E151 Lecture 11 – Common Base and Cascodes

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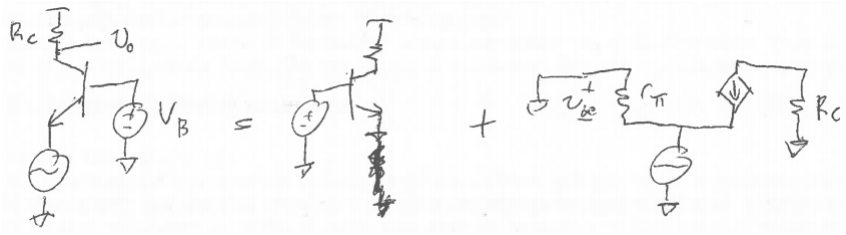
Disclaimer

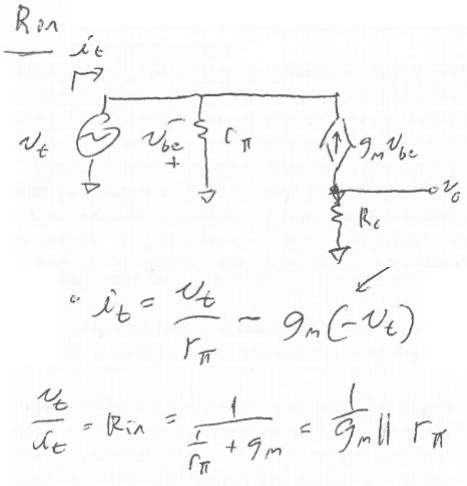
These are notes for Prof. Spencer to give the lecture, they were not intended as a reference for students. Students asked for them anyway, so I'm putting them up as a courtesy. Remember that they are not intended as a substitute for attending lecture.

Common Base Amplifier

- Still missing amplifier capabilities: low rin and very big rout
- Use common base amplifier – good for RF matching, active loads
- Hard to bias this thing: more later



rin, rout, av



Same pattern as EF output: 1/gm

- Skipping ro here. See G&M.
- They do rin, I do rout & av
- rout depends on vin being shorted
  - See above
  - Does Rs matter? Rl?

Av $v_o = -g_m v_{be} R_c$

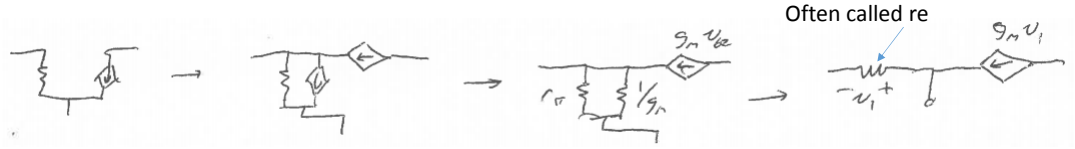
$= -g_m(-v_t) R_c$

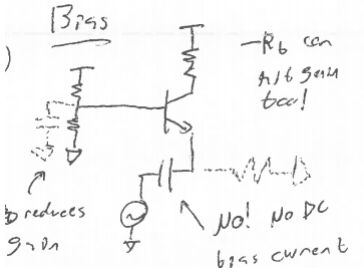
Rout $R_{out} = R_c$

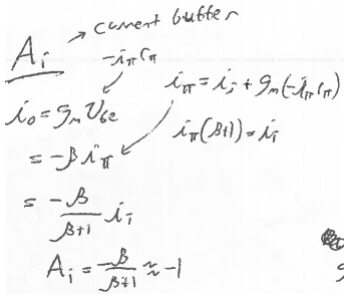
Asides: T-model, biasing, "current buffer"

- Alternative analysis strategy: use a T-model instead of our hybrid-pi

Often called re





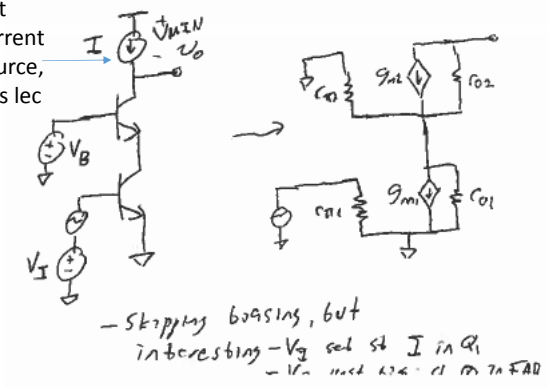


Cascodes

Note to self: Derive as 2 stage amp instead of current gain

- Can we use the common base high rout for gain?
- Yes! CE-CB amplifier, called a cascade, one of two analog tricks

Use Rc, not current source, this lec



$r_{in} = r_{\pi 1}$

$V_{o,MAX} = V_{CC} - V_{MIN}$ } - lose swing

$V_{o,MIN} = 2V_{CESAT}$

- small signal pattern
- g_{m1} off
- g_{m2} on

$r_{out} = r_{\pi 2} \| r_{o1} + r_{o2} + g_{m2} r_{o2} (r_{o1} \| r_{\pi 2})$

$= r_{\pi 2} \| r_{o1} + r_{o2} + \beta_2 r_{o2} r_{o1} / (r_{o1} + r_{\pi 2})$

$a_v = g_{m1} \cdot \frac{\beta_2}{\beta_2 + 1} \cdot r_{out}$

Recall big a_v & r_{out}!

called a cascode! one of the big tricks!