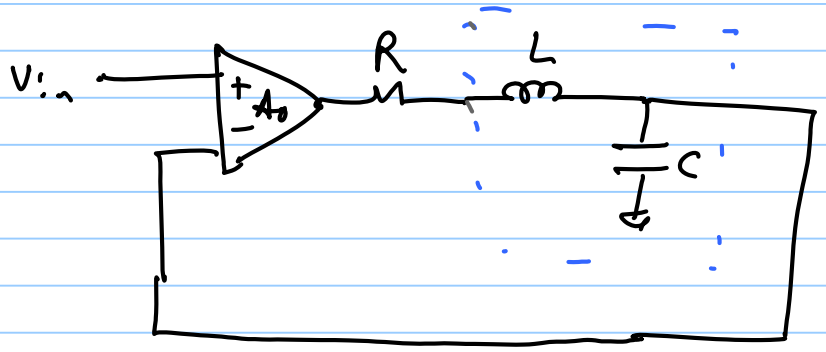
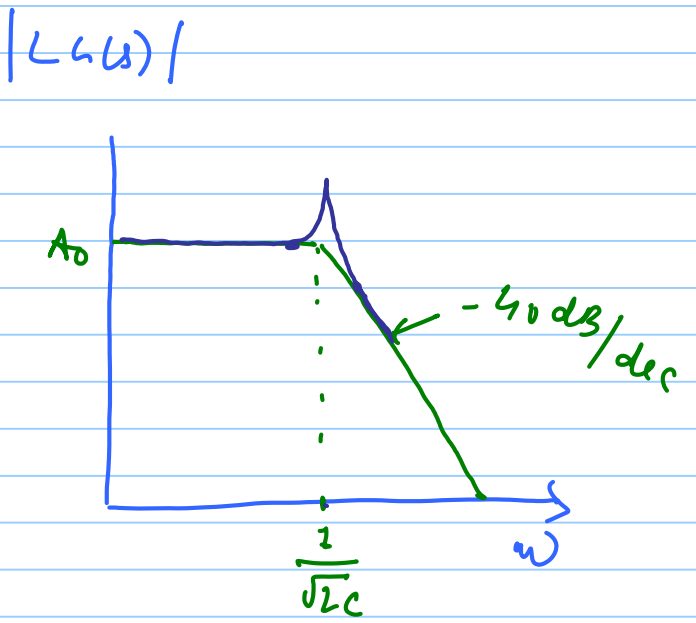
EE2019 Analog Systems & Lab

Note Title 3/5/2020

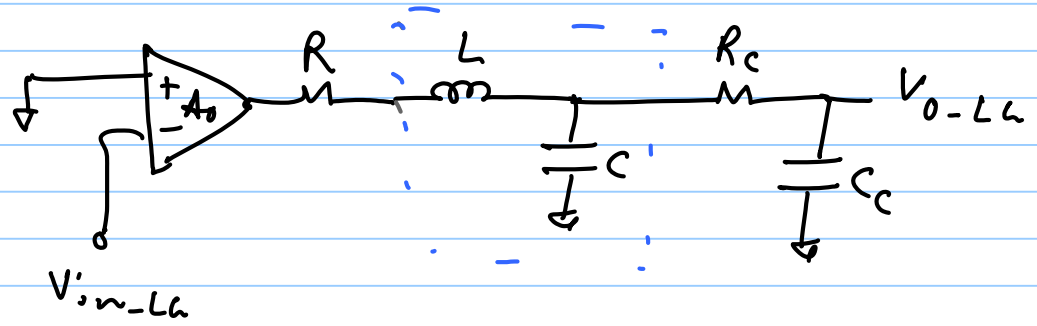
Dominant- pole compensation:





We can't make LC poles dominant so it can't be compensated by adding a capacitor.

we need to add one more pole and make that dominant.



$$LC(s) = A_0 H_{LC}(s) \cdot \frac{1}{1+R_c C_c s}$$

$$H_{LC}(s) = \frac{1/sC}{R + sL + 1/sC} = \frac{1}{RCs + s^2LC + 1} = \frac{1/LC}{s^2 + \frac{R}{L}s + 1/LC}$$

$$LG(s) = A_0 \cdot \frac{1/LC}{s^2 + \frac{R}{L}s + 1/LC} \times \frac{1}{1 + R_c C_c s}$$

$\frac{1}{1 + R_c C_c s}$ → dominant pole

$\frac{1/LC}{s^2 + \frac{R}{L}s + 1/LC}$ → must be moved outside ω_{xb}

for $PM = 60^\circ$

phase contribution from LC poles

$$= -2\tan^{-1}\frac{\omega_{xb}}{\omega_p} \qquad \omega_p = \frac{1}{\sqrt{LC}}$$

$$PM = 90^\circ - 2\tan^{-1}\frac{\omega_{xb}}{\omega_p} = 60^\circ$$

$$2\tan^{-1}\frac{\omega_{ugb}}{\omega_p} = 30^\circ \quad \text{or} \quad \tan^{-1}\frac{\omega_{ugb}}{\omega_p} = 15^\circ$$

$$\frac{\omega_{ugb}}{\omega_p} = \tan 15^\circ = 0.27$$

$$\omega_{ugb} = \frac{\omega_p}{3.7} = \frac{1}{3.7 \times \sqrt{LC}}$$

- for $\frac{1}{R_c C_c}$ dominant pole

$$\omega_{ugb} = A_0 \times \frac{1}{R_c C_c} = \frac{1}{3.7\sqrt{LC}}$$

$$\Rightarrow R_C C_C = A_0 \times 3.7 \times \sqrt{LC}$$

$R_C = 1\,M\Omega$, $\quad \frac{1}{\sqrt{LC}} = 10\ K\,rad/sec$

$$A_0 = 1000$$

$$C_C = \frac{1000 \times 3.7 \times 10^{-8}}{10^3} = 3.7 \times 10^{-7} = 370\,nF$$