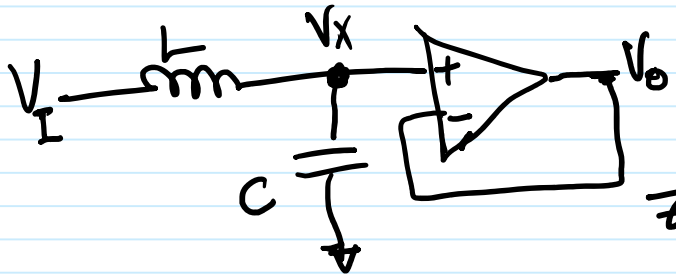
Filters → end

Wednesday, March 6, 2024 4:12 PM



$\frac{V_O}{V_I} = T(s)$

$Z_L = sL$

$Z_C = \frac{1}{sC} = \frac{1}{j\omega C}$

$Z_C = -j\frac{1}{\omega C}$

$$T(s) = \frac{V_O}{V_I}(s) = \frac{V_X}{V_I}(s) = \frac{\frac{1}{sC}}{\frac{1}{sC} + sL} = \frac{1}{s^2LC + 1}$$

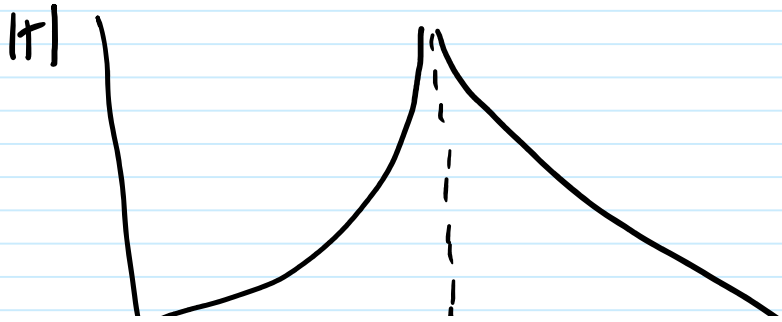
$$T(j\omega) = \frac{1}{-\omega^2 LC + 1} = \frac{1}{1 - \omega^2 LC}$$

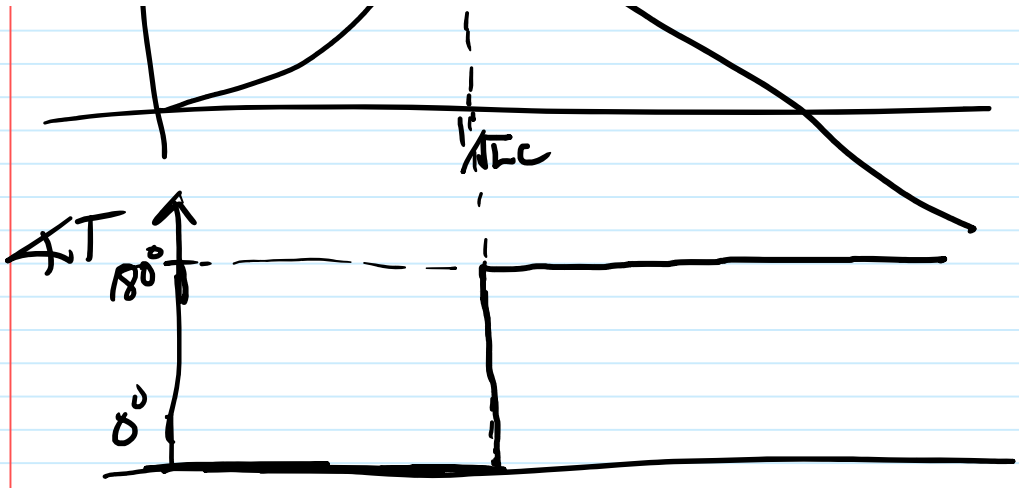
$$|T(j\omega)| = \frac{1}{|1 - \omega^2 LC|}$$

At $\omega = \frac{1}{\sqrt{LC}}$, $|T|$ swaps polarity

	$\omega = 0$	$\omega = \frac{1}{\sqrt{LC}}$	$\omega \to \infty$
$\lvert T \rvert$	1	∞	0

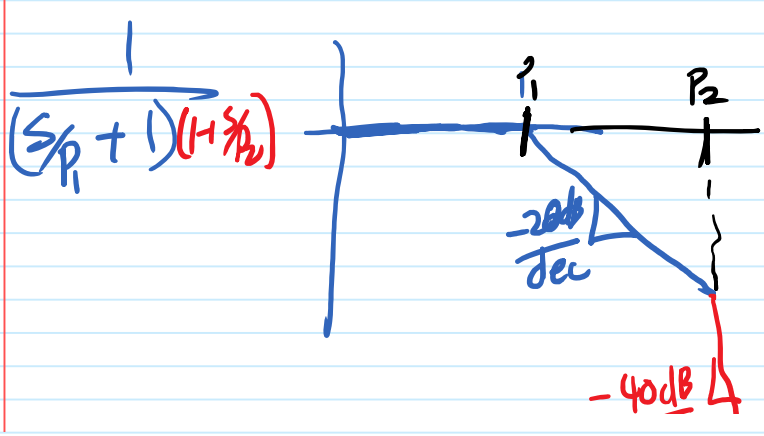
	$\omega \leq \frac{1}{\sqrt{LC}}$	$\omega > \frac{1}{\sqrt{LC}}$
$\angle T$	0	180

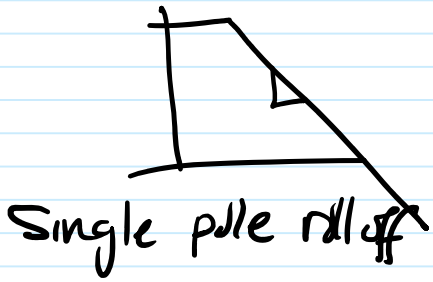




Pole/Zero Approach

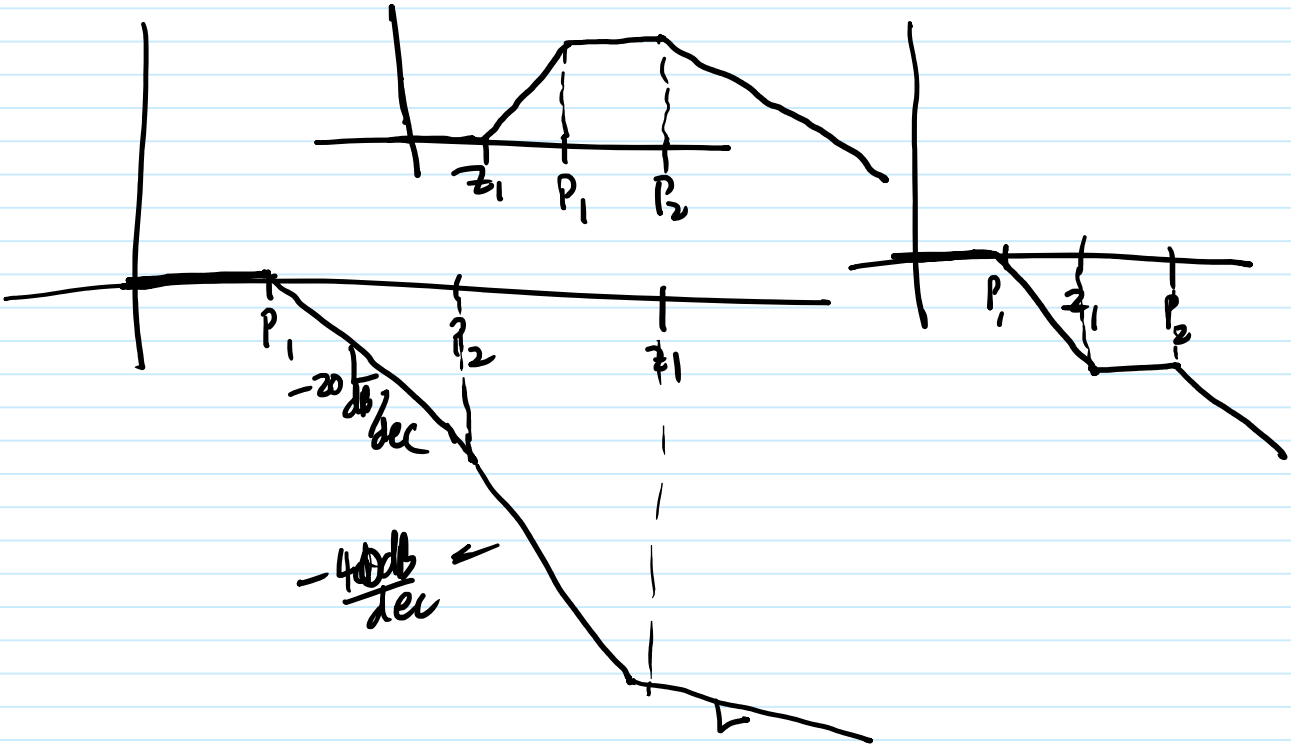
$$T(s) = \frac{(1+s/z_1)(1+s/z_2)}{(1+s/p_1)(1+s/p_2)} = \frac{1+s\left(\frac{1}{z_1}+\frac{1}{z_2}\right)+s^2/z_1z_2}{1+s\left(\frac{1}{p_1}+\frac{1}{p_2}\right)+s^2/p_1p_2}$$



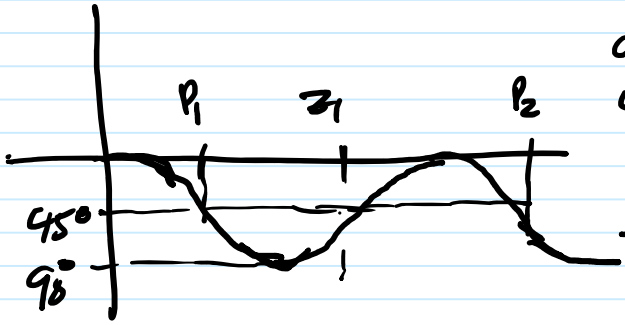


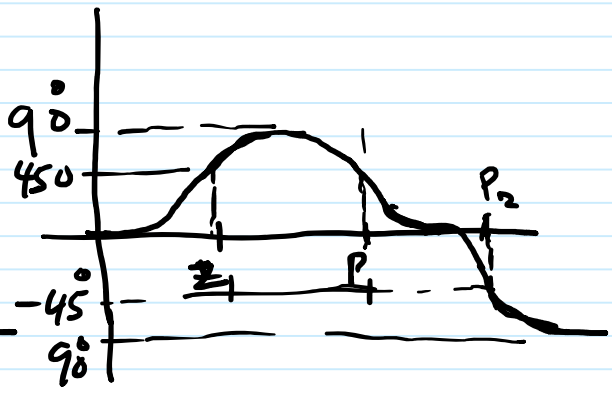
dec

$$\frac{1}{1+\frac{s}{p_1}} \Rightarrow \frac{1}{1+\frac{j\omega}{p_1}} \qquad \frac{1}{\sqrt{1+\left(\frac{\omega}{p_1}\right)^2}}$$



$\angle T$



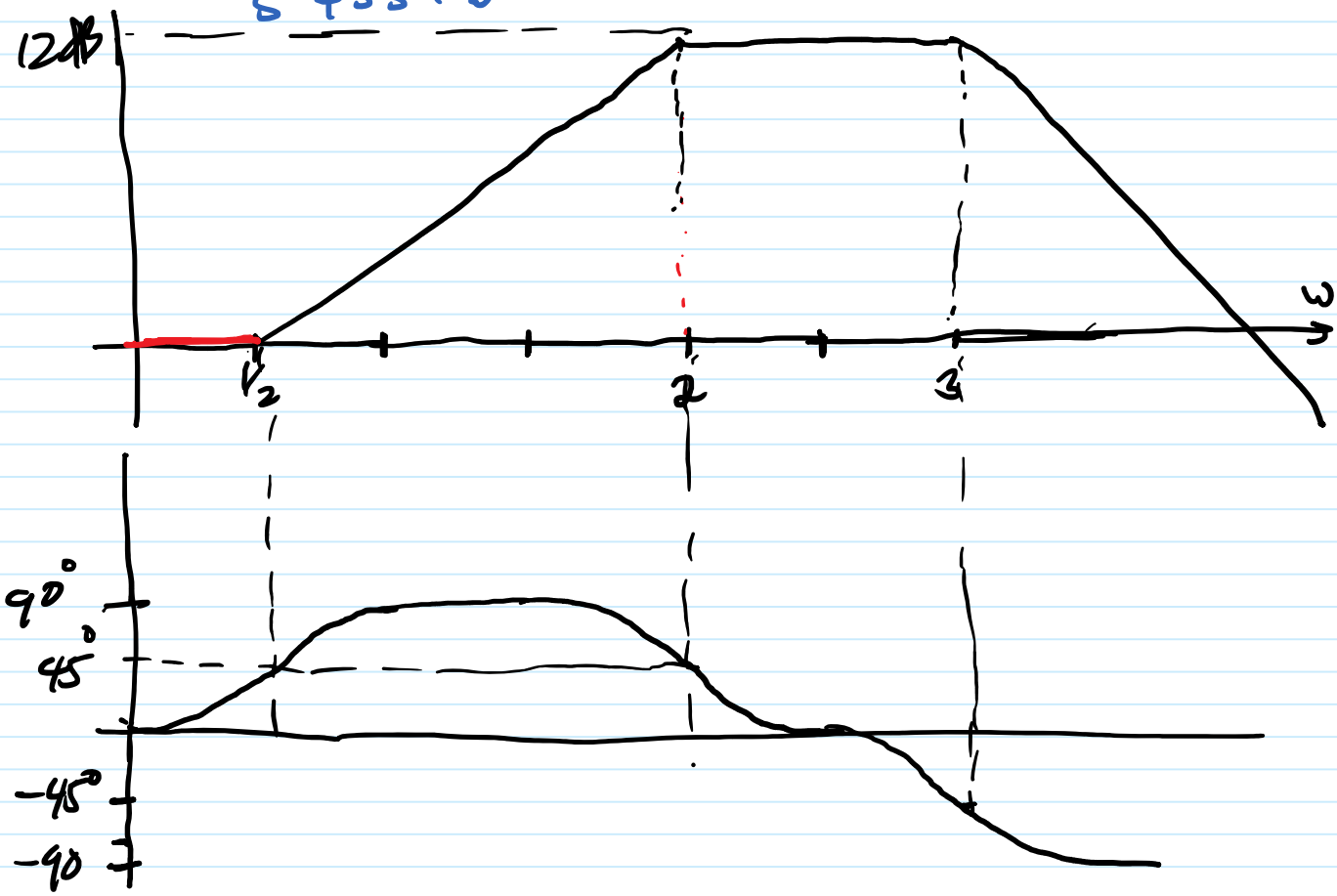


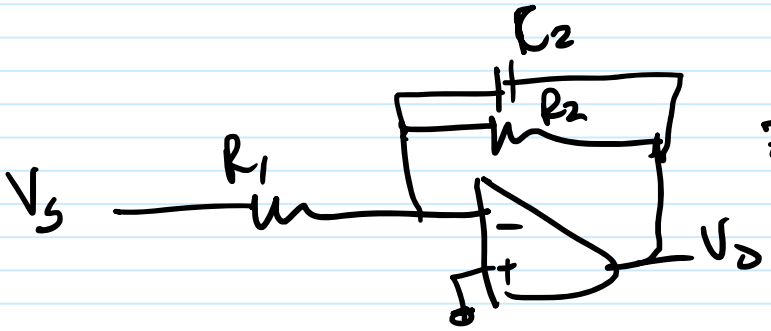
Example #5

$$H = \frac{2s+1}{s^2+5s+6}$$

z: $2s+1=0,\ s=-1/2$

p: $s^2+5s+6=0,\ s=-2,-3$





$$Z_2 = \frac{R_2}{1+sR_2C}$$

$$\frac{V_o}{V_s} = -\frac{Z_2}{Z_1} = \frac{-R_2}{R(1+sR_2C_2)} = -\frac{R_2}{R_1}\frac{1}{1+sR_2C_2}$$

$$T(j\omega) = -\frac{R_2}{R_1}\frac{1}{1+j\omega R_2 C_2}$$

$$|T| = \frac{R_2}{R_1}\frac{1}{\sqrt{1+(\omega R_2 C_2)^2}} \qquad \angle T = 180 - \tan^{-1}(\omega R_2 C_2)$$