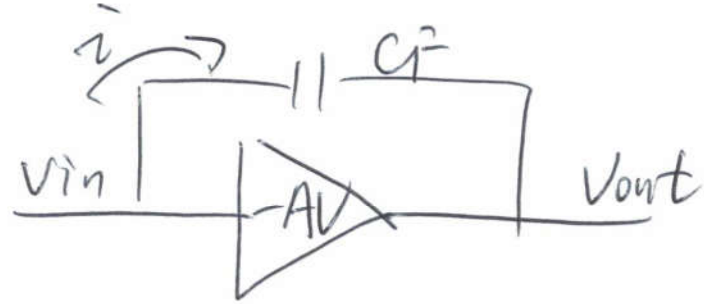
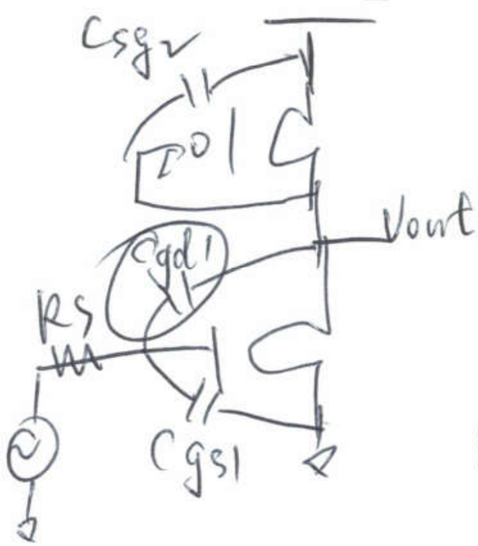
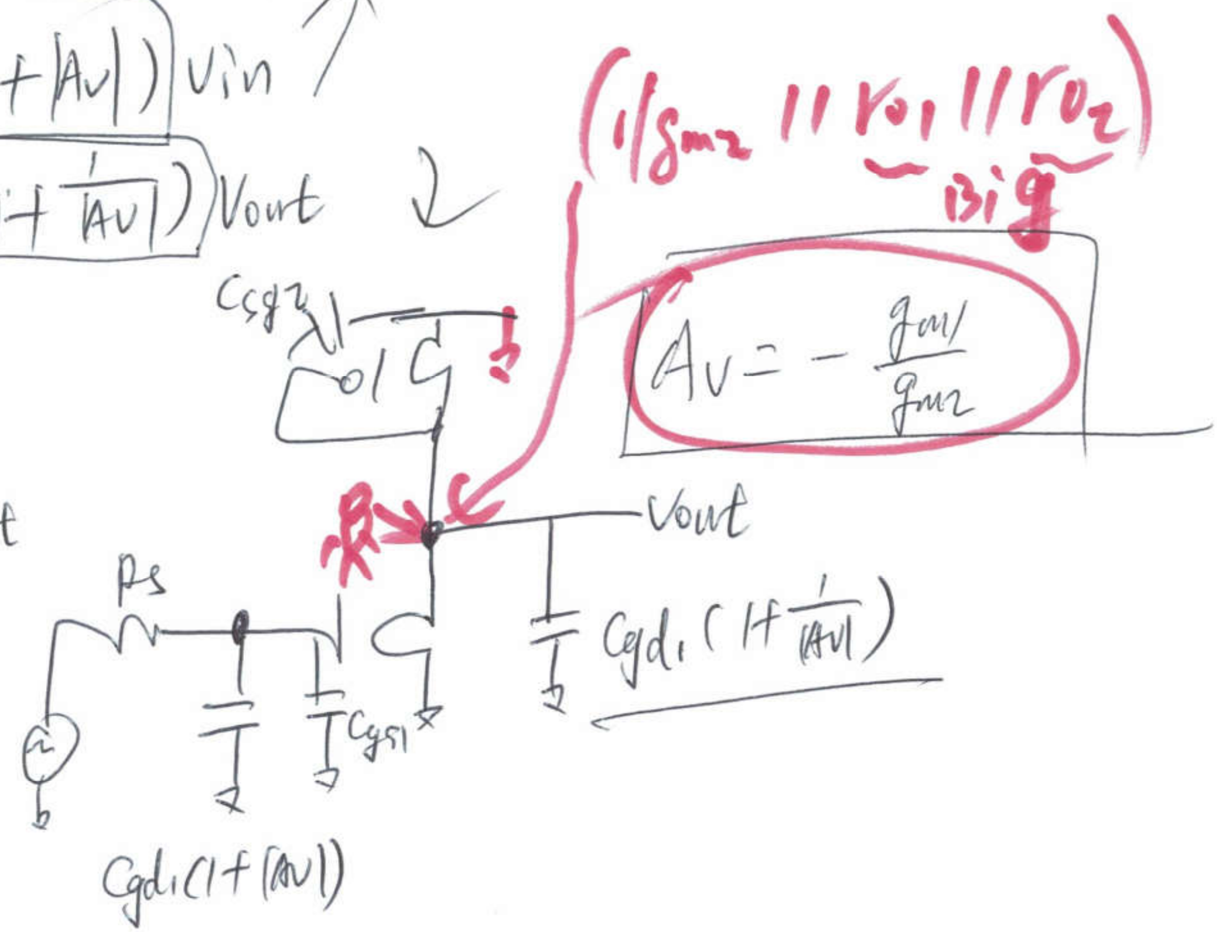


$$\begin{cases} i = \dfrac{V_{in}-V_{out}}{1/j\omega C_F} = j\omega C_F(V_{in}-V_{out}) \\ V_{out} = V_{in}\cdot A_v \end{cases}$$

$$i = j\omega \, C_F(1+|A_v|)\,V_{in}$$

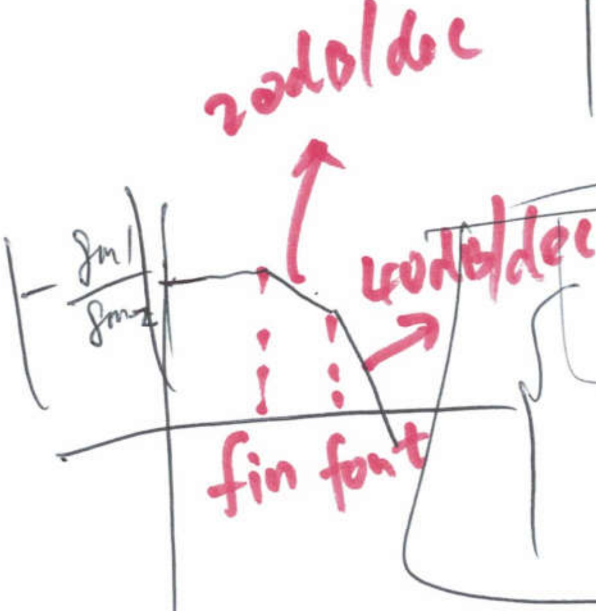
$$= j\omega \, C_F\left(1+\frac{1}{|A_v|}\right)V_{out}$$





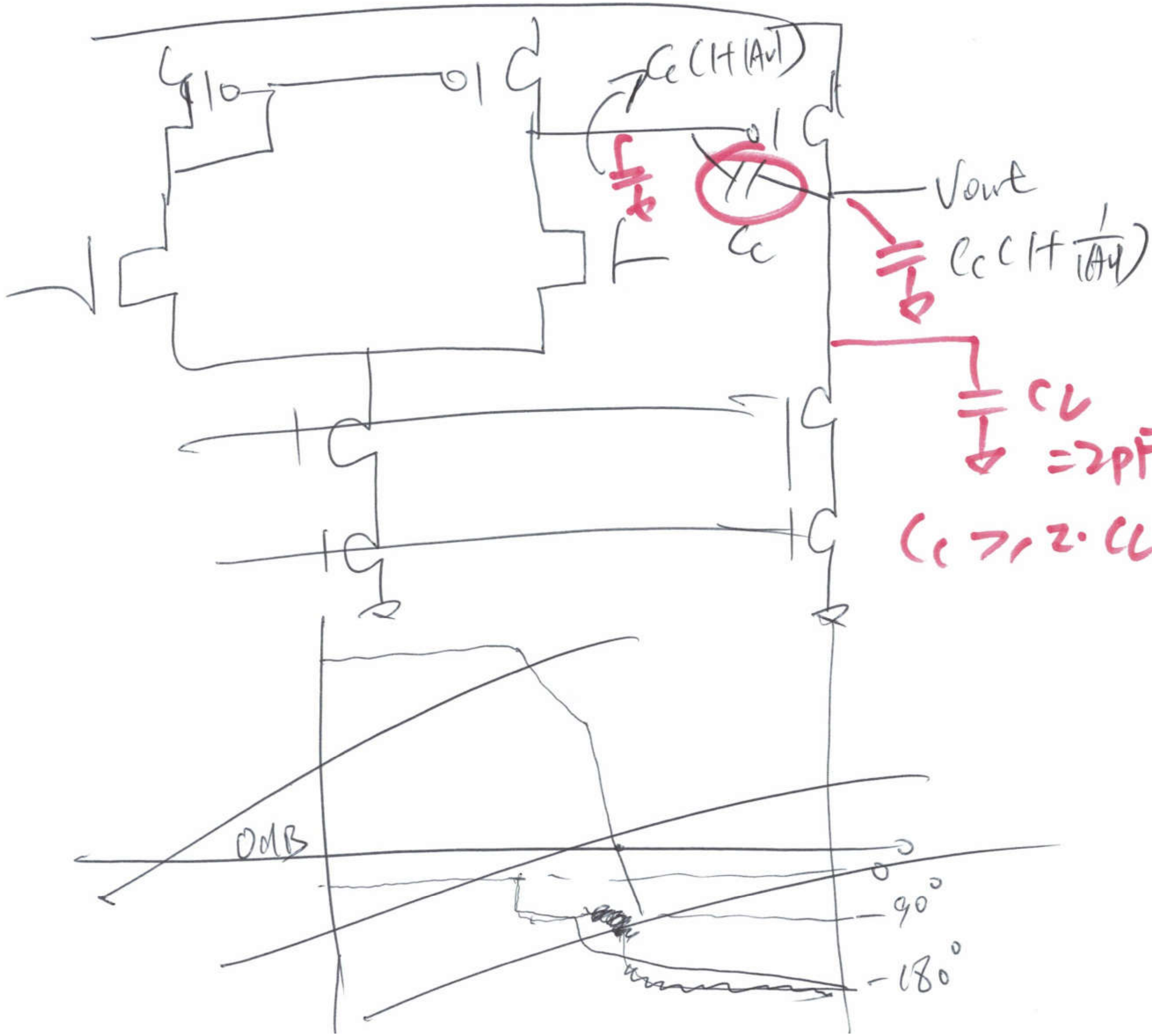
$$\begin{cases} C_{mI} = C_{gd1}\left(1+\frac{g_{m1}}{g_{m2}}\right) \\ C_{mO} = C_{gd1}\left(1+\frac{g_{m2}}{g_{m1}}\right) \end{cases}$$

$$\begin{cases} \tau_{in} = R_1C_1 = R_S\,(C_{mI}+C_{gs1}) \\ \tau_{out} = R_2C_2 = \frac{1}{g_{m2}}\,(C_{mO}+C_{sg2}) \end{cases}$$

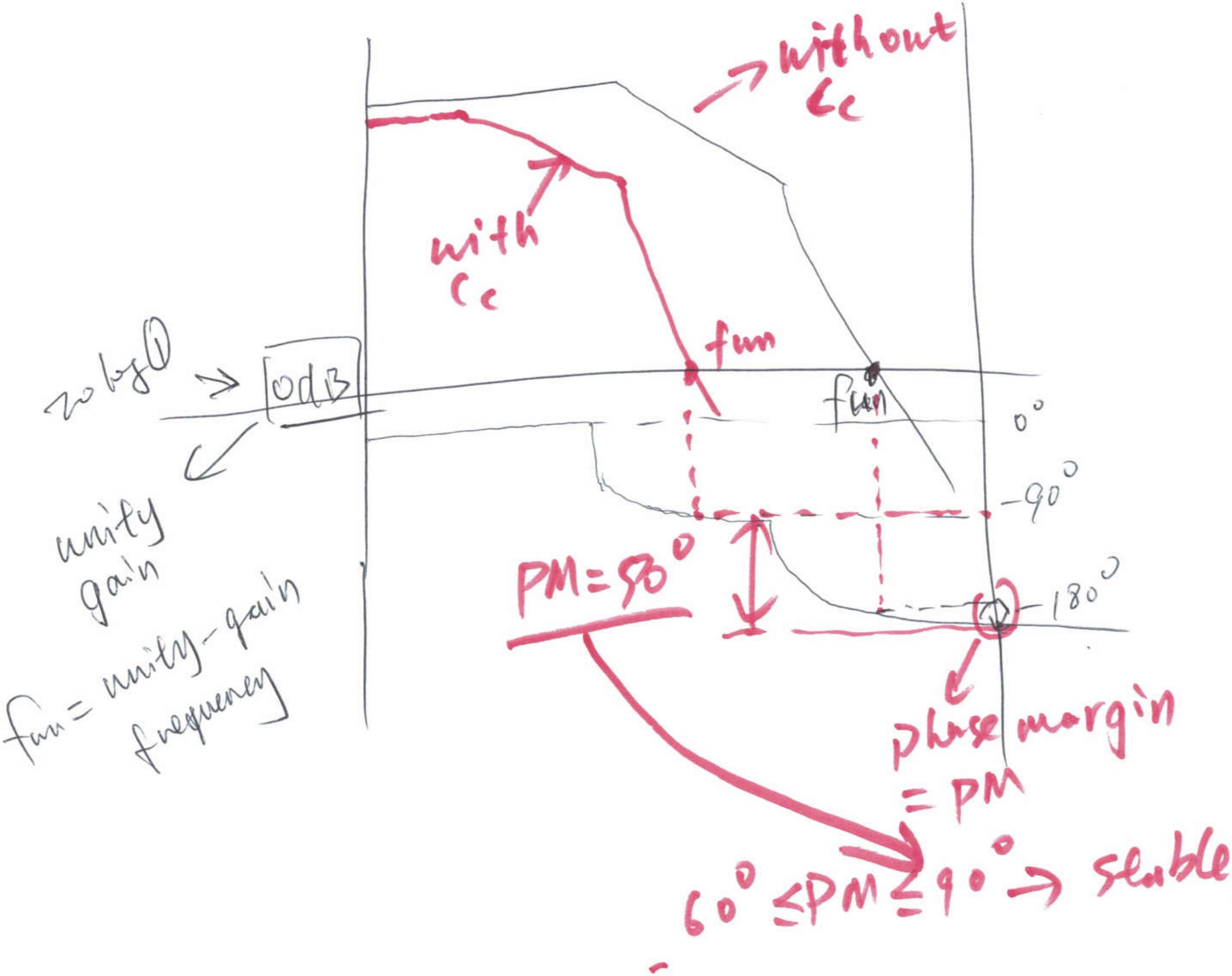


$$\begin{cases} f_{in} = \frac{1}{2\pi R_1C_1} = \frac{1}{2\pi R_S\,(C_{mI}+C_{gs1})} \\ f_{out} = \frac{1}{2\pi R_2C_2} = \frac{1}{(2\pi/g_{m2})\,(C_{mO}+C_{sg2})} \end{cases}$$

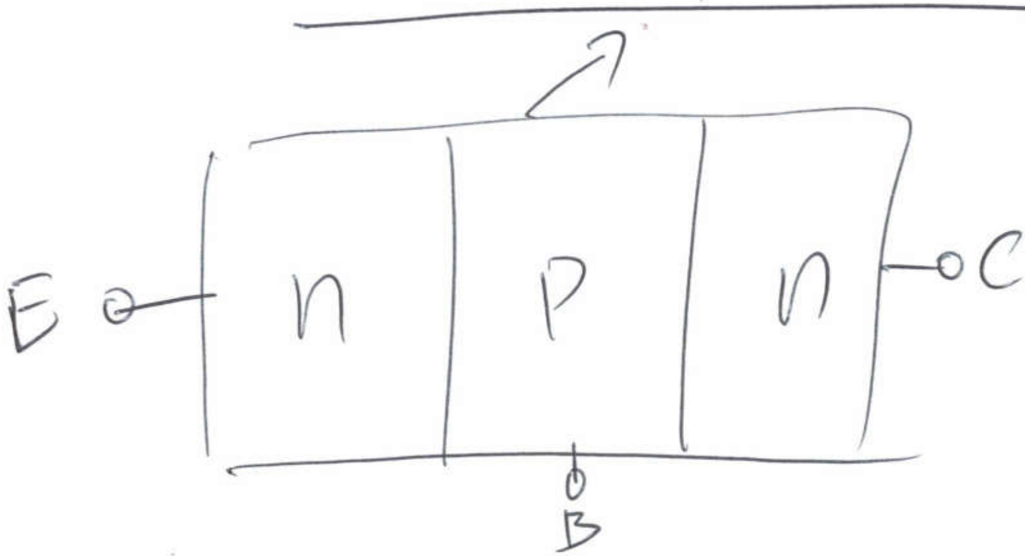
$$A_v(f) = \frac{-\frac{g_{m1}}{g_{m2}}}{\left(1+j\frac{f}{f_{in}}\right)\left(1+j\frac{f}{f_{out}}\right)}$$

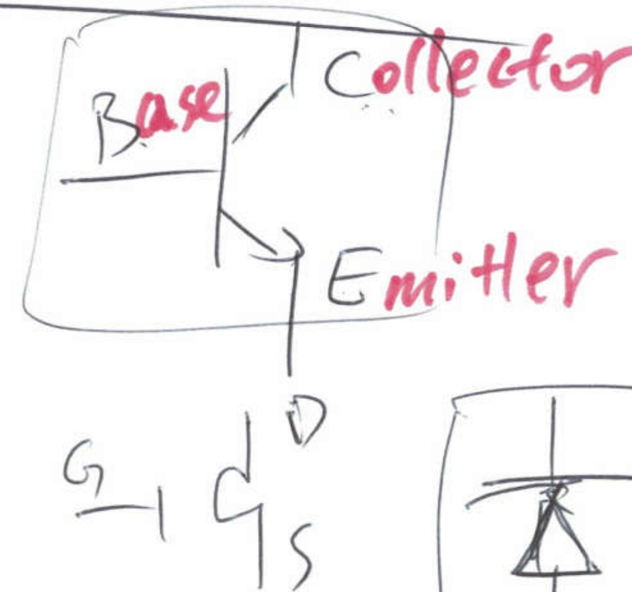


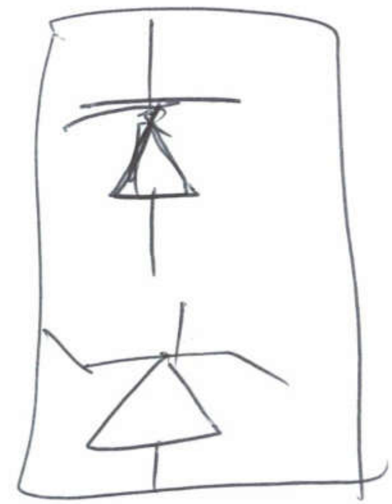
3

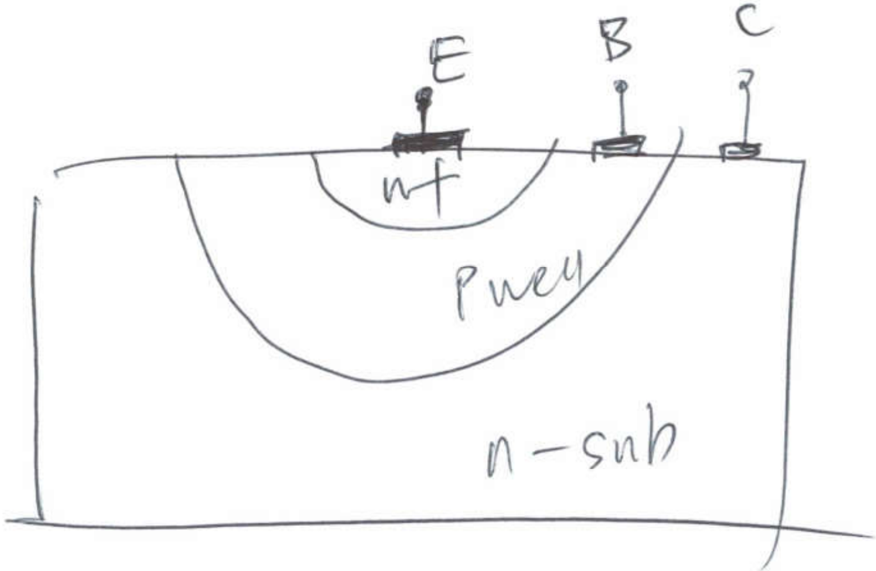

without Cc
with Cc
fun
fun
20 log(1) → 0dB
unity gain
fun = unity-gain frequency
0°
-90°
-180°
PM = 90°
phase margin = PM
60° ≤ PM ≤ 90° → stable

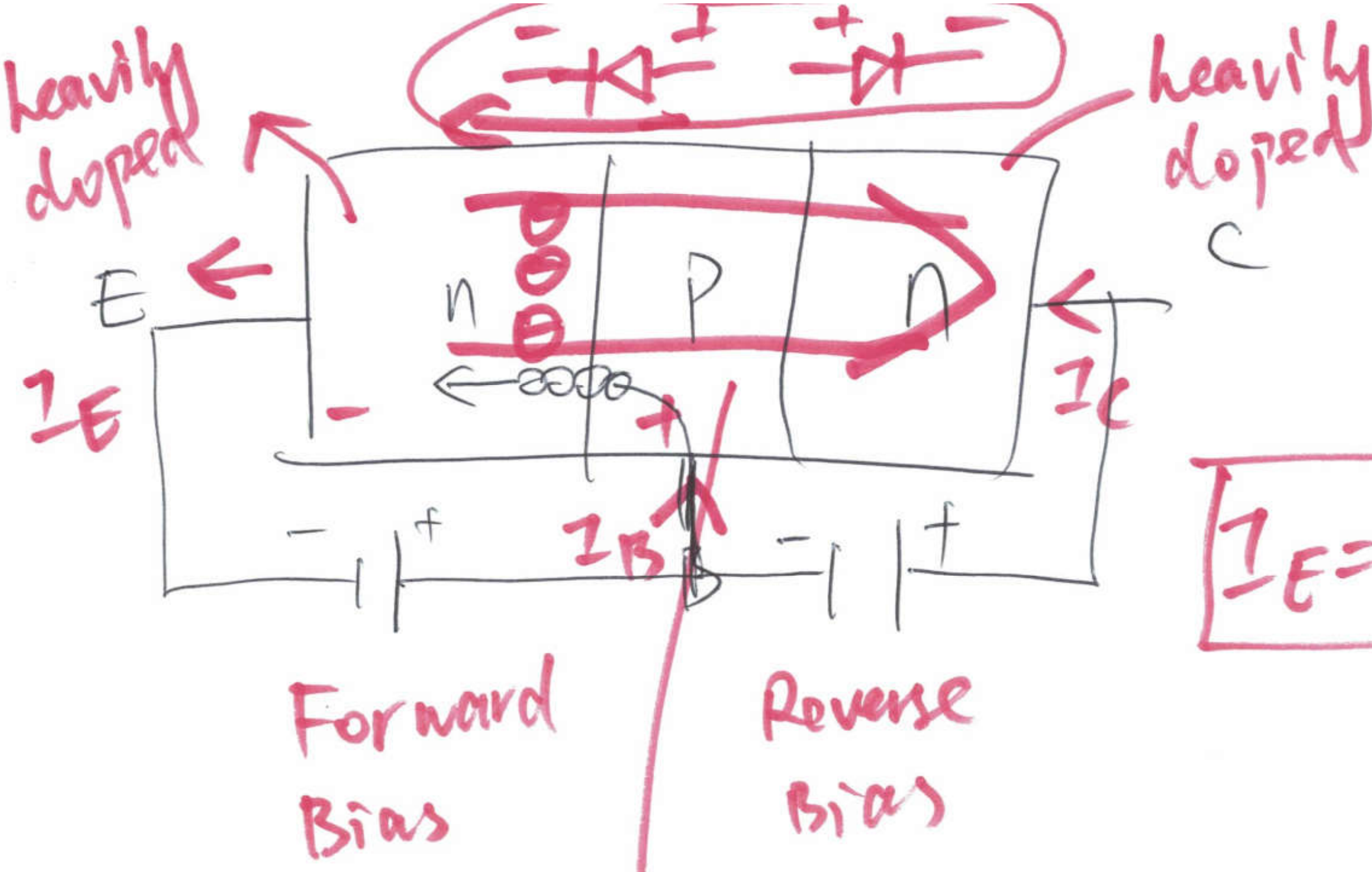
BJT — Transistors



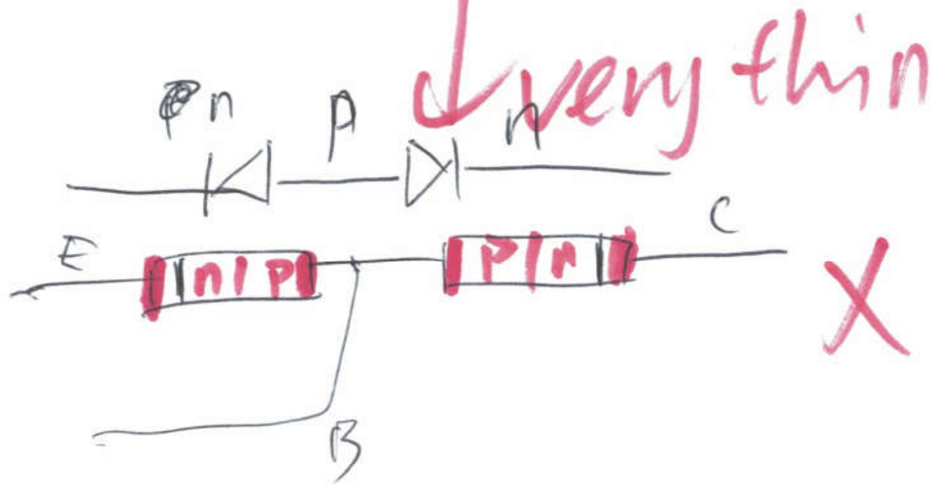




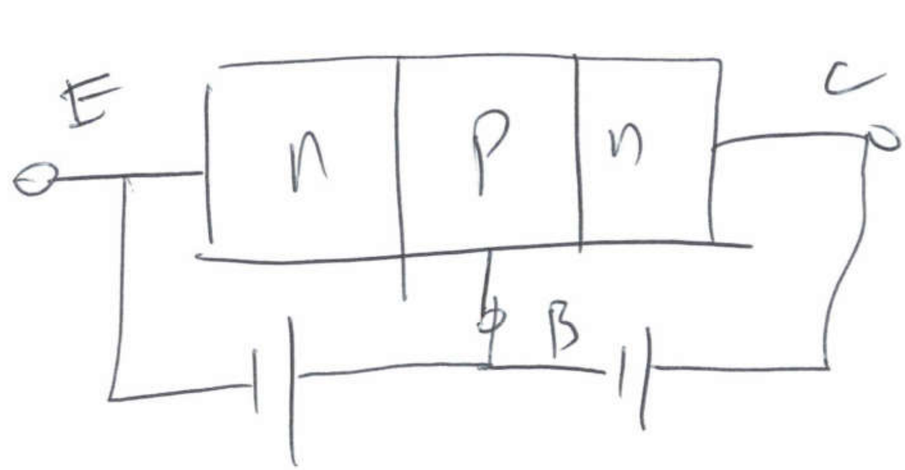


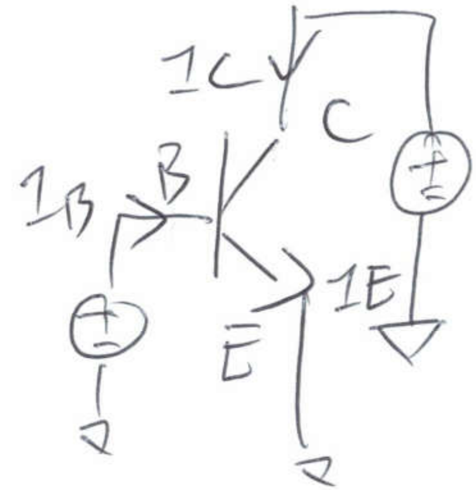


$$I_E = I_B + I_C$$



X won't work
Because of the metal plate.





$$I_E = I_B + I_C$$

$$I_B = \frac{I_C}{\beta} = \frac{I_E}{1+\beta}$$

$$\beta = 100$$

$$I_C = \beta I_B = \alpha I_E$$

$$\alpha = \frac{\beta}{1+\beta}$$

$$I_E = \frac{I_C}{\alpha} = (1+\beta) I_B$$

$$I_C = I_S e^{V_{BE}/V_T}$$

$V_T = 0.25V$ in $25°C$

I_S = Given

(depends on ~~Temp~~ Temperature

$$\left(1+\frac{1}{n}\right)^n = e$$

~~$V_{BE} = V_T \cdot \ln \frac{I_C}{I_S}$~~

$$\frac{de^x}{dx} = e^x$$

$$V_{BE} = V_T \ln \frac{V_C}{I_S}$$