Note Title EE2019 Analog Systems & Lab 3/3/2020

$$\xi = \frac{1}{2\sqrt{A_0}} \sqrt{\frac{\omega_{p_1}}{\omega_{p_2}} + \frac{\omega_{p_2}}{\omega_{p_1}}}$$

$\xi \to 0$ if $\omega_{p_1} = \omega_{p_2}$ $\rightarrow$ system is unstable

$$\omega_{p_1} = \frac{\omega_{ugb}}{A_0} \quad , \quad \omega_{p_2} = \omega_{ugb}$$

$$\xi = \frac{1}{2\sqrt{A_0}} \sqrt{\frac{\omega_{ugb}}{A_0 \times \omega_{ugb}} + \frac{\omega_{ugb}}{\omega_{ugb}/A_0}} = \frac{1}{2\sqrt{A_0}} \sqrt{\frac{1}{A_0} + A_0}$$

$\frac{1}{A_0} \sim 0$

$$\xi = \frac{1}{2}$$

Now assume, $\omega_{p_2} = 2\omega_{gb}$

$$H(s) = \frac{1}{1 + s/\omega_p} \qquad |H(s)| = \frac{1}{\sqrt{1 + (\omega/\omega_p)^2}} \; ; \quad \angle H(s) = -\tan^{-1}\frac{\omega}{\omega_p}$$

$$= \frac{\omega_p}{\omega} \quad \text{for } \omega/\omega_p >> 1$$

$$LG(s) = \frac{A_0}{(1 + s/\omega_{p_1})(1 + s/\omega_{p_2})}$$

$$\angle L(j\omega) = -\tan^{-1}\frac{\omega}{\omega_{p_1}} - \tan^{-1}\frac{\omega}{\omega_{p_2}}$$

$$\omega = \omega_{ugb}$$

$$\omega_{p_1} = \frac{\omega_{ugb}}{A_0}, \quad \omega_{p_2} = 2\omega_{ugb}$$

$$\angle L(j\omega) = -\tan^{-1}A_0 - \tan^{-1}\frac{1}{2}$$

$$A_0 \gg 1$$

$$= -90^\circ - 27^\circ = -117^\circ$$

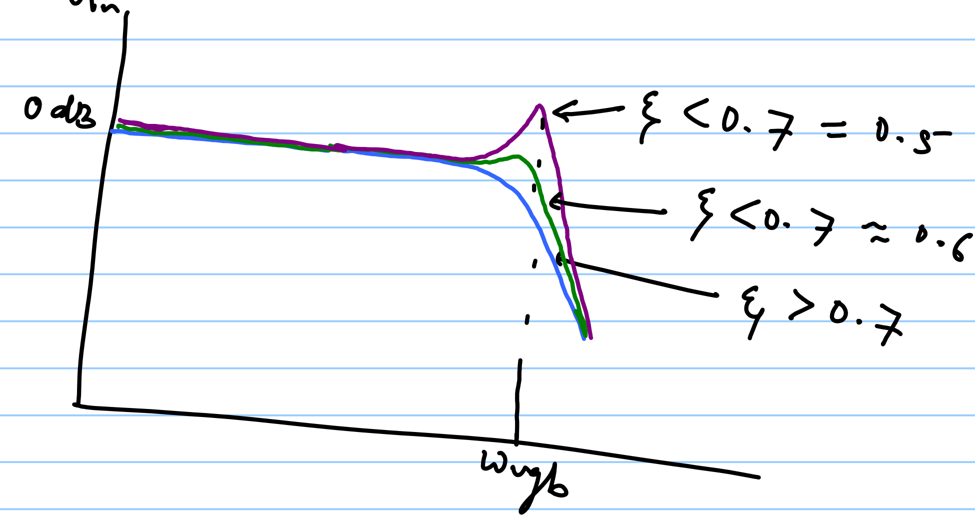
$$PM = 180 + \angle L(j\omega) = 180^\circ - 117^\circ = 63^\circ$$

$$\xi = \frac{1}{2\sqrt{A_0}} \sqrt{\frac{1}{2A_0} + 2A_0}$$

($\frac{1}{2A_0} \to 0$)

$$= \frac{1}{\sqrt{2}} = 0.7$$

$\frac{V_o}{V_{in}}(s) = H_{CL}(s)$

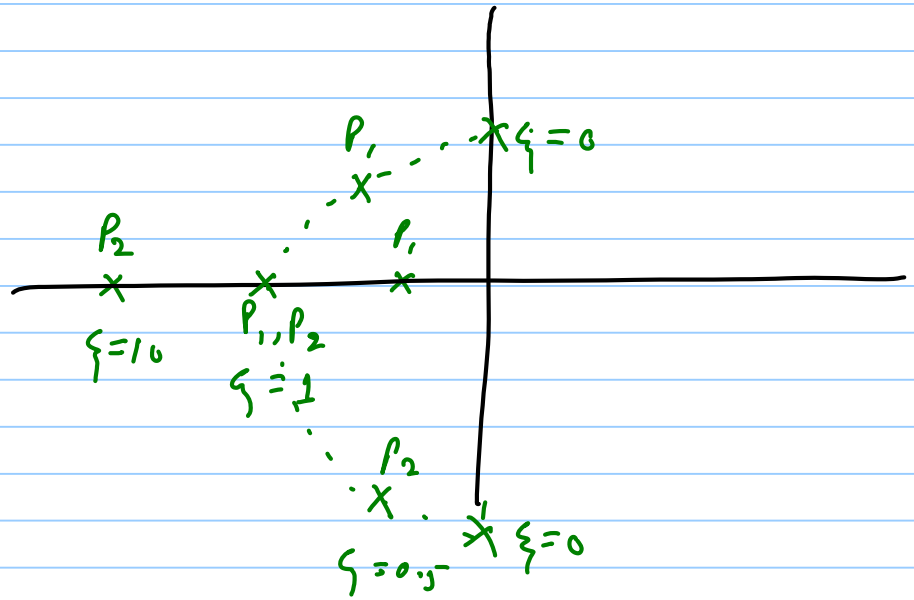


$\xi = 0.5$, $PM = 45^\circ$

$\xi = 0.7$, $PM = 63^\circ$

$\xi = 0$, $PM \approx 0$

$\xi = \infty$, $PM \simeq 90°$



$$\xi = \frac{1}{2\sqrt{A_0}} \sqrt{\frac{\omega_{p_1}}{\omega_{p_2}} + \frac{\omega_{p_2}}{\omega_{p_1}}}$$

$\xi = 1$, $\omega_{p_1} = \omega_{wgb} / A_0$

$$1 = \frac{1}{2\sqrt{A_0}} \sqrt{\frac{\omega_{wgb}}{A_0 \omega_{p_2}} + \frac{A_0 \omega_{p_2}}{\omega_{wgb}}} \quad \Rightarrow \quad 1 = \frac{1}{2\sqrt{A_0}} \times \sqrt{A_0 \frac{\omega_{p_2}}{\omega_{wgb}}}$$

($\frac{\omega_{wgb}}{A_0 \omega_{p_2}} \to 0$)

$\omega_{p_2} = 4\omega_{ugb}$

$\zeta = 1, \quad PM = 76^{\circ}$