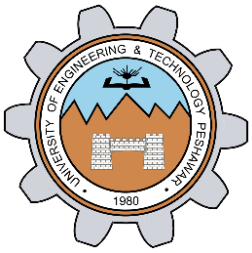
Circuit and System-I Lab

LAB # 12



Spring 2022

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Class Section: **C**

"On my honor, as student of University of Engineering and Technology, I have neither given nor received unauthorized assistance on this academic work."

Student Signature: _____

Submitted to:

Engr. Faiz Ullah

5 July, 2022

Department of Computer Systems Engineering

ASSESSMENT RUBRICS LAB # 12

Complex Circuit Analysis using MATLAB

LAB REPORT ASSESSMENT				
Criteria	**Excellent**	**Average**	**Nill**	**Marks Obtained**
1. Objectives of Lab	All objectives of lab are properly covered [Marks 0.5]	Objectives of lab are partially covered [Marks 0.25]	Objectives of lab are not shown [Marks 0]	
2. Complex Circuit (Theory, Circuit Diagram)	Brief introduction about Complex Circuit (How to apply KVL equations in each mesh) is shown along with properly labeled circuit diagram [Marks 2]	Some of the points about Mesh Current Analysis are missing and circuit diagram is not properly labeled [Marks 0.5]	Introduction about complex circuit and circuit diagram is not shown [Marks 0]	
3. MATLAB	Brief introduction of MATLAB [Marks 1]	Brief introduction of MATLAB Is not shown [Marks 0]		
4. MATLAB code	All experimental code of MATLAB is shown [Marks 3]	Some of the codes are missing [Marks 1.5]	Full codes are missing [Marks 0]	
5. Comparisons of MATLAB and PSpice	Results are verified [Marks 2.5]	Results are not verified [Marks 0]		
6. Conclusion	Conclusion about experiment is shown [Marks 1]	Conclusion about experiment is partially shown [Marks 0.5]	Conclusion about experiment is not shown [Marks 0]	
			Total Marks Obtained:_____	
			Instructor Signature: _____	

Complex Circuit Analysis using MATLAB

OBJECTIVES:

- To know about the complex circuits
- To know the basic interface of MATLAB & it's uses
- To analyze given circuit using MATLAB

APPARATUS USED:

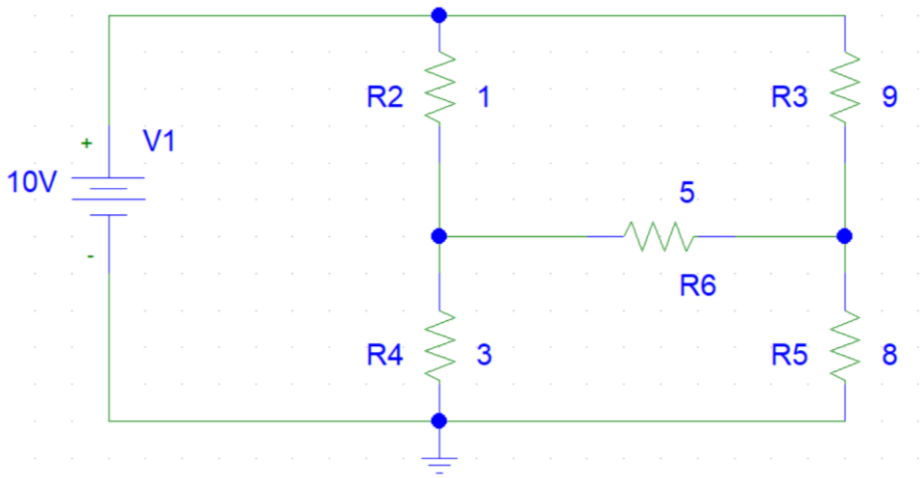
- Computer with PSPICE and MATLAB software installed on it

WHAT IS A COMPLEX Circuit?

A complex circuit configuration is one that contains components that neither a parallel nor series with each other. If a circuit can be reduced to a single resistor, it is a series or parallel.

Complex circuits cannot be reduced to a single resister and contain components that are neither a series nor a parallel. Resistors are connected in a complicated manner. Complex circuits contain more than one source of electromotive force or pure voltage source. They cannot be solved by using series and parallel combinations.

Example:



Complex Circuit in PSPICE

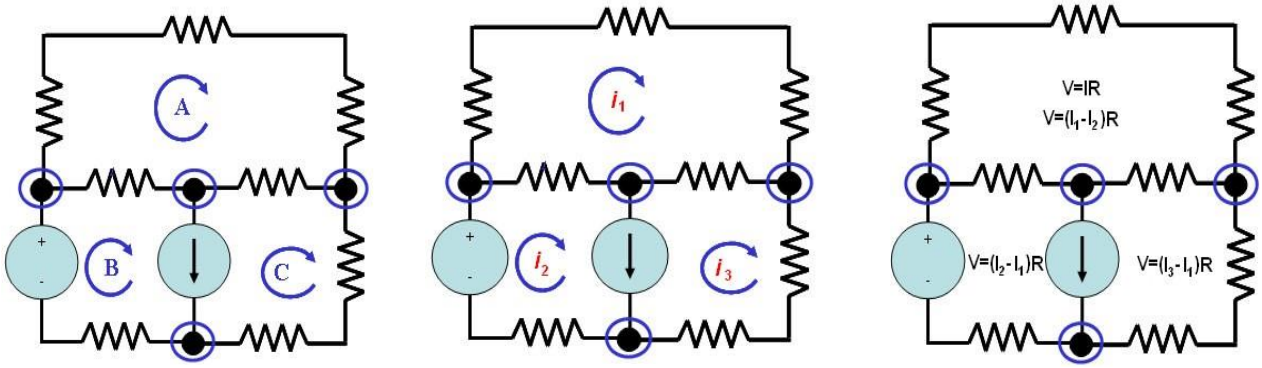
Kirchhoff's Voltage Law:

Kirchhoff's Voltage Law states that in any closed loop circuit the total voltage will always equal the sum of all the voltage drops within the loop.

Steps of applying kvl on meshes:

Following are the main steps involved

1. Identify the number of basic meshes.
2. Assign a current to each mesh.
3. Then apply Kirchhoff's Voltage Law (KVL) in order to get an equation in terms of loop current.
4. Then solve the system of equation(s) obtained as a result of the KVL.



Step 1 Step 2 Step 3

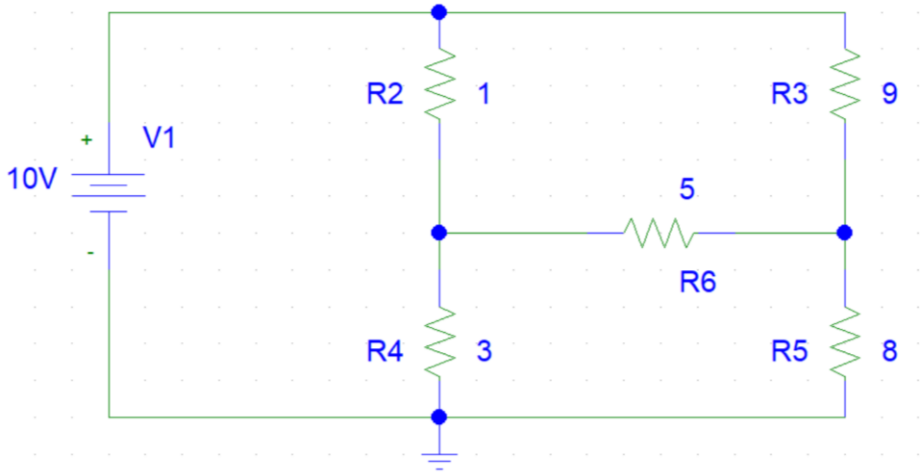
MATLAB:

MATLAB is a high-performance language for technical computing. It integrates computation, visualization, and programming in an easy-to-use environment where problems and solutions are expressed in familiar mathematical notation. Typical uses include:

USES:

MATLAB is used for Math and computation, Algorithm development, Scientific and engineering graphics Application development, including Graphical User Interface building etc

Solution of COMPLEX CIRCUIT:



Consider three meshes containing current I_1,I_2 and I_3. Let's suppose I_1 is flowing in mesh 1, I_2 mesh 2 and I_3 in mesh 3.

Now the mesh current analysis for mesh 1 , 2 and 3 is:

MESH 1:

$$-10 + 1(I_1 - I_2) + 3(I_1 - I_3) = 0$$

$$-10 + I_1 - I_2 + 3I_1 - 3I_3 = 0$$

$$4I_1 - I_2 - 3I_3 = 10$$

MESH 2:

$$9I_2 + 5(I_2 - I_3) + 1(I_2 - I_1) = 0$$

$$9I_2 + 5I_2 - 5I_3 + I_2 - I_1 = 0$$

$$-I_1 + 15I_2 - 5I_3 = 0$$

MESH 3:

$$8I_3 + 5(I_3 - I_2) + 3(I_3 - I_1) = 0$$

$$8I_3 + 5I_3 - 5I_2 + 3I_3 - 3I_1 = 0$$

$$-3I_1 - 5I_2 + 16I_3 = 0$$

Writing matrices form:

$$\begin{bmatrix} 4 & -1 & -3 \\ -1 & 15 & -5 \\ -3 & -5 & 16 \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \\ I_3 \end{bmatrix} = \begin{bmatrix} 10 \\ 0 \\ 0 \end{bmatrix}$$

$$\text{let Z} = \begin{bmatrix} 4 & -1 & -3 \\ -1 & 15 & -5 \\ -3 & -5 & 16 \end{bmatrix}, I = \begin{bmatrix} I_1 \\ I_2 \\ I_3 \end{bmatrix} \; and \; V = \begin{bmatrix} 10 \\ 0 \\ 0 \end{bmatrix}$$

$$\text{AI} = \text{V}$$

$$\text{I} = \text{A}^{-1}\text{V}$$

CODE SCREENSHOT:

MATLAB

Editor - lab12.m | Command Window

lab12.m

```
1 -   clc
2 -   clear all
3 -   Z =[4,-1,-3;
4         -1,15,-5;
5         -3,-5,16];
6 -   V = [10,0,0]';
7 -   I = inv(Z)*V
8
9
10 -  fprintf('the current through I1 is %.3f Amps \n',I(1))
11 -  fprintf('the current through I2 is %.3f Amps \n',I(2))
12 -  fprintf('the current through I3 is %.3f Amps \n',I(3))
13
14 -  IRB = I(3)-I(2)
15
16 -  fprintf('the current through R is %.3f Amps \n',IRB)
17
```

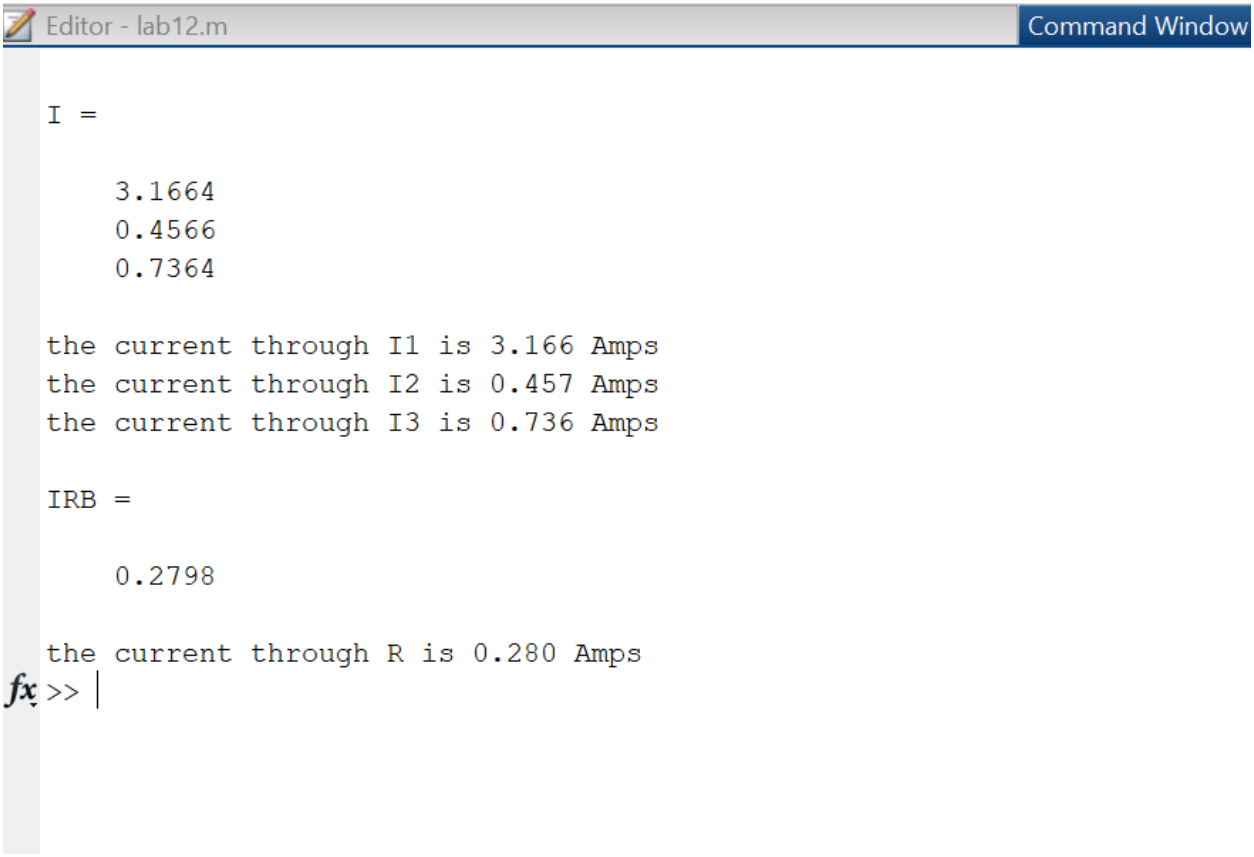
STEPS:

1. First of All,We introduce symbol sign to tell compiler that we have to find them like I1, I2 etc.
2. Then introduce a variable and put all the values of matrix in it what it be of 2 x 3,or 3x3. E.g A=[1 2 3 ;4 5 6;7 8 9]
3. Take another variable I and put all values we have to find.

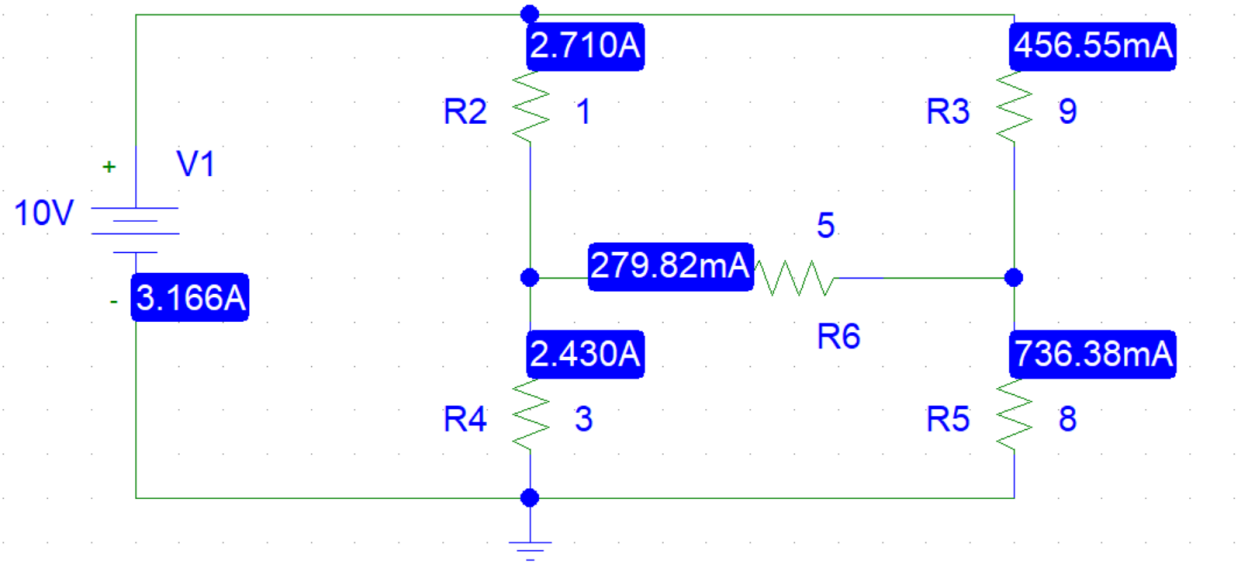
I= [I1,I2,I3]

4. Take matrix third values and give it another name like B=[1;2;3]
5. Now use formula to find value and execute program.
6. Repeat the same procedure for different circuits and equations.

OUTPUT:



VERIFICATION IN PSPICE:



OBSERVATIONS AND RESULTS:

Following results are verified with the help of PSCPICE

S. NO.	MATLAB RESULTS		PSPICE RESULTS	
1	I_1	3.166A	I_1	3.166A
2	I_2	0.457A	I_2	456.55mA
3	I_3	0.736A	I_3	736.38mA
4	I_{RB}	0.280A	I_{RB}	279.82mA

CONCLUSION:

We concluded that MATLAB can be used as a powerful tool for performing mathematical operations such as solving 3x3 matrix in this case.