"A Special Consideration of Capacitors and Coils",
when subjected to
"Controlled Current Sources"

Introduction:

Key words:

Rate of Flow & Container Volume (Capacity)

Rate of Change vs Current Flow

Rate of Change vs CEMF

Review of some definitions:

1 Amp is a flow of 1 Coulomb per second

1 Coulomb (besides being a quantity) is 6.24 x 10^{18} electrons (i.e. a "bucket-full")

1 Farad will hold 1 Coulomb at 1 Volt

1 Henry will develop 1 Volt CEMF against a change of 1 ampere per second, as a Rate of Change

Things to look for:

We are going to discover a case where a constant causes a rate change, and

we are going to discover another case where a rate change causes a constant.

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Remember that Capcitors react to voltage changes by drawing or discharging current, and that Inductors react to changes in current by opposing the voltages by CEMF, but what happens to a Capacitor if we deliberatly control the current being fed to a capacitor? And what happens to the CEMF of an Inductor if we don't change the current? What determines the CEMF of an Inductor if we increase or decrease the rate of change?

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Now, where are we going with this?

How about an ultra-simple example for a start:

Example #1:

Imagine a container of a capacity of 5 gallons, currently empty, being filled at a rate of 1 gal/min.

Here we have rate of flow, the amount of content determined by simple mathematics. (Although there is an association with presure in various ways)

Example #2:

Imagine a container for compressed dry air, with a pump supplying a flow of air at a consistant rate. The container not only consists of volume, but also pressure build at a predicatable value.

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Feeding a Capacitor with a Constant Current

Now, if we take a capacitor with a known "Capacity", totally discharged, and feed this capacitor with a "Constant Current", it will charge at a determined linear "Rate of Change" of the Voltage.

Note that here a constant current will cause a "Rate of Change of the Voltage" of the Capacitor. (As there is a collection of electrons on one side and displacement of electrons on the other side)

If we alter the value of the "Constant Current", we will find that the "Rate of Change" of the charging voltage (i.e. The slope) will change accordingly.

Consider that even a constant flow of 1 microamp, charging a 1 microfarad capacitor, will reach a charge of 1microvolt in 1 second. The rate of change will be linear over the full time.

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Feeding a Capacitor with a Changed, but Otherwise Constant Current

Note particullary that the "Rate of Change" (i.e. Rate of Charge) will be altered to be less (lower slope) or more (higher slope), depending on the actual value of current.

Final Note:
With the Capcitor, the "Rate of Change" (of the Capacitor's Voltage) occurs depending on the value of the charging current.

Feeding an Inductor with a Constant Current

Once a current value is established, and stays constant, there will be no CEMF created.

As the Inductor is not a storage unit, ther is no "Collective Value" to consider, except with the energy stored in the magnetic field.

Feeding an Inductor with an Increasing Current "Rate of Change"

However, if current is being increased at a linear rate, the CEMF with be a constant value, based on the "Rate of Change" and the "Inductive Value". If the"Rate of Change" is doubled, the amount of CEMF will also double

Note particullary that the "Rate of Change" (i.e. Rate of Current Change, as a higher or lower slope) will cause a "Consistant CEMF" of the Inductor

Final Note:
With the Inductor, the "Rate of Change" (of the increase or decrease of current) will determine the "Constant Value of the CEMF"

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