

RC & RL Transients

Electrical Engineering

One exponential describes every first-order circuit, whatever is charging or decaying.

A first-order circuit moves from its initial value to its final value on one exponential.

$$x(t) = x_{\infty} + (x_0 - x_{\infty}) \exp(-t/\tau) \cdot \tau = RC = L/R$$

10 k Ω with 1 μ F

$\tau = 10$ ms

RC.

After one τ

63.2% of the change

After five τ

99.3% settled

Treated as done.

THE COMMON MISTAKE

× Using $\tau = LR$ for an inductive circuit

✓ $\tau = L/R$

Inductance divided by resistance has units of seconds; the product does not.
The dual of RC is L over R.

Capacitor voltage and inductor current cannot change instantaneously.
Every other quantity in the circuit can.