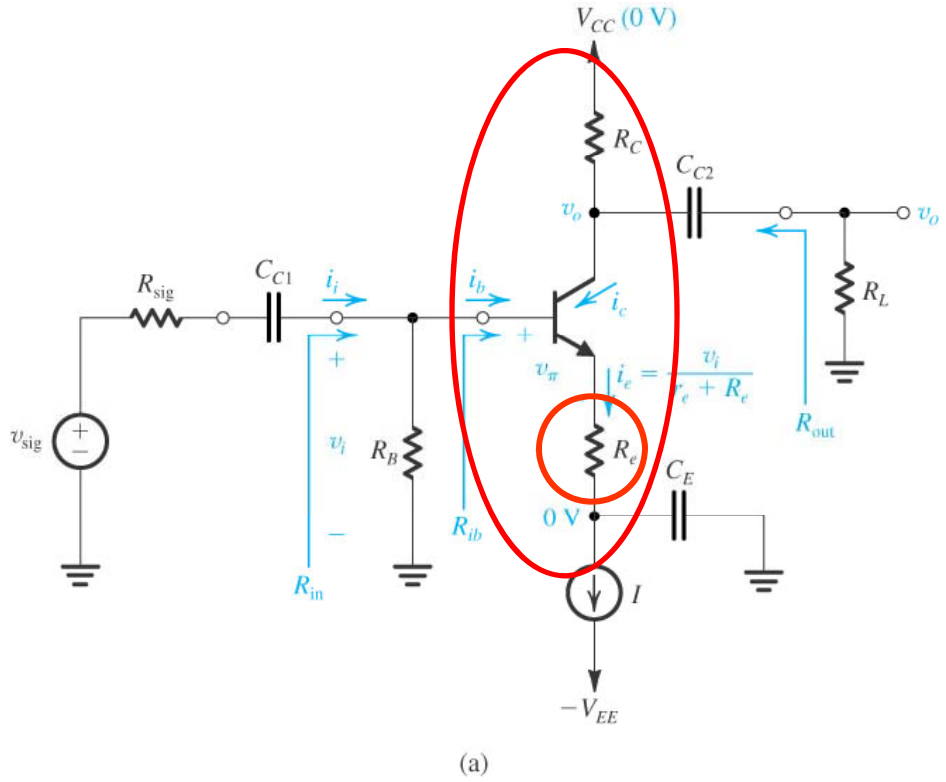
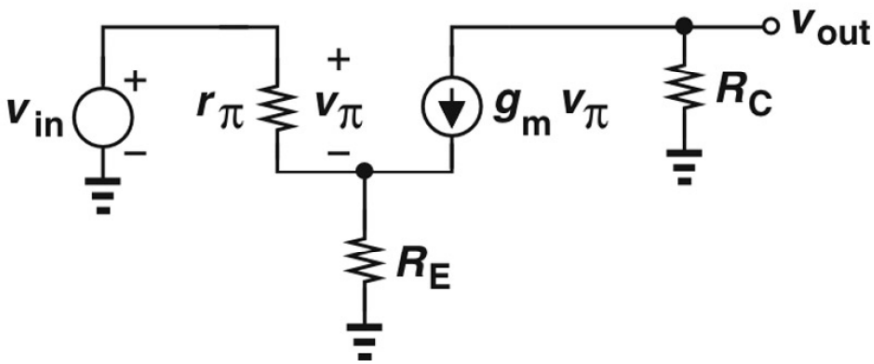
Lect. 14: BJT CE Amplifier with Emitter Resistance

Common-Emitter with emitter resistance (degeneration)



(a)



Voltage Gain, R_{in}, R_{out}

(Ignore r_O for simplicity)

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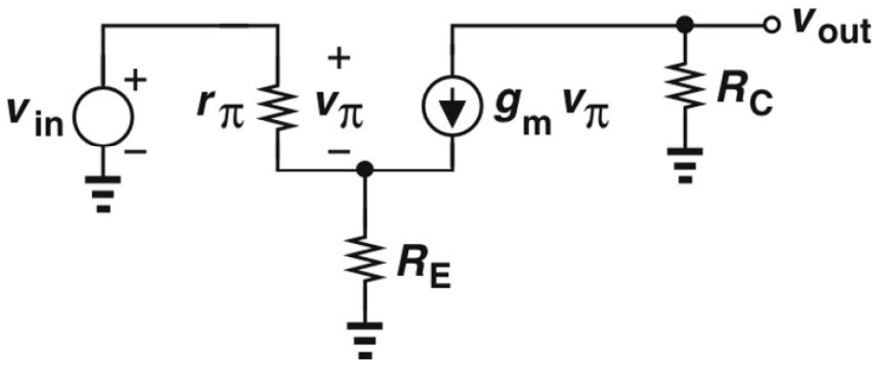
Common-Emitter with emitter resistance



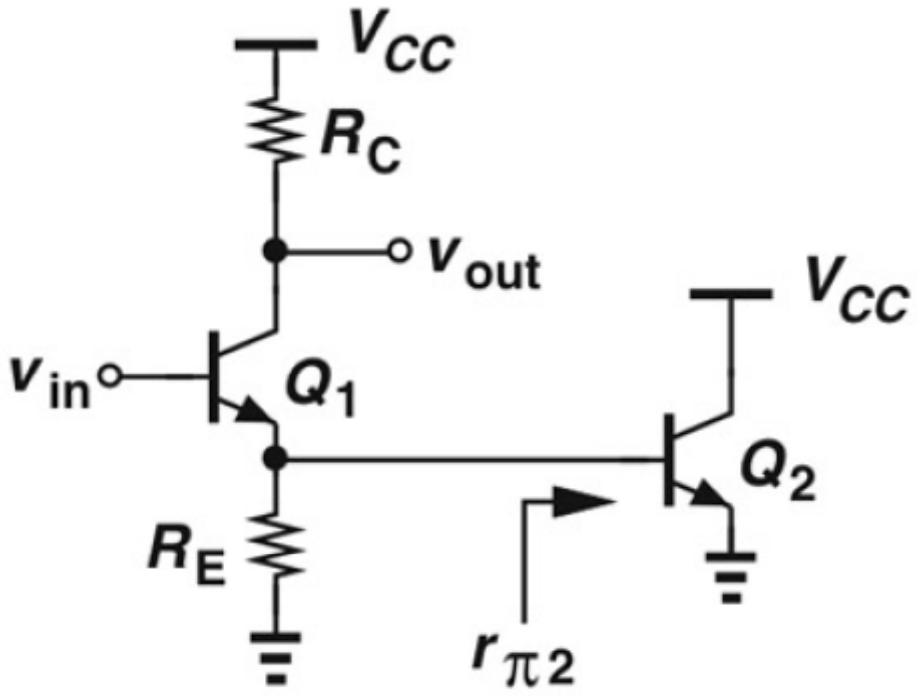
Voltage Gain = ?

$$A_v = -\frac{g_m R_C}{1+\left(\frac{1}{r_\pi}+g_m\right)R_E}$$

$$\sim -\frac{g_m R_C}{1+g_m R_E}$$

$$= -\frac{R_C}{\frac{1}{g_m}+R_E}$$

Lect. 14: BJT CE Amplifier with Emitter Resistance



From CE with ER

$$A_v \sim -\frac{R_C}{\frac{1}{g_m} + R_E}$$

$$A_v \sim -\frac{R_C}{\frac{1}{g_m} + R_E \,\|\, r_{\pi 2}}$$

Voltage Gain = ?

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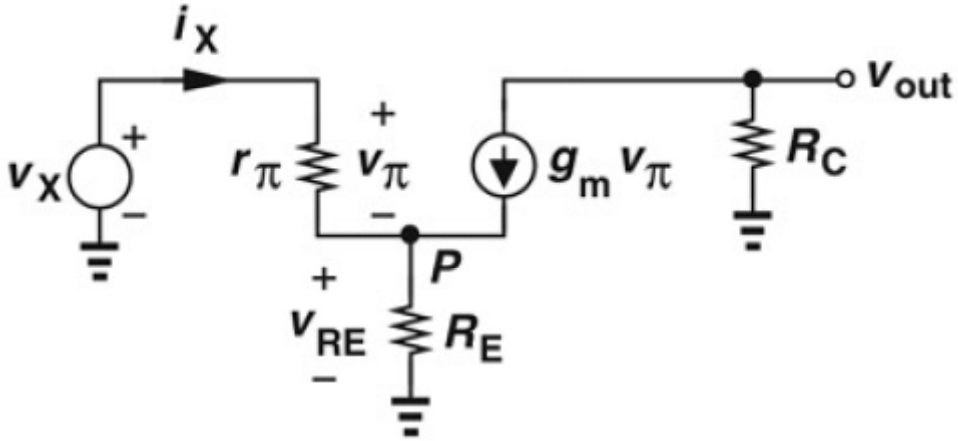
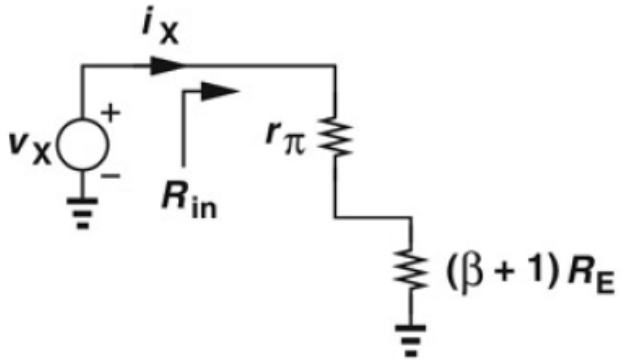
Common-Emitter with emitter resistance



$$v_X = r_\pi i_X + R_E(1+\beta)i_X$$

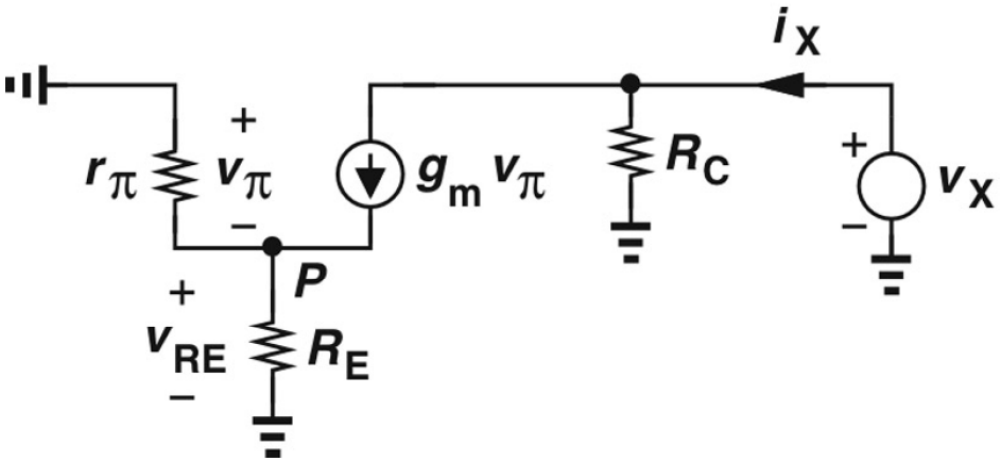
$$R_{in} = \frac{v_X}{i_X} = r_\pi + (\beta+1)R_E$$

R_{in} = ?



Lect. 14: BJT CE Amplifier with Emitter Resistance

Common-Emitter with emitter resistance



R_{out} = ?

$$v_\pi + \left(\frac{v_\pi}{r_\pi} + g_m v_\pi \right) R_E = 0$$

$$v_\pi = 0$$

$$R_{out} = R_C$$