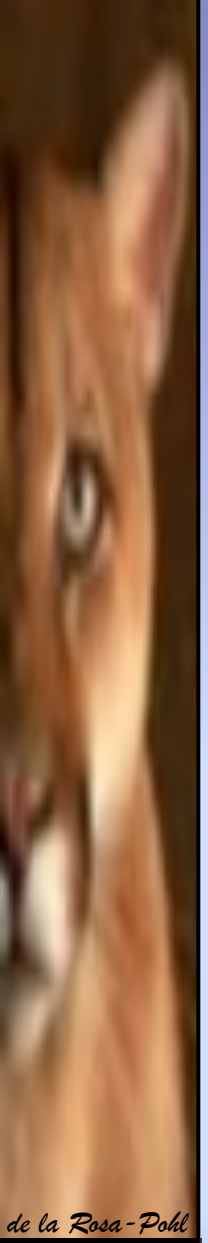

ECE 2300
Circuit Analysis

Circuit analysis made easy
Part II: Kirchhoff's Voltage Law

University of Houston
Len Trombetta

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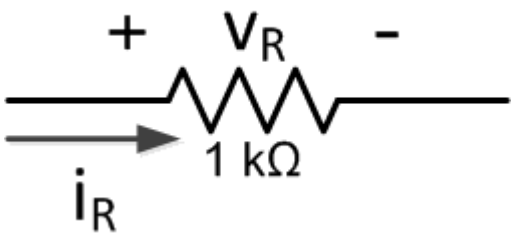
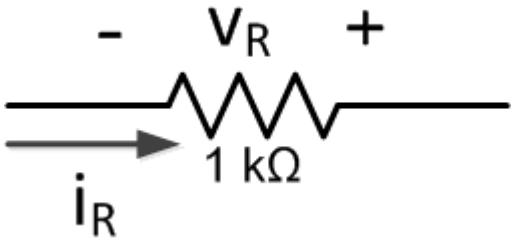
Review: Ohm's Law

Ohm's Law depends on how we label current and voltage:

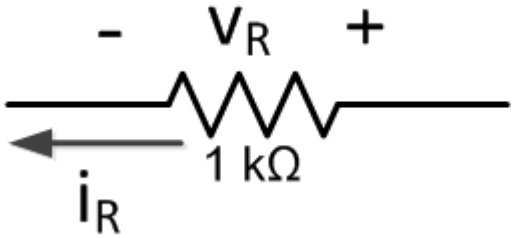


$$v_R = i_R R$$

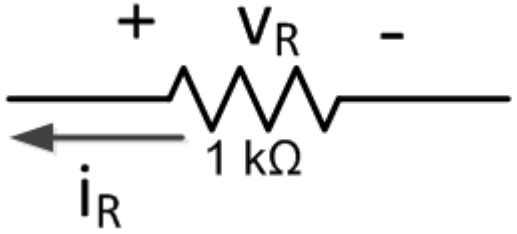


$$v_R = -i_R R$$

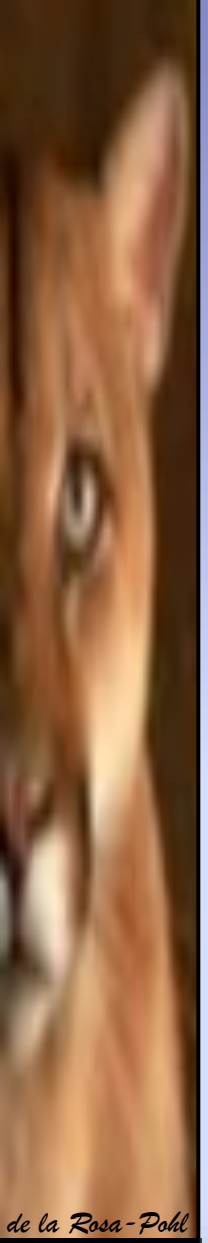
These are of course the same things…



$$v_R = i_R R$$



$$v_R = -i_R R$$

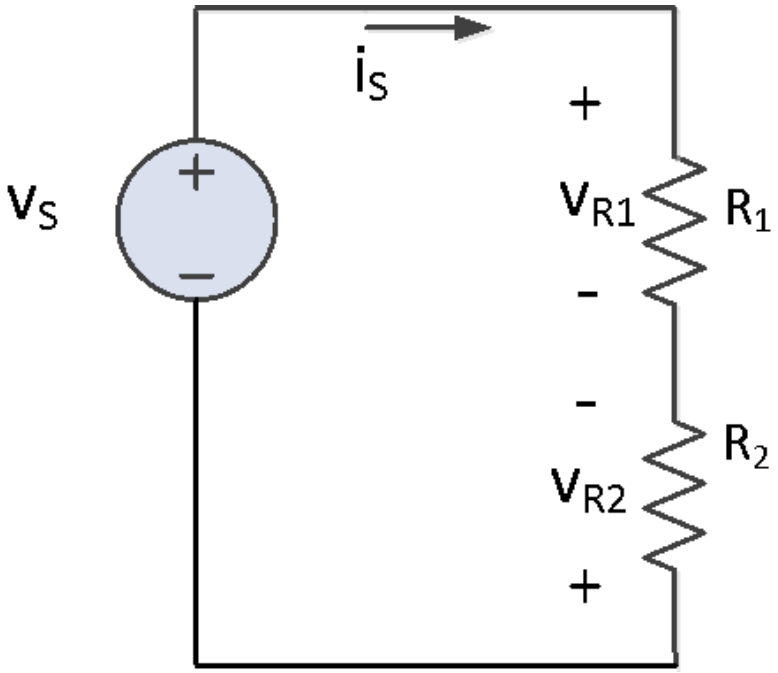


KIRCHHOFF'S VOLTAGE LAW

de la Rosa-Pohl

A Simple Circuit

- We want to "solve" this circuit…



Solve??

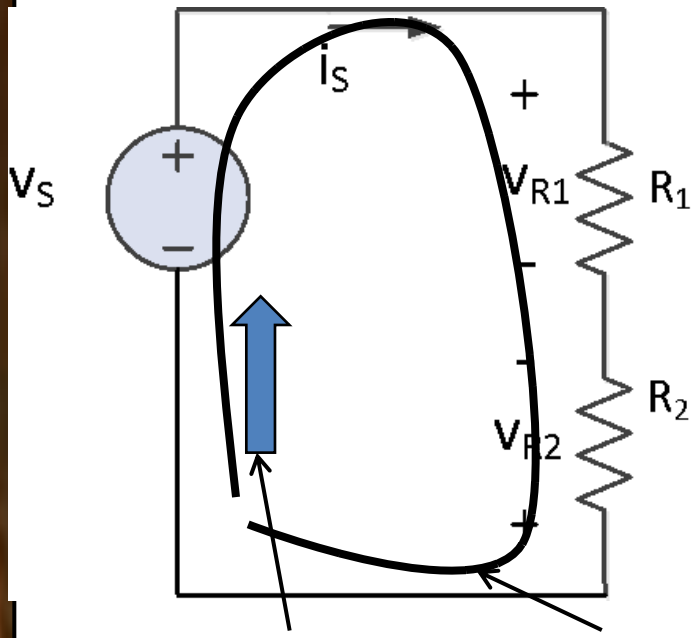
- We want to know all of the voltages (v_{R1}, v_{R2}) and currents (i_S).
- We will assume the source (v_S) and resistances are known.

Why did I label the voltages that way?

Because I can. And anyway, it's my class.

Kirchhoff's Voltage Law

KVL: The algebraic sum of the voltages around a closed loop is 0.



Direction of KVL path (either way is fine).

KVL path

Closed Loop: We will trace a path around the circuit, accounting for all the voltages as we go. It doesn't matter which way the path goes.

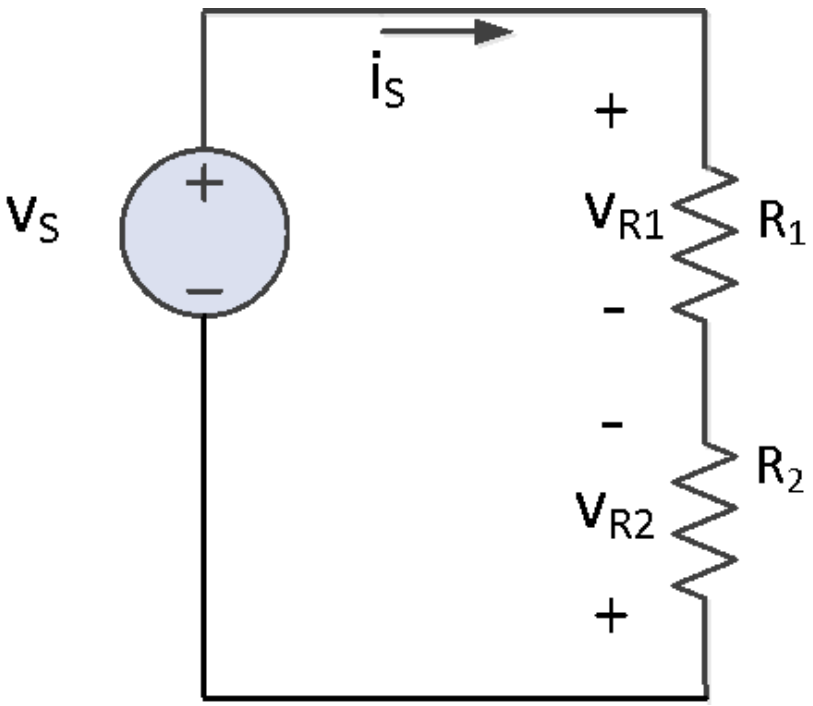
Algebraic: we need to be aware of the sign of the voltage.

$$-v_S + v_{R1} - v_{R2} = 0$$

$$v_S = v_{R1} - v_{R2}$$

My Rule: When we trace a path through a voltage from '-' to '+', we put a minus sign in front of the voltage; otherwise not.

Substitute Ohm's Law for v_R's



KVL

$$v_S = v_{R1} - v_{R2}$$

Ohm's Law

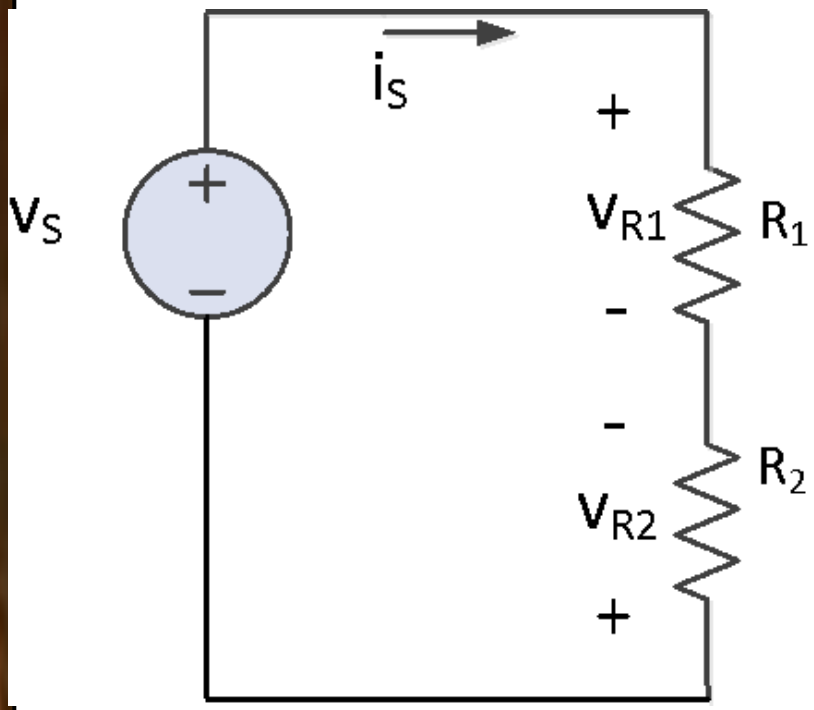
$$v_{R1} = i_S R_1 \qquad v_{R2} = -i_S R_2$$

Algebra…

$$v_S = i_S R_1 + i_S R_2$$

$$i_S = \frac{v_S}{R_1 + R_2}$$

Now You Do It!



KVL

$$v_S = v_{R1} - v_{R2}$$

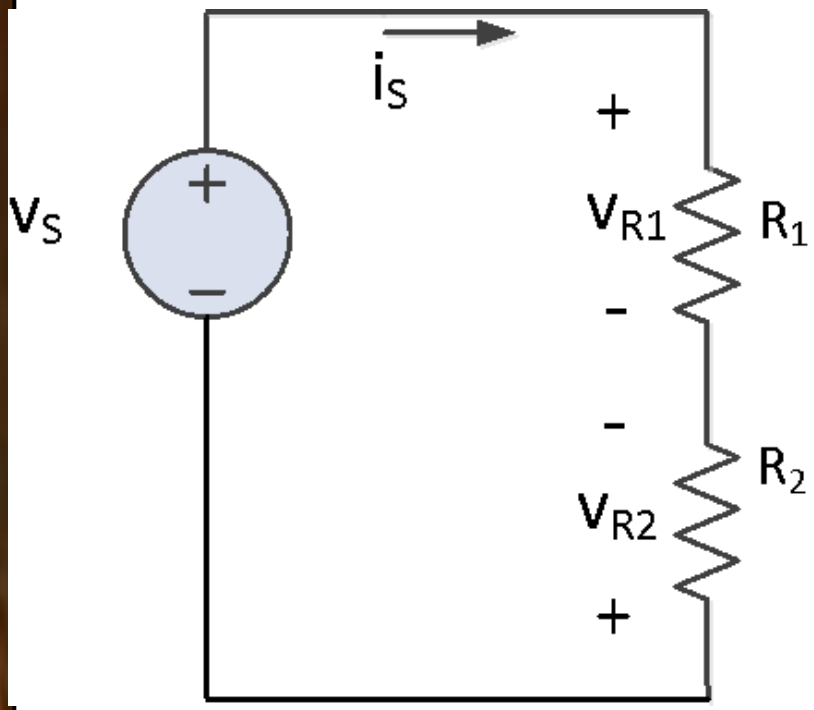
Ohm's Law

$$v_{R1} = i_S R_1 \qquad v_{R2} = -i_S R_2$$

Algebra

$$i_S = \frac{v_S}{R_1 + R_2}$$

Now You Do It!

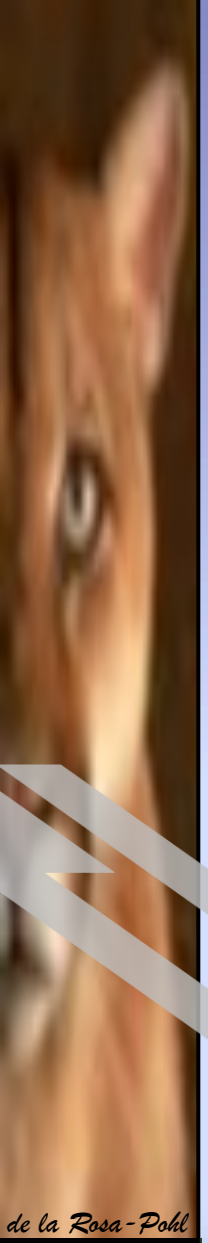


Given:

$R_1 = 1.5\ [k\Omega]$
$R_2 = 2.2\ [k\Omega]$
$v_S = 9\ [V]$

Find:

i_S
v_{R1}



The End

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