5-3-13

Lec 31

$$C_c \approx \sqrt{\frac{G_{m1}}{G_{m2}} C_1 C_2}$$ for PM $\geq 45°$ w/ RC pole cancellation

In the case when $Z_1 \to \infty$, PM is:

$$p_2 \geq \underbrace{A_0 \cdot p_1}_{\omega_u} \quad (\text{assume } p_3 \gg p_2)$$

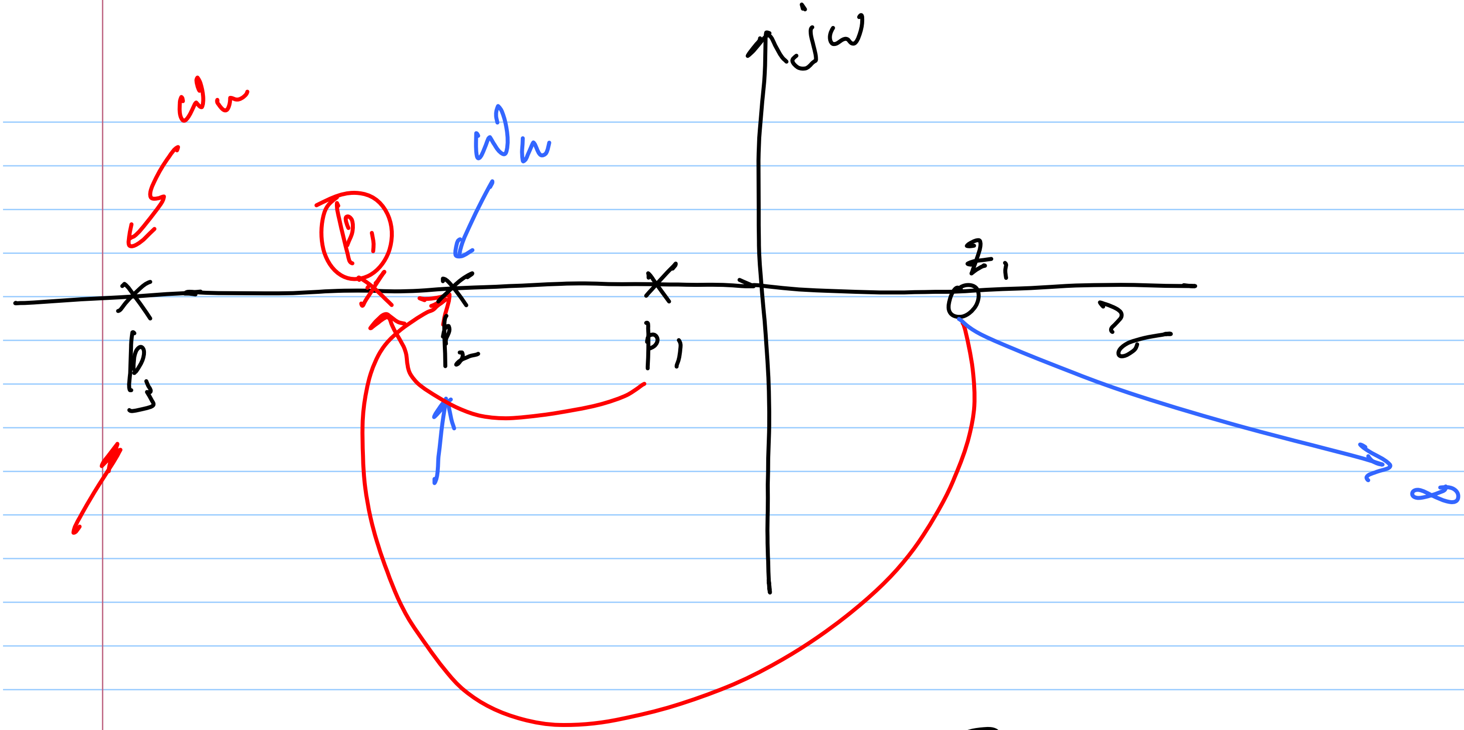
$$\hookrightarrow \quad C_c' \gg \frac{G_{m1}}{G_{m2}} \cdot C_2$$

$$C_c' = \frac{G_{m1}}{G_{m2}} \cdot C_2$$

$$C_c = \sqrt{\frac{G_{m1}}{G_{m2}} \cdot C_1 C_2}$$

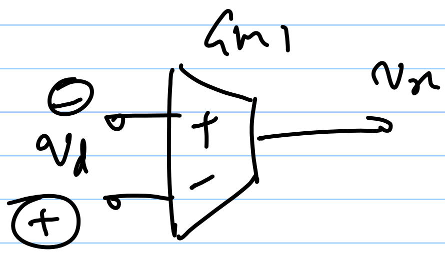
$$= \underbrace{\frac{G_{m1}}{G_{m2}} \cdot C_2}_{C_c'} \cdot \underbrace{\sqrt{\frac{G_{m2}}{G_{m1}}}}_{\approx 1} \cdot \underbrace{\sqrt{\frac{C_1}{C_2}}}_{\ll 1}$$

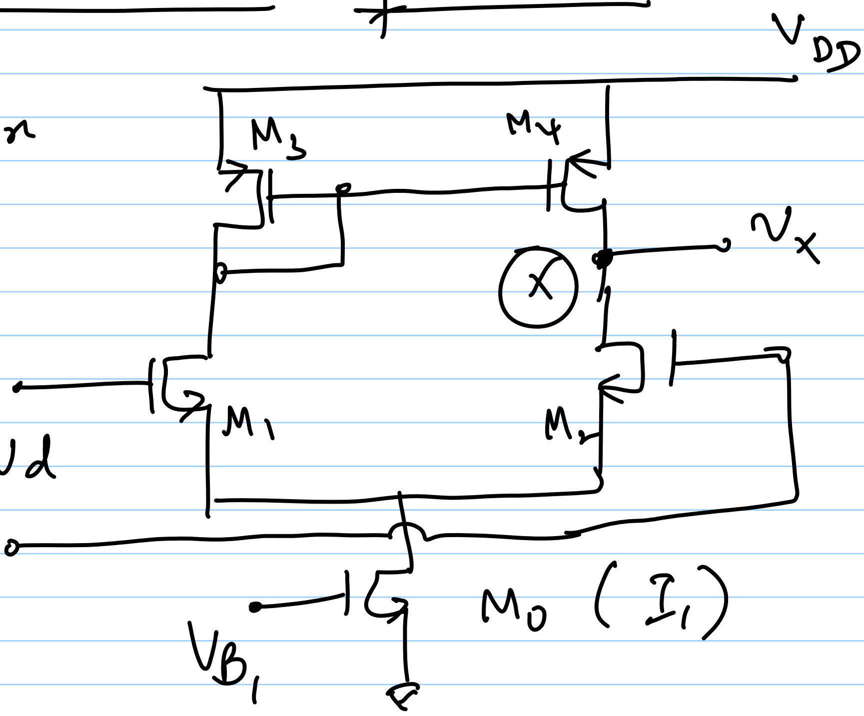
$$C_c < C_c'$$

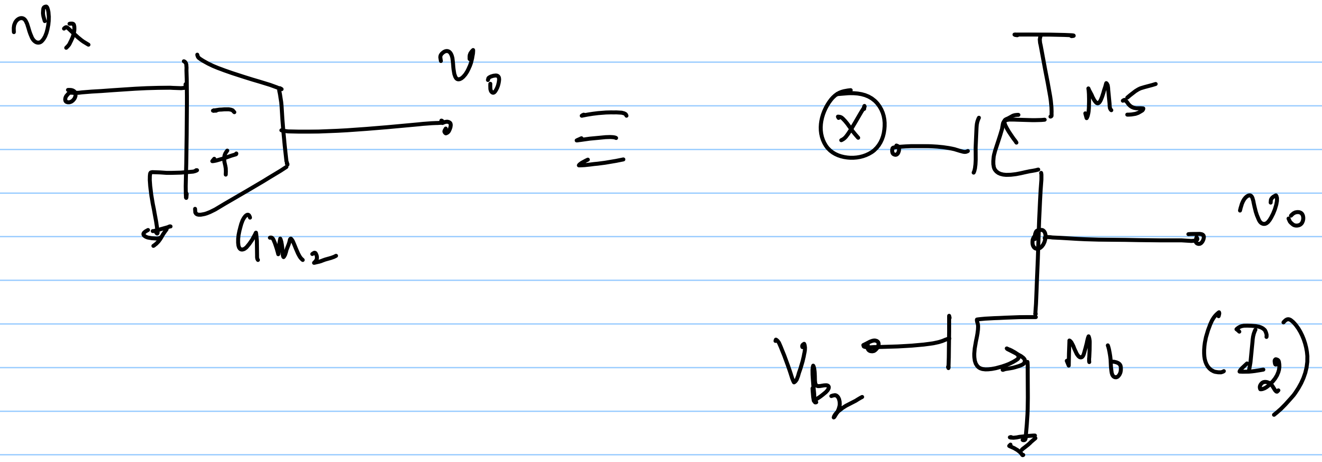


$$R_c = \frac{1}{G_{m_2}}\left[1 + \frac{C_2}{C_c}\right]$$

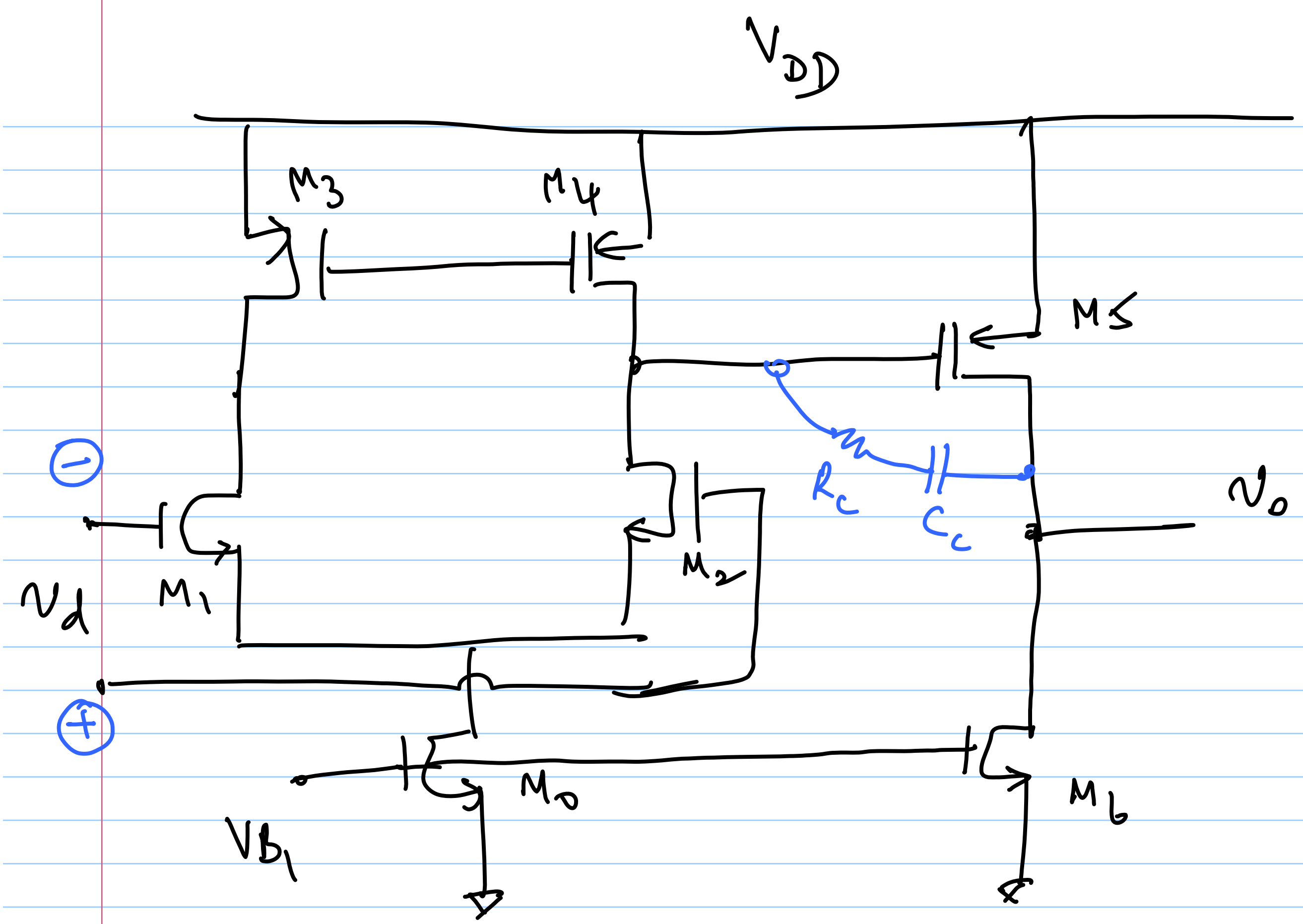
Ckt implementation of blocks



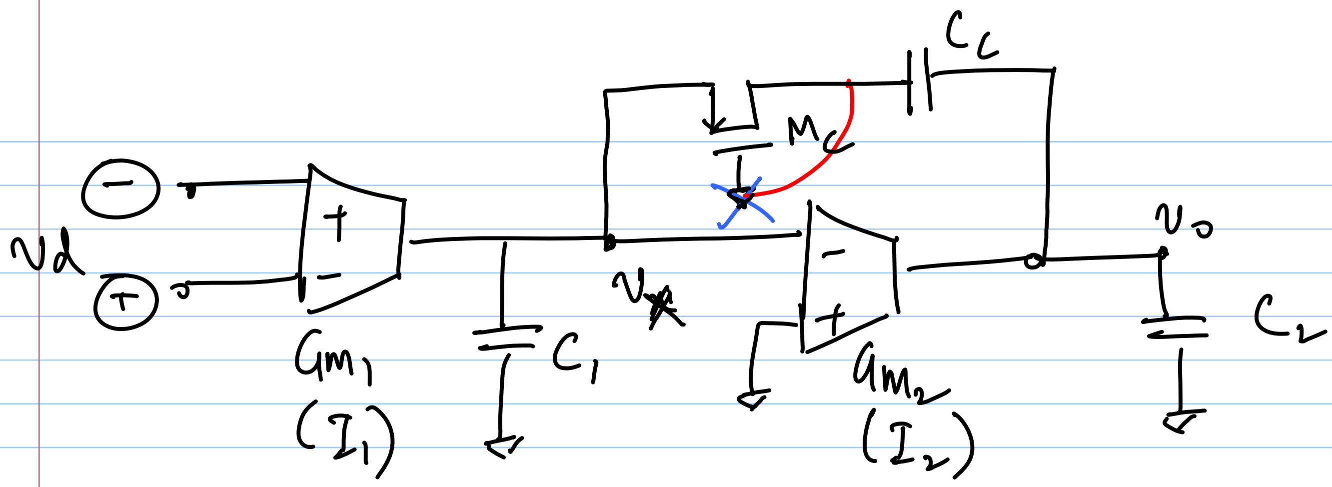




vx
vo
−
+
Gm2
≡
X
M5
vo
Vb2
M6
(I2)



VDD
M3
M4
M5
Rc
Cc
vo
M2
M1
vd
−
+
M0
M6
VB1



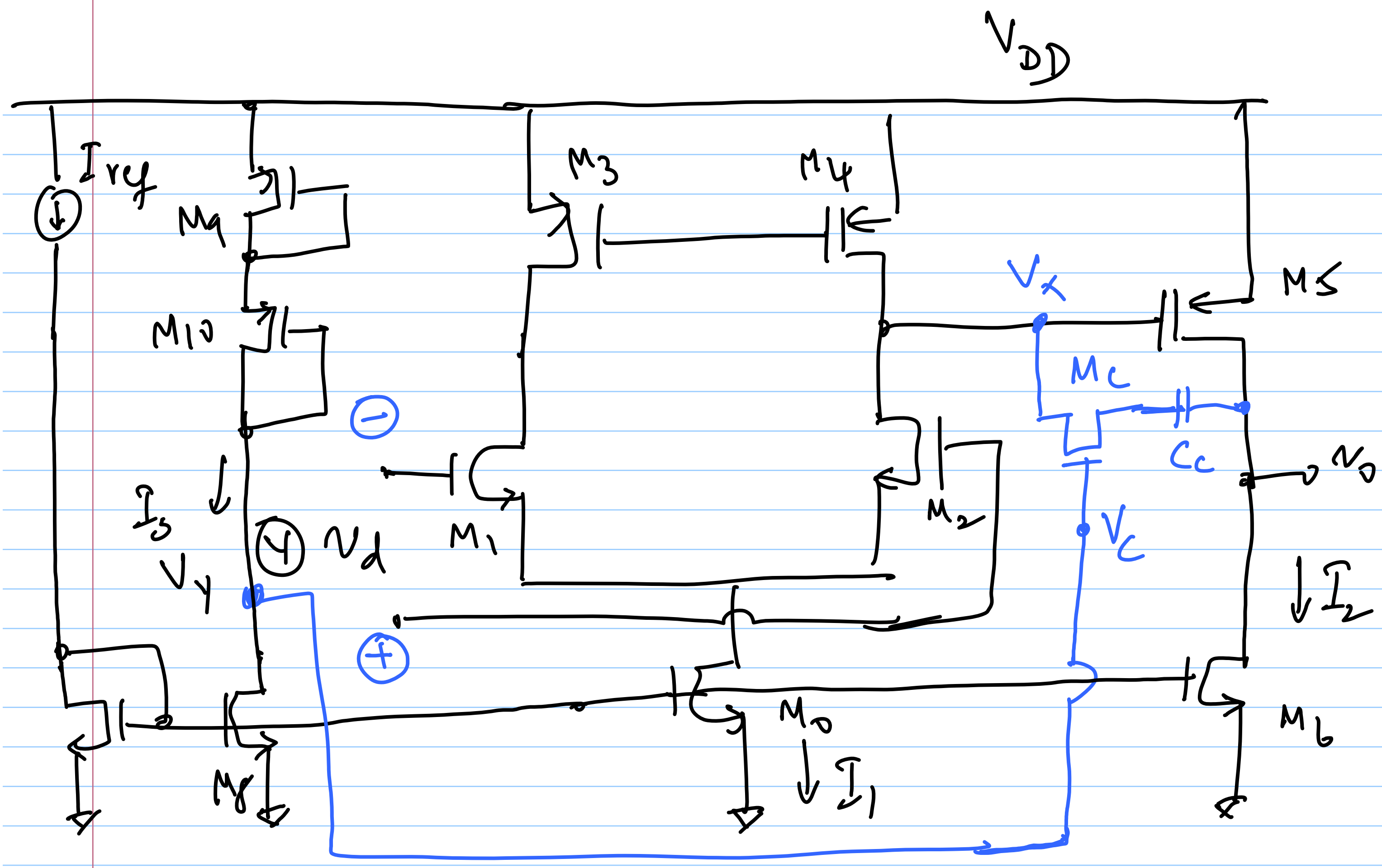
* MOSFET M_c in triode region

→ use PMOS here as G_{m2} is created w/ pmos device

If $\underbrace{I_2}$ ↑ $\Rightarrow$ $p_2 = \dfrac{G_{m2}}{C_2}$ ↑

$$Z_1 = \frac{1}{\left(R_c - \frac{1}{G_{m2}}\right) \cdot C_2} \Rightarrow R_c \text{ should } \downarrow$$

$V_x \downarrow \Rightarrow R_c$ actually ↑



* 2 identically biased transistors

sat. $g_m = \mu C_{ox} \left(\frac{W}{L}\right) (V_{GS} - V_T)$

nonsat $g_{ds} = g_m (\text{sat.})$

<u>We want</u> : $R_c = \frac{1}{g_{m5}} \left[1 + \frac{C_L}{C_c} \right]$