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Resonance Quality factor

What is Quality Factor

In Resonant circuits the quality factor Q is defined as the ratio of reactive to average power

$$Q = \frac{\text{Reactive Power}}{\text{Average Power}}$$

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Quality factor in Resonant Circuits

At resonance the reactive power of the inductor is equal to the reactive power of the capacitor. The Quality factor Q can be expressed in terms of reactive power of either the inductor or capacitor

Mathematically

$$Q_s = \frac{I^2 X_L}{I^2 R} = \frac{X_L}{R}$$



Quality factor in Resonant Circuits

By multiplying and dividing equation by I

$$Q_s = \frac{I \cdot X_L}{I \cdot R}$$

$$I \cdot X_L = V_L$$

$$I \cdot R = E$$

$$Q_s = \frac{V_L}{E} \text{ OR } V_L = Q_s E$$

At resonance $V_L = V_C = Q_s E$



Quality factor in Resonant Circuits

In resonant circuits the voltage across reactive elements can be higher than the applied source voltage.

The reason is that Q in resonant circuit can be larger than 1



Quality factor in Resonant Circuits

Due to this reason while dealing with resonant circuits one should ensure that reactive elements are capable to handle the expected voltages and currents



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