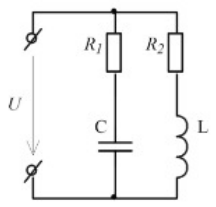
Daria Khaetskaya task 3



1)

$$G_э = \frac{1}{R_1 + \frac{1}{j\omega C}} + \frac{1}{R_2 + j\omega L} = \frac{R_1 - \frac{1}{j\omega C}}{\left(R_1 + \frac{1}{j\omega C}\right)\left(R_1 - \frac{1}{j\omega C}\right)} + \frac{R_2 - j\omega L}{(R_2 + j\omega L)(R_2 - j\omega L)} =$$

$$= \left[\frac{R_1}{R_1^2 + \frac{1}{\omega^2 C^2}} + \frac{R_2}{R_2^2 + \omega^2 L^2} + j\left(\frac{\frac{1}{\omega C}}{R_1^2 + \frac{1}{\omega^2 C^2}} - \frac{\omega L}{R_2^2 + \omega^2 L^2} \right) \right]$$

Усл. резонанса: импеданс действит. $\Rightarrow$ $\frac{\frac{1}{\omega_p C}}{R_1^2 + \frac{1}{\omega_p^2 C^2}} = \frac{\omega_p L}{R_2^2 + \omega_p^2 L^2}$

$$\frac{R_2^2}{\omega_p C} + \frac{\omega_p L^2}{C} = R_1^2 \cdot \omega_p L + \frac{L}{\omega_p C^2} \quad \Big| \cdot \omega_p C$$

$$R_2^2 + \omega_p^2 L^2 = R_1^2 \cdot \omega_p^2 LC + \frac{L}{C}$$

$$\omega_p^2 (L^2 C - R_1^2 L C^2) = L - R_2^2 C$$

$$\omega_p^2 = \frac{1}{LC} \frac{L - R_2^2 C}{L - R_1^2 C}$$

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$$\left[\omega_p = \omega_0 \sqrt{\frac{\rho^2 - R_2^2}{\rho^2 - R_1^2}} \right]$$

При $\omega = \omega_p$ $\quad G_{э.р.} = \frac{R_1}{R_1^2 + \frac{1}{\omega^2 C^2}} + \frac{R_2}{R_2^2 + \omega^2 L^2} = \frac{R_1 + R_2}{\rho^2 + R_1 \cdot R_2}$

Тогда $R_{эр.} = \frac{1}{G_{э.р.}} = \frac{\rho^2 + R_1 R_2}{R_1 + R_2}$

$$\left[Q = \frac{R_{э.р}}{\rho} = \frac{\rho^2 + R_1 R_2}{(R_1 + R_2)\rho} \right]$$

2. При $R_1, R_2 \ll \rho$
   - $Q \simeq \frac{\rho}{R_1 + R_2}$
   - $\omega_p \simeq \omega_0$
   - $G_{э.р} \simeq \frac{R_1 + R_2}{\rho^2}$

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