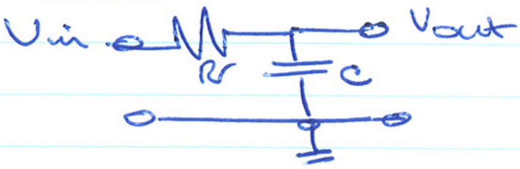
No. OF QUESTION

[illegible] March 2007

ENEL434 Review.

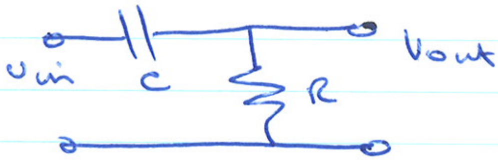
RC networks.

LPF



$$\frac{V_o}{V_{in}} = \frac{1}{1+j2\pi fRC}$$

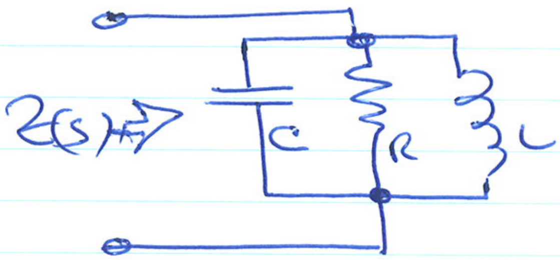
HPF



$$\frac{V_o}{V_{in}} = \frac{j2\pi fRC}{1+j2\pi fRC}$$

In both "cutoff" frequency is $f = \frac{1}{2\pi RC}$

Parallel Resonance



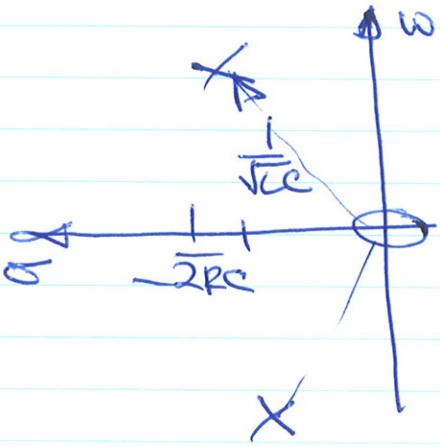
$$Y(s) = \frac{1}{R} + sC + \frac{1}{sL}$$

$$Z(s) = \frac{1}{\frac{1}{R} + sC + \frac{1}{sL}}$$

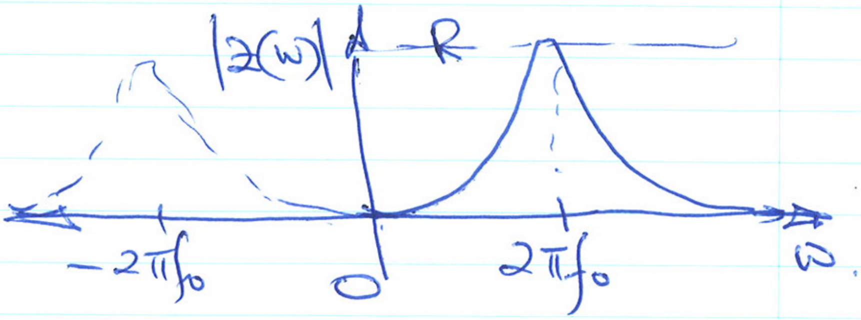
$$= \frac{s/C}{s^2 + \frac{s}{RC} + \frac{1}{LC}}$$

Solve for roots of $s^2 + \frac{s}{RC} + \frac{1}{LC} = 0$

$$s_{1,2} = -\frac{1}{2RC} \pm j\sqrt{\frac{1}{LC} - \left(\frac{1}{2RC}\right)^2}$$



Pole zero plot



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We can also do this completely in the omega domain.

$$Y(\omega) = \frac{1}{R} + j2\pi fC + \frac{1}{j2\pi fL}$$

$$\therefore Z(\omega) = \frac{1}{\frac{1}{R} + j2\pi fC + \frac{1}{j2\pi fL}}$$

$$= \frac{1}{\frac{1}{R} + j\left(2\pi fC - \frac{1}{2\pi fL}\right)}$$

Now when $2\pi f_0 C = \frac{1}{2\pi f_0 L}$

$$Z(\omega) = \frac{1}{\frac{1}{R}} = R.$$