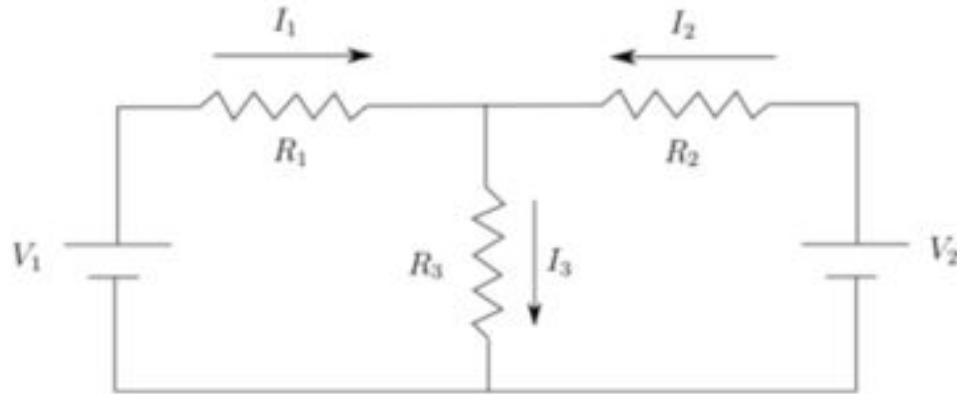


Circuit Analysis

In this problem, you will use Kirchhoff's laws to analyze a circuit in order to calculate the currents in their respective resistors and find the allowable limits for voltage using a system of linear equations. Use the support documentation "Circuit_Analysis_PartII.pdf" and "Circuit_Analysis_PartIII.pdf" to familiarize yourself with concepts covered in the problem.

Task 1: Applying Kirchhoff's Laws

A closed circuit is shown in the diagram below. There are two voltages, V_1 and V_2 , with units of volts; three currents, I_1 , I_2 , and I_3 , with units of amperes; and three resistors, R_1 , R_2 , and R_3 , with units of ohms.



Before you begin using MATLAB, you will need to apply your knowledge of Kirchhoff's Laws to create a system of linear equations for the circuit above. You will need these equations to solve for the currents, I_1 , I_2 , and I_3 .

The VR.m for V_1 , V_2 , R_1 , R_2 , and R_3 . Use this file to create the variables and display them in the command window. (Do not hardcode the values from the VR.m file). You will need to create alternative VR files. Using the set of linear equations you made earlier, create a user-defined function named CircuitSolver that will solve for and return the currents I_1 , I_2 , and I_3 when inputting the values for V_1 , V_2 , R_1 , R_2 , and R_3 . You may not use `linsolve()` for this task.

Using a cell array, display each voltage (1st column), resistance (2nd column), and current (3rd column) in a 3x3 matrix with headers (see formatting below). You may leave the spot for V_3 a 'blank' space as shown below.

V_1	R_1	I_1
V_2	R_2	I_2
	R_3	I_3

Task 2: Current Effects on Voltage

Each resistor is rated for a maximum current of 1 amp. Using your CircuitSolver function created in Task 1, find both the minimum and maximum limits for V_2 such that you do not allow for negative currents. V_1 , R_1 , R_2 , and R_3 are the same as in Task 1. Clearly display your results in the command window.

Circuit Analysis

Task 3: Resistance Effects on Voltage

Now, you are going to investigate how the resistance in R_3 limits the allowable range of the voltage for V_2 . Let the value of R_3 range from 15-115 Ohms. Once again using CircuitSolver, find the minimum and maximum voltage for each different resistance value of R_3 , as well as the average voltage range and display these values in the command window.

On one graph, plot the maximum and minimum values with respect to resistance. On the graph, include a legend labeling each curve by their color, proper axis labels, and a descriptive title. Interpret the graphs and answer the following question in the command window: What is the relationship between voltage and resistance? What would you look for in optimizing the voltage range for the circuit?