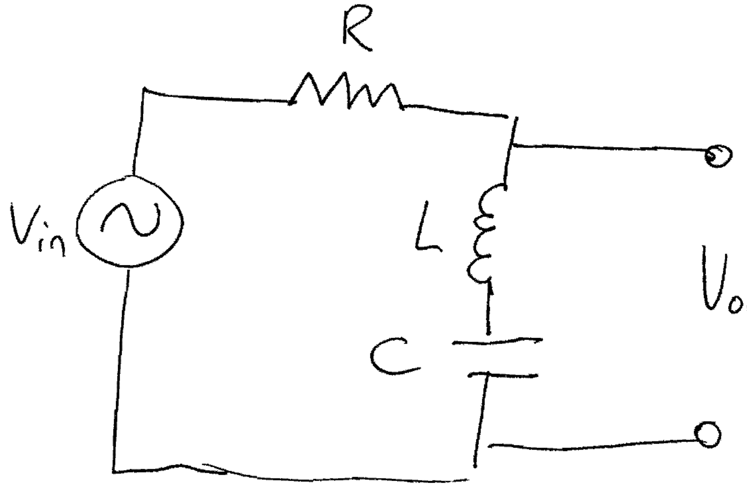
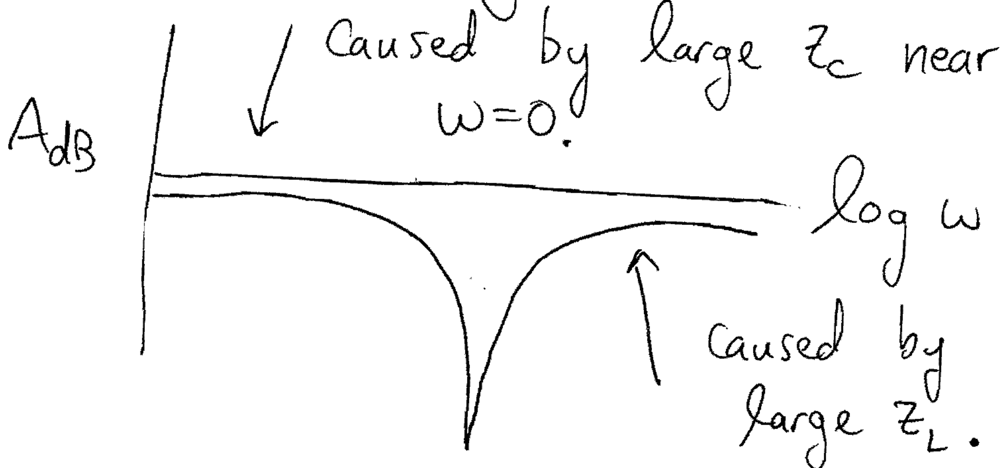
RLC Frequency Response:

Series Circuit:

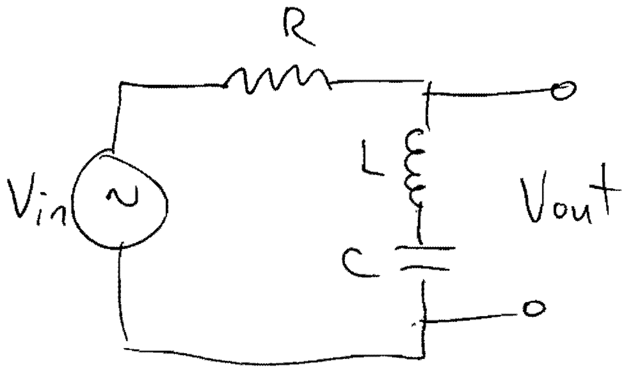


$$V_{out} = \left(\frac{Z_L + Z_C}{Z_L + Z_C + R} \right) V_{in}$$

Remember that high impedance across the circuit element that you're measuring from will result in large V_{out}. Therefore, the circuit above is a notch filter (when measuring from the LC.)



Series RLC transmission function (2)



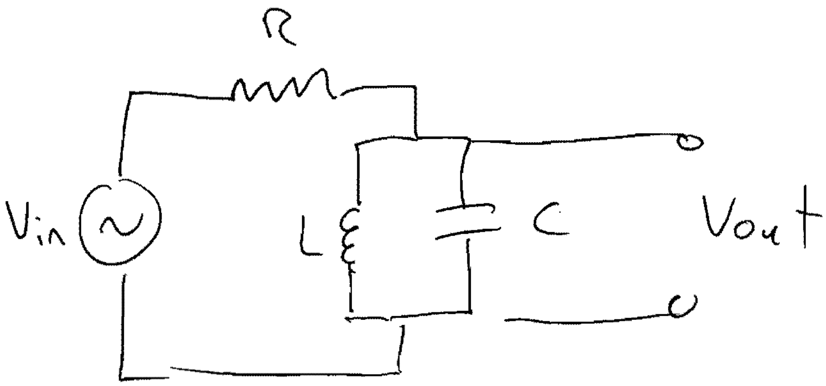
$$A(\omega) = \frac{Z_L + Z_C}{Z_L + Z_C + R}$$

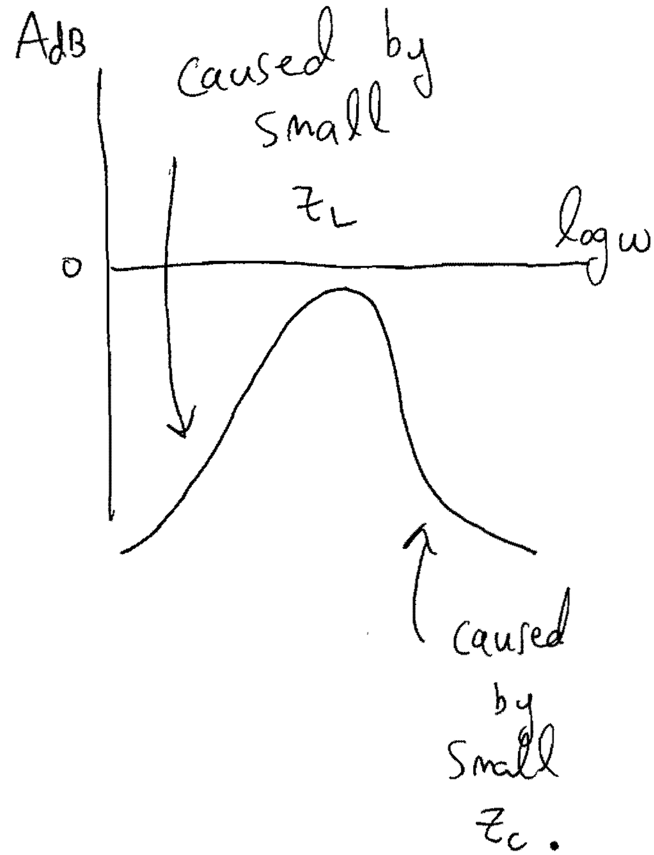
$$A(\omega) = \frac{\left(i\omega L + \frac{1}{i\omega C}\right)}{\left(i\omega L + \frac{1}{i\omega C}\right) + R} = \frac{1}{1 + \frac{R}{i\left(\omega L - \frac{1}{\omega C}\right)}}$$

$$A(\omega) = \frac{1}{1 - \frac{iR}{\left(\omega L - \frac{1}{\omega C}\right)}},$$ put in <u>polar form</u>.

$$A(\omega) = \frac{e^{i \tan^{-1}\left(\frac{R}{\omega L - \frac{1}{\omega C}}\right)}}{\sqrt{1 + \left(\frac{R}{\omega L - \frac{1}{\omega C}}\right)^2}}$$

Parallel RLC Circuit :





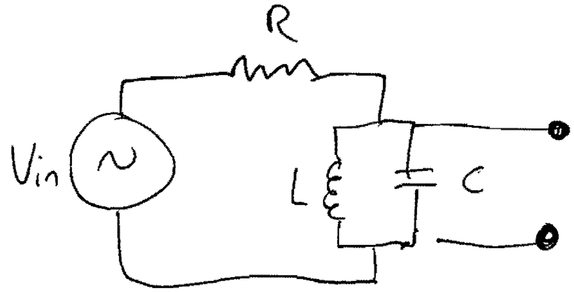
$$A(\omega) = \frac{Z_L \| Z_c}{Z_L \| Z_c + R}$$

$$\frac{1}{Z_{\|}} = \frac{1}{Z_c} + \frac{1}{Z_L} = i\omega C + \frac{1}{i\omega L}$$

$$\frac{1}{Z_{\|}} = i\left(\omega C - \frac{1}{\omega L}\right)$$, therefore

$$\boxed{Z_{\|} = \frac{i}{\left(\frac{1}{\omega L} - \omega C\right)}}$$

plug it in



$$A(\omega) = \frac{Z_{11}}{Z_{11} + R}$$

$$A(\omega) = \frac{\dfrac{i}{\left(\frac{1}{\omega L} - \omega C\right)}}{\dfrac{i}{\left(\frac{1}{\omega L} - \omega C\right)} + R} = \frac{1}{1 + \dfrac{R\left(\frac{1}{\omega L} - \omega C\right)}{i}}$$

$$A(\omega) = \frac{1}{1 - i R\left(\frac{1}{\omega L} - \omega C\right)}$$

$$A(\omega) = \frac{e^{i \tan^{-1}\left(R\left(\frac{1}{\omega L} - \omega C\right)\right)}}{\sqrt{1 + R^2\left(\frac{1}{\omega L} - \omega C\right)^2}}$$