ECET 102/CPET 101

Lab 4

MATLAB Exercises Lab

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Lab Activities

1. Plotting Ohm's law (R = 5 ohms, E = 0 to 30V)
2. Plotting R1 (1 ohms), R2 (10 ohms, E = 0 to 30V on the same plot
3. Calculations for a circuit with 3 resistors in series

1. Plotting Ohm's Law

Problem Statement:

- Build a MATLAB simulation circuit for a variable power supply (E = 0 to 30V), an ammeter, and a 5 Ohms connected in series. Write a simple MATLAB program to plot E vs. I (Ohm's law)

1. Plotting Ohm's Law

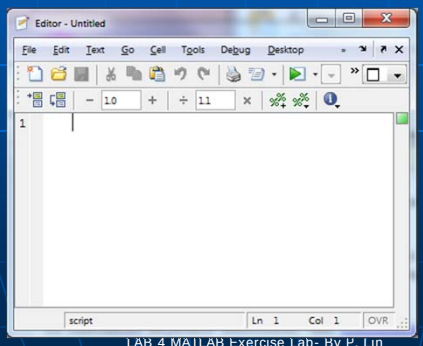
Solution:

- R = 5 Ohms
- E = 0, 5, 10, 15, 20, 25, 30 Volts (changed from 0v, increment by 5 v, with the highest voltage 30 V)
- Compute current I for each of the adjusted voltage value

1. Plotting Ohm's Law

Step 1: Start=> MATLAB (to see MATLAB application window)

Step 2: Click File => New => Script (to create a M file); and see the Editor as shown below

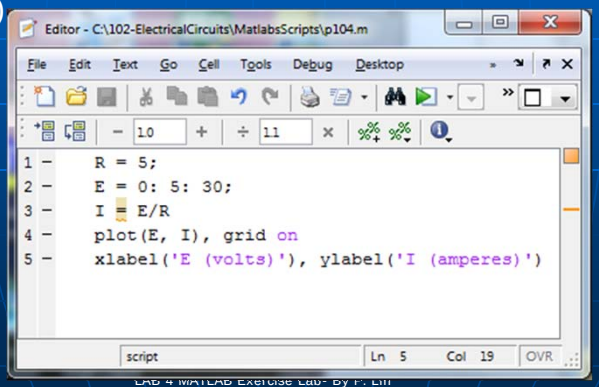


1. Plotting Ohm's Law

Step 3:

(a). Enter the following 5 statements onto the editor.

(b) File => Save as => P104.m (save it in your own USB flash drive)



1. Plotting Ohm's Law

Step 3:

(C) Debug => Run p104.m (Click on ADD path command if prompted)

Display on the command windows:

I =

0 1 2 3 4 5 6

1. Plotting Ohm's Law

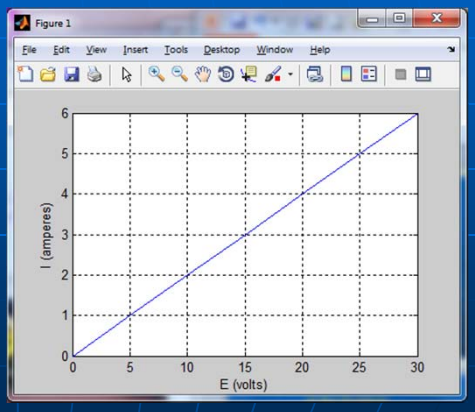
Step 3:

Display on the command windows:

I =

0 1 2 3 4 5 6

And the graphic window the Ohm's law plat



2. Plotting Two Resistors

Solution:

- R1 = 1 Ohms, R2 = 10 Ohms
- E = 0, 5, 10, 15, 20, 25, 30 Volts (changed from 0v, increment by 5 v, with the highest voltage 30 V)
- Compute currents I1, and I2 for each of the adjusted voltage value

2. Plotting Two Resistors

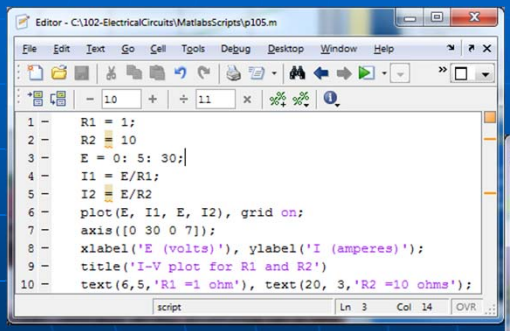
MATLAB Solution:

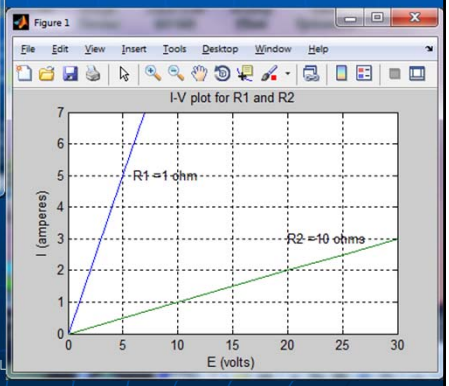
- File => New => Script (create a new script file)
- Enter the following statements, then save it as p105.m

```
R1 = 1;
R2 = 10
E = 0: 5: 30;
I1 = E/R1;
I2 = E/R2
plot(E, I1, E, I2), grid on;
axis([0 30 0 7]);
xlabel('E (volts)'), ylabel('I (amperes)');
title('I-V plot for R1 and R2')
text(6,5,'R1 =1 ohm'), text(20, 3,'R2 =10 ohms');
```

2. Plotting Two Resistors

- Debug => Run to execute the script, and its plot





3. Three Resistor in Series

- Example 3:
  Calculating Series Resistance, Current in the circuit, voltage drops across each resistors R1 = 10ohms, R2=20ohms, and R3 =40ohms; and power supply voltage is E = 10V.

- Problem Statement:
  - You are asked by your supervisor to design a MATLAB program for your colleague. This program should allow the user to calculate the total series resistance of a circuit.

3. Three Resistor in Series (continue)

- Problem Solving Process and Steps:
  - Define the problem
  - Formulate a mathematical model
  - Develop an algorithm
  - Write the code for the problem
  - Test program and verify the solution
  - Document the program and solution

3. Three Resistor in Series (continue)

- **Problem Solving Process and Steps:**
  1. Define the problem
  2. Formulate a mathematical model - Total R = R1 + R2 + R3 + … + Rn
  3. Develop an algorithm

     Step 3.1: User input R1, R2, R3, … Rn, one at a time

     Step 3.2: Compute subtotal resistance

     Step 3.3: Repeat until the end of resistance entering

     Step 3.4: Print total resistance

     Step 3.5: Calculate total circuit current

     Step 3.6: Calculate voltage drops V1, V2, V3
  4. Write the code for the problem

3. Three Resistor in Series – Solution

- **MATLAB Solution 1**
  - Understand who users are
  - How to input resistance values?
  - The mathematical model or equation

  Total R = R1 + R2 + R3 + … + Rn
  - How to display or print total resistance value?

```
>> E = 10;
>> r1 = 10; r2 = 20;
>> r3 = 40;
>> r_total = r1 + r2 + r3
r_total =
    70
>> I = E/r_total;
>> V1 = I*r1; V2 =I*r2;
>>V3 = I*r3;
>> E – (V1 + V2+ V3)
E = 0
```


Summary