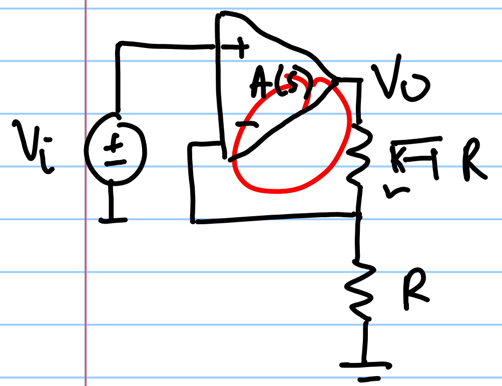
Note Title 18-02-2020

Lecture # 17.

$$A(s) = \frac{V_o}{V_e}$$



1st Order $\quad A(s) = \dfrac{A_o}{1+s/p_1}$ Unconditionally stable

2nd Order $\quad A(s) = \dfrac{A_o^2}{\left(1+\frac{s}{p_1}\right)\left(1+\frac{s}{p_2}\right)}$ Stable, not as good as first order

3rd Order $\quad A(s) = \dfrac{A_o^3}{\left(1+\frac{s}{p_1}\right)\left(1+\frac{s}{p_2}\right)\left(1+\frac{s}{p_3}\right)}$ Potentially stable.

$$\frac{V_o}{V_i} = \frac{k}{1+\frac{k}{A(s)}} =$$

$D(s) = 0$

- if poles of closed loop are R.H.P $\Rightarrow$ unstable.
- find closed loop poles is tedious.

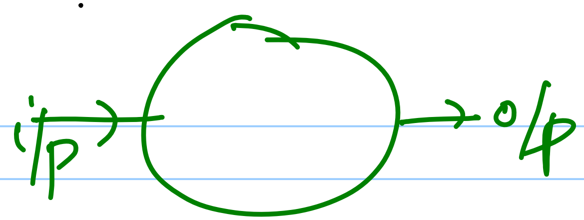
$$D(s) = 1 + \frac{k}{A(s)} = 0 \quad \Rightarrow \quad \frac{k}{A(s)} = -1 \quad \Rightarrow \quad \frac{A(s)}{k} = -1$$

$$\left|\frac{A(s)}{K}\right| = 1$$

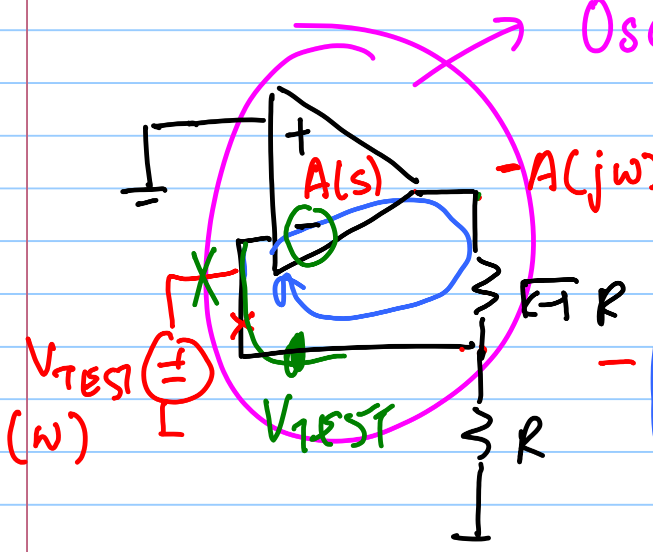
$$\measuredangle \frac{A(s)}{K} = 180^\circ$$

ω : $\left|\frac{A(j\omega)}{K}\right| = 1$.

$$\measuredangle \frac{A(j\omega)}{K} = 180^\circ$$



Oscillator



$-A(j\omega) \cdot V_{TEST}$

$$-\left|\frac{A(j\omega)}{K}\right| V_{TEST} = V_{TEST}$$

-1

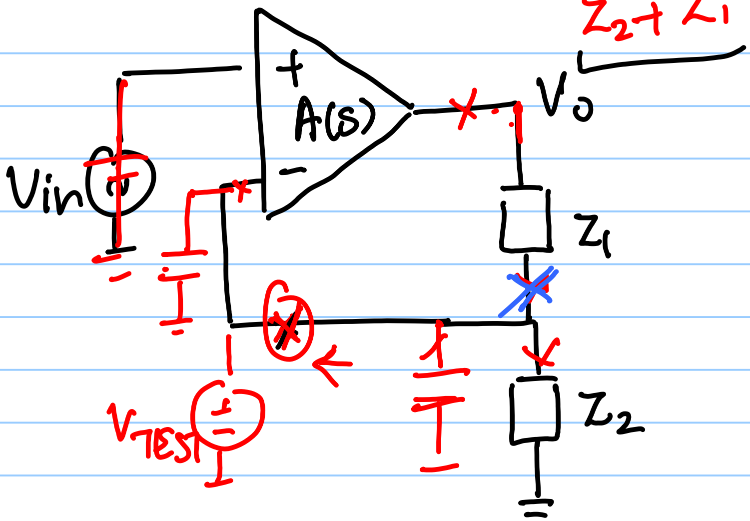
$(1, \; 180^\circ)$

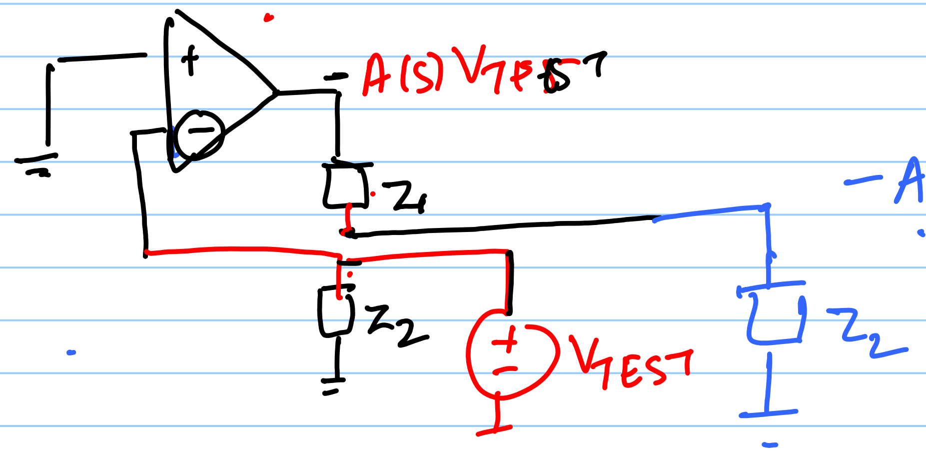
$$\underbrace{\frac{A(s)}{K} + 1}_{D(s)} = 0$$

s: at which $D(s) = 0$

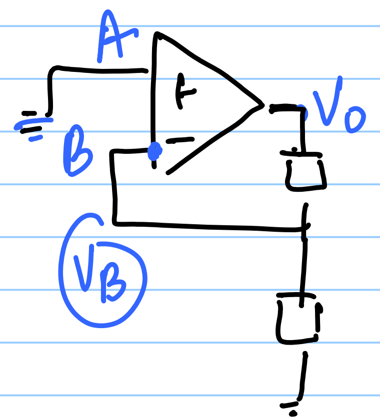
$$\frac{A(s)}{K}\Big|_{s = (j\omega) = [0, \infty]}$$

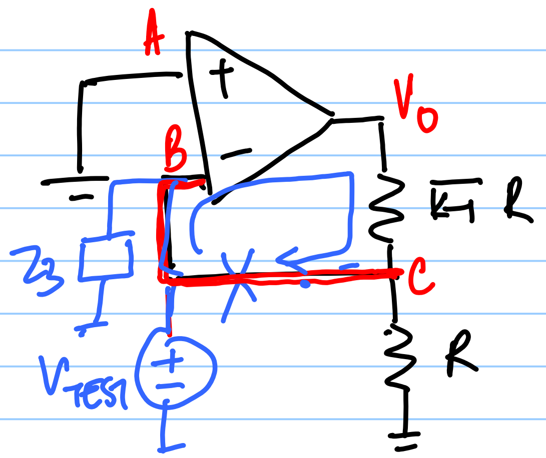
$$LG = A(s) \cdot \frac{Z_2}{Z_2 + Z_1}$$

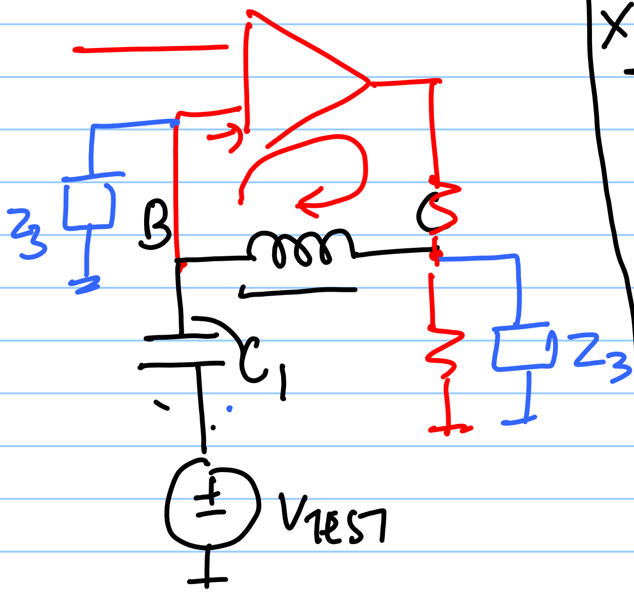


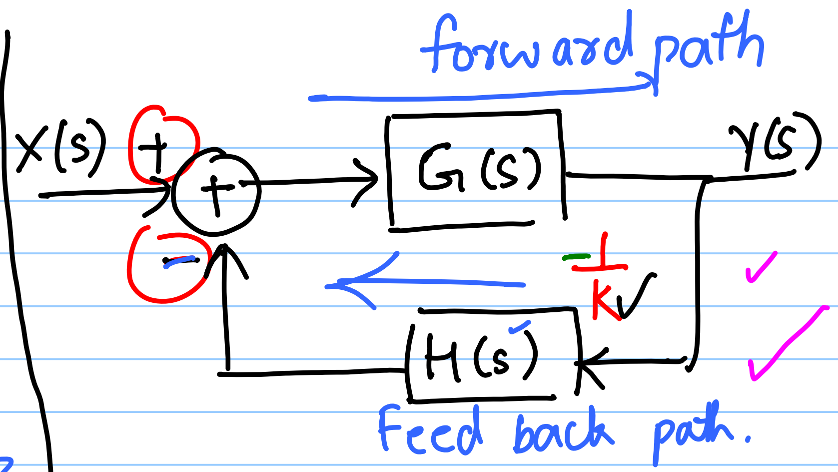


$$-A(s) \cdot V_{TEST} \cdot \frac{Z_2}{Z_2 + Z_1}$$

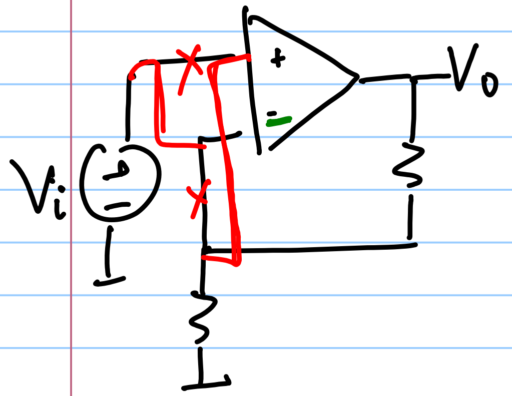








$$\frac{Y(s)}{X(s)} = \frac{1}{H(s)} \cdot \frac{G(s).H(s)}{1+G(s)\,H(s)}$$



$$\frac{V_o}{V_i} = \frac{K}{1+\frac{K}{A(s)}} = K \cdot \frac{A(s)/K}{1+\frac{A(s)}{K}}$$

$G(s) = A(s)$

$H(s) = \frac{1}{K}$

$LG(s) = \frac{A(s)}{K}$

$LG(s) = G(s)\,H(s)$

$$\frac{Y(s)}{X(s)} = \frac{1}{H(s)} \qquad \frac{G(s)\cdot H(s)}{1+G(s)H(s)} = \frac{1}{H(s)} \qquad \underbrace{\frac{LG(s)}{1+LG(s)}}$$

$$\underbrace{1+LG(s)=0}$$

$$G(s)\,H(s) = -1$$

$$\downarrow$$

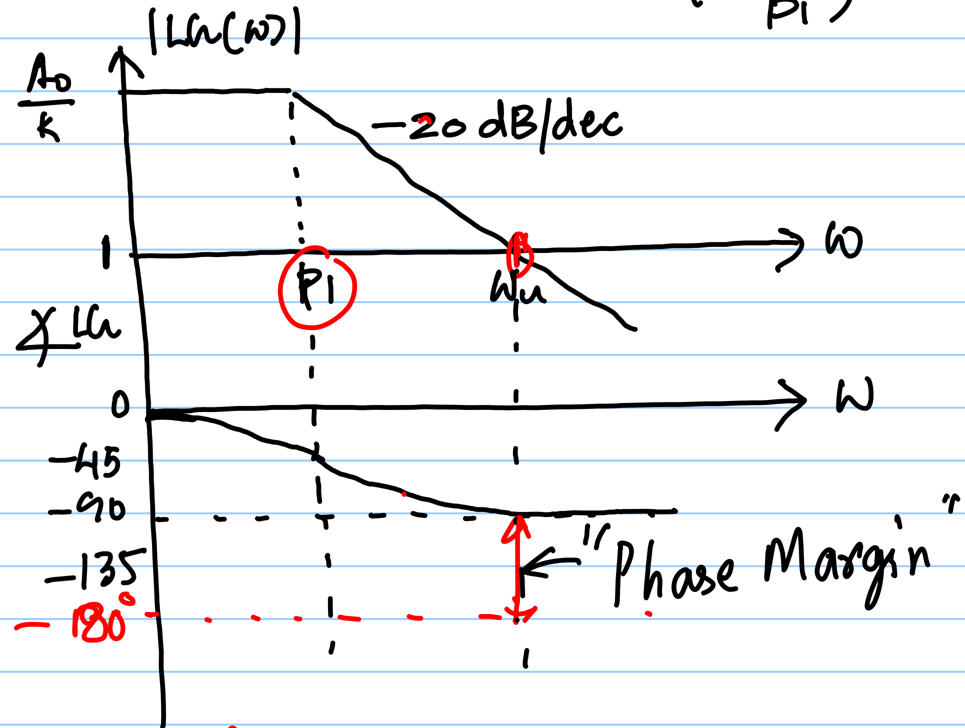
$$\checkmark \quad \frac{A_0}{\left(1+\frac{s}{p_1}\right)} = \frac{-1}{H(s)}$$

$$\left(1+\frac{s}{p_1}\right) = -A_0 H(s)$$

$$\frac{s}{p_1} = -A_0 \underbrace{H(s)} - 1$$

$\hookrightarrow H(s) \Rightarrow +ve$

$$LG(s) = \frac{A_0(s)}{K} = \frac{A_0}{K\left(1+\frac{s}{p_1}\right)} \checkmark$$



$$\omega_u = \frac{A_0 p_1}{K}$$

$$20\log_{10}|L_a| = 20\log_{10}\left(\frac{A_0}{k\sqrt{1+\frac{\omega^2}{p_1^2}}}\right) = 20\log_{10}\left(\frac{A_0/k}{\omega/p_1}\right)$$

$$\begin{cases} |L_a| & \left[0, \frac{A_0}{k}\right] \quad \text{for all } \omega \in [0, \infty) \\ \measuredangle L_a & [0, -90^\circ] \quad \text{"} \end{cases}$$

$$|L_a(\omega)| = 1$$

$$\measuredangle L_a = 180^\circ$$