**BASIC PRINCIPLES**

Any change in the current through a coil induces a voltage which acts such as to oppose the change in current. If an alternating current flows, an AC voltage will be induced, which is shifted in phase with respect to the current. In mathematical terms, the relationship can be expressed most easily if current, voltage and impedance are regarded as complex values, whereby the real components need to be considered.

The relationship between current and voltage for a coil is as follows:

\[ U = I \frac{df}{dt} \]

- \( I \): Current, \( U \): Voltage, \( L \): Inductance

Assume the following voltage is applied:

\[ U = I_0 \exp(2\pi f t) \]

This gives rise to a current as follows:

\[ I = \frac{U_0}{2\pi L} \exp(2\pi f t) \]

The impedance associated with the inductor \( L \) can then be defined as in the following equation:

\[ Z_L = \frac{U_0}{I_0} \exp(2\pi f t) \]

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The real component of this is measurable, therefore

\[ U = U_L \cos(\omega t) \]

As per equation (4), the inductive impedance \( Z_L \) is proportional to the frequency \( f \) and the inductance \( L \). In the relevant graphs, the measurements therefore lie along a straight line through the origin within the measurement tolerances.

The phase of the current through the coil is 90° behind that of the voltage, since every change in current induces an opposing voltage.

**REQUIRE APPARATUS**

Any change in the current through a coil induces a voltage which acts such as to oppose the change in current. If an alternating current flows, an AC voltage will be induced, which is shifted in phase with respect to the current. In mathematical terms, the relationship can be expressed most easily if current, voltage and impedance are regarded as complex values, whereby the real components need to be considered. In this experiment, a frequency generator supplies an alternating voltage with a frequency of up to 2 kHz. A dual-channel oscilloscope is used to record the voltage and current, so that the amplitude and phase of both can be determined. The current through the coil is given by the voltage drop across a resistor with a value which is negligible in comparison to the inductive impedance exhibited by the coil itself.