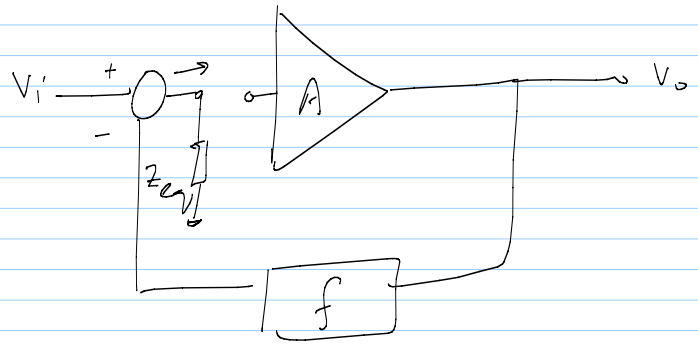
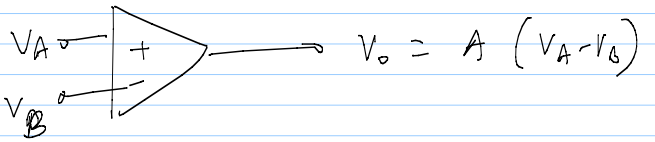
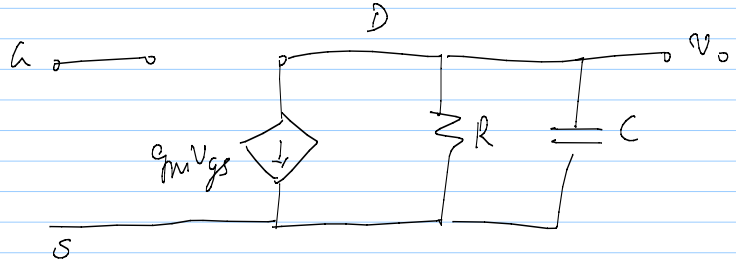
26/8/14

lec 13

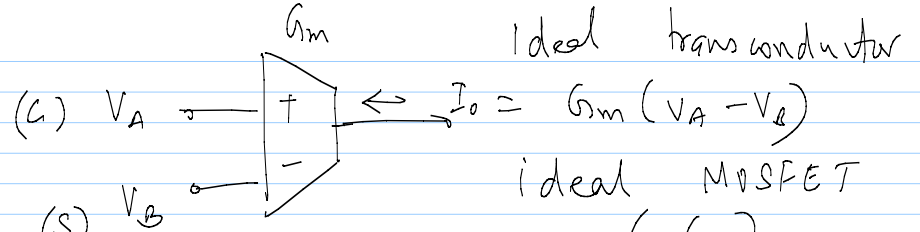


2-stage MOSFET opamp



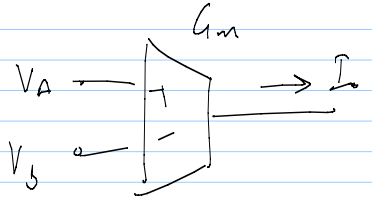


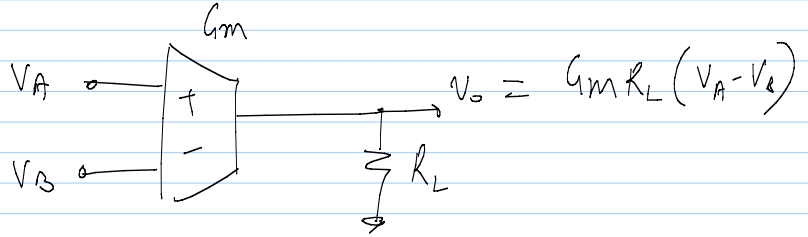
VCCS

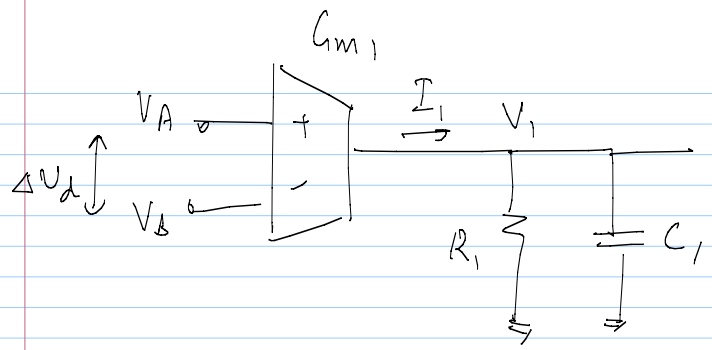


ideal transconductor

ideal MOSFET $(-G_m)$







$$\frac{v_o}{v_a - v_b}(s) = ?$$

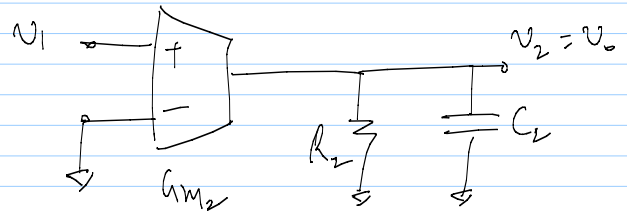
$$I_1 = G_{m1} \cdot v_d$$

$$V_1 = I_1 \cdot Z_1 = I_1 \cdot \frac{R_1}{1 + sC_1R_1}$$

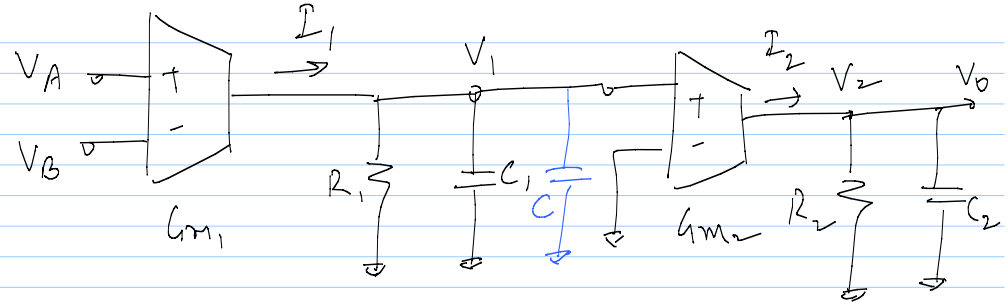
$$\frac{V_1}{V_d} = \frac{G_{m_1} R_1}{1 + sC_1R_1} = \frac{A_0}{1 + s/\omega_p}$$

$$A_0 = G_{m_1}R_1$$

$$\omega_p = \frac{1}{R_1 C_1}$$



$$\frac{v_o}{v_1}(s) = \frac{G_{m_2}R_2}{1+sC_2R_2}$$



$$A(s) = \frac{V_o}{V_A - V_B}(s) = \frac{G_{m_1}R_1}{1+sC_1R_1} \cdot \frac{G_{m_2}R_2}{1+sC_2R_2}$$

$$A_0 = G_{m_1}R_1 \cdot G_{m_2}R_2$$

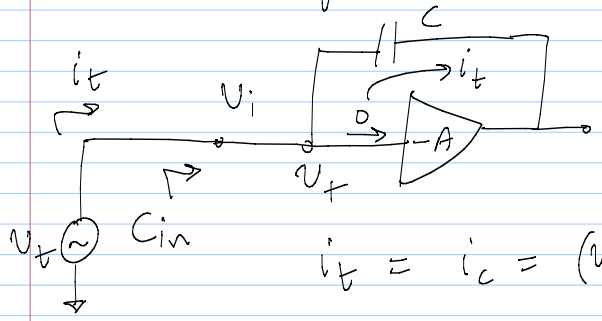
$$\omega_{p_1} = \frac{1}{R_1C_1} \quad ; \quad \omega_{p_2} = \frac{1}{R_2C_2} \qquad \text{say } \omega_{p_1} < \omega_{p_2}$$

* We want to move ω_{p_1} to ω_d

* R_1 is already large due to $A_{0_{max}}$

$\Rightarrow \uparrow C_1 \Rightarrow$ add C in parallel with C_1

e.g. $C = 50 \times C_1 \Rightarrow$ very large cap.

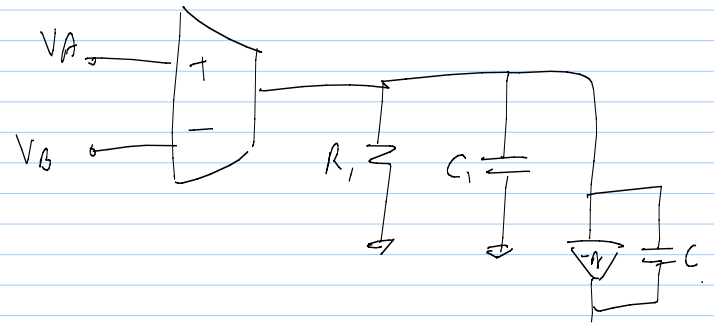


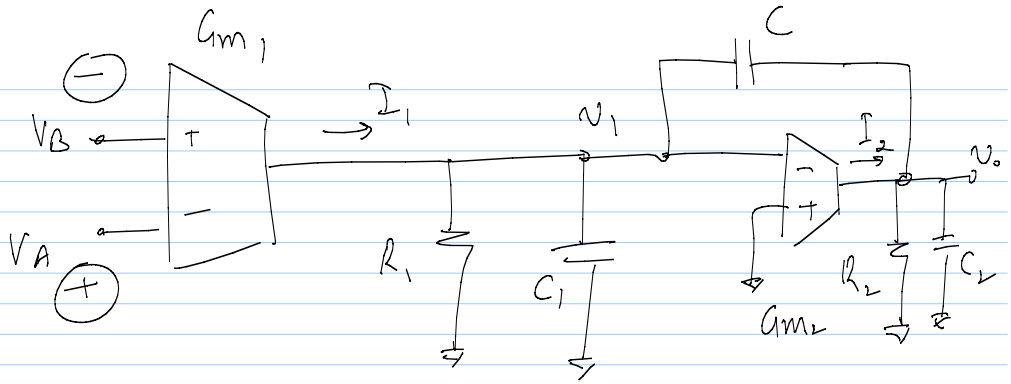
$$i_t = i_C = (v_t + Av_t) \cdot sC$$

$$sC_{in} = \frac{i_t}{v_t} = (1+A)\,sC$$

$$\Rightarrow \boxed{C_{in} = (1+A)\,C}$$

"Miller Effect"





ideal G_m's (no R_i, C_i)

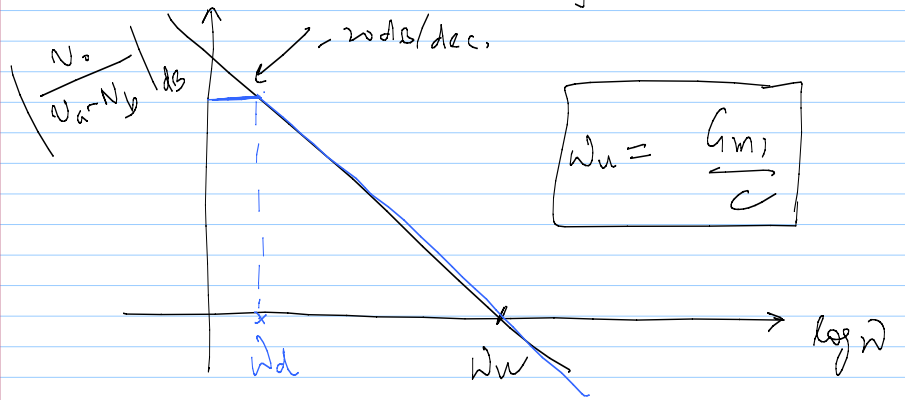
$I_1 = G_{m_1}(V_B - V_A)$ → flows thru' C

$V_1 = 0$

$V_o = \frac{-I_1}{sC}$

$$\frac{V_o}{V_a - V_b} = \frac{G_{m_1}}{sC}$$

integrator



$$\omega_u = \frac{G_{m_1}}{C}$$