INDUCTANCE

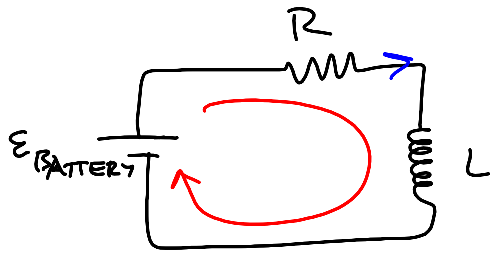
$$\mathcal{E} = -\frac{d\Phi_B}{dt}$$

$$= -\frac{d}{dt}\left(\frac{\mu_0 N I}{d}\pi R^2\right)$$

$$= -\underbrace{\left(\frac{\mu_0 N}{d}\pi R^2\right)}_{=L}\frac{dI}{dt}$$

$$\mathcal{E} = -L\frac{dI}{dt}$$

RL Circuits



$$\Delta V_{Battery} + \Delta V_{Resistor} + \Delta V_{Inductor} = \emptyset$$

$$+\mathcal{E}_{Battery} - IR - L\frac{dI}{dt} = \emptyset$$

$$+\mathcal{E}_{Battery} - IR = L\frac{dI}{dt}$$

$$\frac{dI}{dt} = \frac{\mathcal{E}_{Batt} - IR}{L} \left(\frac{1}{R}\right)$$

$$\frac{dI}{dt} = \frac{\mathcal{E}_{BATT}/R - I}{L/R}$$

$$\frac{dI}{\mathcal{E}_{BATT}/R - I} = \frac{dt}{L/R}$$

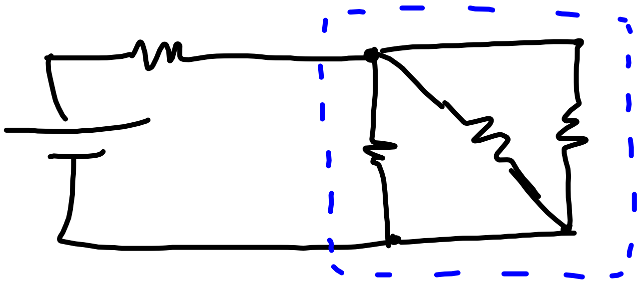
$$\int \frac{dI}{I - \mathcal{E}_{BATT}/R} = \int - \frac{dt}{L/R}$$

$$e^{\ln\left(\frac{I - \mathcal{E}_{BATT}/R}{\mathcal{E}_{BATT}/R}\right)} = e^{-\frac{t}{L/R}}$$

$$\frac{I - \mathcal{E}_{BATT}/R}{\mathcal{E}_{BATT}/R} = e^{-t/(L/R)}$$

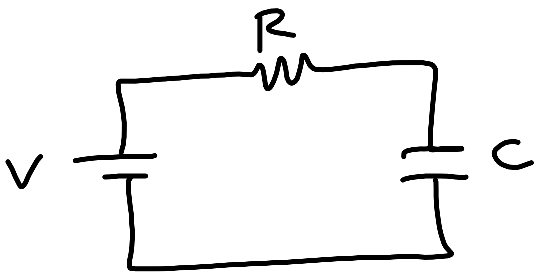
$$I - \mathcal{E}_{BATT}/R = \frac{\mathcal{E}_{BATT}}{R} e^{-t/(L/R)}$$

$$I = \frac{\mathcal{E}_{BATT}}{R}\left[1 - e^{-t/(L/R)}\right]$$



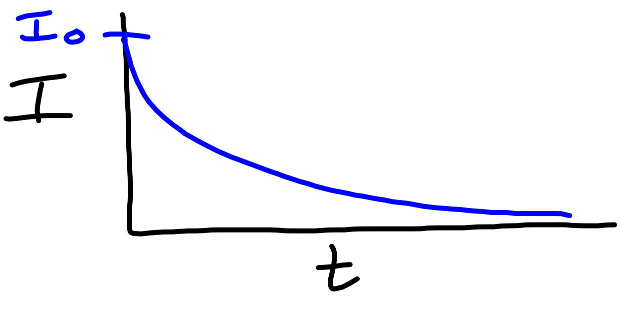
All parallel

RC CIRCUIT

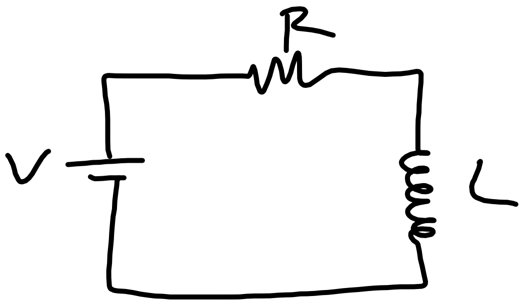


Charging:

$$I = \frac{V}{R}\left(e^{-t/RC}\right)$$



RL CIRCUIT



Charging:

$$I = \frac{V}{R}\left(1 - e^{-\frac{Rt}{L}}\right)$$