4.2 Capacitor and Inductors.md

##### Capacitor and Inductor

A capacitor consists of two conducting plates separated by an insulator (or dielectric).

**The amount of charge stored**, represented by *q*, is directly proportional to the applied voltage *v* so that

$$q = Cv \\1 farad =1 coulomb/volt$$

To obtain the current-voltage relationship of the capacitor, we take the derivative of both sides,

differentiating both sides of Eq above gives

Note from Eq. above that when the voltage across a capacitor is not changing with time (i.e., dc voltage), the current through the capacitor is zero.

The voltage-current relation of the capacitor can be obtained by integrating both sides of Eq. . We get

A capacitor is an open circuit to dc.

The voltage on a capacitor cannot change abruptly.

**The voltage on the capacitor must be continuous.**

Any conductor of electric current has inductive properties and may be regarded as an inductor.

An inductor consists of a coil of conducting wire.

If current is allowed to pass through an inductor, it is found that the voltage across the inductor is directly proportional to the time rate of change of the current. Using the passive sign convention,

Inductance is the property whereby an inductor exhibits opposition to the change of current flowing through it, measured in **henrys (H)**.

For a *nonlinear inductor*, the plot will not be a straight line because its inductance varies with current. We will assume linear inductors in this textbook unless stated otherwise. The current-voltage relationship is obtained as

$$d i = \frac { 1 } { L } v d t\\i = \frac { 1 } { L } \int \_ { - \infty } ^ { t } v ( \tau ) d \tau$$

An inductor acts like a short circuit to dc.

The current through an inductor cannot change instantaneously.