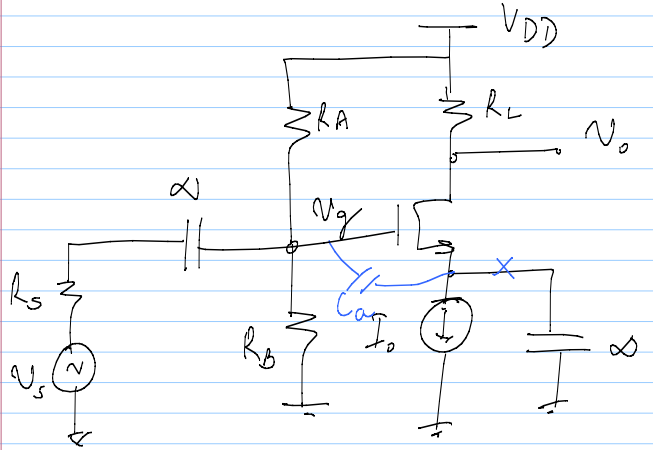
16/9/14

lec 22



$V_s = V_A \sin\omega t$

Swing limit

1) Cut off $\quad I_D = 0$

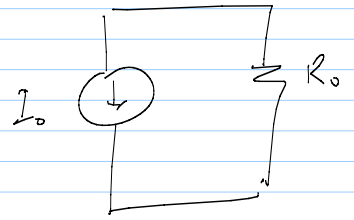
$$I_o + g_m V_A \sin\omega t = 0$$

$$|V_A| = \frac{I_o}{g_m}$$

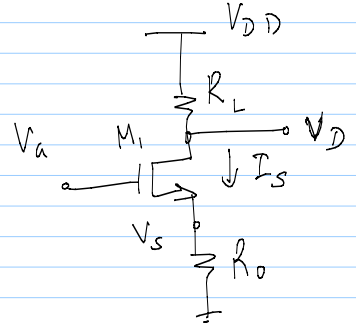
2) Triode $\quad V_D = V_G - V_T$

$$V_{DD} - I_o R_L - g_m R_L V_A \sin\omega t = \frac{V_{DD} R_B}{R_A + R_B} + V_A \sin\omega t - V_T$$

Non-ideal C.S.



* I_S slightly larger than I_o
* $I_S = f(V_G, I_o)$



$$V_S = I_S \cdot R_o$$

$$V_{GS} = V_G - V_S$$

$$I_S = \frac{1}{2}\mu_n C_{ox}\left(\frac{W}{L}\right)\left(V_{GS} - V_T\right)^2$$

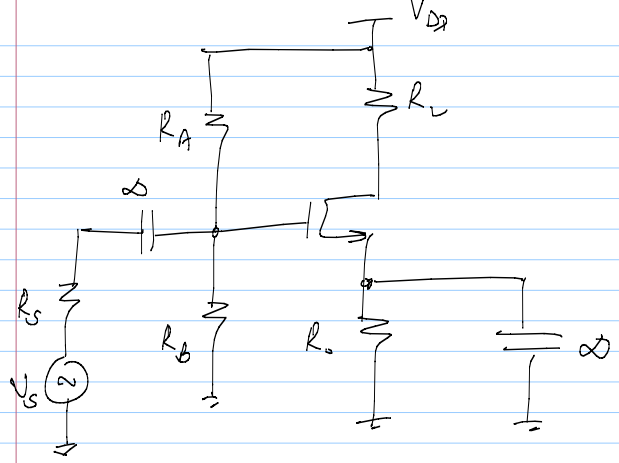
What value of V_L will bias M_1 @ I_{ref}

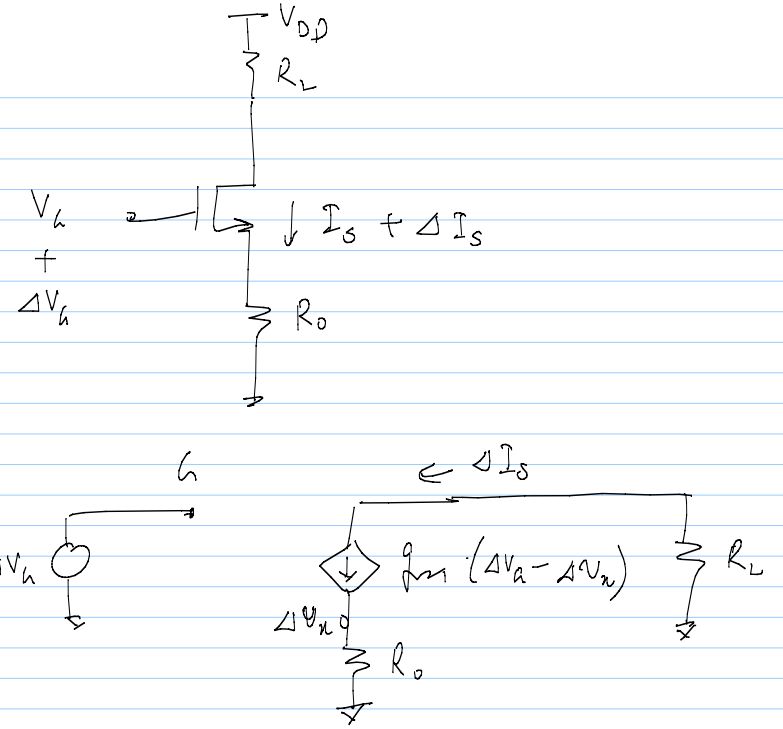
$$V_S = I_{ref} \cdot R_o$$

$$V_{GS} = V_T + \sqrt{\frac{2I_{ref}}{\mu_n C_{ox}\left(\frac{W}{L}\right)}}$$

$$V_G = V_S + V_{GS}$$

$$= I_{ref} R_o + V_T + \sqrt{\frac{2I_{ref}}{\mu_n C_{ox}\left(\frac{W}{L}\right)}}$$





$$\Delta I_S \cdot R_o = \Delta V_x$$

$$\Delta I_S = g_m (\Delta V_g - \Delta V_x)$$

$$= g_m \Delta V_g - g_m R_o \cdot \Delta I_S$$

$$\boxed{\Delta I_S = \frac{g_m}{1 + g_m R_o} \cdot \Delta V_g}$$

$$\omega_x = \frac{1}{C_g (R_S + R_A \| R_B)}$$