Re: Resistive load / Inductive Load ??

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news wrote:

>
> *Can someone tell me what a Resistive Load and Inductive Load are ??*
> *Im thinking a light bulb is a resistive load. After that Im not sure ?*
>
> *Thanks.*

Ideal resistors have a fixed ratio between the voltage across them and current through them. The value of this ratio is called the resistance of the device. So volts per ampere is also know as ohms. This applies to any waveform, instantaneously, from DC to radio frequencies. There are no actual ideal resistors, but many metals and oxides are pretty good approximations over some temperature range. Light bulb filaments are only described by a single value of resistance over a very small range of temperature, such as the variations within a single AC line cycle. They may have an operating temperature resistance as high as 10 times their room temperature resistance. The important difference between resistive and inductive loads is that resistances do not store electrical energy, so when you interrupt the voltage across them, the current falls to zero, essentially instantaneously.

Inductive loads store energy in magnetic fields that is proportional to the square of the current, or
E= 1/2 * L * I^2
Where E is the stored energy is in joules or watt seconds,
L is the inductance in henries
and I is the current in amperes.

For a pure inductance (most inductive loads, except for super conducting ones, also have resistive losses, so are not pure inductance) there is a different relationship between voltage and current than the simple ratio that resistors have.
V = L* (di/dt)
Where V is the volts across the inductor,
L is the inductance in henries
and di/dt is the rate of change of the current through the inductor in amperes per second

Note that this formula tells you nothing about the current except for how it will change value as voltage is applied.

When an inductor is connected to a DC voltage, the current starts at zero and ramps up at a constant rate determined by the voltage (more increases the rate of change) and the inductance (more decreases the rate of change).

When a real inductive load that also includes some series resistance is connected to a DC voltage, the inductance initially is the limiting factor and sets the current rate of change. But as the current ramps up, the internal resistance starts using up some of the applied voltage so the effective voltage across the inductive part of the load gets smaller, so the rate of change of the current slows, also. The actual current rises as an exponential with a time constant (which is L/R) to a final current that doesn't involve the inductance at all, but is just determined by the resistance and Ohm's law. This pretty accurately describes a relay coil being energized by DC.

The practical upshot of this characteristic of an inductive load is that the switch turning it on does not have to handle a sudden current rise, since the current ramps up smoothly, after the switch is closed, making it easier on the switch than if it was switching on instantaneous full current into a resistor or a big inrush current into a cold bulb filament.

Turning that current off, is another matter. The only way to get an infinite rate of change from steady state (or any other) value to zero in zero time, requires an infinite reverse voltage to be applied ot the inductor for zero time. This, of course is very difficult to arrange. But if you just open a set of contacts or turn off a transistor in series with the inductance, the inductance generates a very large voltage to ramp the current back down very fast. There is no other way the current can change quickly. This high generated voltage can be very hard on both mechanical contacts and transistors. So practical switches have to make provisions to limit this voltage by allowing a path for the decaying current, or handle the arching the voltage produces.

If the inductance is driven by an AC voltage, things get even more interesting, since the switch on and off can take place at different points in the AC cycle and the current, of course does not reach a steady state value, except as a steady state AC amplitude. But throughout any case, the V=L*(di/dt) applies. Are you ready for AC?

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John Popelish