LC Resonant Circuit

Fluxion Example Description

1 Theory

A resonant circuit consisting of a capacitor with capacitance C and a coil with inductance L is set up (see picture).

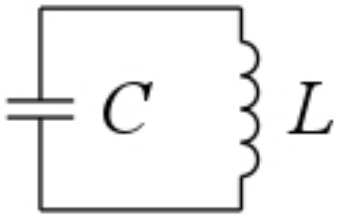

Abb. 1: LC Circuit.
Source: By Saure - Own Work, Public domain, https://commons.wikimedia.org/w/index.php?curid=6893307

The capacitor is provided with an initial charge, this is given by:

$$Q = C \cdot U \tag{1}$$

Alternatively, an initial current through the coil can be specified.
Now, for the case of an initial charge in the capacitor, the capacitor starts to discharge and provides a current through the coil, which builds up a magnetic field (to oppose the change in magnetic field caused by the current in the coil). After complete discharge of the capacitor, the entire energy is now stored in the magnetic field of the coil and the process reverses. The energy is periodically exchanged between the electric and magnetic fields.

2 Mathematical Derivation

The general relationship between charge and current is given by:

$$Q' = I \tag{2}$$

The equivalent of Ohm's Law for an inductor is:

$$U_{ind} = L \cdot I' \tag{3}$$

After applying Kirchhoff's Loop Rule, we get:

$$U_C + U_L = 0 \tag{4}$$

Substituting Equations (3) and (1) into Equation (4) one obtains:

$$I' = -\frac{1}{L \cdot C} \cdot Q \tag{5}$$