

Equivalence Resistance of A Serial Circuit

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1 Theoretical Background

Equivalent resistance is the resistance value that should be replaced if you remove all the elements in the circuit without changing the current and voltage values. The calculation of equivalent resistance may differ from circuit to circuit. In this experiment we will investigate equivalent resistance in some basic circuits.

1.1 Serial Circuits

In a serial circuit, because of there is only one path for the current, the currents over all circuit components must be the same. On the other hand, because of the conservation of energy, the sum of voltage values of all circuit elements must be equal to the source voltage. This situation is shown in Figure (1).

$$I = i_1 = i_2, \quad V_s = V_1 + V_2 \quad (1)$$

And according to the Ohm's Law, we've got,

$$V = IR \Rightarrow \frac{V_s}{R_{eq}} = \frac{V_1}{R_1} = \frac{V_2}{R_2}, \quad IR_{eq} = i_1 R_1 + i_2 R_2. \quad (2)$$

But if we use the equivalence of all the currents in a serial circuit in the last equation, we obtain,

$$R_{eq} = R_1 + R_2. \quad (3)$$

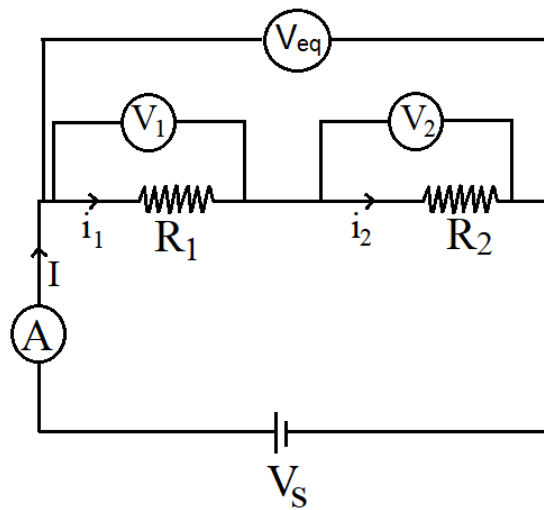


Figure 1: Serial circuit.

2 Procedure

We will perform the serial circuit in this experiment.

2.1 Experimental Procedure

CAUTION!!!

Perform this experiment in a short period of time and do not forget to turn off the electrical supply while you are writing your data and making calculations.

1. Set the circuit given in Fig (1).
2. Write your resistance values in Data & Analysis section.
3. By using the power supply, adapt the source voltage to the 1st source voltage value at Table (1).
4. By reading from multimeters, note the current and voltage through the wire and write these values on Table (1).
5. Repeat the steps number 3 and 4 with other source values from Table (1).

2.1.1 Analysis Procedure

1. Using values on Table (1) plot the I-V graph.
2. Calculate the slope of the plot. This should yield the equivalent resistance values of the serial circuits.
3. Find the theoretical values of the equivalent resistance values of the serial circuits and calculate the percentage error.

3 Data & Analysis

Serial Circuit

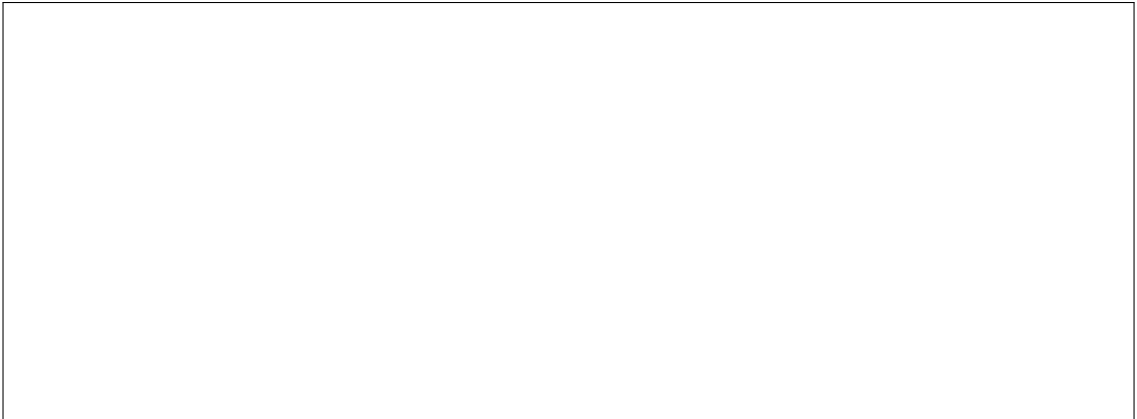
- Resistance values:

- Theoretical value of equivalence resistance (Do the math explicitly):

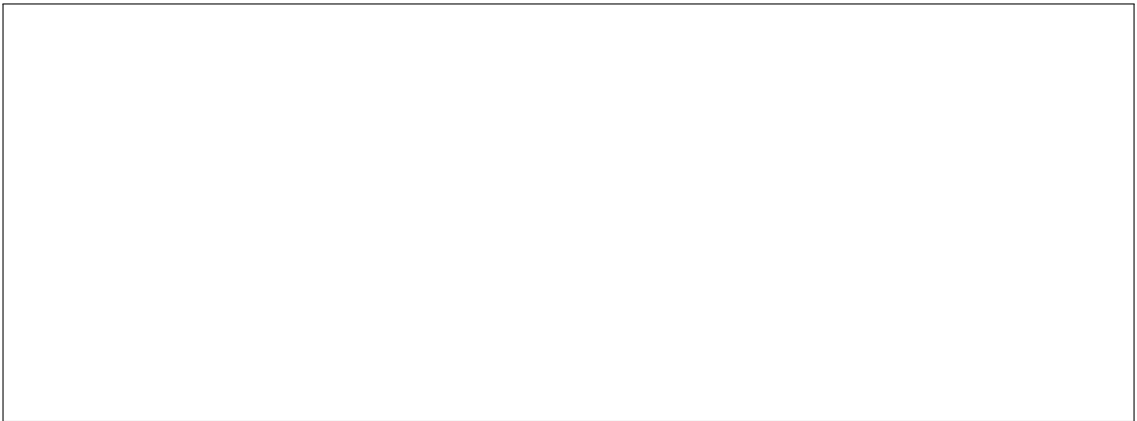
Table 1: Current and voltage values for different supply voltages in a serial circuit.

#	V_s (V.)	v_1 (---)	i_1 (---)	v_2 (---)	i_2 (---)	I (---)	V_{eq} (V)
1	1						
2	2						
3	3						
4	4						
5	5						

- Experimental value of equivalence resistance (do the math explicitly):



- Percentage Error (do the math explicitly):



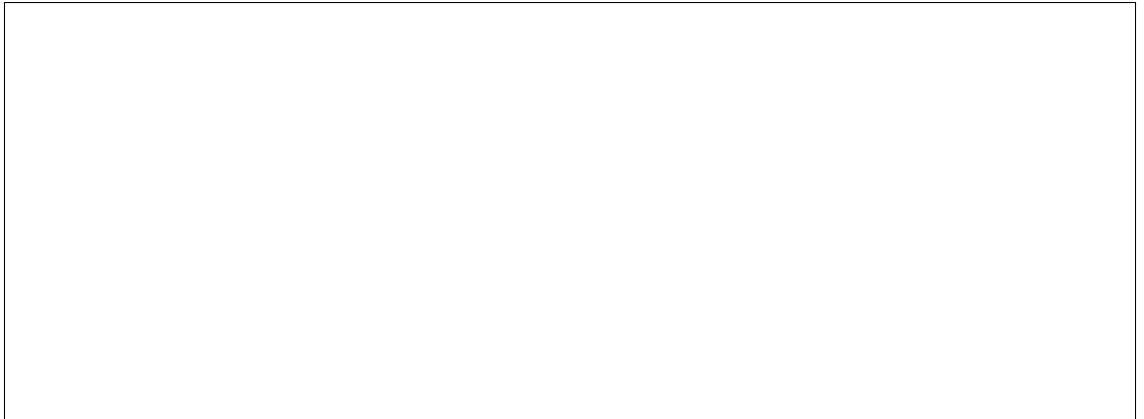
- Calculate the current and voltage values for all the resistors in the circuit for one row in Table(1).
Row number:----

– Current in resistor#1:

– Voltage in resistor#1:

– Current in resistor#2:

– Voltage in resistor#2:



5 Contribution

