

UNIVERSITY OF NORTH CAROLINA AT CHARLOTTE
Department of Electrical and Computer Engineering

EXPERIMENT 5 – PARALLEL AND SERIES-PARALLEL CIRCUIT CHARACTERISTICS

OBJECTIVES

This experiment will have the student investigate the characteristics of parallel circuits. After that the student will investigate the voltage and current relationships in a combination series-parallel circuit.

MATERIALS/EQUIPMENT NEEDED

Resistors: (7)1.2k Ω , (1) 2.2k Ω , (1) 3.3k Ω , (1) 5.6k Ω

Agilent U8031A DC Power Supply

Agilent 34461A Digital Multimeter

INTRODUCTION

Parallel Circuits: A parallel circuit is one that has two or more paths for the electricity to flow. In other words, the loads are parallel to each other. If the loads in this circuit were light bulbs and one blew out there would still be current flowing to the others as they are still in a direct path from the negative to positive terminals of the power supply (e.g. battery). Parallel circuits have the following rules:

1. The voltage is the same across each branch of a parallel circuit.
2. The sum of the individual branch currents equals the total current in the circuit.
3. The reciprocal of the total resistance equals the sum of the reciprocals of the individual branch resistances.

Series-Parallel Combination Circuits: A combination circuit is one that has a “combination” of series and parallel paths for the electricity to flow. Its properties are a synthesis of both the series and parallel circuits.

PRELAB

1. Using one of the relationships for resistors connected in parallel, solve for the total resistance in Figure 5-1. Show Calculations.

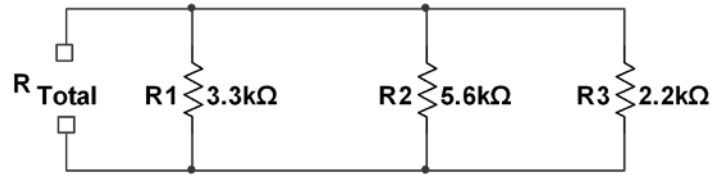


Figure 5-1 Parallel resistive circuit for part 1 of the prelab

2. Refer to the circuit in Figure 5-2. Answer the following;
 - a. In branch C, how are R_5 , R_6 and R_7 related to each other? How are their currents related? How is their voltage drops related to the voltage across branch A and branch B?
 - b. In branch B, how are R_3 and R_4 related to each other? How are their voltage drops related to the voltage across branch B?
 - c. What is the relationship between the sum of the currents of branches A,B, and C to the current through R_1 ? Why?
 - d. Make a statement that compares the amount of current through each branch (A,B, and C) with the resistance on the branches (A, B, and C).
 - e. Branch B and branch C connected in series or parallel? How is the voltage across them related?
 - f. Is the voltage across R_3 in branch B and R_5 in branch C the same? Why or why not?

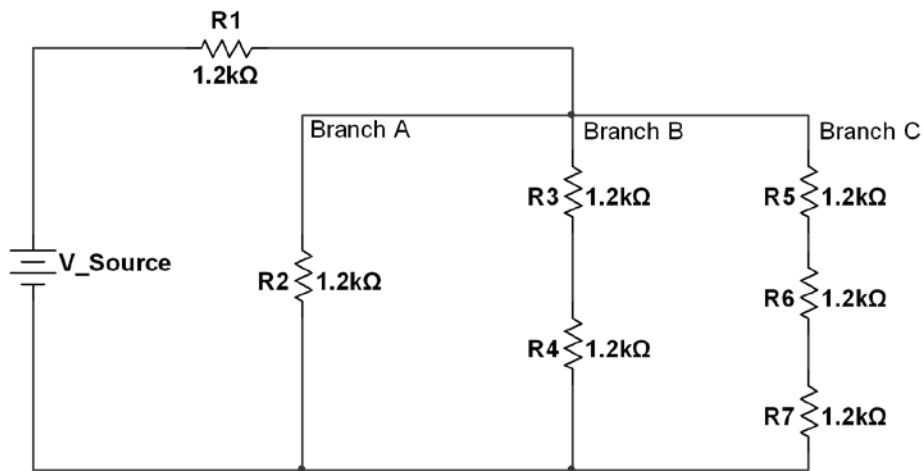


Figure 5-2 Series-parallel circuit for part 2 of the prelab

PROCEDURE

Voltage Characteristics in a Parallel Circuit

1. Show your pre-lab work to the instructor at the beginning of the lab session.
2. Connect the circuit in Figure 5-3.
3. Adjust the power supply to a value of 12V (with the circuit connected).
4. Using the DMM, measure the voltage across each resistor and record in Table 5-1.

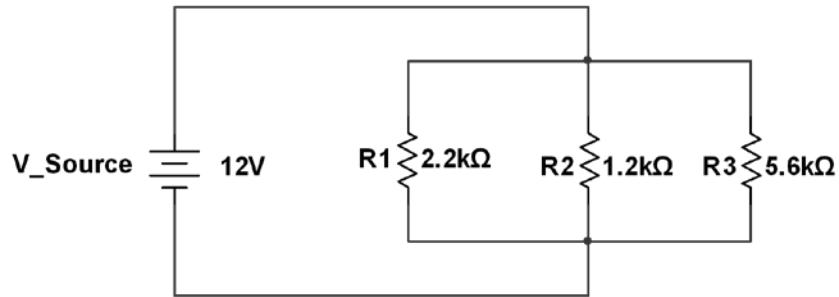


Figure 5-3 Parallel circuit to measure the voltage characteristics

Current Relationship in a Parallel Circuit

1. Connect the circuit in Figure 5-4.
2. Make sure that the source is properly set to 12V (with the circuit connected).
3. Using the DMM, measure and record in Table 5-2 the current through each resistor and the total current.

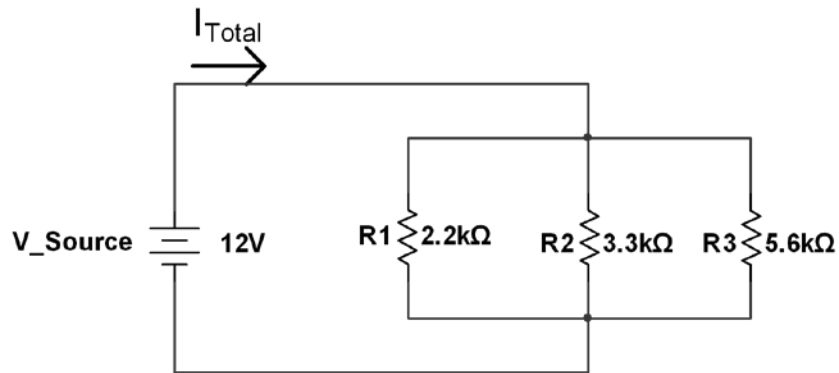


Figure 5-4 Parallel circuit to measure the current relationships

Resistance Relationship in a Parallel Circuit

1. For the circuit in Figure 5-1. Note that there is no source voltage connected.
2. Using the DMM, measure the total resistance and record in Table 5-3.
3. Remove each resistor from the circuit and individually measure R_1 , R_2 and R_3 . Record in Table 5-3.

Characteristics in a Series-Parallel Circuit

1. For the circuit in Figure 5-2. When wiring this circuit, allow for convenient means of measuring each individual current and voltage drop.
2. Set the supply voltage so that the supply current reads exactly **6mA**. Measure the source voltage and record in Table 5-4.
3. Using the DMM, measure each resistor's voltage drop and record in Table 5-4.
4. Using the DMM, measure the current through each resistor and record in Table 5-4.
5. Disconnect the circuit from the DC source terminals. Measure with the DMM the total resistance. Record in Table 5-4.

DATA/OBSERVATIONS

Table 5-1: Voltage measurements for circuit in Figure 5-3

Resistor	Voltage (V)
R₁	
R₂	
R₃	

Table 5-2: Current measurements for circuit in Figure 5-4

Resistor	Current (A)
R₁	
R₂	
R₃	
I_{Total}	

Table 5-3: Resistance measurements for circuit in Figure 5-1

Resistor	Resistance (Ω)
R₁	
R₂	
R₃	
R_{Total}	

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DATE:

Table 5-4: Measurements for circuit in Figure 5-2

Resistor	Voltage	Current
R₁		
R₂		
R₃		
R₄		
R₅		
R₆		
R₇		
R_{Total}	Source Voltage	

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POST-LAB

Voltage Characteristics in a Parallel Circuit

1. What conclusion can be made from this part of the experiment?

Current Relationship in a Parallel Circuit

2. Add the measured currents through R_1 , R_2 , and R_3 and compare with the measured total current. What conclusion can be made?

Resistance Relationship in a Parallel Circuit

3. How the total resistance of the circuit is related to resistance measured for R_1 , R_2 , and R_3 ?

Characteristics in a Series-Parallel Circuit

4. What observations or conclusions can be made from the measurements made for the series-parallel circuit?

Be sure to include all items from the post-lab exercise above in your written lab report.