

EET 150
Introduction to EET
Lab Activity 7
Solving Circuits Using Circuit Simulators

Required Parts, Software and Equipment

Parts

None for this activity

Equipment

Computer

Software

Multisim simulation software.

MS Word

Introduction:

Circuit simulation software uses mathematical models of real circuit components and integrated circuits to produce representations of the actual circuit's operation. Circuit simulation allows designers to create prototype circuits and test their performance without going through the time and expense of constructing the actual circuits. Designers can test the effects of changing circuit components on the performance of a test design and do "what if" analysis quickly. This speeds the development time of electronic products and systems. For simulator results to match actual circuit performance, the mathematical models must accurately represent the physical operation of the circuits. Software developers must test circuit models and simulators thoroughly before designers can trust their output. Multisim uses a well-known and trusted simulation engine called SPICE to model electronic/electrical circuit performance.

Objective

The objective of this lab is to introduce the use of circuit simulation software. The goals are to learn how to construct simple circuits using the schematic drawing tool, select and run the correct analysis tools to solve the circuit, and make and interpret current and voltage measurements results from the simulator analysis.

Procedure:

1. View the online demonstration videos that accompany this lab.
2. Construct the circuit in Figure 1 using Multisim. Use the multimeter instrument from Multisim to measure the dc voltages across all the resistors in the circuit. Create an instrument for each of the resistors. Also use a multimeter to measure the current flowing in the circuit. Run the simulation and record the voltages across all resistors and the circuit current in Table 1 below.

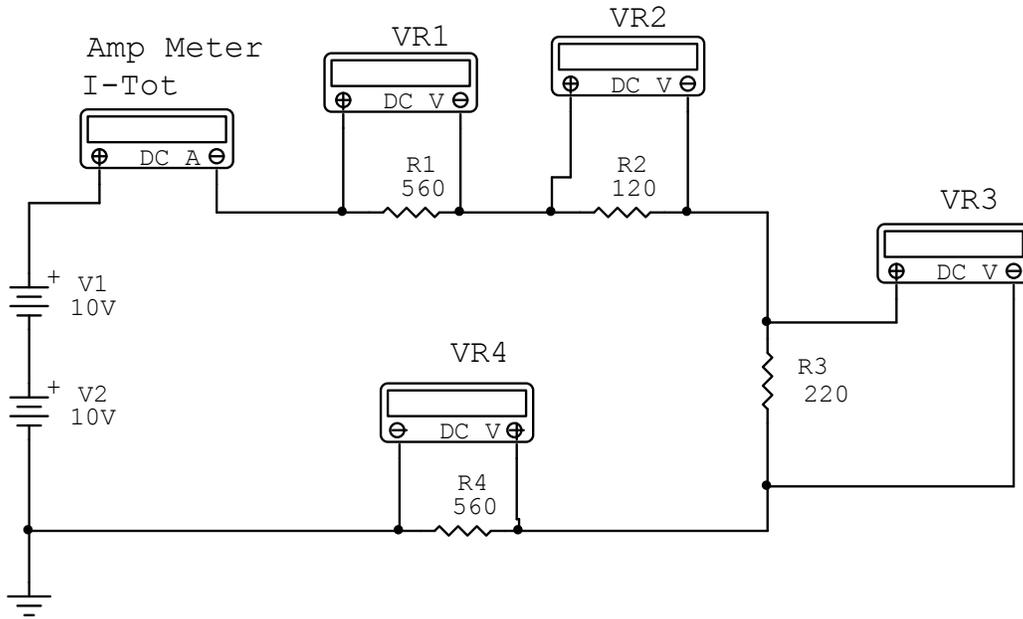


Figure 1. Series Simulation Circuit.

Table 1 Series Circuit Readings

Resistor Voltage	Simulated Voltage Value (V)
VR1	
VR2	
VR3	
VR4	
Circuit Current	Simulated Current Value (mA)
I-Tot	

3. Find the total voltage drop across all the resistors by using the following formula.

$$V_T = V_{R1} + V_{R2} + V_{R3} + V_{R4}$$

Record the value in the space provided. $V_T = \underline{\hspace{2cm}}$

Use the following formula to find the total battery voltage and record it in the space provided.

$$V_{\text{bat}} = V_1 + V_2$$

$V_{\text{bat}} = \underline{\hspace{2cm}}$

Does the total source voltage approximately equal the sum of the resistor voltage drops? What resistor has the highest voltage drop? Is there a relationship between the size of the resistor?

- Construct the circuit shown in Figure 2 below using Multisim. Use the multimeter instrument from the program to measure the currents in each circuit resistance and the

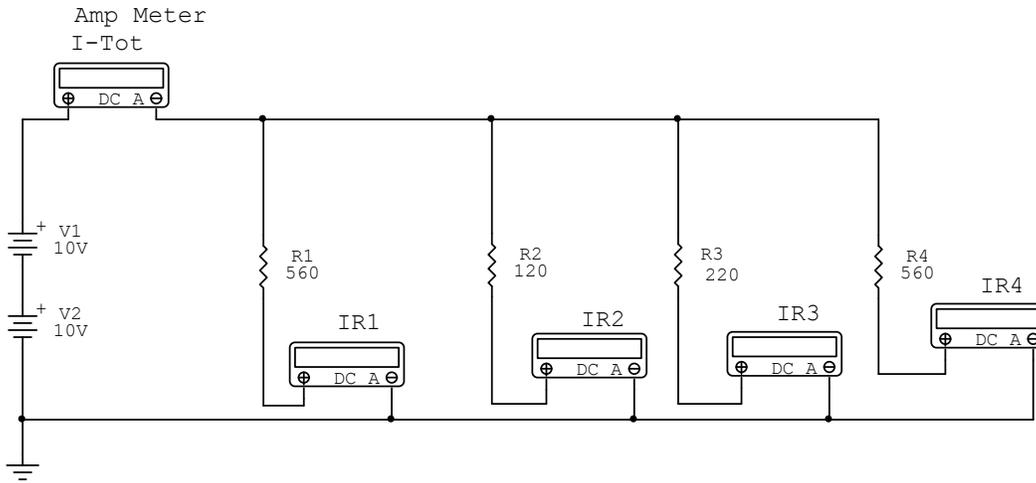


Figure 2. Parallel Simulation Circuit

total circuit current. Run the circuit simulation and record all the measured currents in Table 2 below.

Table 2 Parallel Circuit Readings

Resistor Currents	Simulated Resistor Current Values (mA)
IR1	
IR2	
IR3	
IR4	
Circuit Current	Total Current Value (mA)
I-Tot	

- Find the current flow through all the resistors by using the following formula.

$$I_T = I_{R1} + I_{R2} + I_{R3} + I_{R4}$$

Record the value in the space provided. $I_T =$ _____

Compare the value computed above with the measured value of I_{Tot} . What can be determined from this comparison? What resistor value draws the greatest amount of current? What relationship exists between the size of the resistor and the amount of current that it draws?

6. Construct the circuit in Figure 3 using Multisim. Use the multimeter instrument to measure the current flowing in each resistor, the total current, the voltage across resistor R4 and the voltage across resistors R1, R2, R3. Run the simulator and record all the multimeter values in Table 3

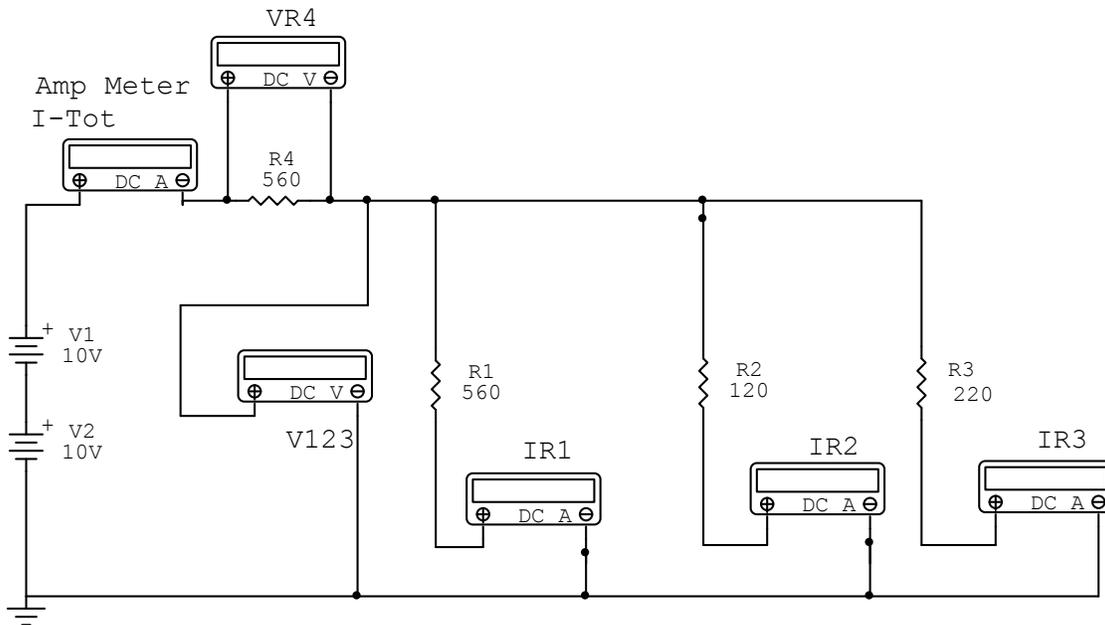


Figure 3. Series-Parallel Simulation Circuit.

Table 3 Series-Parallel Circuit Readings

Resistor Currents	Simulated Resistor Current Values (mA)
IR1	
IR2	
IR3	
Circuit Current	Total Current Value (mA)
I-Tot	
Resistor Voltages	Simulated Resistor Voltage Values (V)
VR4	
V123	

7. Use the formula below to find the total current flowing in resistors R1, R2, R3 and record it below.

$$I_T = I_{R1} + I_{R2} + I_{R3}$$

$$I_T = \underline{\hspace{2cm}}$$

Is this value equal to the total circuit current, I-Tot?

Use the formula below to compute the total circuit voltage, V_T , from the readings in Table 3 Record the result in the space provided

$$V_T = V_{123} + V_{R4}$$

$$V_T = \underline{\hspace{2cm}}$$

Does the value of V_T equal the voltage produced by the circuit batteries? Make note of these two results for the lab report.

Discussion Points:

Fill out all tabular data and save it for later use in a quiz. Answer all questions posed in the procedure section. Why is circuit simulation useful? How does circuit simulation software represent electrical/electronic components? What is the circuit analysis engine used by Multisim to perform circuit calculations?