"LEYES DE KIRCHHOFF"

PRACTICE 3

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1CM10

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CHECKING THE KIRCHHOFF'S LAW FOR VOLTAGE

With the voltage source turned off, build the circuit of the figure 1 over the protoboard. Once it is armed, set the values of the voltajes sources from the table below.

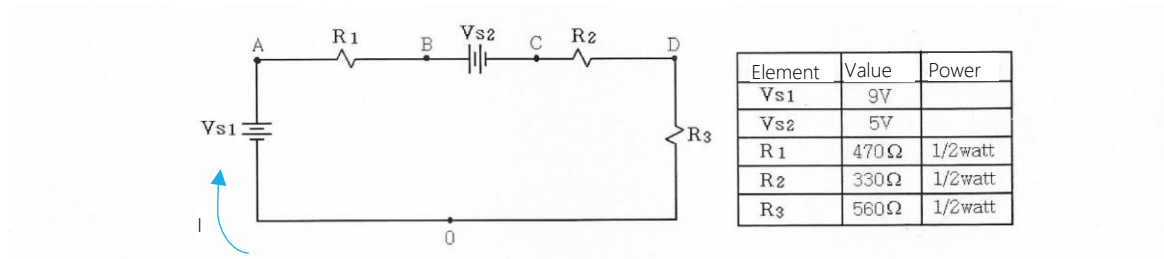| Element	Value	Power
Vs1	9V	
Vs2	5V	
R1	470Ω	1/2watt
R2	330Ω	1/2watt
R3	560Ω	1/2watt

Figure 1. Circuit and values for the first circuit

Set the direction of the electric current and fill the table below with the data you recovered from the circuit.

Table 1. Values of theoretical values and experimental values

Measures	Theoretical value (Voltage)	Measured value (Voltage)	Theoretical power	Measured power	Absorb (A) / Supply (S)
V_{0A}	9 V	9 V	0.26 W	0.2646 W	S
V_{AB}	-1.38 V	-1.386 V	4 mW	4.07 mW	A
V_{BC}	-5 V	-5 V	0.0145 W	0.0197 W	A
V_{CD}	-0.97 V	-0.961 V	2.85 mW	2.82 mW	A
V_{D0}	-1.64 V	-1.65 V	4.82 mW	4.851 mW	A
	$\sum V = 0.01$ V	$\sum V = 0.033$ V	$\sum P = 0.299$ W	$\sum P = 0.296$ W	

Now we put the data on a graph to look at the differences of the empiric way and the math way.

CHECKING THE KIRCHHOFF'S LAW FOR ELECTRIC CURRENT

With the voltage source turned off, build the circuit of the figure 2 over the protoboard. Once it is armed, set the values of the voltajes sources showed on the table below and connect the circuit.

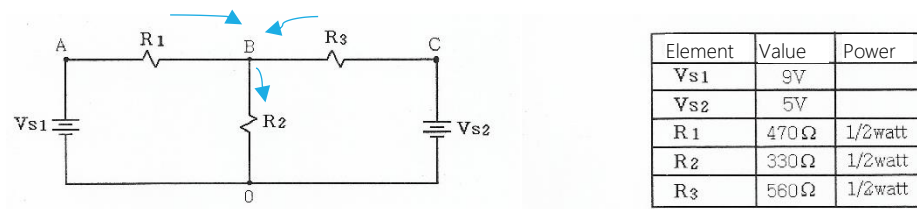| Element	Value	Power
Vs1	9V	
Vs2	5V	
R1	470Ω	1/2watt
R2	330Ω	1/2watt
R3	560Ω	1/2watt

Figure 2. Circuit 2 and values for the second circuit

For the electric currents, set directions on every branch of the circuit. Now fill the tables below.

Table 2. Values of electric currents

Measures	Theoretical value (amps)	Measured value (amps)
I_1 (left branch)	11 milliamps	0.010 amps
I_2 (middle branch)	11.6 milliamps	0.013 amps
I_3 (right branch)	-0.6 milliamps	-1.708 milliamps

Table 3. Values of voltages (theoretical and measured)

Measures	Theoretical value (Voltage)	Measured value (Voltage)	Theoretical power	Measured power	Absorb (A) / Supply (S)
V_{0A}	9 V	9 V	0.099 W	.099 W	S
V_{AB}	-5.1 V	-4.956 V	0.561 W	.0545 W	A
V_{B0}	-3.82 V	-4.094 V	0.443 W	0.0433 W	A
V_{BC}	-0.336 V	-0.961 V	0.0002 W	0.1632 W	A
V_{C0}	5 V	5 V	3 W	4.78 W	S
			$\sum P$ = 4.99 W	$\sum P$ = 5.14 W	

QUESTIONARY

WHAT IS A NODE IN AN ELECTRIC CIRCUIT?

It is a point (not necessarily but easier to look at), where two (or more) electric elements are connected.

WHAT IS AN ELECTRIC CIRCUIT?

It is an electrical network, which contains at least a closed path.

EXPRESS IN A MATHEMATIC FORM THE KIRCHHOFF'S LAW FOR ELECTRIC CURRENT

$\sum_{k=1}^{n} I_k = 0$ where $\forall$I, I is in the studied node.

WHAT IS A CLOSED PATH IN AN ELECTRIC CIRCUIT?

It is a path where you start from one of the nodes and using some paths of the circuit you return to the same node.

WHAT IS AN ELECTRIC FALL?

It is a point where voltage drops.

CONCLUSIONS

CABAÑAS BAXCAJAY JESÚS FRANCISCO

In this practice, we observed how currents work in circuits, it is hard to measure current on every single part from the circuit. Theoretical and measured are always different, but this does not affect too much. We hope to use this knowledge for better things in the future.

HERNÁNDEZ VELÁZQUEZ ÁNGEL

In practice 3, we could observe the physical demonstration of Kirchhoff's laws, both current and voltage, we could observe how the voltage would be conserved when the circuit is in parallel, however, the problem was that we had more sources altering this value. The electric current, in the same way, was the sum of these in the nodes. This is how Kirchhoff's laws are proven.

MARTÍNEZ CORONEL BRAYAN YOSAFAT

It is amazing the way we are improving, I think these topics should be obligatory with practices in all the school of our nation. If everyone knows how the electricity works, we could make more efficient our consuming of energy. As the other topics, this one is as important as those, now we can say that we can do analysis of our circuits, I think, one day, if we need to pay to an electrician engineer, we can easily know what to pay to him.

CALCULATIONS

For 1st Circuit:

From LCK:

-Vs1+ R1*I + Vs2 +R2*I + R3*I = 0

-9V+470I+5V+30I+560I=0

I=4/1360=0.0029A=2.9mA

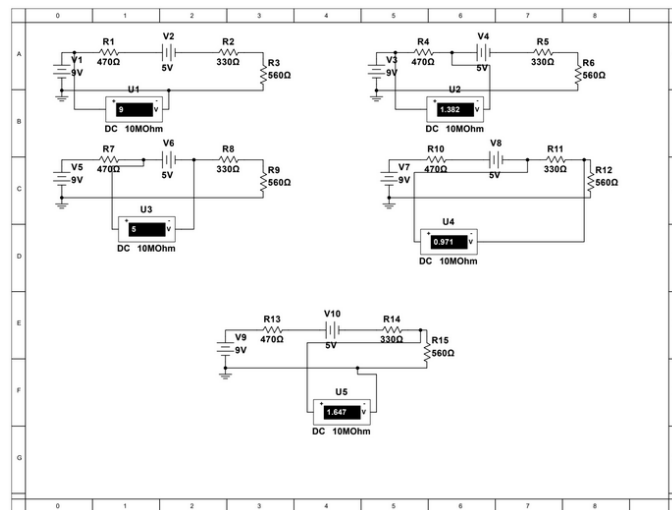Then, from Ohm Law, we substitute I in V=IR for each branch, and then P = VI

For 2nd Circuit:

I1+I2+I3=0

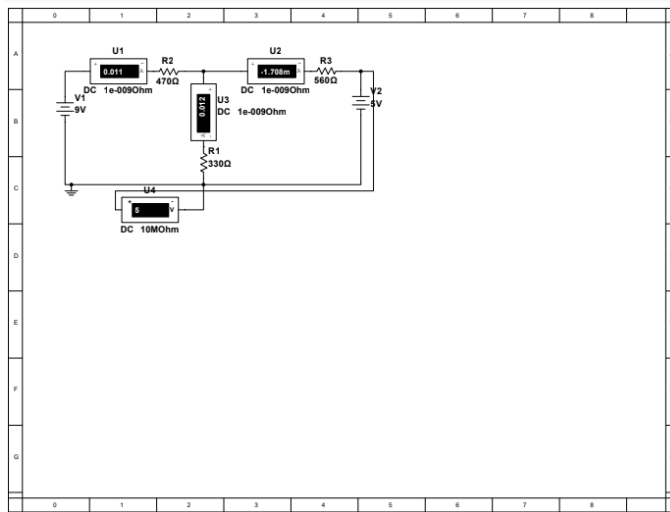For I2: -Vs1+R1*I-R2*I=0, -9V+470Ω*11mA-330I=0, I2 = 11.60 and we already have I=11mA, so I3 = -0.60mA.

Then we use Ohm law for each branch, V=IR.

SIMULATIONS

Top schematic (upper diagram):

U1 0.011 R2 470Ω U2 -1.708m R3 560Ω
V1 9V DC 1e-009Ohm DC 1e-009Ohm V2 5V
U3 0.012 DC 1e-009Ohm
R1 330Ω
U4 9 DC 10MOhm

U5 0.011 R5 470Ω U6 -1.708m R6 560Ω
V3 9V DC 1e-009Ohm DC 1e-009Ohm V4 5V
U7 0.012 DC 1e-009Ohm
R4 330Ω
U8 4.956 DC 10MOhm

U9 0.011 R8 470Ω U10 -1.708m R9 560Ω
V5 9V DC 1e-009Ohm DC 1e-009Ohm V6 5V
U11 0.012 DC 1e-009Ohm
R7 330Ω
U12 4.044 DC 10MOhm

U13 0.011 R11 470Ω U14 -1.708m R12 560Ω
V7 9V DC 1e-009Ohm DC 1e-009Ohm V8 9V
U15 0.012 DC 1e-009Ohm
R10 330Ω
U16 -0.956 DC 10MOhm

Bottom schematic (lower diagram):

U1 0.011 R2 470Ω U2 -1.708m R3 560Ω
V1 9V DC 1e-009Ohm DC 1e-009Ohm V2 5V
U3 0.012 DC 1e-009Ohm
R1 330Ω
U4 5 DC 10MOhm

INSTITUTO POLITÉCNICO NACIONAL

ESCUELA SUPERIOR DE CÓMPUTO

LABORATORIO DE ANÁLISIS FUNDAMENTAL DE CIRCUITOS

ESCOM

PRÁCTICA No. 3

"LEYES DE KIRCHHOFF"

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REVISADO

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