

E151 Lecture 11 – Common Base and Cascodes

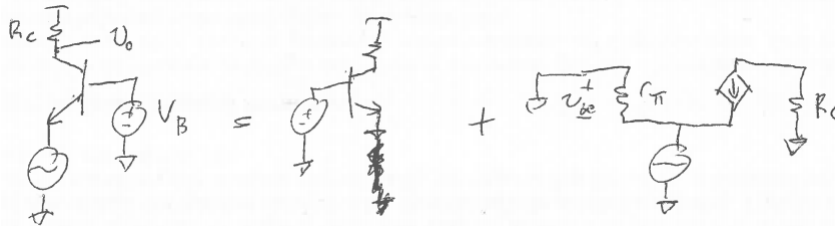
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Disclaimer

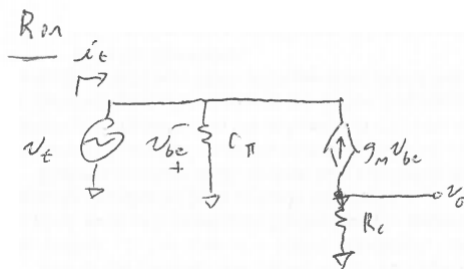
These are notes for Prof. Spencer to give the lecture, they were not intended as a reference for students. Students asked for them anyway, so I'm putting them up as a courtesy. Remember that they are not intended as a substitute for attending lecture.

Common Base Amplifier

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



r_{in} , r_{out} , a_v



$$i_t = \frac{v_t}{r_{\pi}} - g_m (-v_t)$$

$$\frac{v_t}{i_t} = R_{in} = \frac{1}{\frac{1}{r_{\pi}} + g_m} = \frac{1}{g_m} \parallel r_{\pi}$$

Same pattern as EF output: $1/g_m$

- Skipping r_o here. See G&M.
- They do r_{in} , I do r_{out} & a_v
- r_{out} depends on v_{in} being shorted
 - See above
 - Does R_s matter? RI?

$$\begin{aligned} \underline{A_v} \quad v_o &= -g_m v_{be} R_c \\ &= -g_m (-v_t) R_c \end{aligned}$$

$$\underline{R_{out}} \quad R_{out} = R_c$$

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

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

Often called r_e

$A_i \rightarrow$ current buffer

$i_{\pi} = i_i / \beta$

$i_o = g_m v_{be}$

$\lambda_{\pi} = \lambda_i + g_m(-\lambda_i r_e)$

$i_{\pi}(\beta + 1) = i_i$

$= -\beta i_{\pi}$

$= -\frac{\beta}{\beta + 1} i_i$

$A_i = \frac{-\beta}{\beta + 1} \approx -1$

R_b can hit g_m too!

reduces g_m

NO! NO DC bias current

Active Loads

- Always trading off between V_{SW} and a_v w/ resistive loads
- What's the gain of these two amplifiers (if everything is in FAR)

load given by:

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

$r_{out} \approx 1/g_{m2}$

$a_v = g_{m1}/g_{m2}$

$V_{oMAX} = V_{cc} - V_{BEON2}$

$V_{oMIN} = V_{CESAT1}$

Still a swing issue...

cool! b23 $r_{out} \rightarrow$ b25 a_v

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

$r_{out} = r_{o1} || r_{o2}$

$a_v = g_{m1}(r_{o1} || r_{o2})$

what's V_o

$V_{oMAX} = V_{cc} - V_{CESAT2}$

$V_{oMIN} = V_{CESAT1}$