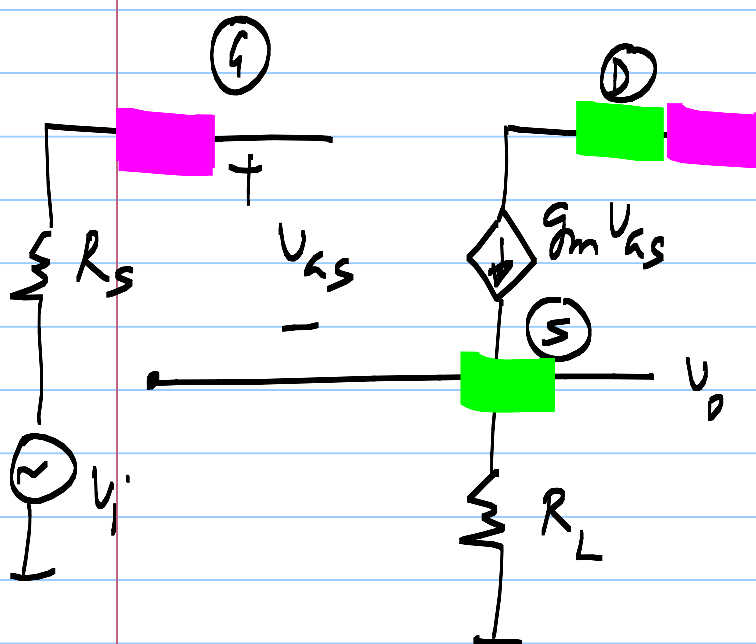
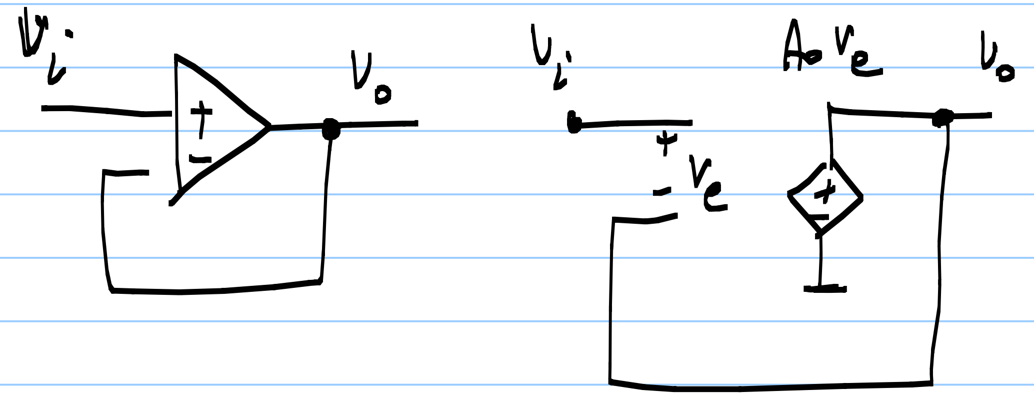
Lecture 21

VCVS using a transistor

VCVS $\left(\frac{v_o}{v_i} = 1\right)$

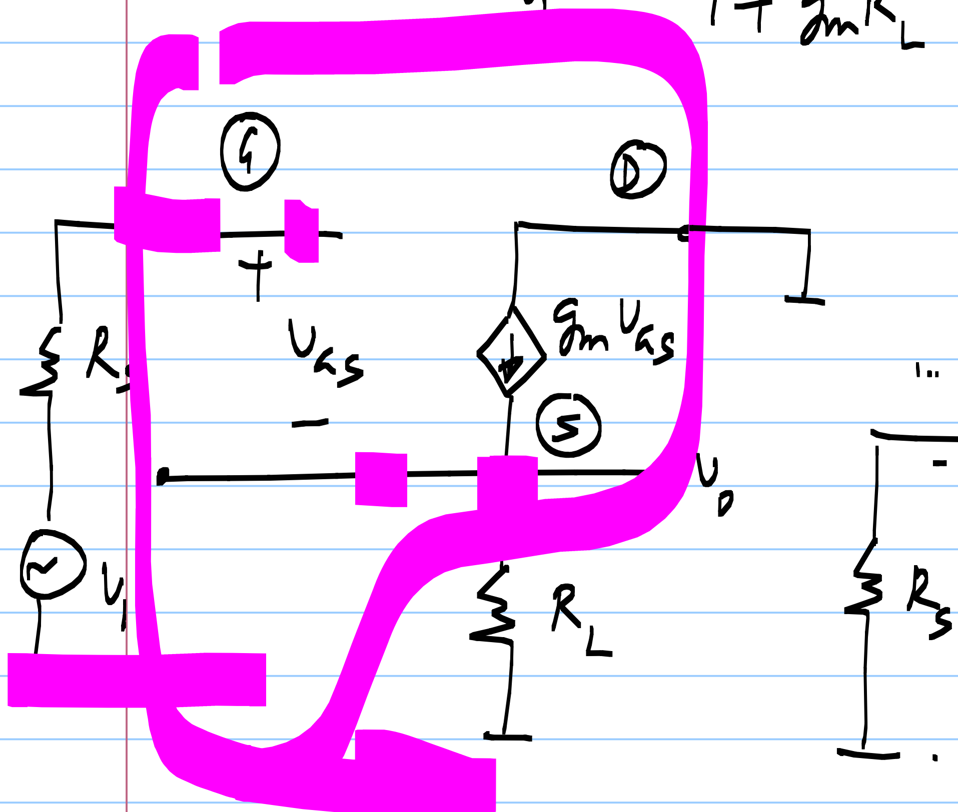


$$\frac{v_o}{v_i} = \frac{g_m R_L}{1 + g_m R_L} \simeq 1 \quad \text{if } g_m R_L \gg 1$$

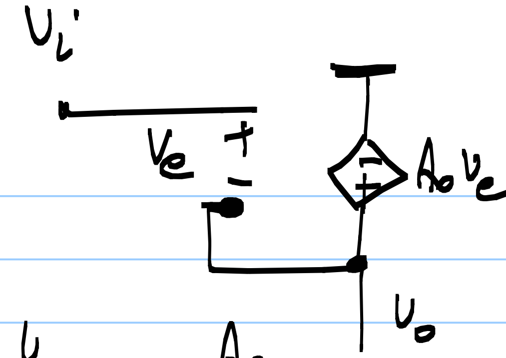


Common-drain amplifier

Lecture 21



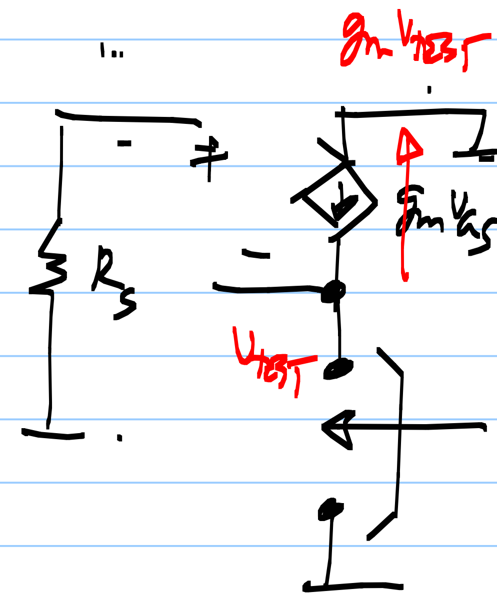
$$\frac{v_o}{v_i} = \frac{g_m R_L}{1 + g_m R_L}$$

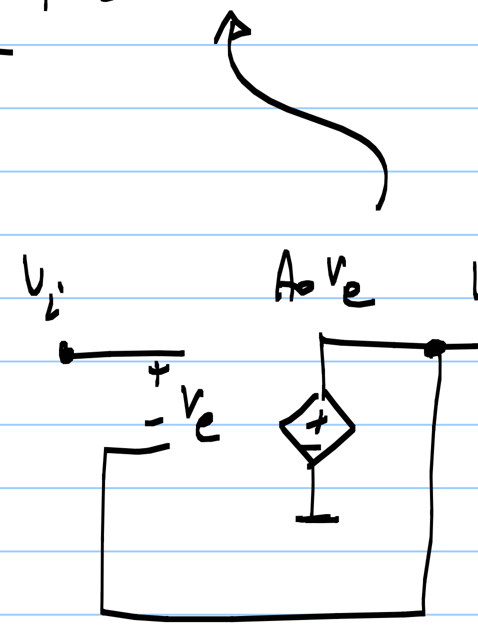


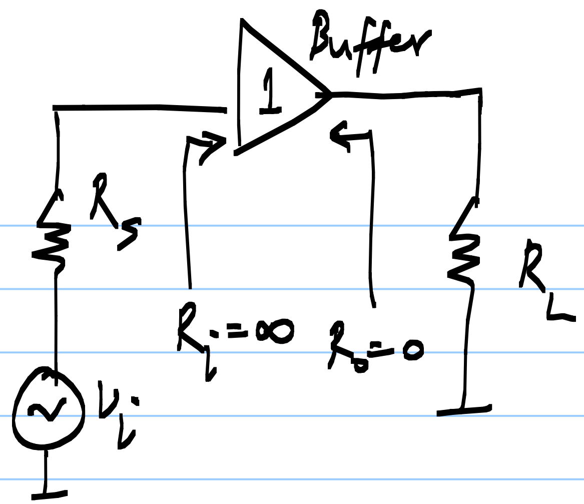
$$\frac{v_o}{v_i'} = \frac{A_o}{1 + A_o}$$

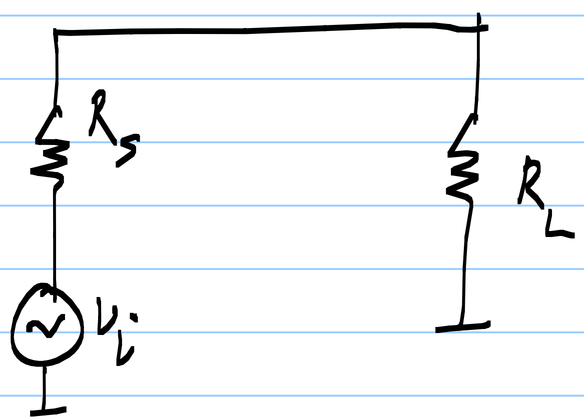
$R_i = \infty$

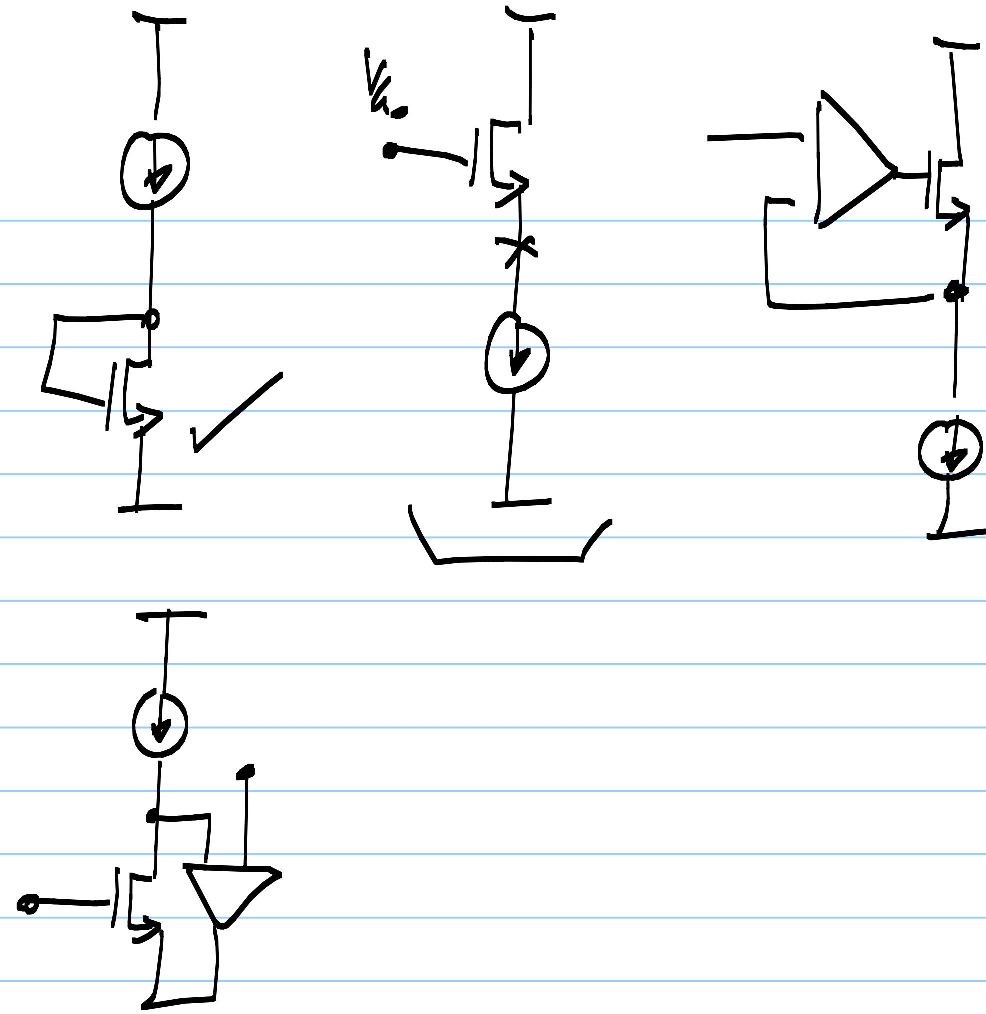
$R_o = 1/g_m$





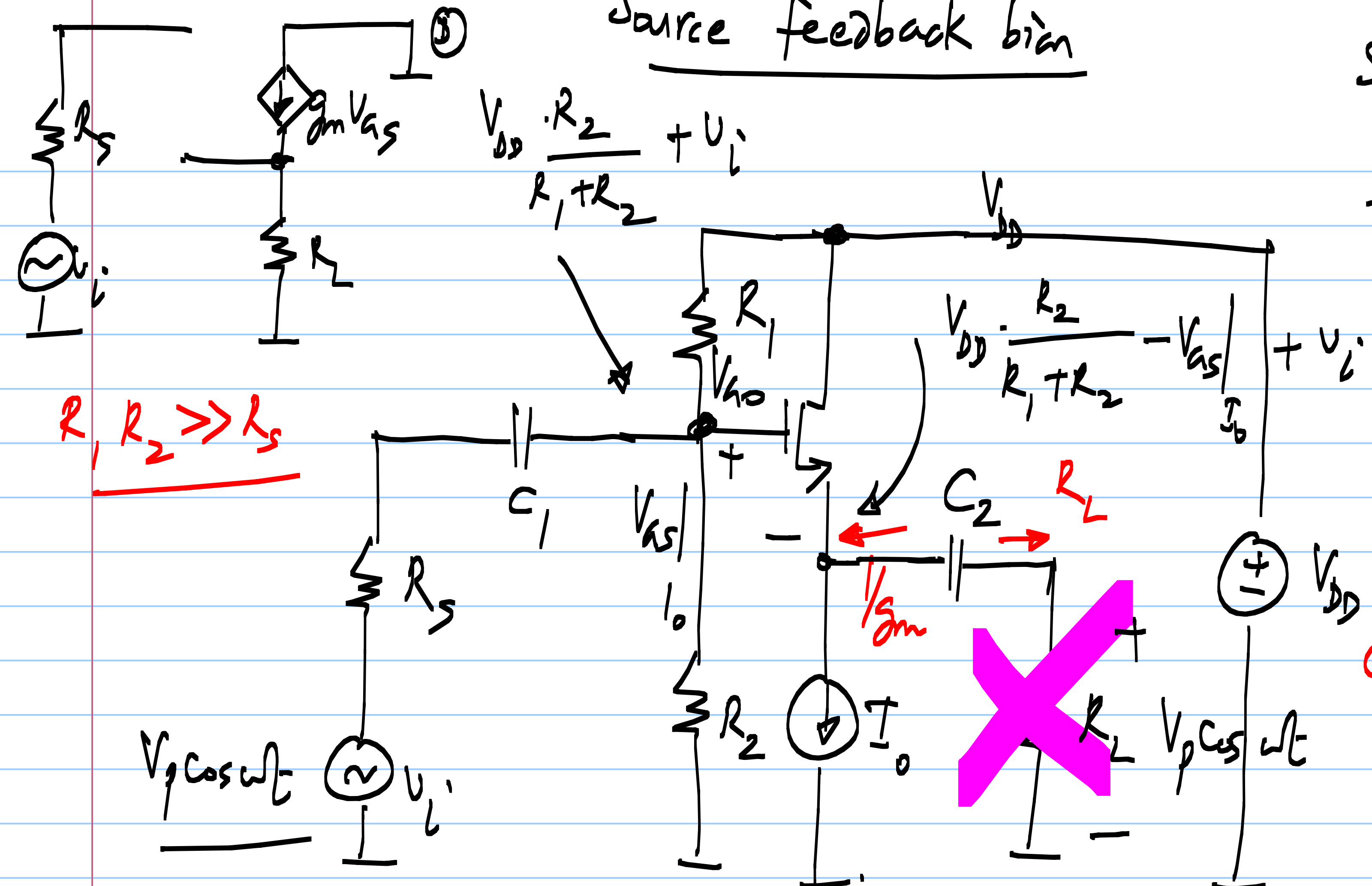

Buffer
1
R_s
R_L
$R_i = \infty$
$R_o = 0$
v_i


R_s
R_L
v_i


V_{in}

Source feedback bias

Source follower

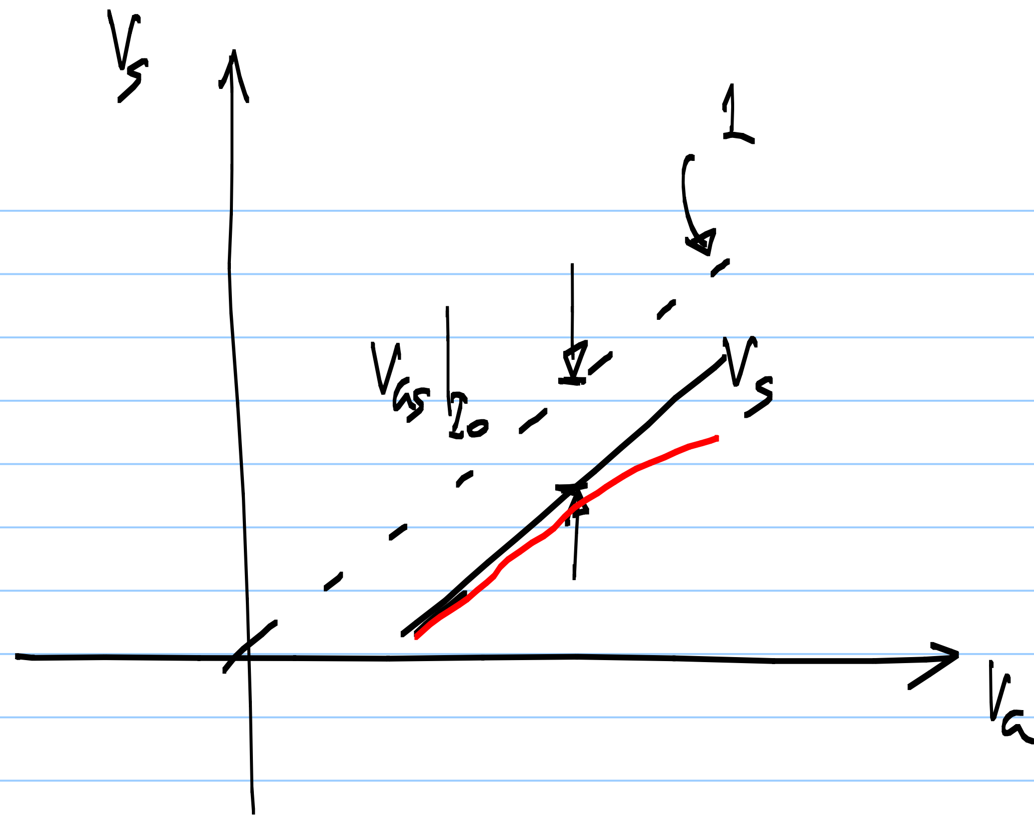


$R_1, R_2 \gg R_S$

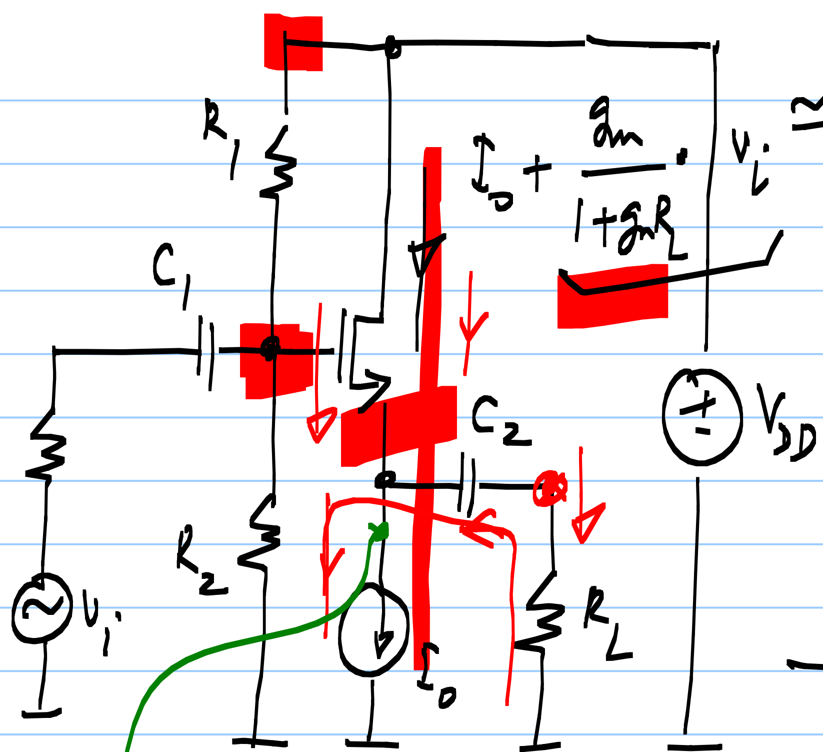
$$C_1 \gg \frac{1}{\omega(R_S + R_1 \| R_2)}$$

$$C_2 \gg \frac{1}{\omega(1/g_m + R_L)}$$

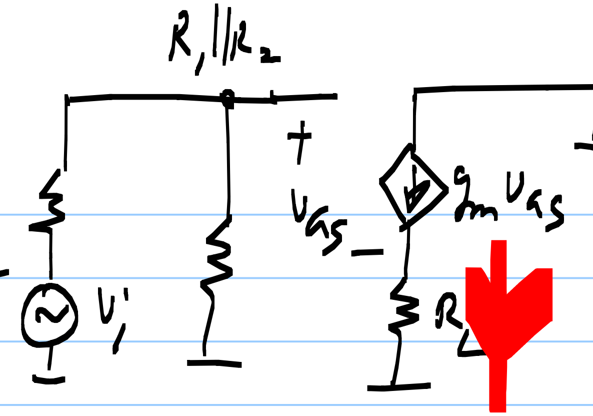
$=$



V_S
V_G
V_{GS}
I_0
V_S
1

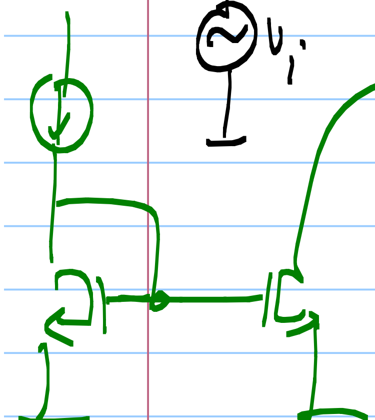


$$I_o + \frac{g_m}{1+g_m R_L} \cdot v_i \simeq I_o + \frac{v_i}{R_L}$$

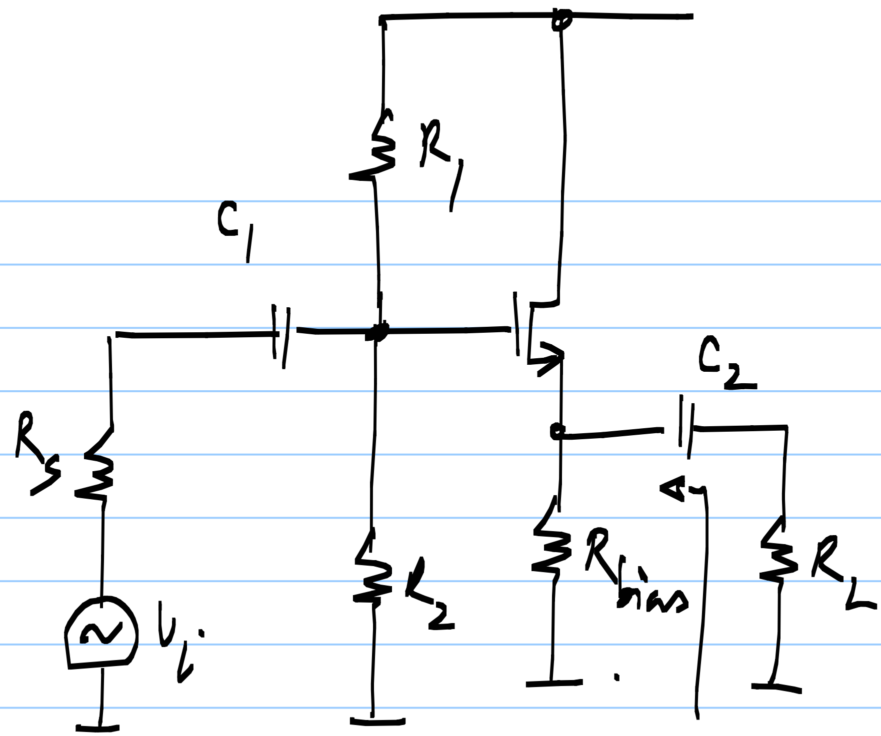


$$v_i < V_{DD} \cdot \frac{R_1}{R_1+R_2} + V_T$$

$$-I_o R_L < v_i$$



$$v_i \left(\frac{g_m R_L}{1+g_m R_L}\right) \cdot \frac{1}{R_L}$$



$$\frac{1}{g_m} \| R_{bias}$$

$$\frac{g_m\left[(R_L \| R_{bias}) \| r_{ds}\right]}{1 + g_m\left[(R_L \| R_{bias}) \| r_{ds}\right]}$$