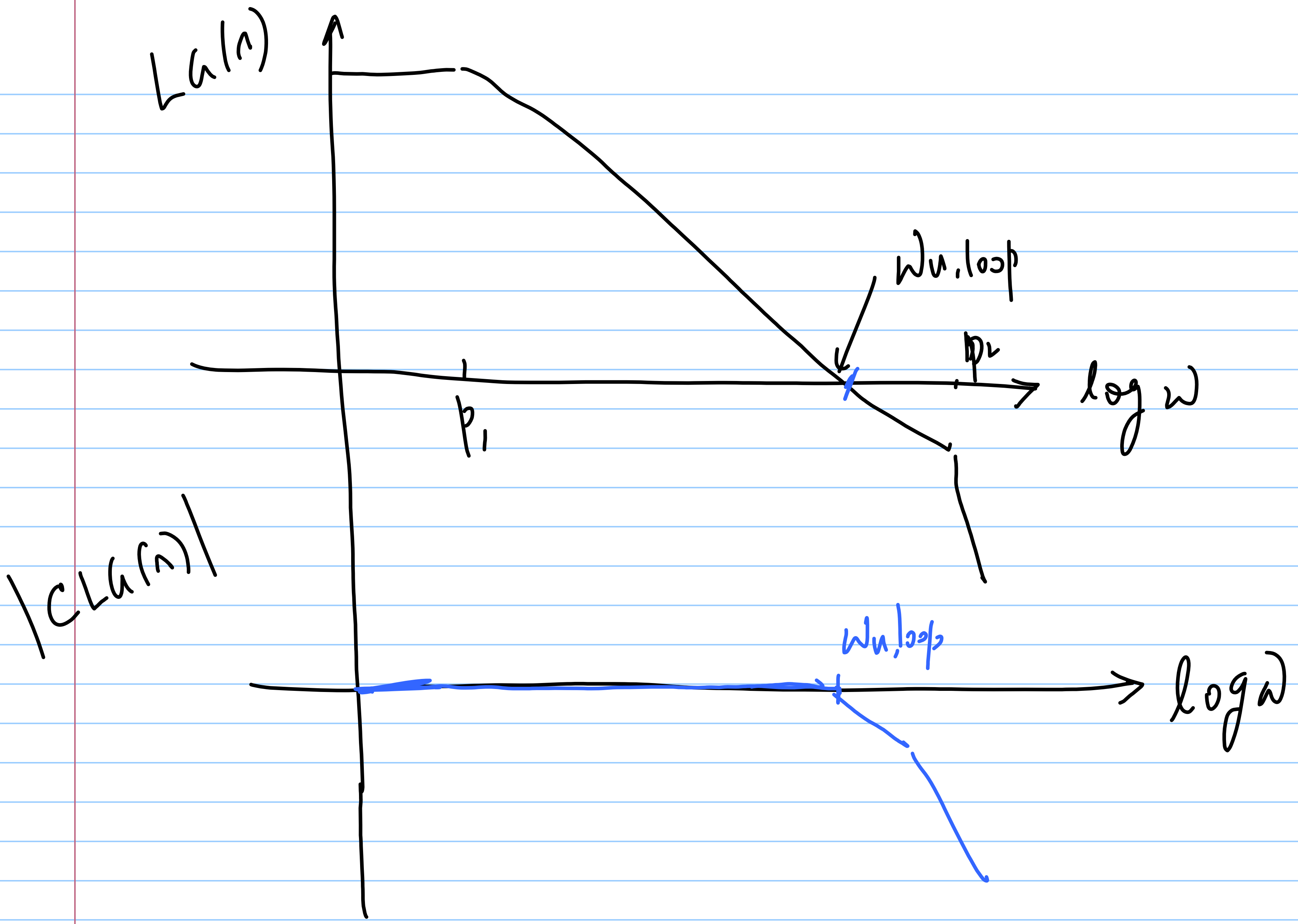
22/2/19

Lec 20

$p_1 << p_2 \Rightarrow$ large PM

LG $A(s) \cdot \frac{1}{K}$

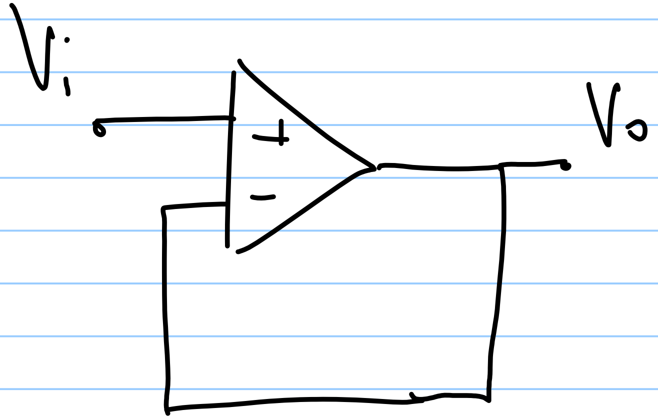
$\Rightarrow$ CLG

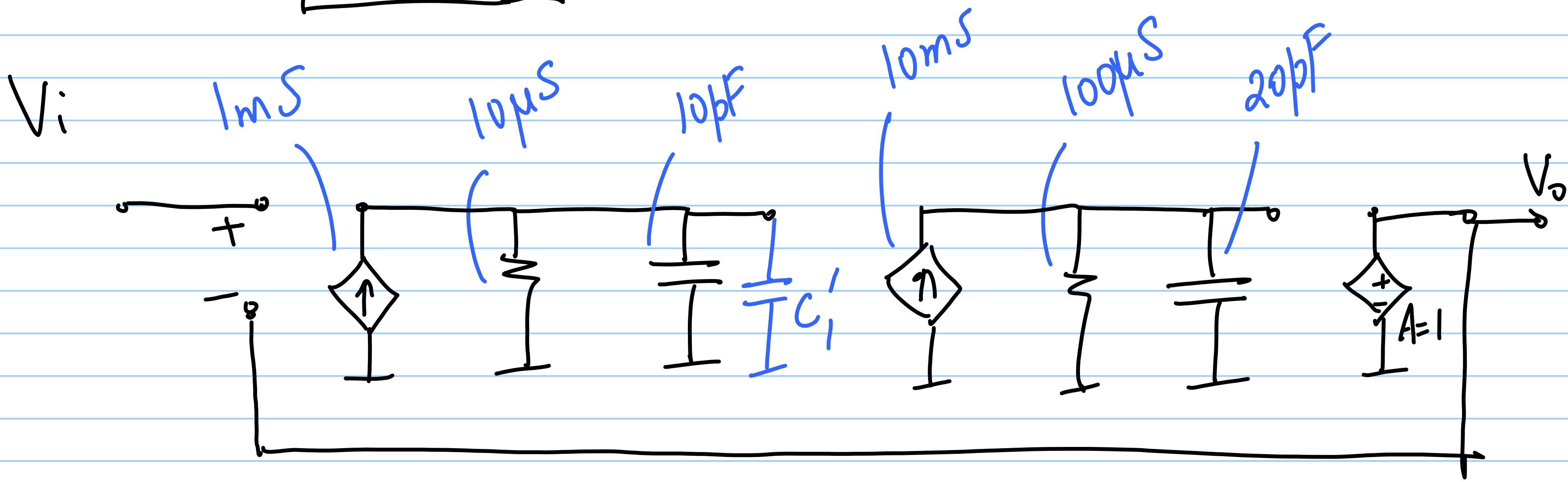


e.g. buffer

$$\frac{V_o}{V_i} = 1$$

"Nyquist Plot"





$$A_0 = 100 \times 100 = 10^4$$

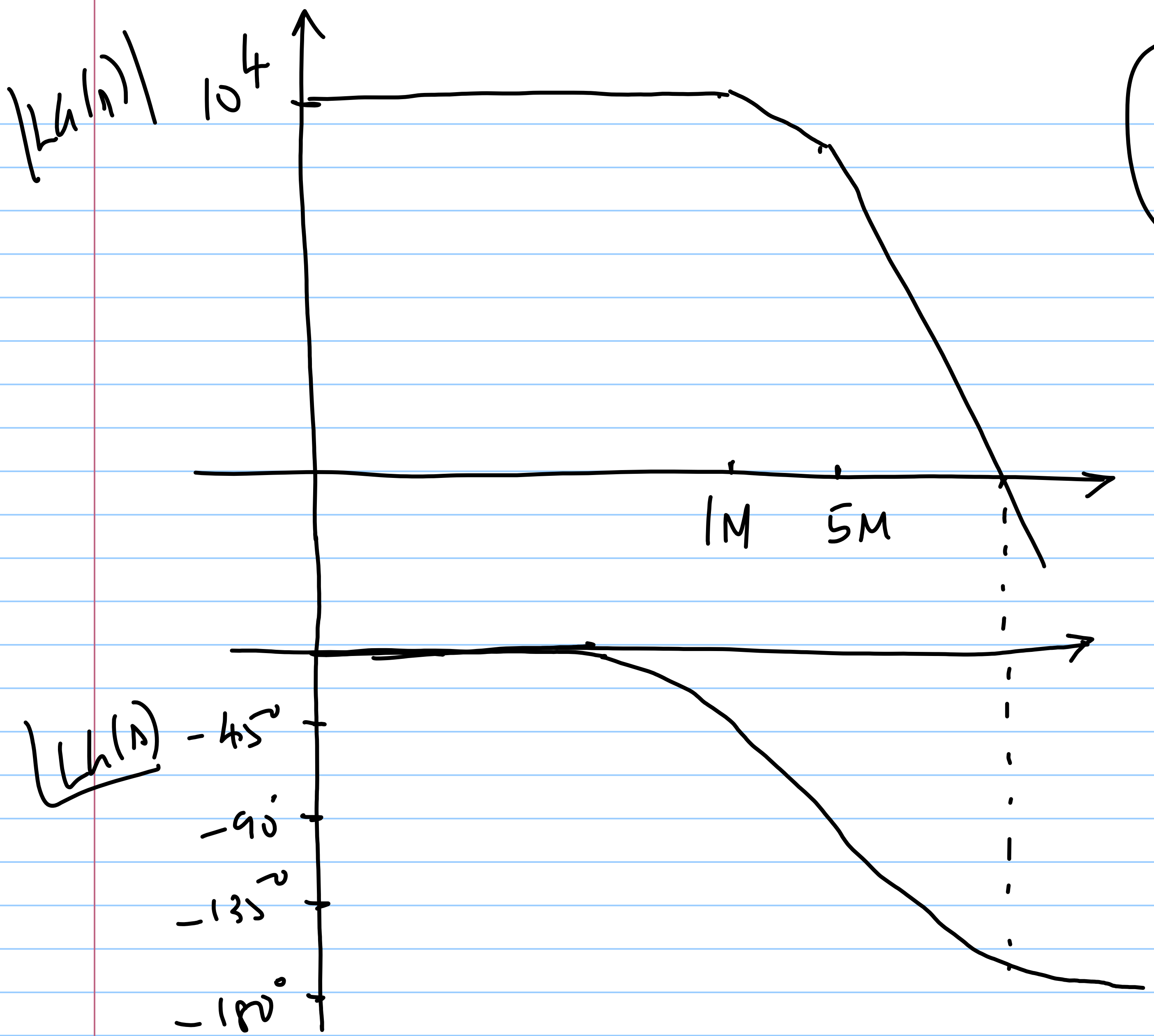
$$k = 1 \quad \{\beta = 1\}$$

$$p_1 = \frac{G_{01}}{C_1} = \frac{10\mu S}{10pF} = 10^6 \text{ rad/s} \longleftrightarrow 160kHz$$

$$p_2 = \frac{G_{02}}{C_2} = \frac{100\mu S}{20pF} = 5\times10^6 \text{ rad/s} \longleftrightarrow 800kHz$$

$$\zeta = \frac{1}{2}\left(\sqrt{\frac{p_1}{p_2}} + \sqrt{\frac{p_2}{p_1}}\right)\cdot\sqrt{\frac{k}{A_0+k}} = \frac{1}{2}\left(\sqrt{1/5}+\sqrt{5}\right)\cdot\sqrt{\frac{1}{10^4}}$$

$$= 0.013$$



PM = HW

ω_n

$$\omega_n = \sqrt{\frac{A_0}{k}+1}\,\sqrt{p_1 p_2}$$

$$= 100\sqrt{p_1 p_2}$$

e.g. 1) $p_1 = \frac{1}{100} \cdot p_2 \Rightarrow \omega_n = 10 \cdot p_2 = 50M\ rad/s$

poles @ 500k rad/s, 50M rad/s ; $\omega_{u,loop} = 10^4 \cdot 500k$

2) $p_2 = \frac{1}{100} p_1 \Rightarrow \omega_n = 10 p_1 = 10M\ rad/s$

poles @ 100k rad/s, 10M rad/s ; $\omega_{u,loop} = 10^4 \cdot 100k$

* clearly p_1 should be decreased.
* by how much?

e.g. $\zeta = 1$, $PM = 76^\circ$

$$\frac{p_2}{\omega_{u,loop}} = 4 \Rightarrow \omega_{u,loop} = 1.25\ \text{Mrad/s}$$

$$\omega_{u,loop} = p_1' \cdot \frac{A_0}{k}$$

$$p_1' = \frac{1.25\ \text{Mrad/s}}{10^4} = 125\ \text{rad/s}$$

$C_{tot.}$ for p_1':

$$\frac{G_{01}}{C_{tot.}} = p_1'$$

$$C_{tot.} = \frac{10\,\mu s}{125} = 80\,nF$$

$$C_1' = C_{tot.} - C_1$$