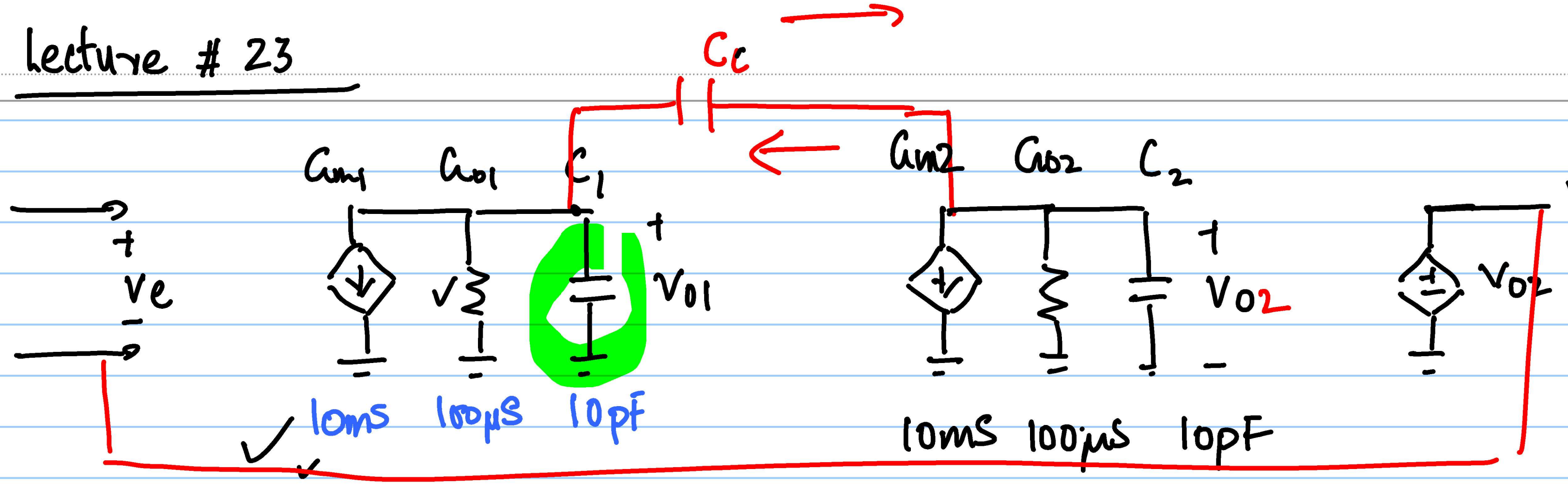
lecture # 23



$$p_1' = -\frac{G_{o1}}{C_1}$$

$$p_2' = -\frac{G_{o2}}{C_2}$$

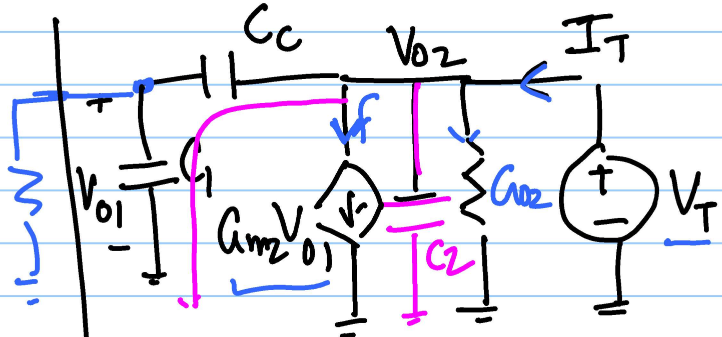
$$p_1' = 10^5 \text{ rad/s}$$

$$p_2' = 10^7 \text{ rad/s}$$

$$p_1 = -\frac{G_{o1}}{C_1 + C_c\left(1 + \frac{G_{m2}}{G_{o2}} + \frac{G_{o1}}{G_{o2}}\right) + C_2 \frac{G_{o1}}{G_{o2}}} \approx -\frac{G_{o1}}{C_1 + C_c\left(1 + \frac{G_{m2}}{G_{o2}}\right)}$$

$$W_u = 5 \times 10^7$$

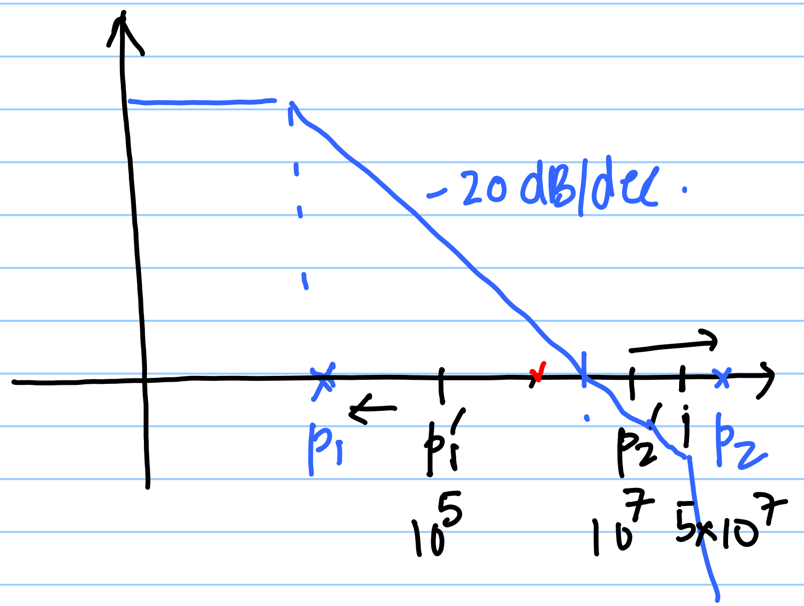
$$p_2 = -\frac{G_{o2} + G_{o1}\frac{C_2 + C_c}{C_1 + C_c} + G_{m2}\frac{C_c}{C_1 + C_c}}{\frac{C_1 C_c}{C_1 + C_c} + C_2}$$



$$V_{01} = \frac{C_c}{C_1 + C_c}.$$

$C_2 + \max.(C_1, C_c)$ ✗

$C_2 + \min.(C_1, C_c)$



$$\frac{V_o}{V_e} = \frac{A_0 \left(1 - s/z_1\right)}{\left(1 + \frac{s}{p_1}\right)\left(1 + \frac{s}{p_2}\right)}$$

$$z_1 = \frac{G_{m2}}{C_c}$$

- $z_1 > \omega_u$
- $p_1 \ll \omega_u$
- $p_1 \approx \dfrac{G_{o1}}{C_1 + C_c\left(\frac{G_{m2}}{G_{o2}} + 1\right)}$

$$\approx \frac{G_{o1}}{C_c \cdot \frac{G_{m2}}{G_{o2}}}$$ ✓

- $\omega_u = A_0 \cdot p_1 = \dfrac{G_{m1} G_{m2}}{G_{o1} G_{o2}} \times \dfrac{G_{o1}}{C_c \frac{G_{m2}}{G_{o2}}}$

$$= \frac{G_{m1}}{C_c}$$

$$p_2 = -\frac{G_{o2} + G_{m2}\dfrac{C_c}{C_1+C_c}}{C_2 + \dfrac{C_1 C_c}{C_1+C_c}} \checkmark$$

$$\frac{p_2}{\omega_u} = \frac{G_{m2}}{C_2 + \dfrac{C_1 C_c}{C_1+C_c}} \times \frac{C_c}{G_{m1}} = \tan(\phi_m)$$

$$\frac{G_{m2}}{G_{m1}} \frac{C_c(C_1+C_c)}{C_2(C_1+C_c)+C_1 C_c} = \tan(\phi_m)$$

$$\frac{G_{m2}}{G_{m1}} \frac{\dfrac{C_1}{C_c}+1}{\dfrac{C_2}{C_c}\left(\dfrac{C_1}{C_c}+1\right)+\dfrac{C_1}{C_c}} = \tan\phi_m$$

$$\measuredangle LG = -\tan^{-1}\left(\frac{\omega}{p_1}\right) - \tan^{-1}\left(\frac{\omega}{p_2}\right)$$

$$\phi_m = \measuredangle LG - (-180^\circ)$$

$$= 180^\circ - \tan^{-1}\left(\frac{\omega_u}{p_1}\right) - \tan^{-1}\left(\frac{\omega_u}{p_2}\right)$$

$$\phi_m = 76^\circ.$$

$$76^\circ = 180^\circ - \tan^{-1}\left(\frac{\omega_u}{p_1}\right)$$

$$\phi_m = 90^\circ - \tan^{-1}\left(\frac{\omega_u}{p_2}\right)$$

$$\checkmark \frac{p_2}{\omega_u} = \tan(\phi_m)$$

$$\frac{G_{m2}}{G_{m1}} \frac{1 + \frac{C_1}{C_2} \cdot \frac{C_2}{C_c}}{\frac{C_2}{C_c}\left(\frac{C_1}{C_2} \cdot \frac{C_2}{C_c} + 1\right) + \frac{C_1}{C_2} \cdot \frac{C_2}{C_c}} = \tan\phi_m .$$

$$\left(\frac{C_2}{C_c}\right)^2 + \qquad \left(\frac{C_2}{C_c}\right) + \qquad 1 = 0$$

$$1 \quad \frac{\left(1 + \frac{C_2}{C_c}\right)}{\left(1 + \frac{C_2}{C_i}\right)\frac{C_2}{C_c} + \frac{C_2}{C_c}} = \tan\phi_m$$

$$C_c = 80\ pF$$

$G_{m1} = 1mS \rightarrow 10mS$

$G_{m2} = 10mS$

$C_1 = 100\ pF \rightarrow 10pF$

$C_2 = 10\ pF$

$\frac{C_1}{C_2} = 10$

$\frac{G_{m2}}{G_{m1}} = 10$

$\tan(\phi_m) = 4$

G_{m1}	G_{o1}	C_1	C_c	$G_{m2} \frac{C_c}{C_1+C_c}$
1mS	10 μS	100 pF	6pF	$1mS \cdot \frac{6}{106} = 10\mu S$
✓ 10 mS	100 μS	10 pF	80pF	$10mS \cdot \frac{80}{90}$ 9mS

$$P_2 = -\frac{G_{o1} + G_{m1}\frac{C_c}{C_1+C_c}}{\quad}$$

$$P_1 = -\frac{G_{o1}}{C_1 + C_c\left(1+\frac{G_{m2}}{G_{o2}}\right)} = -\frac{100\times10^{-6}}{(10 + 80 \times 100)\times10^{-12}} = \frac{10^8}{8000}$$

$$= 1.25 \times 10^4 \text{ rad/s.}$$

$$P_2 = -\frac{G_{m2}\frac{C_c}{C_1+C_c}}{C_2 + \frac{C_1 C_c}{C_1+C_2}} = -$$