Scilab Manual for Simulation Lab by Dr Santosh Desai Instrumentation Engineering BMS College of Engineering, Bangalore[1]

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Experiment: 1

Transient response of first order system - using programming

Scilab code Solution 1.1 Transient response of first order system using programming

```
1  //windows OS(10/7/8.1) . Scilab 6.0.1 (64-bit)
2  //toolbox null
3
4  // Transient response of RC Network using output
       equation method
5
6  clc
7  clear
8
9  R=500                                    // Resistance
       in a network
10 Ei=5                                     // Amplitude
       of input step signal
11 t=0:0.001:1;
12
13 //Case-1:
14 C1=10e-6                                 // Capacitance
       value in RC circuit 10uF provided by user
```

```
15 Y1=R*C1
16 E1=Ei*(1-exp(-t/Y1))                    // Formula for
      output voltage across capacitor
17 xlabel('Time')                          //Leveling x axis
       as time
18 ylabel('Output voltage(V)')              //Leveling y
      axis as output voltage
19 title('Transient Response of RC circuit at Different
       Capacitance')     //Title of Graph
20 plot(t,E1)                               //Output
      Response with respect to time
21 plot(E1,"b")                            //Blue colour at
      C1
22
23 //Case-2:
24 C2=100e-6                                        //
      Cacitance value in RC circuit 100uF provided by
      user
25 Y2=R*C2
26 E2=Ei*(1-exp(-t/Y2))                     // For output
      voltage across capacitor
27 xlabel('Time(s)')                              //Leveling
       x axis as time
28 ylabel('Output voltage(V)')              //Leveling y
      axis as output voltage
29 plot(t,E2)
30 plot(E2,"g")                           //Green colour at C2
31
32 //Cse-3:
33 C3=200e-6                            // Cacitance value in
       RC circuit 200uF provided by user
34 Y3=R*C3
35 E3=Ei*(1-exp(-t/Y3))                     // For output
      voltage across capacitor
36 xlabel('Time(s)')                        //Leveling x
      axis as time
37 ylabel('Output voltage(V)')              //Leveling y
      axis as output voltage
```

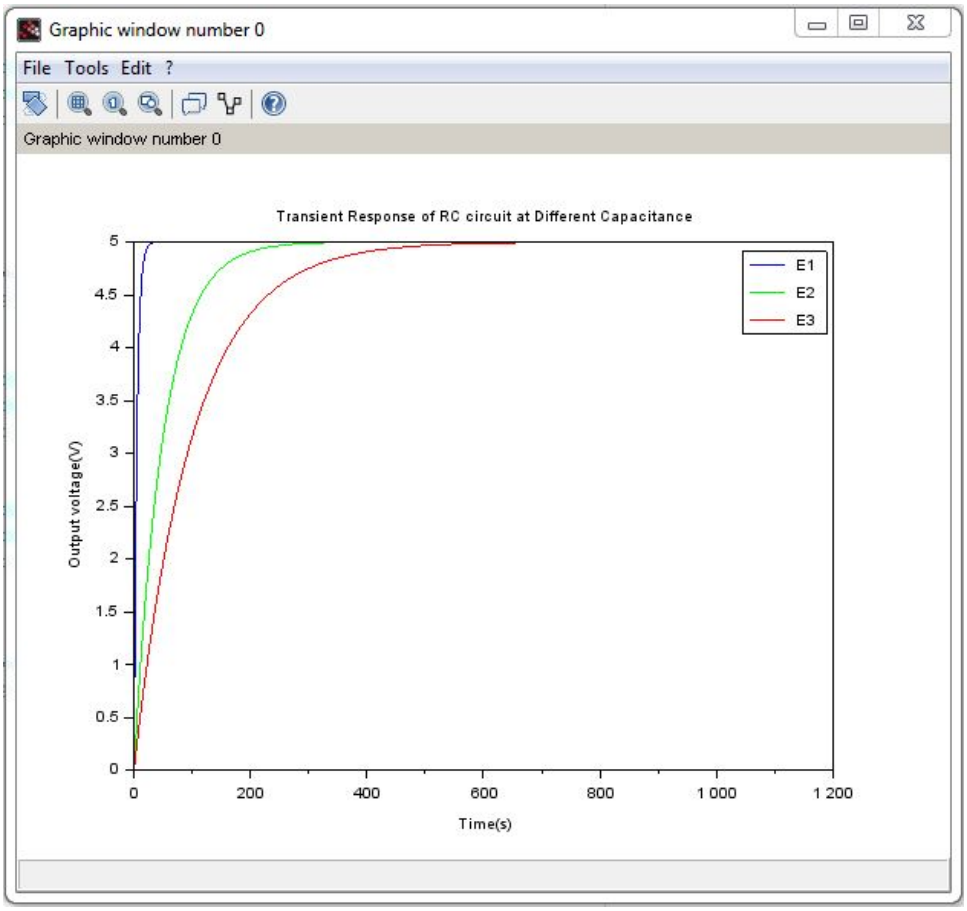


Figure 1.1: Transient response of first order system using programming

```
38 plot(t,E3)
39 plot(E3,"r")                                    //Red
      colour at C3
40
41 legends(['E1';'E2';'E3'],[2,3,5],opt=1)         //Legend
42 xgrid(1)                                        //Grid
```

Experiment: 2

Transient response of second order system - using programming

Scilab code Solution 2.2 Transient response of second order system using programming

```
1 //windows 10 . Scilab 6.0.1 (64-bit)
2 //toolbox null
3
4 //Transient resoponse of second order system example
      RLC circuit
5 //zeta is damping ratio given by user
6 //If 0< zeta <1, Damped System
7 //If zeta=1, Critically Damped System
8 //If zeta >1, Over Damped System
9 //If zeta=o, Undamped System
10 //wn is the system's natural frequency provided by
     user
11
12
13 clc
14 clear
```

```
15 t=0:0.002:1
16 wn=100;
17
18 xlabel('Time')                          //Leveling x axis
       as time
19 ylabel('Output voltage(V)')              //Leveling y
      axis as output voltage
20 title('Transient Response of Second order System')
         //Title of Graph
21 //for under damped system
22 zeta=0.2
23     phi=acos(zeta);
24     b=sin((wn*sqrt(1-zeta^2)*t)+phi);
25     C=1-(1/sqrt(1-zeta^2))*(exp(-zeta*wn*t).*b)
          //output equation
26     plot(t,C);
27     plot(C,"b")                  // ouput waveform in
          blue colour
28
29
30 //for over damped system
31 zeta1=5
32     phi1=acos(zeta1);
33     b1=sin((wn*sqrt(1-zeta1^2)*t)+phi1);
34     C1=1-(1/sqrt(1-zeta1^2))*(exp(-zeta1*wn*t).*b1)
35     plot(t,C1);
36     plot(C1,"y")                   //ouput waveform in
          yellow colour
37
38
39 //for critically damped system
40 zeta2=0.999999
41     phi2=acos(zeta2);
42     b2=sin((wn*sqrt(1-zeta2^2)*t)+phi2);
43     C2=1-(1/sqrt(1-zeta2^2))*(exp(-zeta2*wn*t).*b2)
44     plot(t,C2);
45     plot(C2,"r")                   //ouput waveform in
          red colour
```

```
46
47
48 //for undamped system
49 zeta3=0
50     phi3=acos(zeta3);
51     b3=sin((wn*sqrt(1-zeta3^2)*t)+phi3);
52     C3=1-(1/sqrt(1-zeta3^2))*(exp(-zeta3*wn*t).*b3)
53     plot(t,C3);
54     plot(C3,"g")                    //ouput waveform
          in green colour
55
56
57 legends(['C';'C1';'C2';'C3'],[2,7,5,3],opt=1)     //
     Legend
58 //xgrid(1)                                        //Grid
```

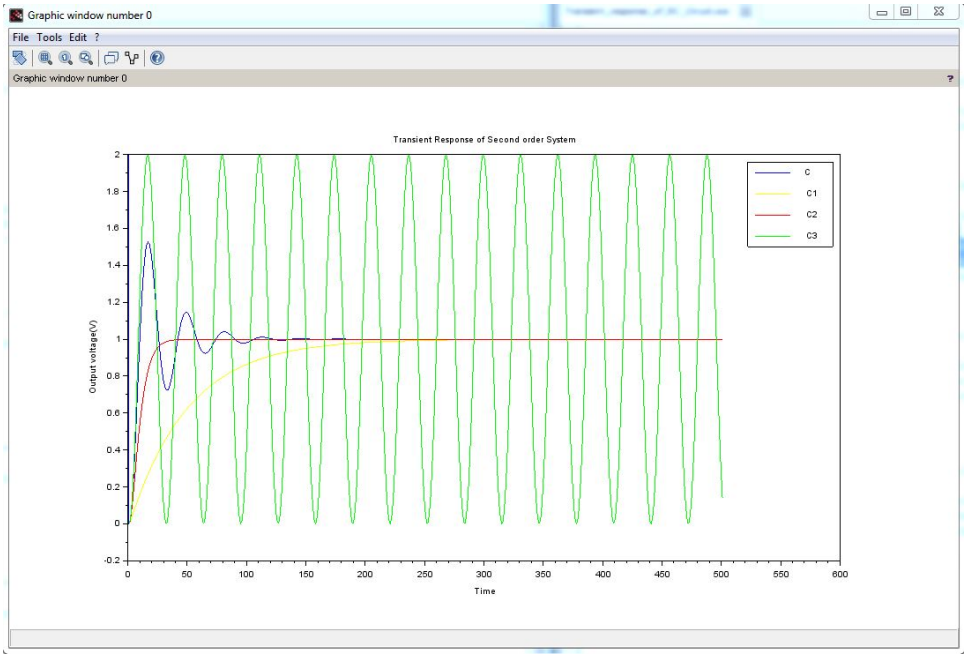


Figure 2.1: Transient response of second order system using programming

Experiment: 3

Transient response of first order system - using Xcos

This code can be downloaded from the website wwww.scilab.in

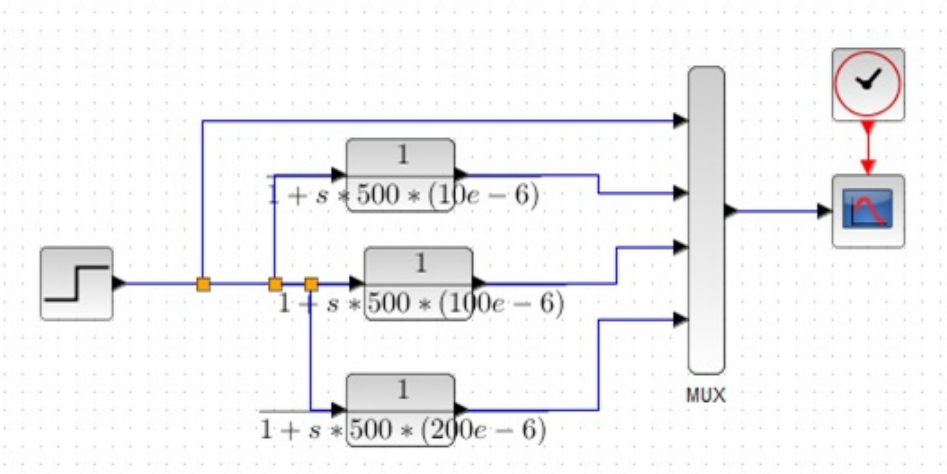


Figure 3.1: Step Response of RC Circuit using Xcos

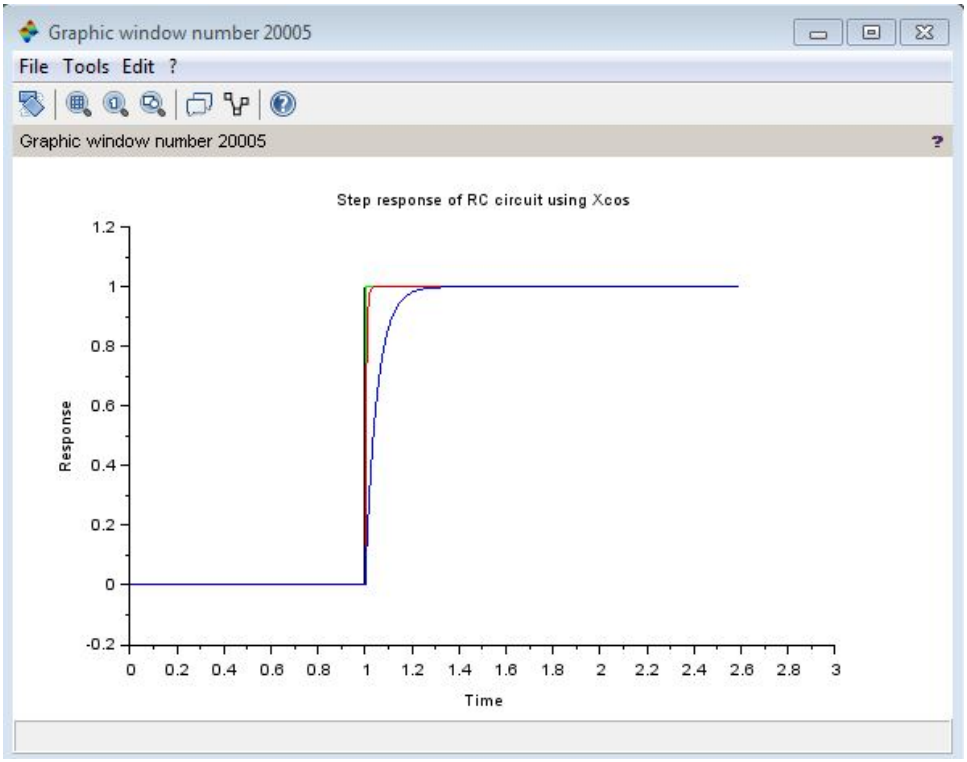


Figure 3.2: Step Response of RC Circuit using Xcos

Experiment: 4

Transient response of second order system - using Xcos

This code can be downloaded from the website wwww.scilab.in

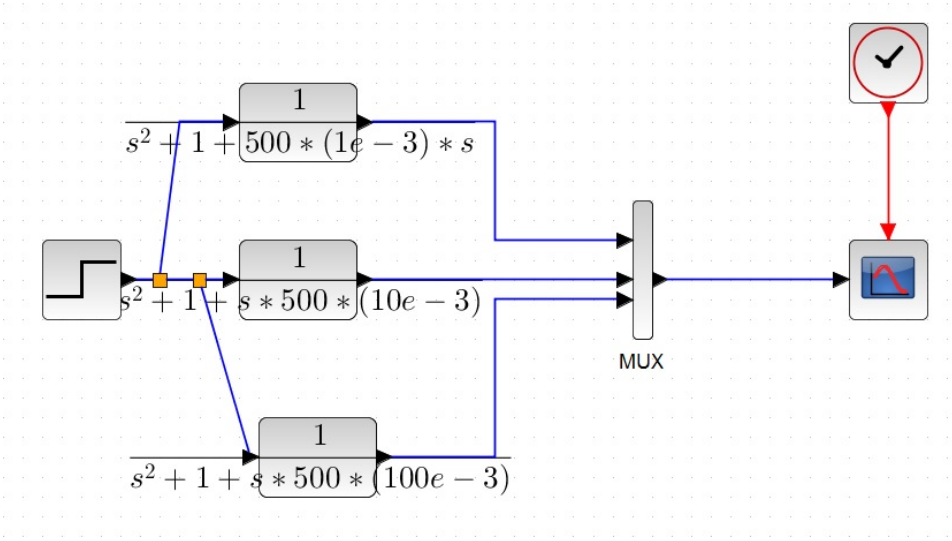


Figure 4.1: Step response of second order system using xcos

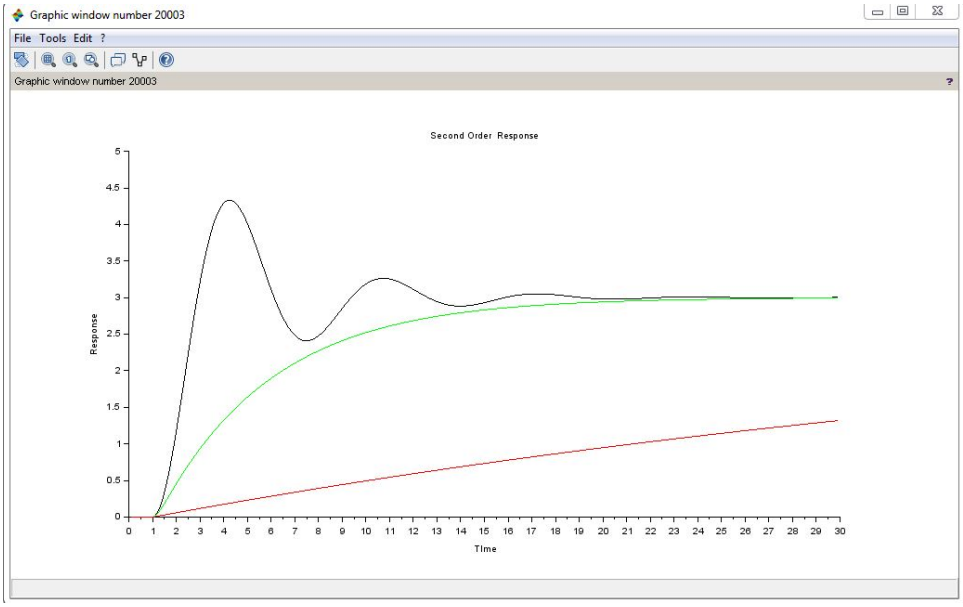


Figure 4.2: Step response of second order system using xcos

Experiment: 5

Solution of branch current and voltages for a given circuit by applying KCL & KVL

Scilab code Solution 5.5 Current in a circuit using KVL KCL

```
1 //windows 10 . Scilab 6.0.1 (64-BIT)
2 //toolbox null
3 // Find current in a circuit using KVL
4 //Current in Wheatstones's bridge using Cramer's
    Rule
5 //The value of V and R is provided by user
6 //V and R written in matrix form
7 //Same direction of current takes positive sign else
    negative
8
9
10 clc
11 clear
```

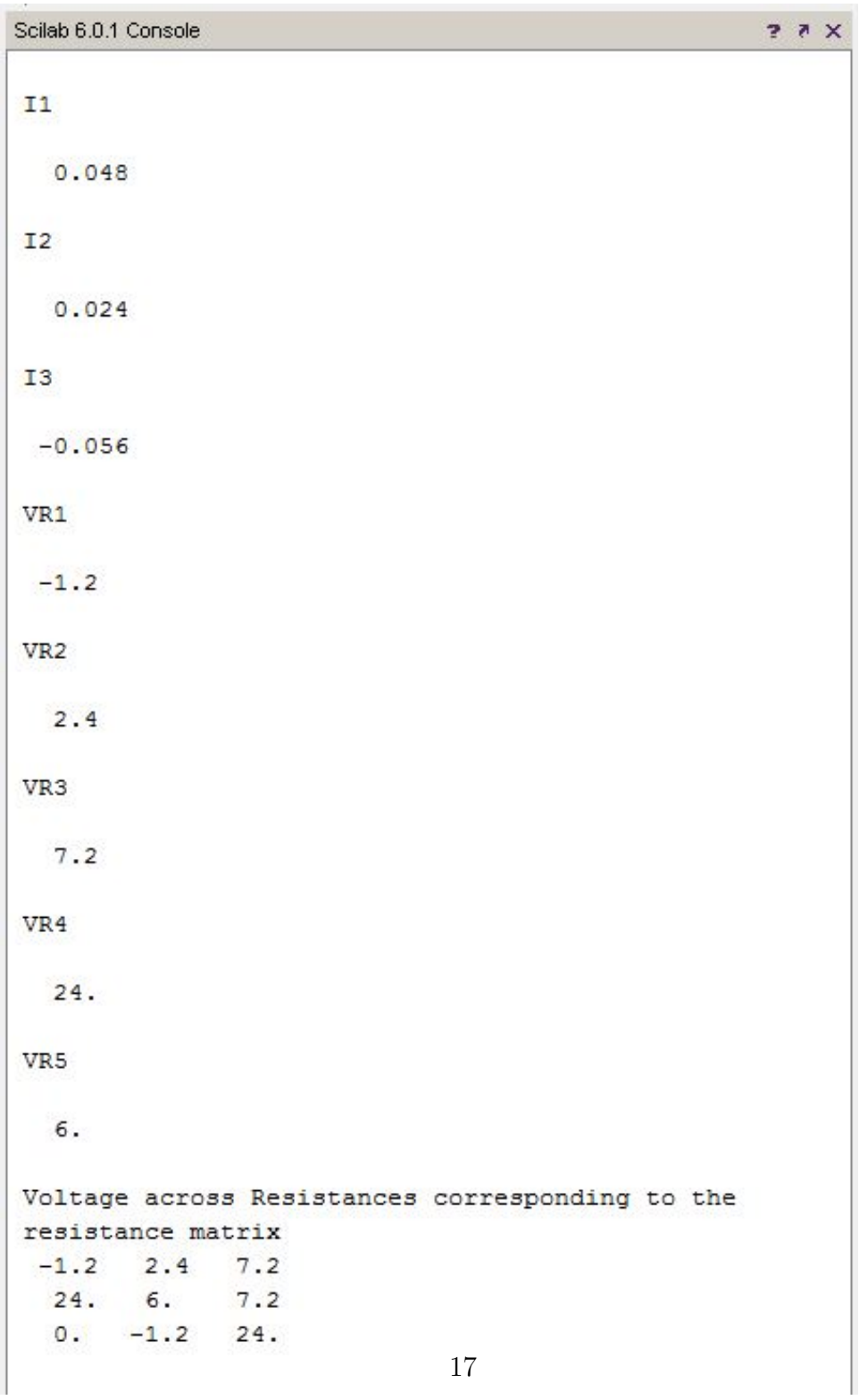


Figure 5.1: Current in a circuit using KVL KCL

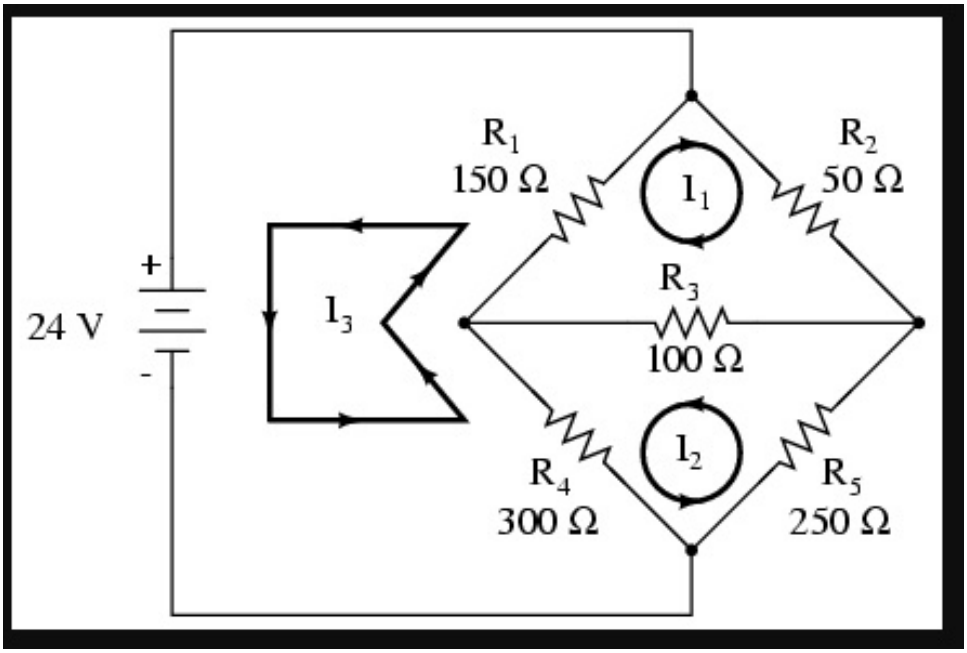


Figure 5.2: Current in a circuit using KVL KCL

```
12 V=[0;0;24]
13 R=[150 50 100;-300 250 100;0 150 -300]
14 I=inv(R)*V;
15 d=det(R);
16 d1=[0 0 24;-300 250 100;0 150 -300];
17 d2=[150 50 100;0 0 24;0 150 -300];
18 d3=[150 50 100;-300 250 100;0 0 24];
19 I1=det(d1)/d                                    //current
      in loop1
20 disp([I1],"I1")
21 I2=det(d2)/d                                   //current in
       loop3
22 disp([I2],"I2")
23 I3=det(d3)/d                                    //current
      in loop3
24 disp([I3],"I3")
25
26 //Calculating  Voltage across each resistor
```

```
27 VR1=(I1+I3)*150;
28 disp([VR1],"VR1")
29 VR2=(I1)*50;
30 disp([VR2],"VR2")
31 VR3=(I1+I2)*100;
32 disp([VR3],"VR3")
33 VR4=(I2-I3)*300;
34 disp([VR4],"VR4")
35 VR5=(I2)*250;
36 disp([VR5],"VR5")
37 Vout=[VR1 VR2 VR3;VR4 VR5 VR3;0 VR1 VR4]          //
     Voltage across Resistances corresponding to the
     resistance matrix
38 disp([Vout],"Voltage across Resistances
     corresponding to the resistance matrix")
```