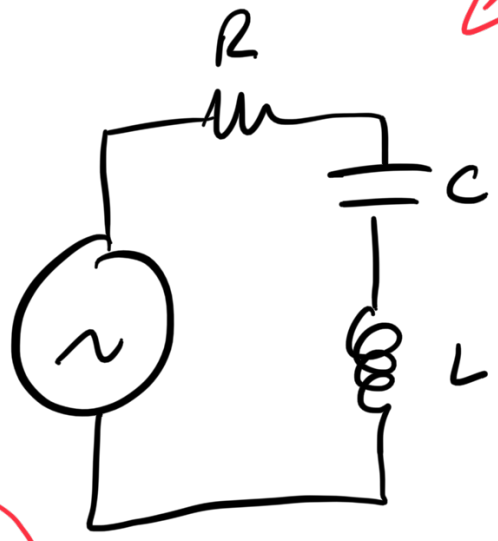
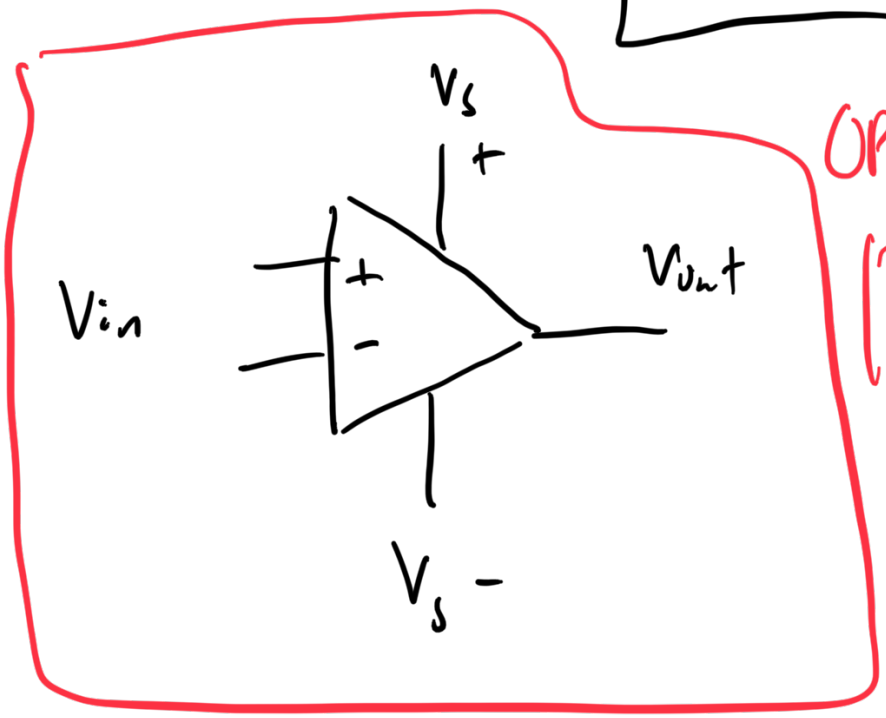
Physics 421 - Lecture 28

Electronics →

RLC →





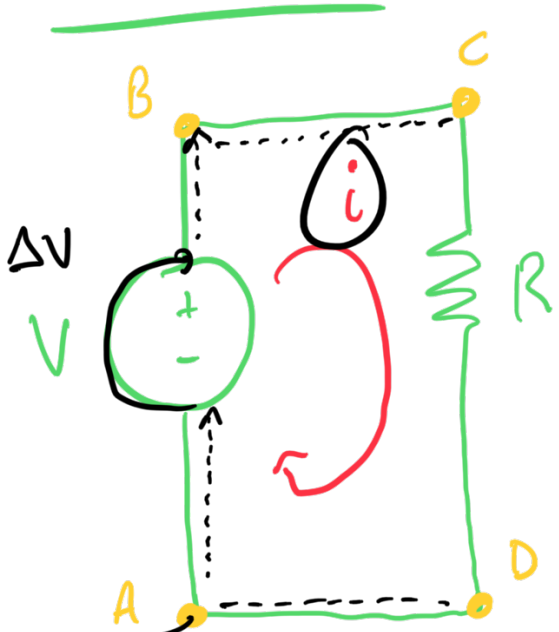
OP AMP

Simulate

DC circuits

V → DC battery.

AA



I have no idea!!

Voltage at a point in a circuit

vs. ΔV across an element of the circuit.

$\vec{x}$ vs. $\Delta\vec{x}$

$V_A = 0$

$V_B = V_A + \Delta V_{Battery.} = V_{Battery.}$
$\quad\ \ = 0$

$V_C = V_B$

$V_D = V_A = 0$

Define the point where $V = 0$.

Grounding the circuit.

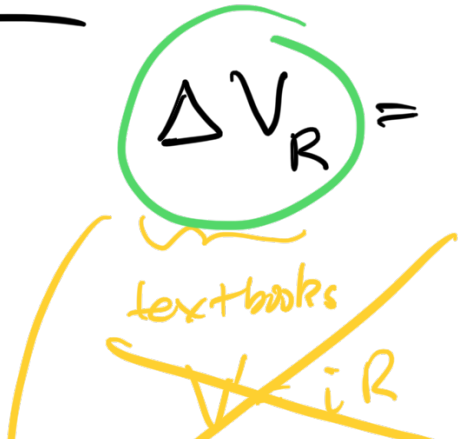
Ground Loops

$\Delta V_{wires} \approx 0$

(include in simulation!) $R_{wires} \approx 0$ ← not true!

Ohm's Law

Resistors: $\Delta V_R = iR$

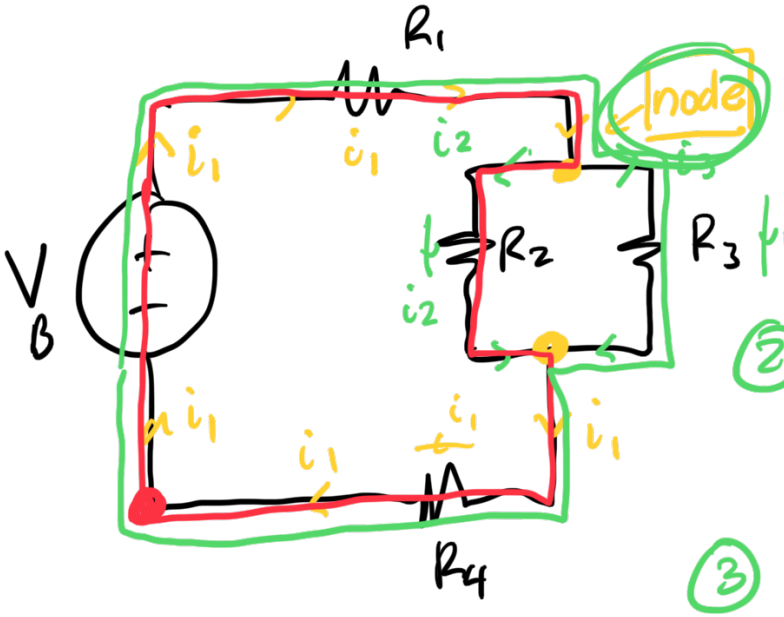


$$V_C - V_D = iR$$

V_C: $V_{Battery}$ ↑ — V_D: 0 ↑

$$V_{Battery} = iR$$

$$\boxed{i = \frac{V_{Battery}}{R}}$$



★ super important

trees / graph

② $V_B - i_1 R_1 - i_2 R_2 - i_1 R_4 = 0$

③ $V_B - i_1 R_1 - i_3 R_3 - i = 0$

"Follow the money" → Follow the current.

$$

i_1, i_2, i_3 Goal

↳ 3 equations

Nodes → Current in = current out

2 nodes ① $i_1 = i_2 + i_3$ 1 equation.

$i_2 + i_3 = i_1$

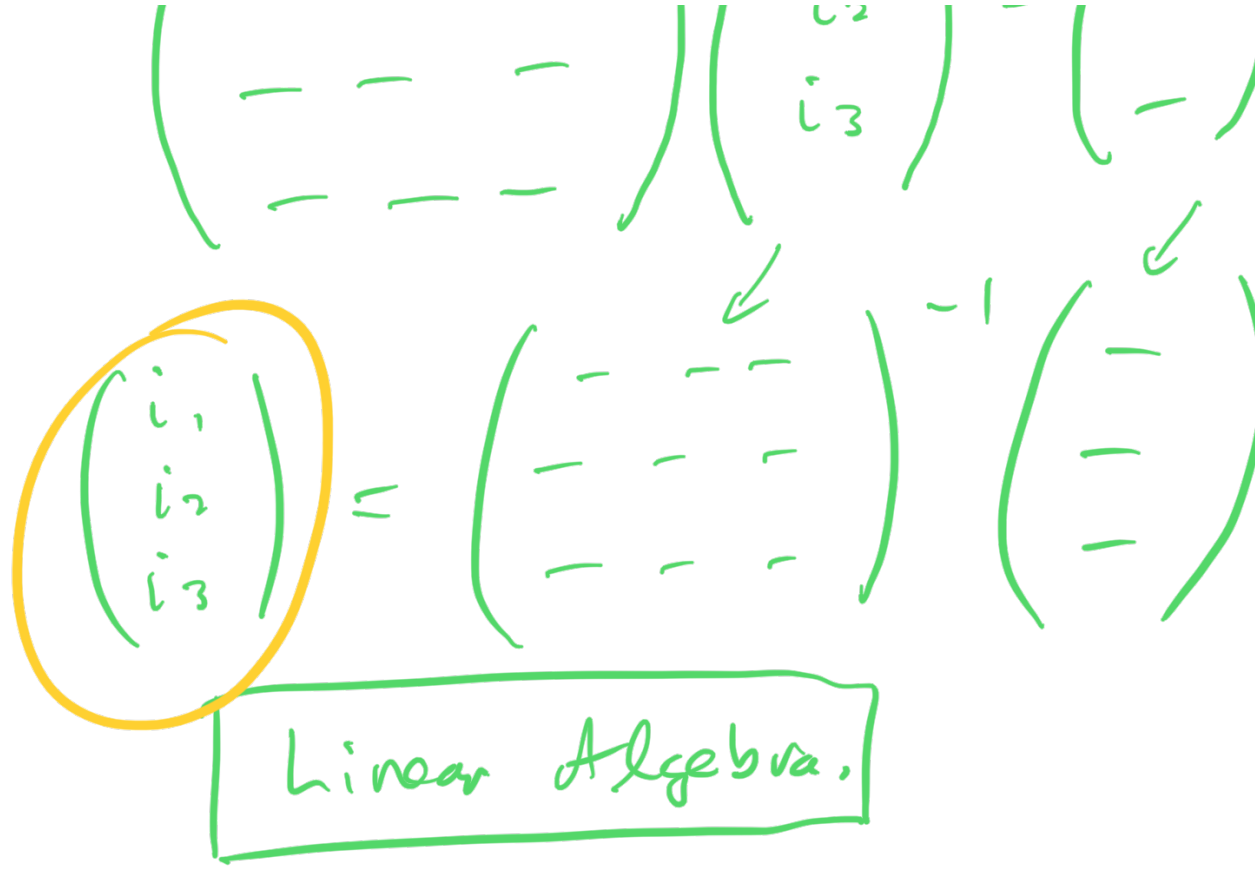
# of node equations = $\frac{\#\ \text{nodes}}{2}$

Closed Loops

$\sum_{\text{elements}} (\Delta V_i) = 0$

create using graph theory.

$\begin{pmatrix} - & - & - \end{pmatrix} \begin{pmatrix} i_1 \\ \vdots \end{pmatrix} = \begin{pmatrix} - \end{pmatrix}$


i_1
i_2
i_3
$=$
-1
Linear Algebra.