相对通频带与半功率点推导

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有：$I=\dfrac{U_s}{\sqrt{R^2+(\omega L-\frac{1}{\omega C})^2}}$ $Q=\frac{1}{R}\sqrt{\frac{L}{C}}$.

$I_0=\frac{U_s}{R}$，则：$\dfrac{I}{I_0}=\dfrac{1}{\sqrt{1+[\frac{1}{R}(\omega L-\frac{1}{\omega C})]^2}}$，此时：

①：当

$\frac{1}{R}(\omega L-\frac{1}{\omega C})=\pm 1$ 时

有：$\omega L-\frac{1}{\omega C}=\pm R$，则

⑴ $\omega_1 L-\frac{1}{\omega_1 C}=R$ ⑵ $\omega_2 L-\frac{1}{\omega_2 C}=-R$.

从而有：

$$\frac{\omega_1}{\omega_0}\sqrt{\frac{L}{C}}-\frac{\omega_0}{\omega_1}\sqrt{\frac{L}{C}}=R \rightarrow \frac{\omega_1}{\omega_0}-\frac{\omega_0}{\omega_1}=\frac{1}{Q}$$

同样：$\frac{\omega_2}{\omega_0}-\frac{\omega_0}{\omega_2}=-\frac{1}{Q}$.

联立：$\frac{\omega_2}{\omega_0}-\frac{\omega_0}{\omega_2}=\frac{\omega_0}{\omega_1}-\frac{\omega_1}{\omega_0}$，

$$\frac{\cancel{\omega_1+\omega_2}}{\omega_0}=\omega_0\left(\frac{\cancel{\omega_1+\omega_2}}{\omega_1\omega_2}\right) \Longrightarrow \omega_1\omega_2=\omega_0^2 \quad ①.$$

又：$\frac{\omega_1-\omega_2}{\omega_0}-\omega_0\left(\frac{\omega_2-\omega_1}{\omega_1\omega_2}\right)=\frac{2}{Q}$

$$\frac{\cancel{2}(\omega_1-\omega_2)}{\omega_0}=\frac{\cancel{2}}{Q} \Longrightarrow \Delta\omega=\boxed{\omega_1-\omega_2=\frac{1}{Q}\omega_0}$$

为相对通频带，

对应地，半功率点处：

$$P_1=P_2=\frac{U^2}{R}=I^2R\xrightarrow{I=\frac{1}{\sqrt{2}}I_0}=\frac{1}{2}I_0^2R=\frac{1}{2}P$$