02/07/11

EE303

Note Title 2/7/2011

BJT's ⇒ used next in 307 lab

TA in AVW 1371 on M 10–12

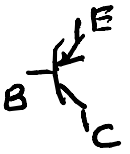
I am in the 417 lab 2-5 & after to help with Spice

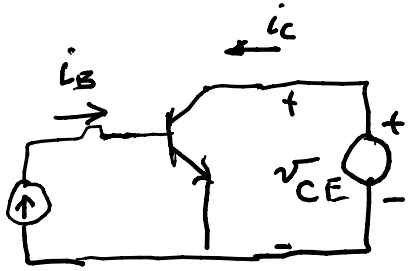
G_value ≠ G in the ABM library

Spice command for voltage V(node_name)

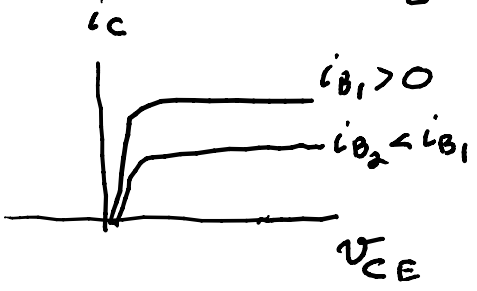
for 307 use 2N3904 = npn ⇒

2N3906 = pnp ⇒

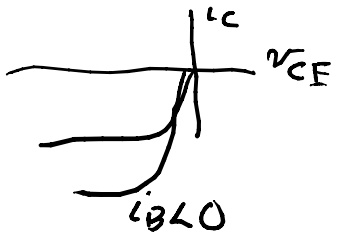


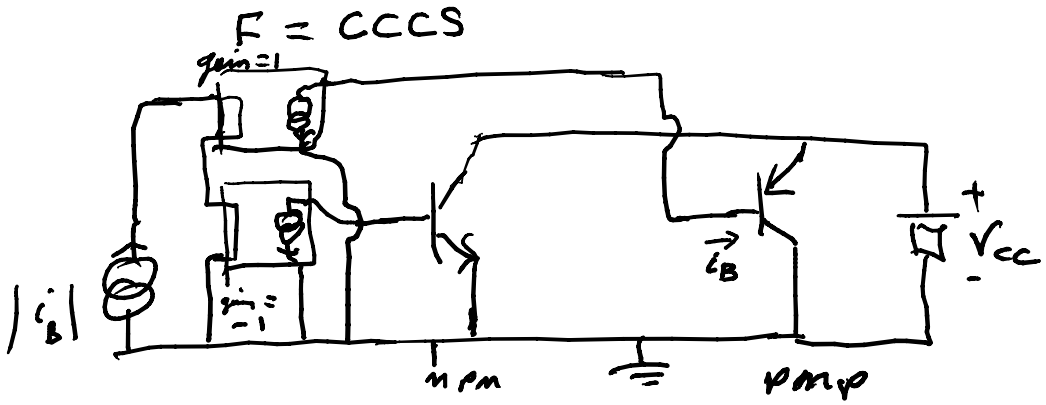


p. 375

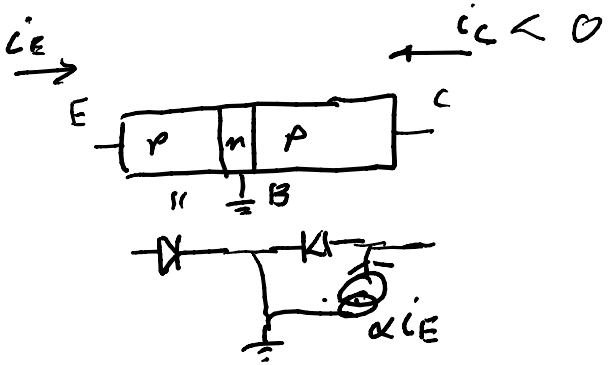


chapter 6

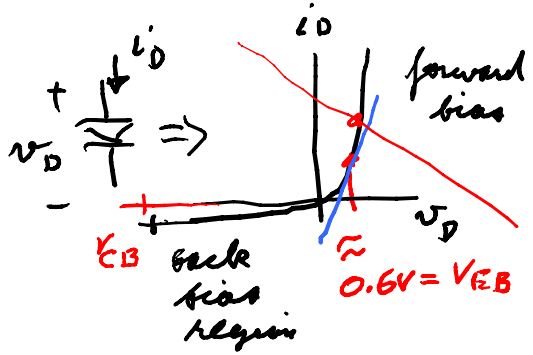




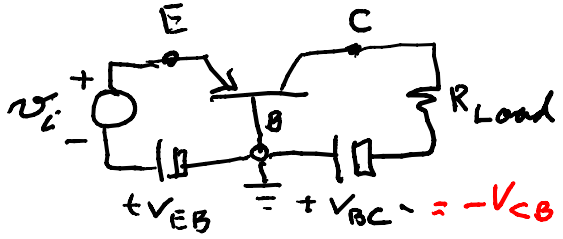
for SPICE to give transistor curves



$\alpha \approx 1$ = current gain of grounded base

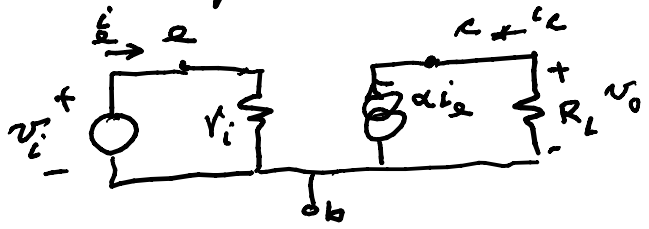


see p. 364 for bias



For small signal (v_i small)

current gain $\simeq -1$
$= -\alpha$



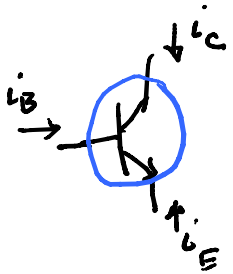
$i_E = v_i / r_i$

$v_o = -R_L i_C = -R_L(-\alpha i_E)$

$= +\frac{R_L}{r_i}\alpha \cdot v_i$

$\frac{v_o}{v_i} = \alpha \frac{R_L}{r_i}$ if $R_L = 5\,K\Omega$
$r_i = 50\,\Omega$
$\alpha = 0.998$

$\frac{v_o}{v_i}$ = voltage gain ≈ 100



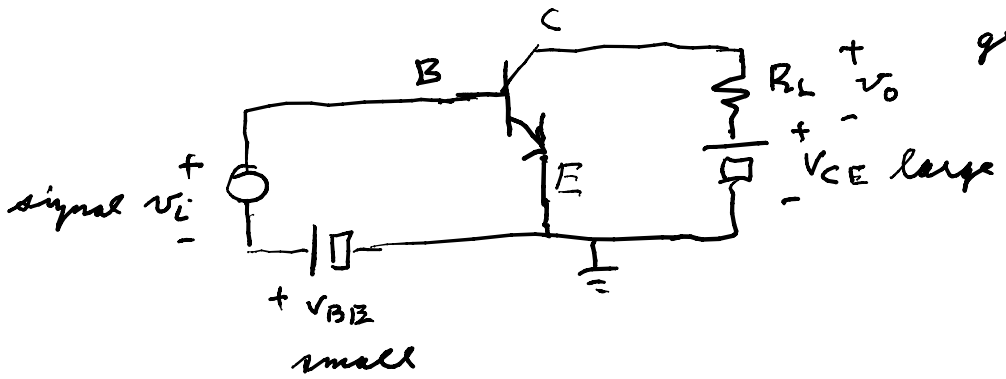
KCL: $0 = i_C + i_B + i_E$; $i_C = -\alpha i_E \Rightarrow i_E = -\frac{1}{\alpha} i_C$

$= i_C + i_B - \frac{1}{\alpha} i_C \Rightarrow -i_B = \frac{(\alpha - 1)}{\alpha} i_C$

$i_C = \frac{\alpha}{1-\alpha} i_B = \beta i_B$, $\beta = h_{fe}$ = β forward of the Transistor

gives a current gain $\simeq 10^2 - 10^3$ large

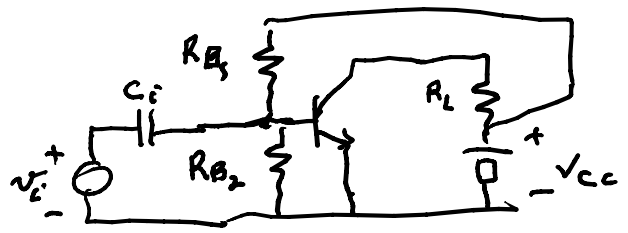
∴ use the grounded emitter transistor for amplifying
we get $\left|\frac{v_o}{v_i}\right| \sim \beta \frac{R_L}{r_i}$, $\left|\frac{i_{out}}{i_b}\right| \approx \beta$ both large



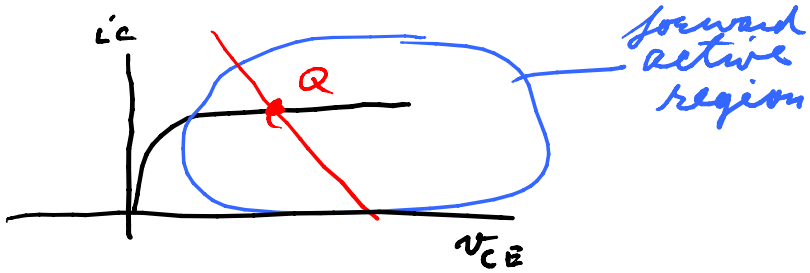
grounded emitter

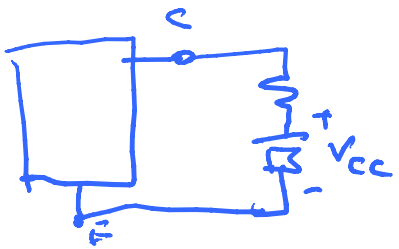
to eliminate V_{BE} battery we divide down $V_{CE} \Rightarrow V_{cc}$

V.390



↑
C_i large, coupling capacitor $Z = \frac{1}{\omega C}$, C large $Z \to 0$ for signal
$\to \infty$ at bias


i_C
Q
v_{CE}
forward active region


C
+
V_{CC}
-
E