Canadian Amateur Radio Operator Guide
Advanced

Contents

Keywords

farad The unit of capacitance (symbol: F), 1 farad is the capacitance of a capacitor that has a charge of 1 coulomb when applied voltage drop of 1 volt.

henry The unit of inductance (symbol: H), 1 henry is the amount of inductance that causes a voltage of one volt, when the current is changing at a rate of one ampere per second.

RC circuit A resistor–capacitor circuit (RC circuit), or RC filter or RC network, is an electric circuit composed of resistors and capacitors driven by a voltage or current source. A first order RC circuit is composed of one resistor and one capacitor and is the simplest type of RC circuit.

RL circuit A resistor–inductor circuit (RL circuit), or RL filter or RL network, is an electric circuit composed of resistors and inductors driven by a voltage or current source. A first-order RL circuit is composed of one resistor and one inductor and is the simplest type of RL circuit.

1 Advanced Theory

1.1 RC circuits

1.1.1 Time constant

The time constant of an RC circuit (in seconds), is equal to the product of the circuit resistance (in ohms) and the circuit capacitance (in farads).

$$\tau = R \cdot C$$

For example:

$$6s = 2\Omega \cdot 3F$$

It is the time required to:

- **charge** the capacitor from an initial charge voltage of zero to approximately **63.2%** of the value of an applied DC **voltage**, or
- **discharge** the capacitor to approximately **36.8%** of its initial charge **voltage**.

1.2 RL circuits

1.2.1 Time constant

The time constant of an RL circuit (in seconds), is equal to the circuit inductance (in henries) divided by the circuit resistance (in ohms).

$$\tau = L/R$$

For example:

$$3s = 6H/2\Omega$$

It is the time required to:

- **build** the current in the **circuit** up to **63.2%** of its maximum value.

1.2.2 Back EMF

Back EMF or 'counter electromotive force' is the voltage induced by changing current in an inductor. It is the force opposing changes in current through inductors. **Back EMF** is **A voltage that opposes the applied EMF**.