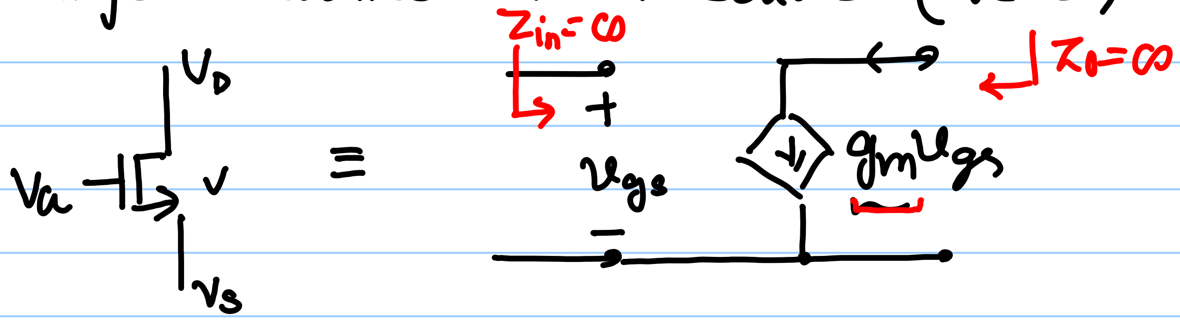
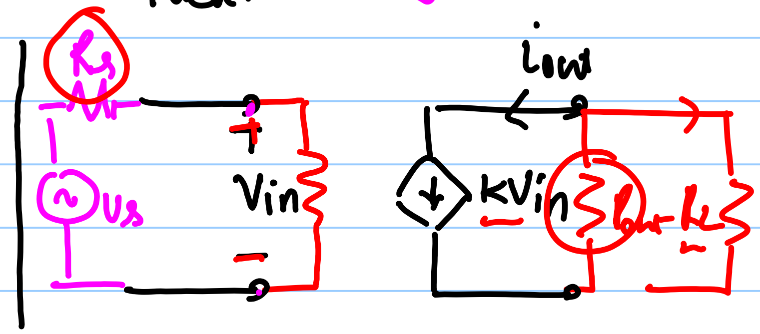
Note Title 17-09-2021

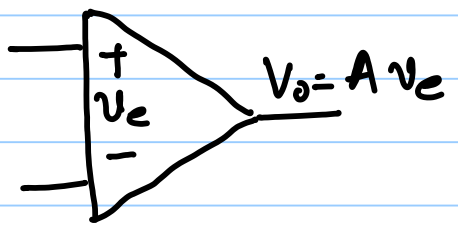
Lecture # 20

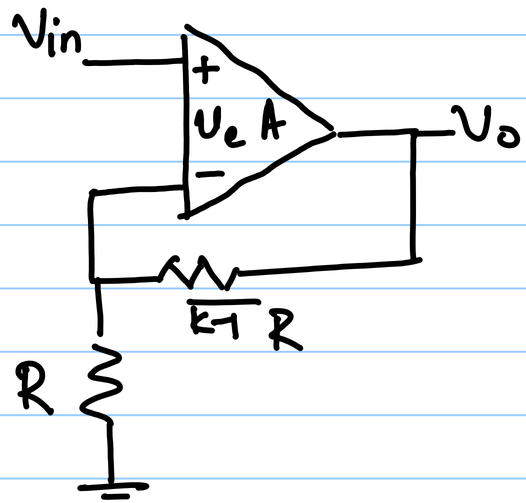
Voltage Controlled Current Source (VCCS)



$i_{out} = g_m v_{gs}$

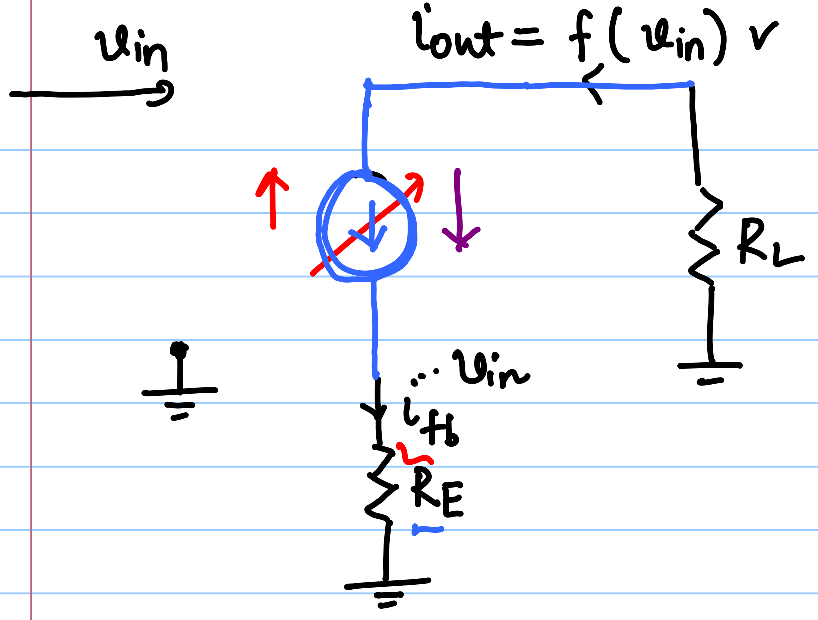


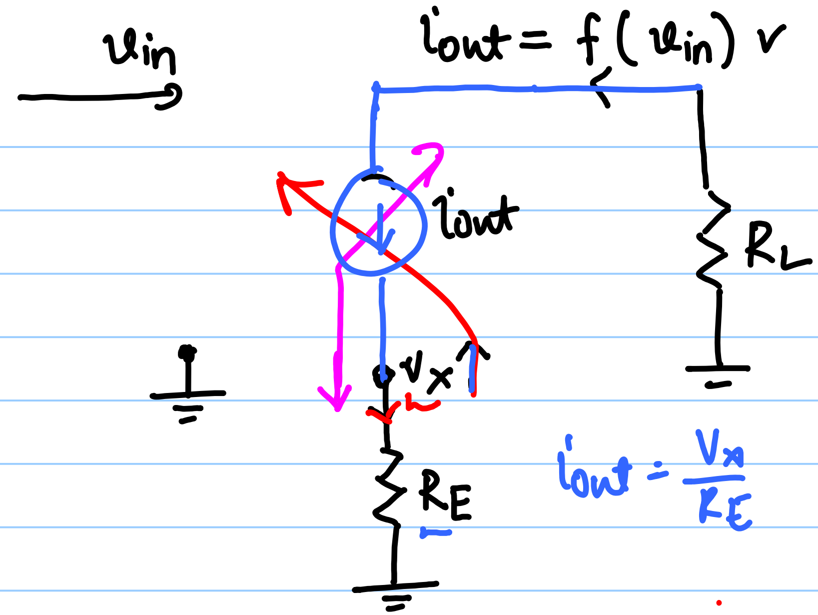




$\frac{v_o}{v_{in}} = K \quad f(A, K)$

$\approx K$





$i_{out} = \frac{V_x}{R_E}$

$i_{out} > \frac{V_{in}}{R_E} \Rightarrow V_x > V_{in}$

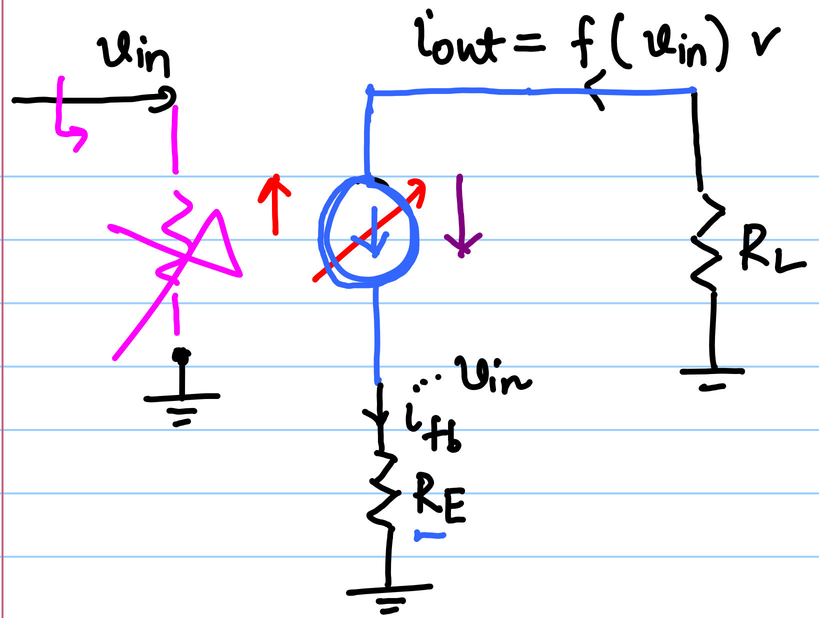
$i_{out} < \frac{V_{in}}{R_E} \Rightarrow V_x < V_{in}$

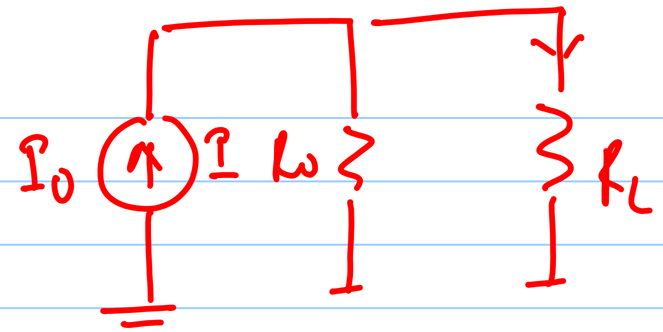
compare i_{fb} w/ i_{out}.

$i_{fb} = \frac{v_{in}}{R_E}$.

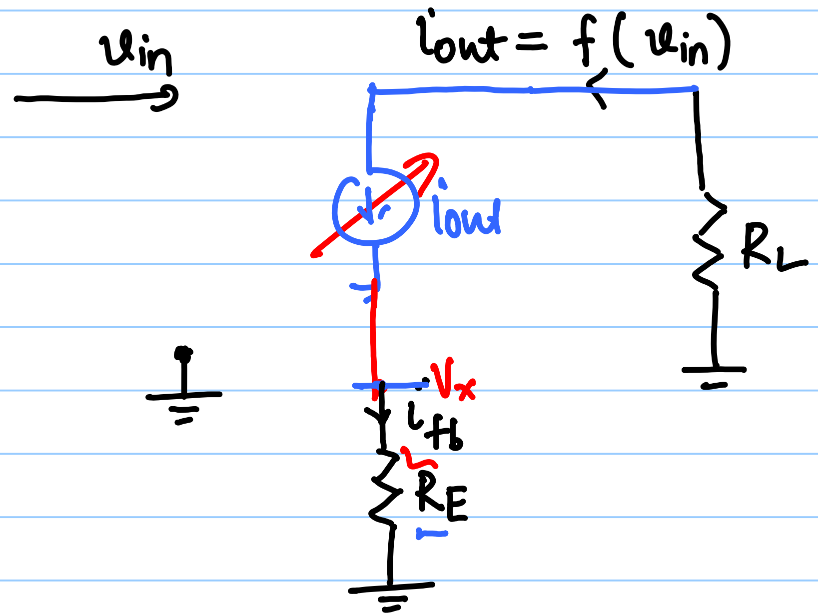
if $i_{out} > i_{fb}$ $\quad \Delta i = i_{out} - i_{fb}$

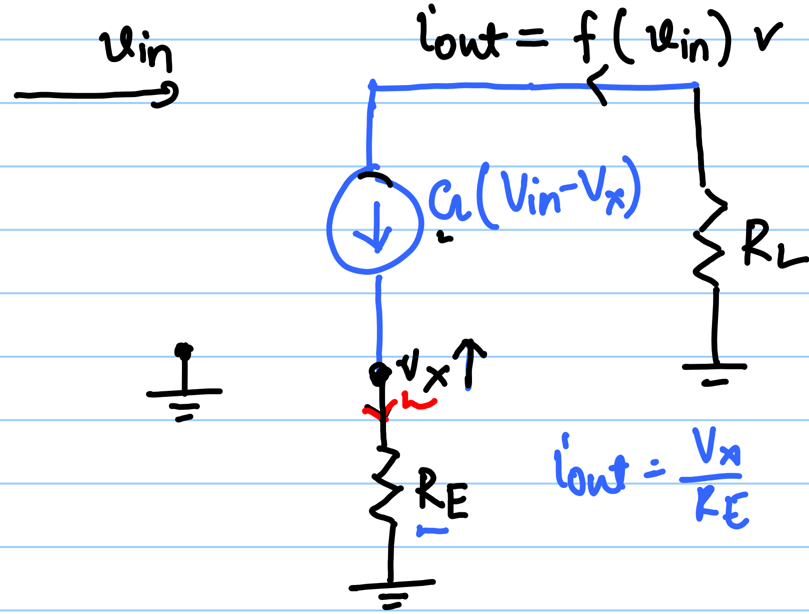
$i_{out} < i_{fb}$ $\quad \Delta i = -(i_{out} - i_{fb})$





$$\frac{R_0}{R_0 + R_L} \times I_0$$

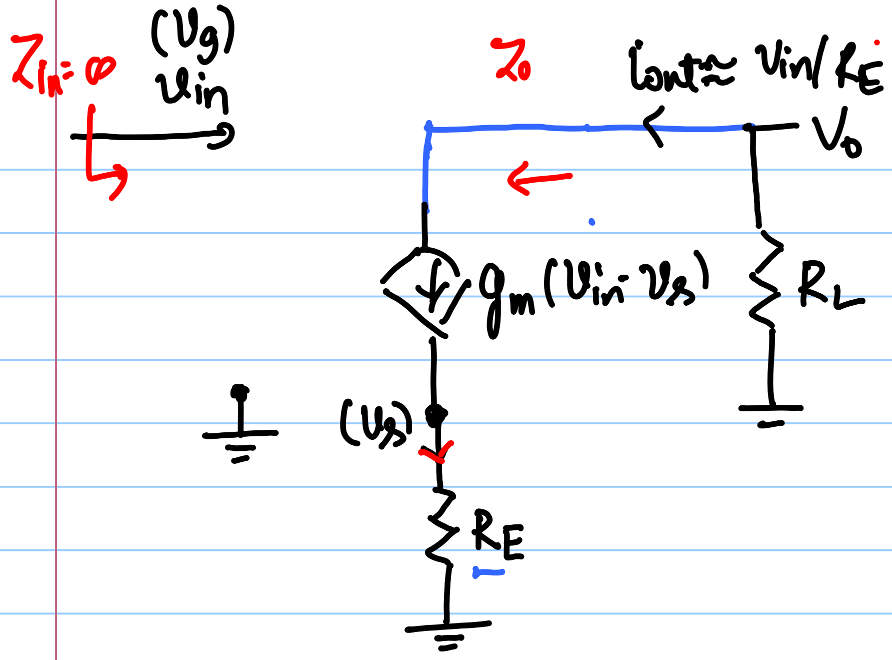


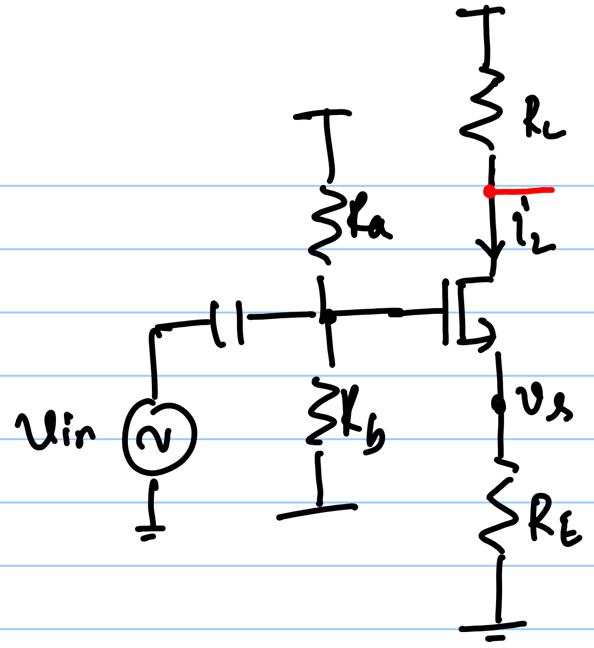


Compare i_{out} w/ i_{fb}

$$i_{out} = G(V_{in} - V_x) = \frac{V_x}{R_E}$$

$$V_x = \frac{G R_E}{1 + G R_E} V_{in} \xrightarrow[G \to \infty]{} V_x = V_{in}$$





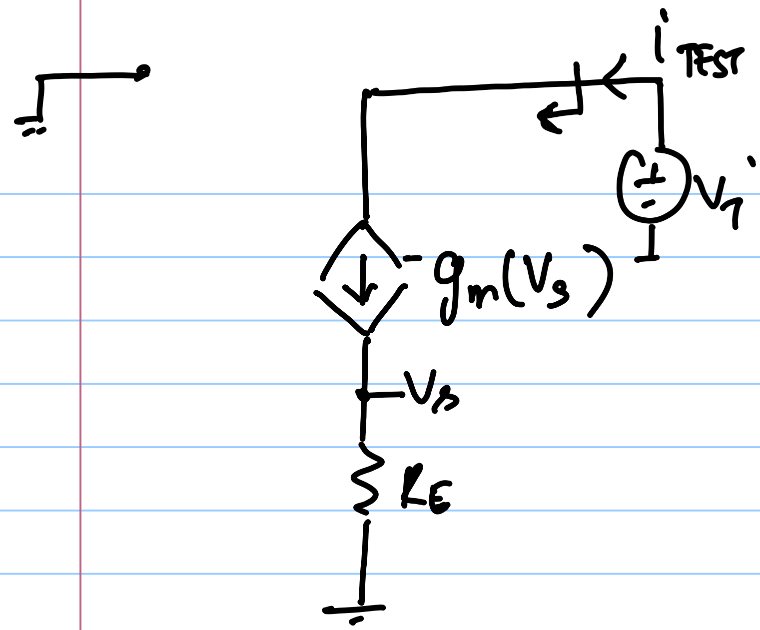
$$\boxed{i_L = \frac{v_{in}}{R_E}}$$ VCCS.

$$g_m(v_{in} - v_s) = \frac{v_s}{R_E}$$

$$v_s = \frac{g_m R_E}{1 + g_m R_E} v_{in}$$

$$i_L = \frac{v_s}{R_E} = \frac{g_m}{1 + g_m R_E} \cdot v_{in}$$

$$i_L \approx \frac{g_m}{g_m R_E} v_{in} = \frac{v_{in}}{R_E}$$



$$-g_m V_s = \frac{V_s}{R_E} \Rightarrow V_s = 0$$

$$Z_0 = \frac{V_t}{i_{TEST}} = \infty$$