Equivalence Resistance of A Parallel 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 Parallel Circuits

At a junction point, the sum of all outgoing-currents must be equal to the sum of all incoming-currents. Besides the voltage between same points of a circuit over different paths are the same. We will use these principle for a parallel circuit to calculate its equivalent resistance. Please look at the Figure (1) to understand following equations.

$$\text{at x :} \qquad I = i_1 + i_2, \tag{1}$$

$$\text{between x-y :} \qquad V_s = v_1 = v_2. \tag{2}$$

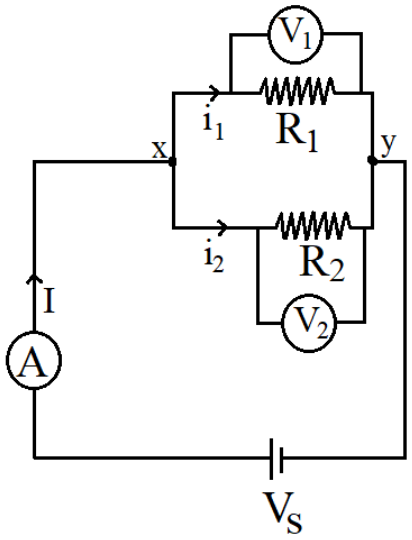


Figure 1: Parallel circuit.

By using Ohm's Law we get,

$$\frac{V_s}{R_{eq}} = \frac{v_1}{R_1} + \frac{v_2}{R_2} \quad \Rightarrow \quad \frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2}. \tag{3}$$

At the last step, we have used Eqn (2).

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 parallel circuits.
3. Find the theoretical values of the equivalent resistance values of the parallel circuits and calculate the percentage error.

3 Data & Analysis

Parallel Circuit

- Resistance values:

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

Table 1: Part B, current and voltage values for different supply voltages in a parallel circuit.

#	v_1 (___)	i_1 (___)	v_2 (___)	i_2 (___)	V_s (V.)	I (___)
1					1	
2					2	
3					3	
4					4	
5					5	

- Experimental value of equivalence resistance:

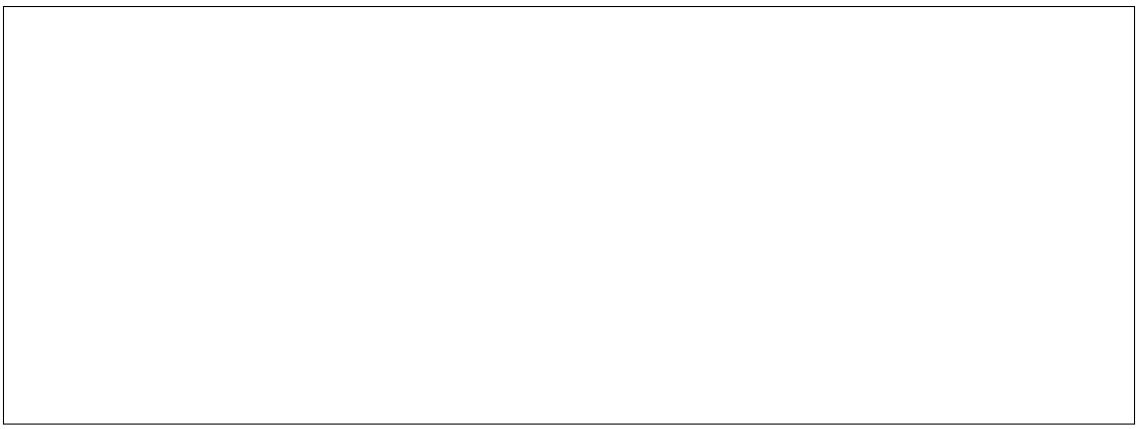
- Percentage Error (do the math explicitly):

- Calculate the current and voltage values for all the resistors in the circuit for one row in Table(**??**). Row number:____
  - Current in resistor#1:

  - Voltage in resistor#1:

  - Current in resistor#2:

– Voltage in resistor#2:



4 Conclusions

5 Contribution

6 Notes