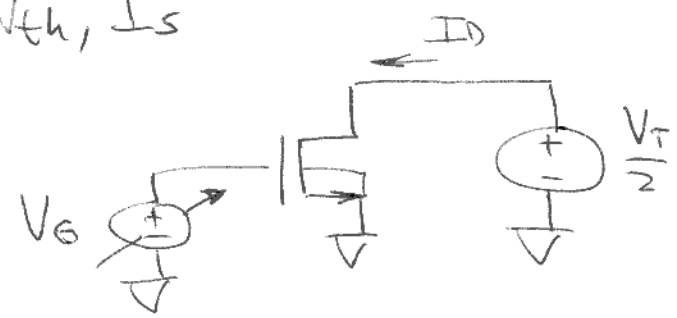
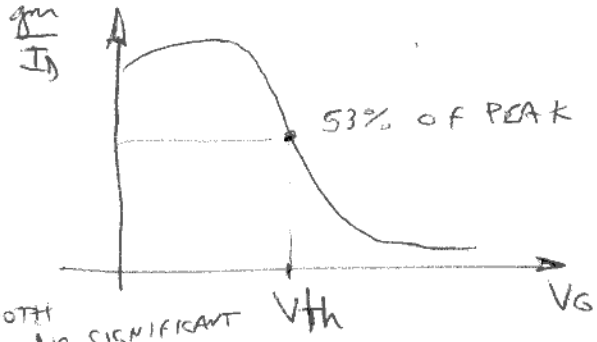
EXTRACTION OF ACM PARAMETERS FROM SIMULATIONS

1) V_{th}, I_S



PLOT $\frac{g_m}{I_D}$



$\frac{g_m}{I_D} = \frac{\partial \log I_D}{\partial V_G}$

SINCE BOTH i_f, i_r SIGNIFICANT

$$\frac{g_m}{I_D} = \frac{g_{mg}}{I_D} = \frac{g_{ms} - g_{md}}{n I_D} = \frac{2 I_S}{n V_T I_D}\left(\sqrt{1+i_f} - \sqrt{1+i_r}\right)$$

$$I_D = (i_f - i_r) I_S$$

WHEN $V_G = V_{th} \Rightarrow i_f = 3$

$i_r \cong i_f$ SINCE $V_G \gg V_D$

$$\frac{g_m}{I_D} \simeq \frac{1}{n V_T} \frac{1}{\sqrt{1+i_f}} = \frac{1}{2 n V_T} \text{ IF } i_f = 3$$

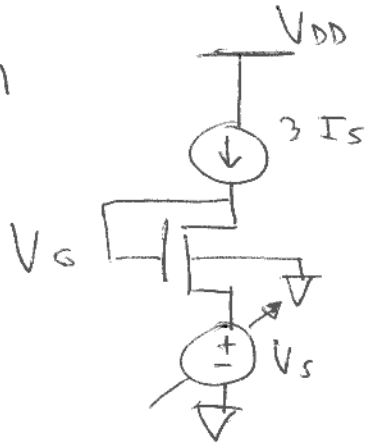
$$\frac{\sqrt{1+i_f} - \sqrt{1+i_r}}{i_f - i_r} \cdot \frac{\sqrt{1+i_f} + \sqrt{1+i_r}}{\sqrt{\quad} + \sqrt{\quad}} = \frac{1 + i_f - 1 - i_r}{i_f - i_r} \cdot \frac{1}{\sqrt{1+i_f} + \sqrt{1+i_r}}$$

$i_f \approx i_r \Rightarrow \frac{g_m}{I_D} = \frac{2 I_S}{n V_T I_S} \cdot \frac{1}{2\sqrt{1+i_f}}$ → MORE ACCURATE 53%

$$I_D \simeq \frac{2 V_{DS}}{V_T} I_S \quad \text{IF } V_{DS} < V_T$$

$$\therefore \boxed{I_S = I_D\Big|_{V_G = V_{th}}} \longrightarrow \text{BUT MORE ACCURATE } I_S = 1.13 I_D\Big|_{V_G = V_{th}}$$

2) n

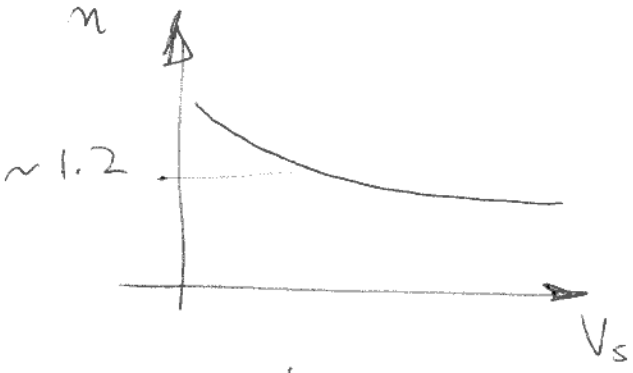


$$\frac{V_p - V_s}{V_T} = f(i_f)$$

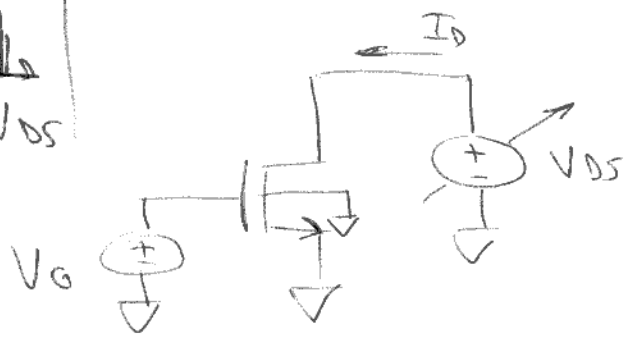
$$i_f = 3 \Rightarrow V_p = V_s = \frac{V_G - V_{th}}{n} \Rightarrow V_G = V_{th} + nV_s$$

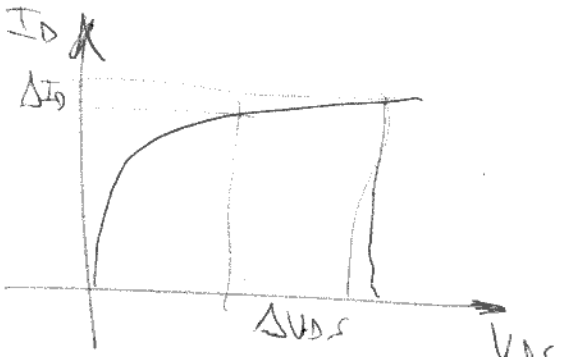
$$\therefore n = \frac{V_G - V_{th}}{V_s} \quad (i_f \to 3)$$

$$\boxed{n = \frac{\partial V_G}{\partial V_S}}$$



3) $\left|\frac{\partial}{\partial V_{DS}}\right|$





$$\frac{\Delta V_{DS}}{\Delta I_D} = r_o = \frac{1}{\lambda I_D} = \frac{L}{\left|\frac{\partial L}{\partial V_{DS}}\right| I_D} \rightarrow \text{SOLVE FOR } \left|\frac{\partial L}{\partial V_{DS}}\right| = \frac{L_{eff}}{\frac{\Delta V_{DS}}{\Delta I_D} I_D}$$