# RL Time Constant

You should have already read the section/paper on RC time constant before reading this paper.

An RL time constant is a metric associated with an RL circuit, which contains a resistor and an inductor. It is analogous to the RC time constant for RC circuits.

RL circuits can be wired in series or parallel, although the series wiring is more common.

Inductors resist current initially due to the back-EMF generated as the result of Lenz's law of electromagnetism, while the voltage on an inductor is immediately close to full input voltage in a series RL circuit; thus the voltage across the inductor leads the current through the inductor. This is the opposite behavior of the capacitor in a series RC circuit, where the voltage across the capacitor lags the current flow through the capacitor.

The series circuit is a voltage divider. The voltage across the inductor starts out at the input voltage, then reduces exponentially toward zero. The voltage across the resistor starts out near zero, and increases exponentially approaching the input voltage. At the amount of time called the RL time constant, the value of current that flows through the circuit increases to 63.2 percent of the maximum current. Also, the voltage across the inductor is 36.8 percent of the applied voltage. This relationship is related to but opposite that of the RC circuit, where the voltage across the capacitor increases over time and the current through the capacitor decreases over time.

The RL time constant is equal to the inductance of the inductor in henrys divided by the resistance of the resistor in ohms. The formula for the RL time constant is t (tau) = L / R.

 Bob McDonald