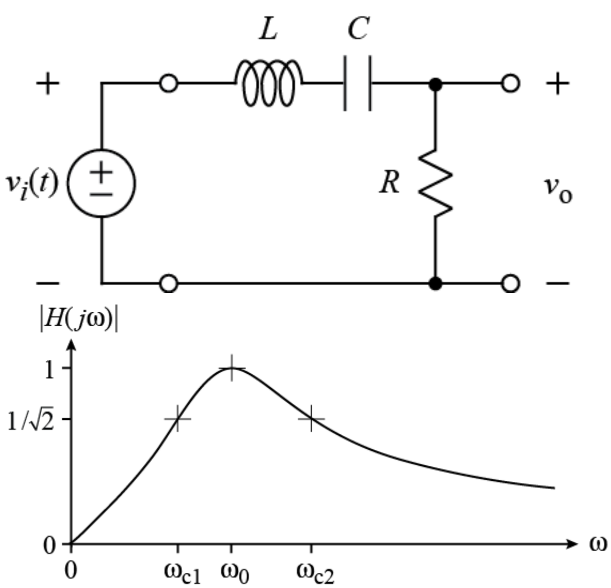
TOOL: The *RLC* circuits shown below act as two-pole band-pass filters.

Series or parallel *LC*: $\omega_0^2 = \dfrac{1}{LC}$ (resonant frequency; $z_L = -z_C$)

$$\omega_{c1} = -\alpha + \sqrt{\alpha^2 + \omega_0^2} \quad \text{(lower cutoff frequency)}$$

$$\omega_{c2} = \alpha + \sqrt{\alpha^2 + \omega_0^2} \quad \text{(higher cutoff frequency)}$$

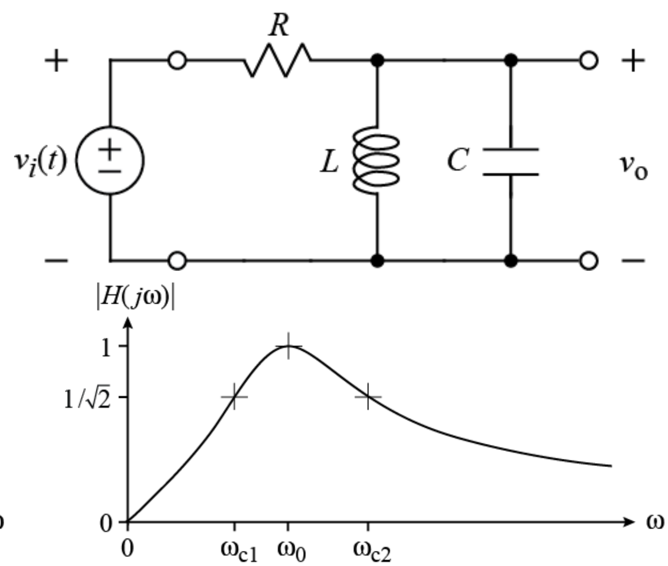
Series *LC*: $\alpha = \dfrac{R}{2L}$



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

Fig. 1. Series *LC* band-pass filter.

Parallel *LC*: $\alpha = \dfrac{1}{2RC}$



$$H(j\omega) = \frac{j\omega L \,\|\, \dfrac{1}{j\omega C}}{R + j\omega L \,\|\, \dfrac{1}{j\omega C}} = \frac{1}{1 + jR\left(\omega C - \dfrac{1}{\omega L}\right)}$$

Fig. 2. Parallel *LC* band-pass filter.

TOOL: The *RLC* circuits shown below act as two-pole band-reject filters.

Series or parallel *LC*:

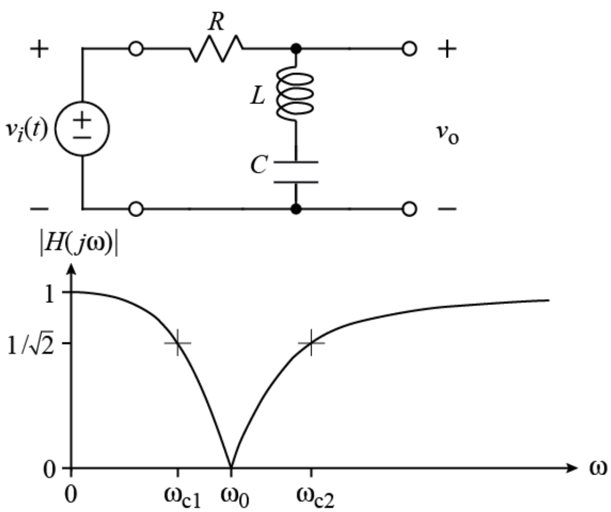
$$\omega_0^2 = \frac{1}{LC} \quad \text{(resonant frequency; } z_L = -z_C\text{)}$$

$$\omega_{c1} = -\alpha + \sqrt{\alpha^2 + \omega_0^2} \quad \text{(lower cutoff frequency)}$$

$$\omega_{c2} = \alpha + \sqrt{\alpha^2 + \omega_0^2} \quad \text{(higher cutoff frequency)}$$

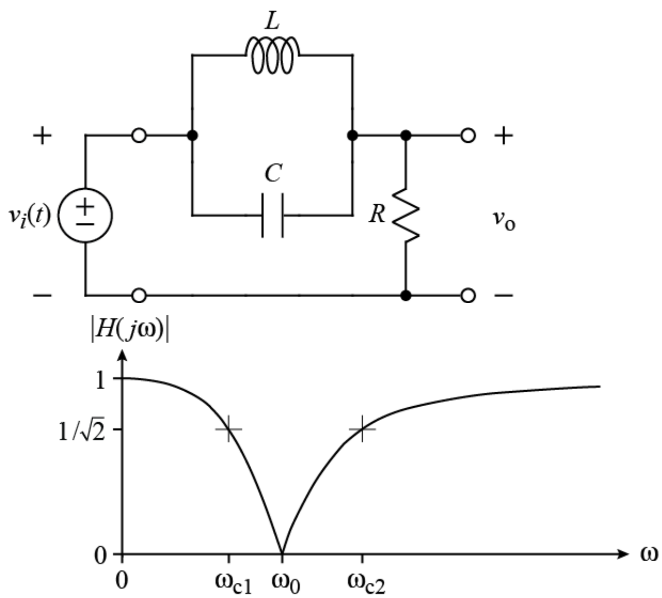
Series *LC*: $\alpha = \dfrac{R}{2L}$

Parallel *LC*: $\alpha = \dfrac{1}{2RC}$



$$H(j\omega) = \frac{j\omega L + \dfrac{1}{j\omega C}}{R + j\omega L + \dfrac{1}{j\omega C}} = \frac{1}{1 - jR\left(\dfrac{1}{\omega L - \dfrac{1}{\omega C}}\right)}$$

Fig. 1. Series *LC* band-reject filter.



$$H(j\omega) = \frac{R}{R + j\omega L \,\|\, \dfrac{1}{j\omega C}} = \frac{1}{1 - j\dfrac{1}{R}\left(\dfrac{1}{\omega C - \dfrac{1}{\omega L}}\right)}$$

Fig. 2. Parallel *LC* band-reject filter.