Experiment-1

Verification of Thevenin's Theorem

Aim :-

To simulate the given circuit using Mat lab Simulink & Verify Thevenin's Theorem.

Apparatus Required:-

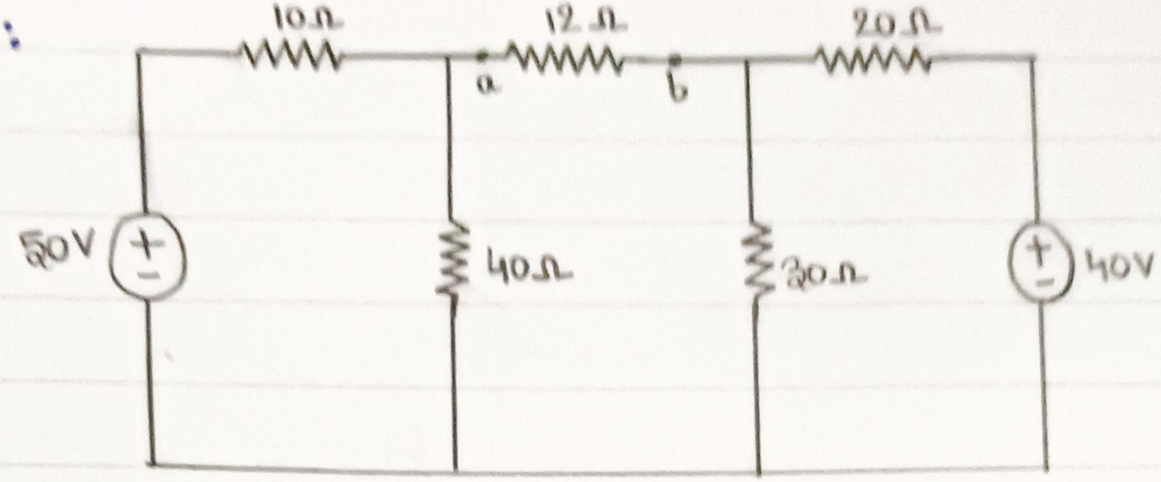
1. Laptop/Desktop
2. MATLAB

Requirements :-

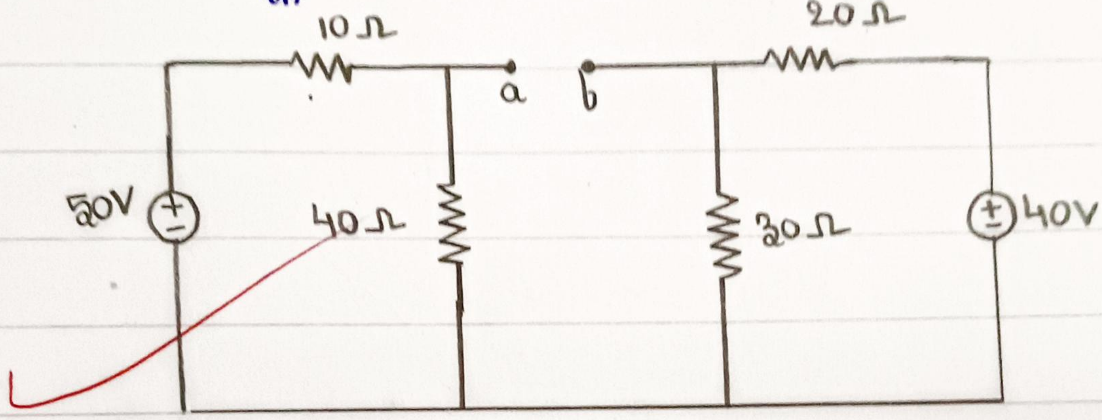
Components	Tool Box/Library browser	BLOCK	Parameters
Voltage Source	Simpower systems/ Electrical Sources	DC Voltage Source	Amplitude = 50V, 40V
Resistors	Simpower systems / Elements	Series RLC Branch(Select R)	Resistance(ohm) =10, 40, 12, 30 & 20
Measurements	Simpower Systems/ Electrical Measurements	Current/ Voltage Measurement	Default
Display	Simulink/ Sinks	Display	Default
Powergui	Simpower systems/ Elements	Powergui	Continuous

Theoretical Calculations :-

CKT-1:



CKT-2: To find V_{th}



$$V_a = 50 \times \frac{40}{40+10}$$

$$V_a = 40V$$

$$V_b = 40 \times \frac{30}{30+20}$$

$$V_b = 40 \times \frac{30}{50}$$

$$V_b = 24V$$

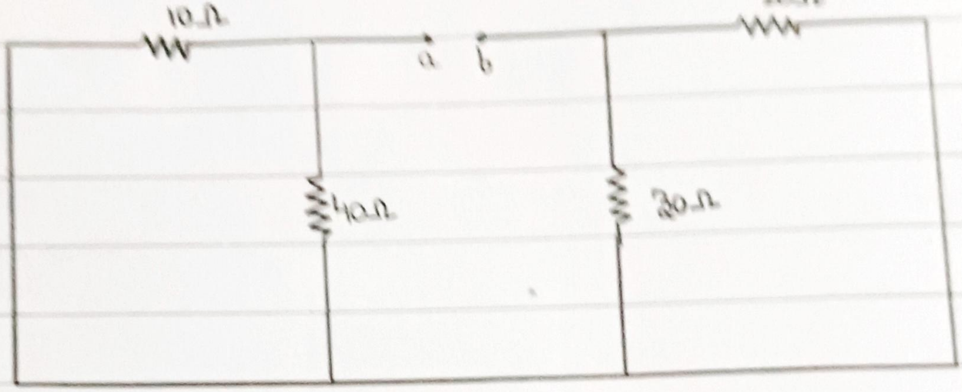
$\therefore V_{ab} = V_a - V_b$

$V_{ab} = 40 - 24$

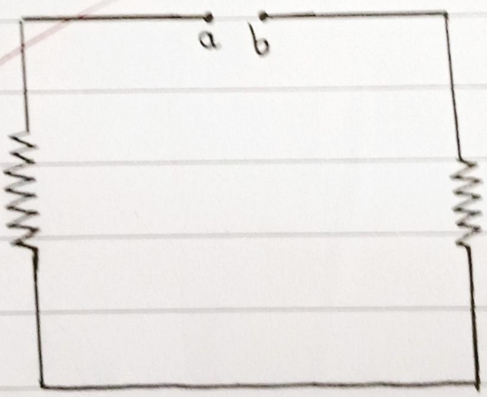
$V_{ab} = 16V$

$V_{ab} = V_{th} = 16V$

CKT-3 : To find R_{th} :-



The above circuit can be redrawn as follows



$= \frac{10 \times 40}{10 + 40}$

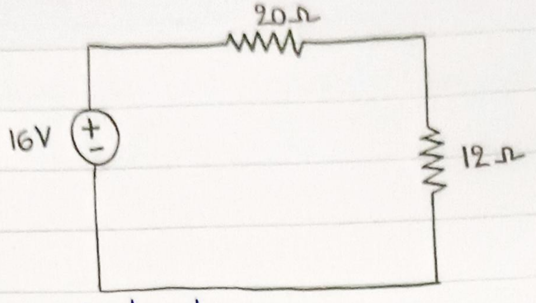
$= 8\Omega$

$\frac{30 \times 20}{30 + 20} = 12\Omega$

$R_{th} = 8\Omega + 12\Omega$

$\therefore R_{th} = 20\Omega$

CKT-4: Equivalent Thevenin circuit



We get the Equivalent values as follows

$V_{th} = 16V$

$R_{th} = 20\Omega$

∴ Voltage across 12 Ω resistor is

$$V_{12\Omega} = V_{th} \times \frac{R_L}{R_L + R_{th}}$$

$$V_{12\Omega} = 16 \times \frac{12}{12+20}$$

$$\boxed{V_{12\Omega} = 6V}$$

Comparision Table:-

S. No	Parameters	Theoretical	Practical
1.	V_{th}	16V	16V
2.	R_{th}	20 Ω	20 Ω
3.	$V_{12\Omega}$	6V	6V

Result:-

Hence thevenin's Theorem is verified both theoritically as well as using Simulation tools.

19/11/2021

Experiment-2

Verification of Norton's Theorem

Aim:

To simulate the given circuit using Mat lab Simulink & verify Norton's Theorem.

Apparatus Required:

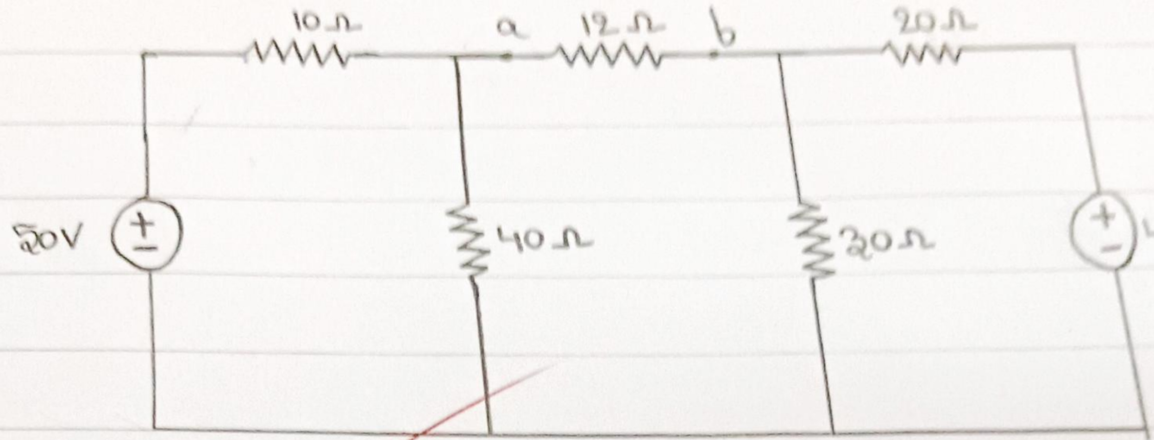
1. Laptop / Desktop
2. MATLAB

Requirements:

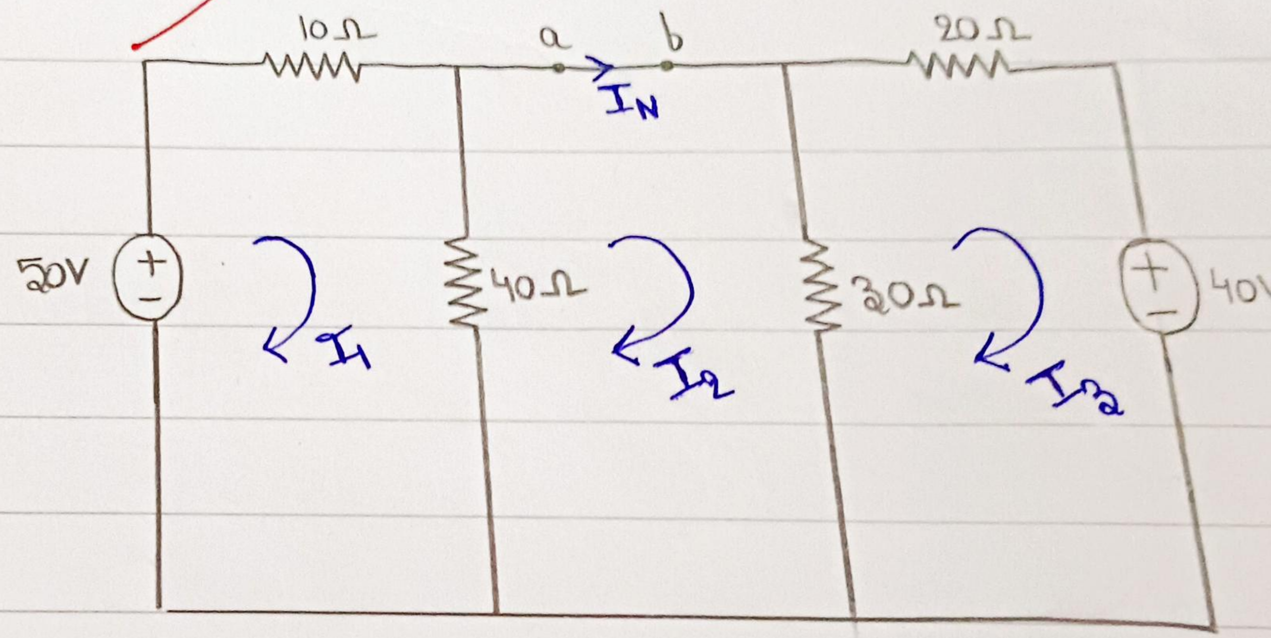
Components	Tool Box/ Library browser	Block	Parameters
Voltage source	Simpower systems/ Electrical sources	DC voltage source	Amplitude = 50V, 40V
Resistors	Simpower Systems/ Elements	Series RLC Branch (Select R)	Resistance(Ohm) =10, 40, 12, 30 & 20
Measurements	Simpower Systems/ Electrical Measurements	Current/ Voltage Measurement	Default
Display	Simulink/ Sinks	Display	Default
Powergui	Simpower systems/ elements	Display powergui	Default Continuous

Theoretical Calculations:-

CKT:-1



CKT-2: 1



$20 - 10(I_1) - 40(I_1 - I_2) = 0$

$-20I_1 + 40I_2 = -20$ —— (1)

$-40(I_2 - I_1) - 30(I_2 - I_3) = 0$

$-40I_2 + 30I_2 + 40I_1 - 30I_3 = 0$

$-10I_2 + 40I_1 - 30I_3 = 0$ —— (2)

$-20I_3 - 40 - 30(I_3 - I_2) = 0$

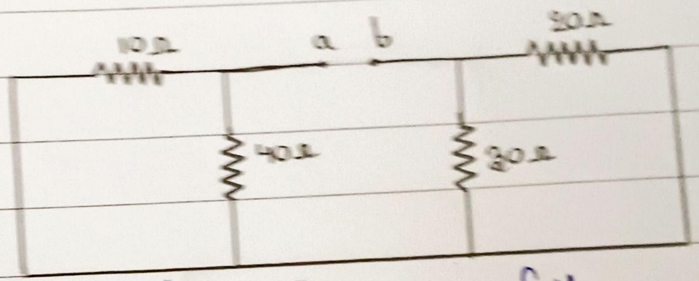
$-50I_3 + 30I_2 = 40$ —— (3) Solving eq (1) & (2) & (3)

We get $I_1 = 1.64$

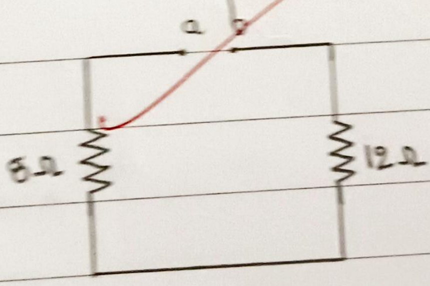
$I_2 = 0.8$

$I_3 = 0.32$

Circuit-3:-

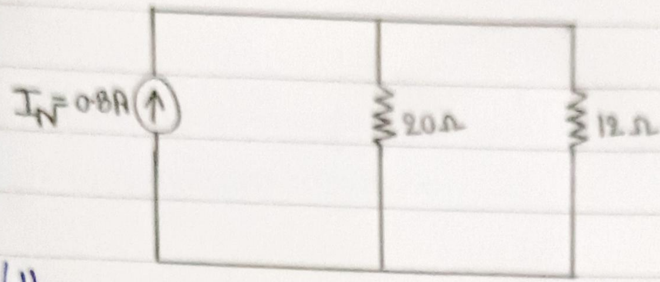


The above circuit can be redrawn as follows



$R_{ab} = 8 + 12 = 20\,\Omega$

CKT-4: Equivalent circuit



Voltage across 12Ω

$$0.8 = \frac{V_{ab}}{20} + \frac{V_{ab}}{12}$$

$$V_{ab} = 6V$$

Comparision Table:

S.No	Parameters	Theoritical	Practical
1.	I	0.8A	0.8A
2.	R_N	20Ω	20Ω
3.	$V_{12\Omega}$	6V	6V

Result: Hence Norton's theorem is verified both theoritically as well as using Simulation tools.

26/11/2021

Experiment-3

Verification of Superposition Theorem

Aim:

To simulate the given circuit using Mat lab Simulink & verify superposition theorem.

Apparatus Required:

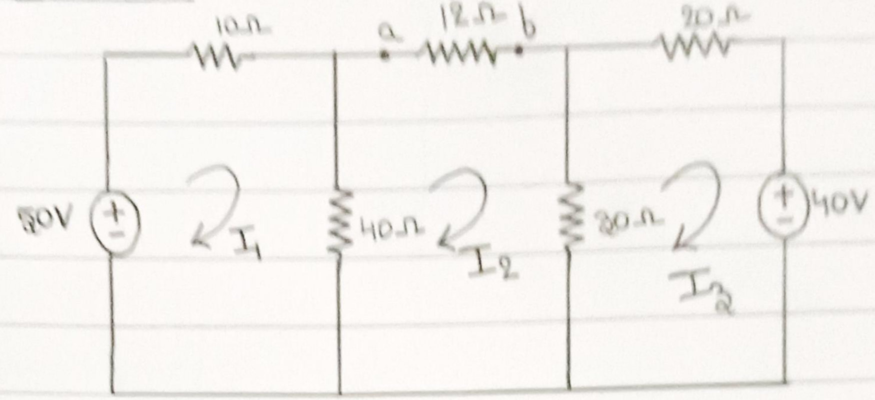
1. Laptop/ Desktop
2. MATLAB

Requirements:

Components	Tool Bar/ Library browser	Block	Parameters
Voltage Source	Simpower System/ Electrical sources	Dc Voltage Source	Amplitude = 50V, 40V
Resistors	Simpower systems/ Elements	Series RLC Branch(Select R)	Resistance (Ohm)= 10,40, 12,30 & 20.
Measurements	Simpower systems /Electrical Measure -ments	Current/ Voltage Measurement	Default
Display Powergui	Simpower Systems/Elements	Display Powergui	Default Continuous

Theoretical Calculations:-

CKT-1:-



$-50+10I_1+40(I_1-I_2)=0$

$50I_1-40I_2=50$ —— ①

$-40(I_2-I_1)+12I_2+30(I_3-I_2)=0$

$-30I_2 + 82I_2+30I_3+40I_1=0$

$82I_2-40I_1+30I_3=0$ —— ②

$20I_3+30(I_3-I_2)=0$

$-30I_2+50I_3=0$ —— ③

By solving ① & ② & ③, we get

$I_1=2A$

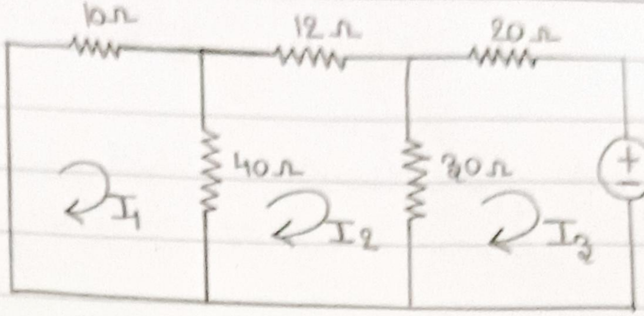
$I_2=1.25\,A$

$I_3=0.75\,A$

$V_{ab_1}=1.25\times12$

$V_{ab_1}=15V$

CKT-3:-



$$10I_1 + 40(I_1 - I_2) = 0 \quad \text{---} ①$$

$$-40(I_2 - I_1) + 12I_2 + 30(I_2 - I_3) = 0$$

$$-40I_2 + 42I_2 + 40I_1 - 30I_3 = 0$$

$$2I_2 + 40I_1 - 30I_3 = 0 \quad \text{---} ②$$

$$-30(I_3 - I_2) + 20I_3 + 40 = 0$$

$$I_1 = -0.6A$$

$$I_2 = -0.75A$$

$$I_3 = -1.25A$$

$$V_{ab_2} = -0.75 \times 12$$

$$V_{ab_2} = -9V$$

03/12/2021

$$V_{ab_1} + V_{ab_2} = V_{ab}$$

$$15 + (-9) = V_{ab}$$

$$\boxed{V_{ab} = 6V}$$

Comparision Table:-

S.No	Parameter	Theoritical	Practical
1.	Vab1	15V	15V
2.	Vab2	-9V	-9V
3.	Vab	6V	6V

Result:- Hence Superposition theorem is verified both theoretically as well as using Simulation tools.

Experiment-4

Verification of KCL & KVL

Aim: To simulate the given circuit using MATLAB Simulink & Verify KCL & KVL

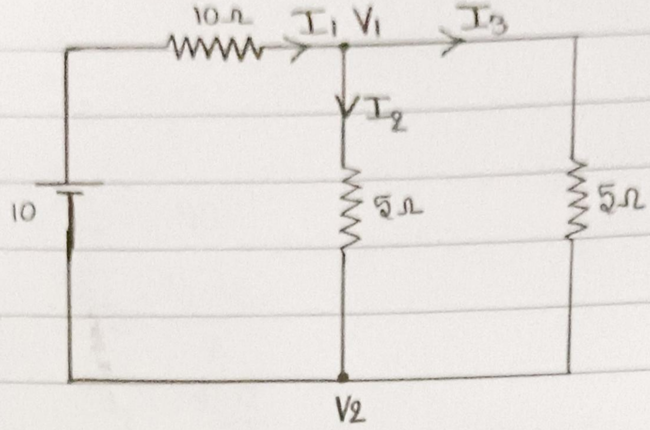
Apparatus Required:

1. Laptop / Desktop
2. MATLAB

Requirements

Components	ToolBox/ Library browser	BLOCK	Parameters
Voltage Source	Simpower systems/ Electrical Sources	DC Voltage source	Amplitude = 50V, 40V
Resistors	Simpower systems/ Elements	Series RLC Branch(Select R)	Resistance(ohm) =10, 40, 12, 30 & 20
Measurements	Simpower Systems / Electrical Measurements	Current/ Voltage Measurement	Default
Display	Simulink/ Sinks	Display	Default
Powergui	Simpower systems/ Elements	Powergui	Continuous

Theoretical Calculation for KCL :-



$$I_1 = I_2 + I_3$$

$$\frac{V_2 - V_1 + 10}{10} = \frac{V_1 - V_2}{5} + \frac{V_1 - V_2}{5}$$

$$\frac{0 - V_1 + 10}{10} = \frac{V_1 - 0}{5} + \frac{V_1 - 0}{5}$$

$$-\frac{V_1}{10} + 1 = \frac{V_1}{5} + \frac{V_1}{5}$$

$$1 = \frac{2V_1}{5} + \frac{V_1}{10}$$

$$1 = \frac{4V_1 + V_1}{10}$$

$$10 = 5V_1$$

$$V_1 = 2V$$

$$I_1 = \frac{V_2 - V_1 + 10}{10}$$

$$I_1 = \frac{0 - 2 + 10}{10}$$

$$I_1 = 0.8A$$

$$I_2 = \frac{V_1 - V_2}{5}$$

$$I_2 = \frac{2 - 0}{5}$$

$$I_2 = 0.4A$$

$$I_3 = \frac{V_1 - V_2}{5}$$

$$I_3 = \frac{2 - 0}{5}$$

$$I_3 = 0.4A$$

$$I_1 = I_2 + I_3$$

$$0.8 = 0.4 + 0.4$$

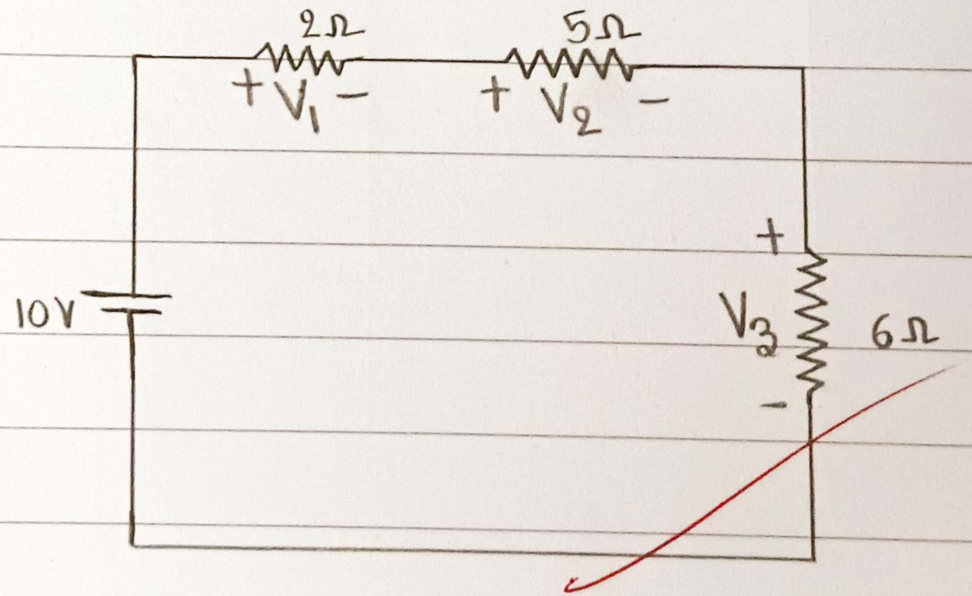
$$0.8 = 0.8$$

Hence KCL is verified theoretically

Comparision Table:-

S.No	Parameter	Theoritical	Practical
1.	I_1	1.875A	1.875A
2.	$I_2 = I_N$	0.625A	0.625A
3.	I_3	1.25A	1.25A

Theoretical Calculation:-



$$-10 + V_1 + V_2 + V_3 = 0$$

$$-10 + 2I + 5I + 6I = 0$$

$$-10 + 13I = 0$$

$$I = \frac{10}{13}$$

$$I = 0.769$$

$$V_1 = IR$$

$$V_1 = 0.769 \times 2$$

$$V_1 = 1.538$$

$$V_2 = 5 \times 0.769 = 3.845V$$

$$V_3 = 6 \times 0.769 = 4.614V$$

$$-10 + 1.538 + 3.845 + 4.614 = 0$$

$$9.997 = 10$$

$$10 = 10$$

Comparision Table:-

S.No	Parameters	Theoritical	Practical
1.	V_1	2V	2V
2.	V_2	4V	4V
3.	V_3	4V	4V

Result:-

Hence KCL & KVL is verified both theoritically as well as using simulation tools.

10/12/2021

Experiment-5

Verification of mesh analysis

Aim:

To simulate the given circuit using MATLAB Simulink and verify Mesh analysis.

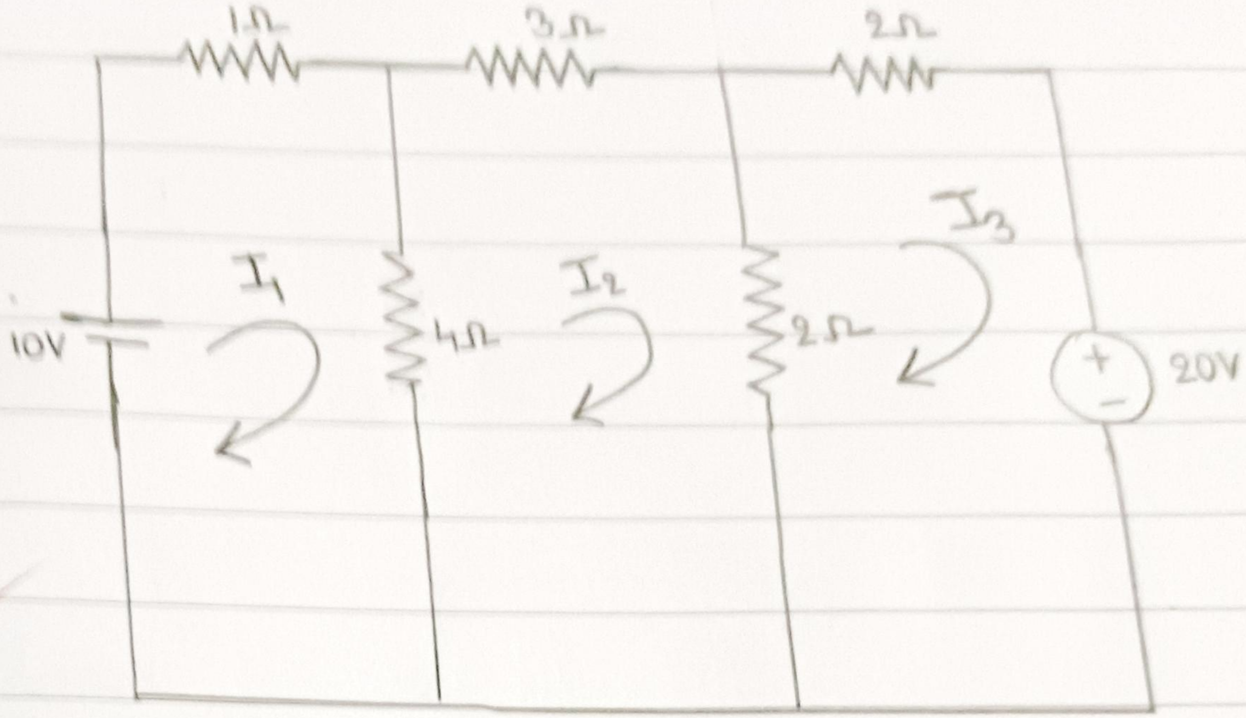
Apparatus Required:-

1. Laptop/Desktop
2. MATLAB

Requirements:-

Components	Tool box/ Library browser	Block	Parameters
Voltage Source	Simpower system /electrical sources	DC voltage Source	Amplitude = 50V, 40V
Resistors	Simpower systems/ Elements	Series RLC branch (Select R)	Resistance(Ohm) = 10, 40, 12, 30 & 20
Measurements	Simpower systems /electrical measurement	Current/ Voltage measurement	Default
Display	Simulink/Sinks	Display	Default
Powergui	Simpower system / Elements	Powergui	Continuous

Theoritical Calculations:-



Apply Mesh analysis for loop 1

$$10 - I_1 - 4(I_1 - I_2) = 0$$

$$-5I_1 + 4I_2 = -10 \quad — ①$$

Apply Mesh analysis for loop 2

$$-3I_2 - 2(I_2 - I_3) - 4(I_2 - I_1) = 0$$

$$4I_1 - 9I_2 + 2I_3 = 0 \quad — ②$$

Apply Mesh analysis for loop ③

$$-2I_3 - 20 - 2(I_3 - I_2) = 0$$

$$2I_2 - 4I_3 = 20 \quad \text{--- (3)}$$

By solving eq (1), (2) & (3)

$I_1 = 1.66A$

$I_2 = 0.416A$

$I_3 = -5.21A$

Comparision Table:-

S.No	Parameter	Theoritical	Practical
1.	I_1	1.66A	1.66A
2.	I_2	-0.416A	-0.416A
3.	I_3	-5.21A	-5.21A

Result:-

Hence Mesh analysis is verified both theoritically as well as using simulation tools.

24/02/2021

Experiment-6

Verification of nodal analysis

Aim:-

To simulate the given circuit using MATLAB Simulink and verify nodal analysis

Apparatus Required:

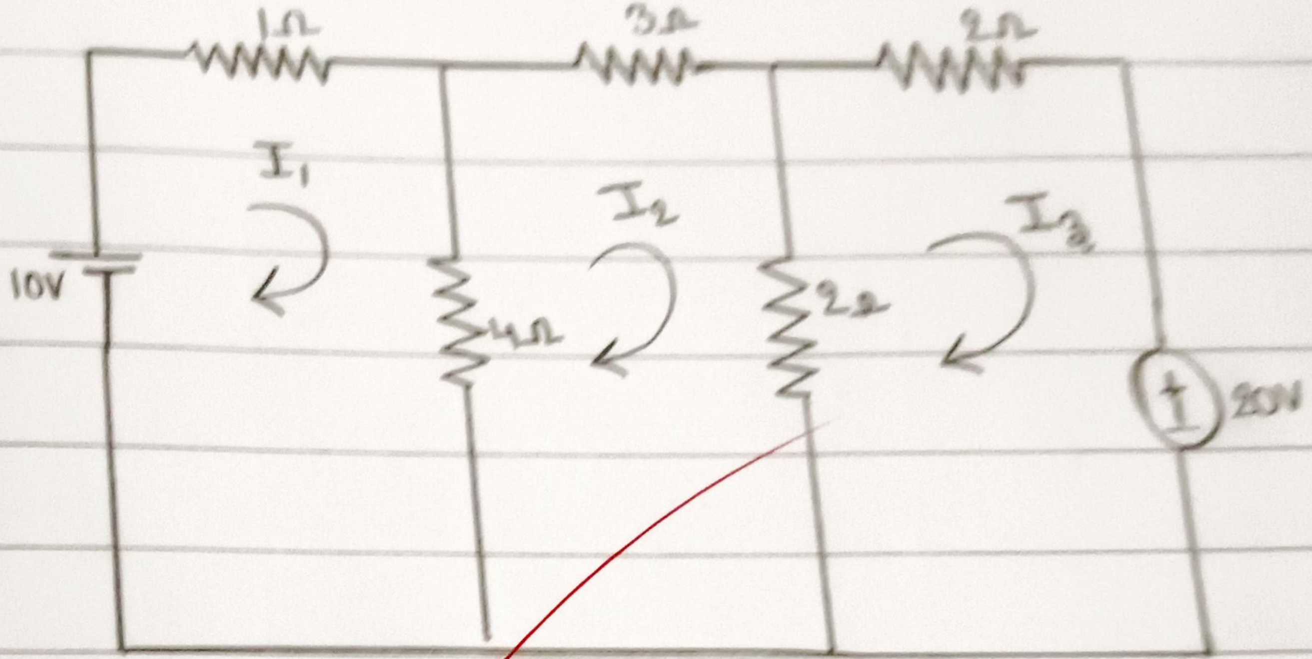
1. Laptop / Desktop
2. MATLAB

Requirements:

Components	Tool Box / library browser	Block	Parameters
Voltage Source	Simpower System / Electrical Sources	DC Voltage Source	Amplitude = 50V, 40V
Resistors	Simpower systems / Elements	Series RLC branch (Select R)	Resistance =10, 40, 12, 30 & 20
Measurements	Simpower Systems / electrical measurements	Current / Voltage Measurement	Default
Display	Simulink / Sinks	Display	Default
Powergui	Simpower system / Elements	Powergui	Continuous

Steps to do Nodal Analysis :-

Theoritical Calculations :-



Apply Nodal analysis at loop 1

$$\frac{V_1-10}{1}+\frac{V_1}{4}+\frac{V_1-V_2}{3}=0$$

$$12V_1-120+3V_1+4V_1-4V_2=0$$

$$19V_1-4V_2-120=0 \quad \text{—}\ 1$$

Apply Nodal analysis at loop ②

$$\frac{V_2-V_1}{3}+\frac{V_2}{2}+\frac{V_2-20}{2}=0$$

$$2V_2-2V_1+3V_2+3V_2-60=0$$

$$-2V_1+8V_2-60=0 \quad — ②$$

By solving eq ① & ②
we get

$V_1 = 8.33V$

$V_2 = 9.58V$

Current passing through 1Ω resistor

$$I=\frac{10-V_1}{1}=\frac{10-8.33}{1}$$

$$\boxed{I = 1.67A}$$

Comparision Table:-

S.NO	Parameters	Theoretical	Practical
1.	V_1	8.33V	8.33V
2.	V_2	9.58V	9.58V
3.	IΩ	1.67A	1.67A

Result:-

Hence Nodal analysis is verified both theoriti cally as well as using simulation tools.

31/02/2011

Experiment-7

Generation of various signals like impulse signal/ impulse wave form step signal, square waveform, sinusoidal signal, ramp, triangular signal.

Aim: To generate various signals & sequences (Periodic & Aperiodic) such as unit Impulse, Step, Square, Saw tooth, Triangular, Sinusoidal, Ramp using MATLAB Simulink.

Apparatus Required:-

1. Laptop / Desktop
2. MATLAB

Generation of Sawtooth wave form:-

```
clc;
clear all;
close all;
t=0:0.001:0.1
y2=t
y=10* sawtooth (2*Pi*50*t)
plot (t,y)
```

Generation of Square wave form:-

```
clc;
clear all;
close all;
t=0:0.001:0.1
y2=t
y=10*square(2*pi*50*t)
plot(t,y)
```

Generation of Sinusoidal wave form:-

```
clc;
clear all;
close all;
t=0:0.1:2
for i=1:length(t)
    if (0<=t(i)<=1)
        x(:,i)=sin(Pi*t(i))
    elseif (1<t(i)<=2)
        x(:,i)=-2*sin(Pi*t(i))
    else
        x(:,i)=0
    end
end
plot(t,x)
```

Generation of Unit Impulse Waveform:-

```
clc;
clear all;
close all;
t1=-1:0.01:1
for i=1:length(t1)
    t1= -1:0.01:1
    if t1(i)<0
        y1(:,i)=0
    elseif t1(i)==0
        y1(:,i)=1
    else
        y1(:,i)=0
    end
end
plot(t1,y1);
xlabel('time');
ylabel('amplitude');
title('Unit impulse signal');
```

P. No

Generation of unit step wave form:-

```
clc;
clear all;
close all;
t2=-10:0.2:10;
for i=1:length(t2)
    if t2(i)<0
        y1(:,i)=0;
    elseif t2==0
        y1(:,i)=1;
    else
        y1(:,i)=1;
    end
end
y2=(t2>=0);
plot(t2,y2);
xlabel('time');
ylabel('amplitude');
title('Unit step signal');
```

P.No 32

Generation of triangular waveform:

```
clc;
clear all;
close all;
t = 0:0.001:0.1;
x = t;
y = 10 * sawtooth(2*pi*50*t, 0.5)
plot(t, y)
xlabel('time');
ylabel('amplitude');
title('triangular signal');
```

Generation of Ramp signal waveform:-

```
clc;
clear all;
close all;
t=0:0.001:0.1;
y2=t;
plot(t,y2)
xlabel('time');
ylabel('amplitude');
title('Ramp signal');
```

Result:-

Hence generation of various signals & sequences such as Unit Implulse, Step, Square, Saw tooth, Triangular Sinusoidal, Ramp are verified using Simulink tools.

07/01/2022

Experiment-8

Operations on signals & sequences such as Addition, Multiplication, Scaling, Shifting, Folding, Computation of Energy, and Average Power.

Aim: To operate signals and sequences such as Addition, Multiplication, Scaling, Shifting, Folding, Computation of Energy, and Average Power using MATLAB simulink.

Apparatus Required:-

1. Laptop/Desktop
2. MATLAB

Addition of two signals:-

```
% generating two input signals
clc;
clear all;
close all;
t=0:0.1:1;
x1=sin(2*pi*4*t);
x2=sin(2*pi*8*t);
subplot(2,2,1);
plot(t,x1);
xlabel('time');
ylabel('amplitude');
title('input signal 1');
subplot(2,2,2);
plot(t,x2);
xlabel('time');
ylabel('amplitude');
title('input signal 2');
% addition of signals
y1=x1+x2;
subplot(2,2,3);
plot(t,y1);
xlabel('time');
ylabel('amplitude');
title('addition of two signals');
```

Multiplication of two signals:-

```
% generating two input signals
clc;
clear all;
close all;
t=0:0.1:1;
x1=sin(2*pi*4*t);
x2=sin(2*pi*8*t);
subplot(2,2,1);
plot(t,x1);
xlabel('time');
ylabel('amplitude');
title('input signal 1');
subplot(2,2,2);
plot(t,x2);
xlabel('time');
ylabel('amplitude');
title('input signal 2');
% multiplication of signals
y2=x1*x2;
subplot(2,2,3);
plot(t,y2);
xlabel('time');
ylabel('amplitude');
title('multiplication of two signals');
```

Scaling of a signal:-

```
% generating two input signals
clc;
clear all;
close all;
t=0:0.1:1;
x1 = sin(2*Pi*4*t);
x2 = sin(2*Pi*8*t);
% Scaling of a signal 1
A=15;
y3 = A*x1;
figure;
subplot(2,2,1);
plot(t,x1);
xlabel('time');
ylabel('amplitude');
title('input signal');
subplot(2,2,2);
plot(t,y3);
xlabel('time');
ylabel('amplitude');
title('amplified input signal');
```

Shifting of a Signal:-

```
% generating two input signals
clc;
clear all;
close all;
t=0:0.1:1;
x1 = sin (2*pi*4*t);
figure;
subplot(2,1,1);
plot(t,x1);
subplot(2,1,2);
plot(t+2,x1);
xlabel('t+2');
ylabel('amplitude');
title('right shifted signal');
```

Result:-

Hence operations on signals & sequences such as Addition, Multiplication, Scaling, Shifting, Folding, Computation of energy & Average power are verified using simulation tools.

28/01/2022

Experiment-9

Verification of Series Resonance Using simulation tools

Aim: To obtain the plot of frequency vs. Xl, frequency vs. XC, frequency vs. impedance and frequency vs. Current for the given series RLC Circuit and determine the resonant frequency & check by theoretical Calculations. R=15 Ω, C=10μF, L=0.1H, V=50V vary frequency in steps of 1Hz Using Matlab.

```
% Program to find the Series Resonance
clc;
clear all;
close all;
r=input('enter the resistance value -->');
l =input('enter the inductance value -->');
c= input('enter the capacitance value -->');
v=input('enter the input voltage -->');
f = 5:2:300;
xl = 2* pi*f*l;
xc =(1./(2*pi*f*c));
x = xl-xc
z= sqrt((r^2)+(x.^2));
i= v./z;
Subplot(2,2,1);
plot(f,xl);
grid;
x label('frequency');
y label('xl');
```

```
subplot (2,2,2);
plot (f, xc);
grid;
xlabel ('frequency');
ylabel ('xc');
subplot (2,2,3);
plot (f,z);
grid;
xlabel ('frequency');
ylabel ('z');
subplot(2,2,4);
plot (f,i);
grid;
xlabel ('frequency');
ylabel ('I');
```

Result:- Hence series resonance is verified using simulation tools.

28/01/2022

Experiment - 10

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Verification of Parallel Resonance using Simulation tools

Aim:- To obtain the graphs of frequency vs. BL, frequency vs. BC, frequency vs. admittance & frequency vs. current vary frequency in steps for the given circuit & find the resonant frequency & check by theoretical calculations. R = 1000 Ω, C = 400 μF, L = 1H, V = 50 V vary frequency in steps of 1 Hz using Matlab.

```
% Program to find the Parallel Resonance
clc;
clear all;
close all;
r = input('enter the resistance value ——>');
l = input('enter the inductance value ——>');
c = input('enter the capacitance value ——>');
v = input('enter the input voltage ——>');
f = 0:2:50;
xl = 2*pi*f*l;
xc = (1./(2*pi*f*c));
bl = 1./xl;
bc = 1./xc;
b = bl-bc;
g = 1/r;
y = sqrt((g^2) + (b.^2));
```

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```
i=v*y; % plotting the graph
subplot (2,2,1);
plot(f,b1);
grid;
x label ('frequency');
y label('B1');
subplot (2,2,2);
plot (f,bc);
grid;
xlabel ('frequency');
y label('BC');
subplot(2,2,3);
plot(f,y);
grid;
x label('frequency');
y label('y');
Subplot(2,2,4);
plot(f,i);
grid;
x label('frequency');
y label ('I');
```

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Hence:- Result:-

Hence parallel resonance is verified using simulation tools.