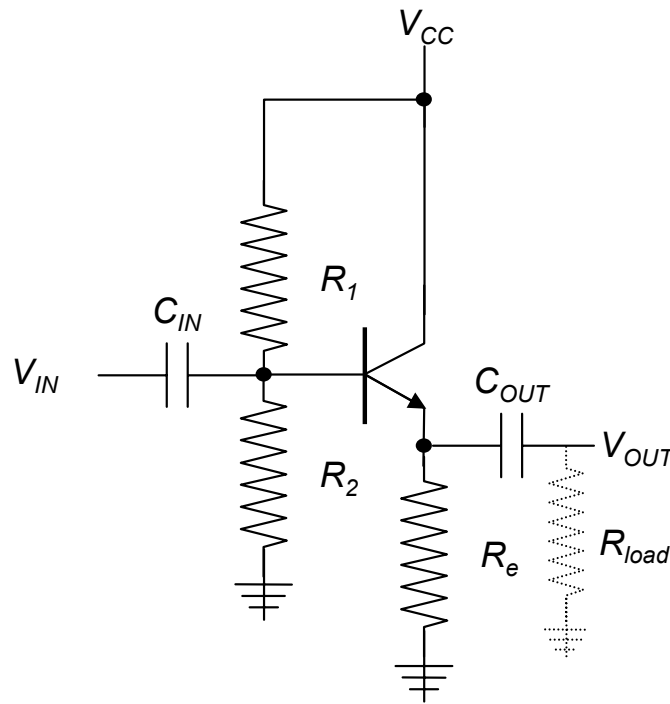
Combine both circuits:



Push-Pull BJT Amplifier
No DC bias required

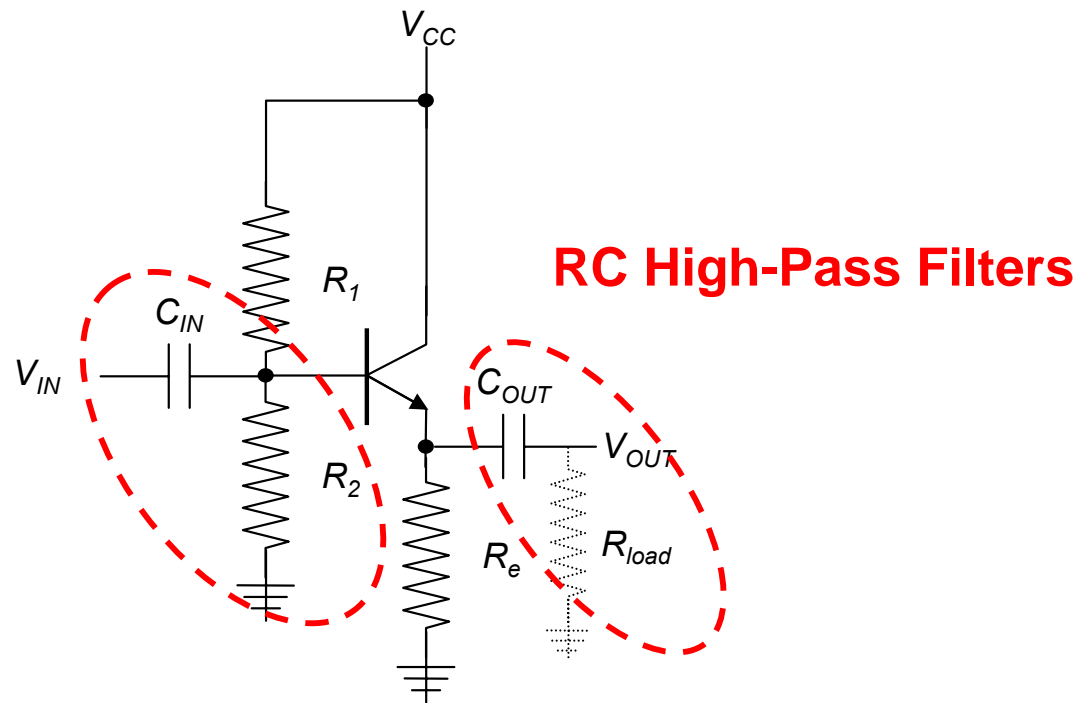
AC-coupled Biased-Amplifier

- AC-couple the input and output signals with capacitors (i.e. high-pass RC filters)
- DC-bias the input with a voltage divider.



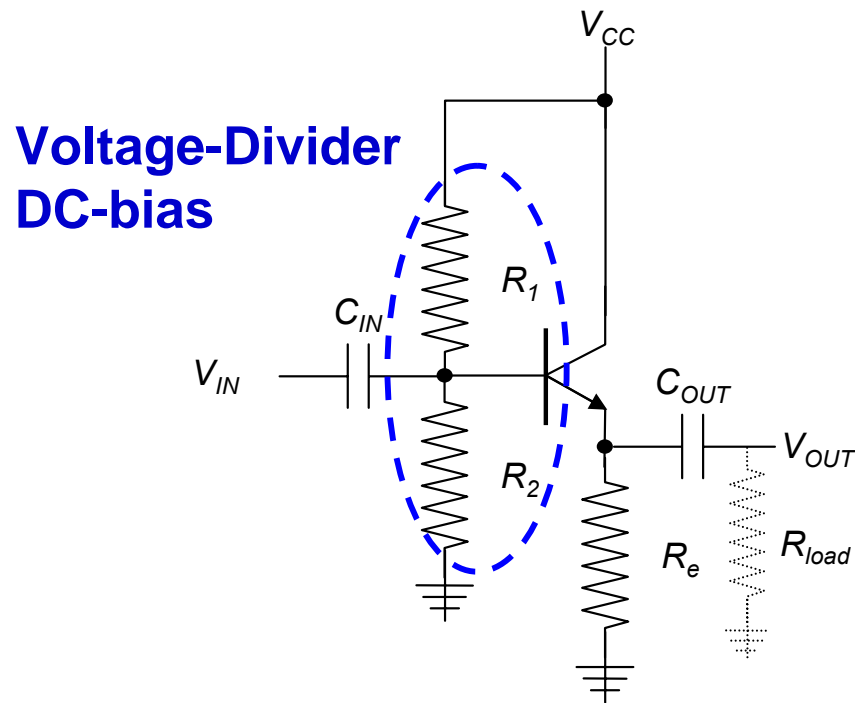
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AC Transistor Amplifier Design

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 $V_{base} \sim V_{emitter} + 0.6$.
- Make sure that the voltage divider DC-bias and the transistor don't load each other (i.e. I_{base} 10x smaller than $I_{voltage-divider}$).