

Scilab Manual for  
Simulation Lab  
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Solutions provided by  
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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

```

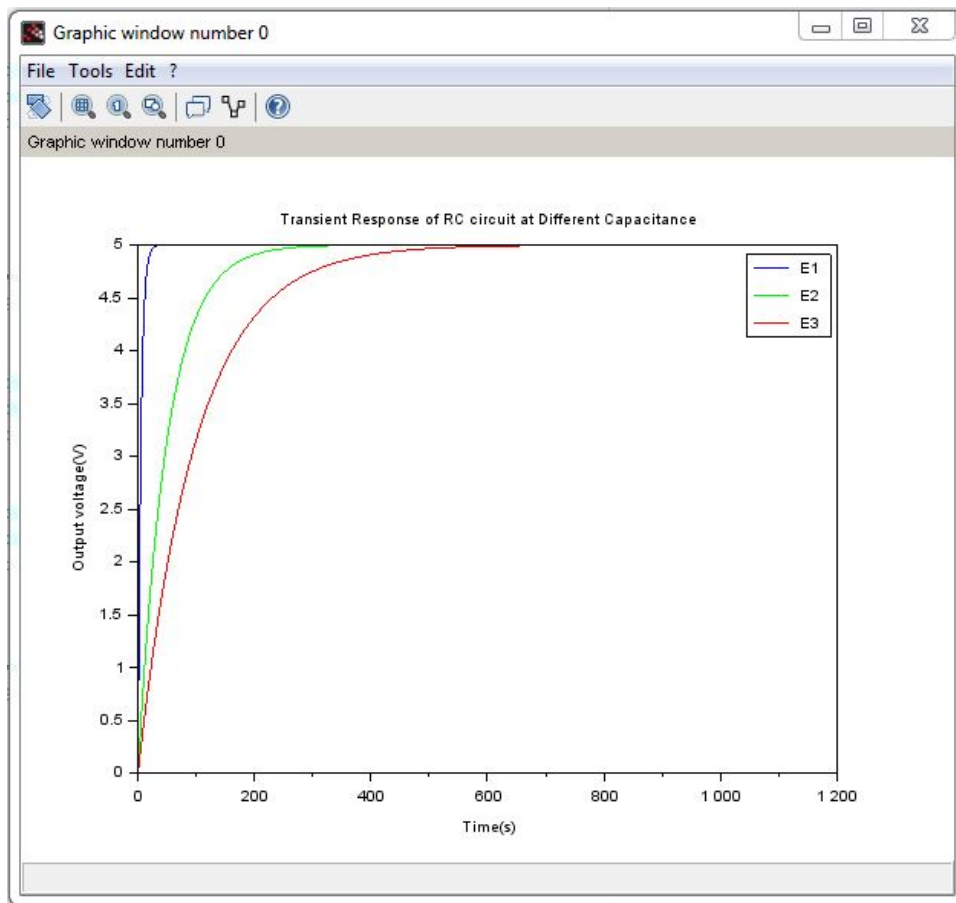


Figure 1.1: Transient response of first order system using programming

```

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 response 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  $\zeta = 0$ , 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

```

---

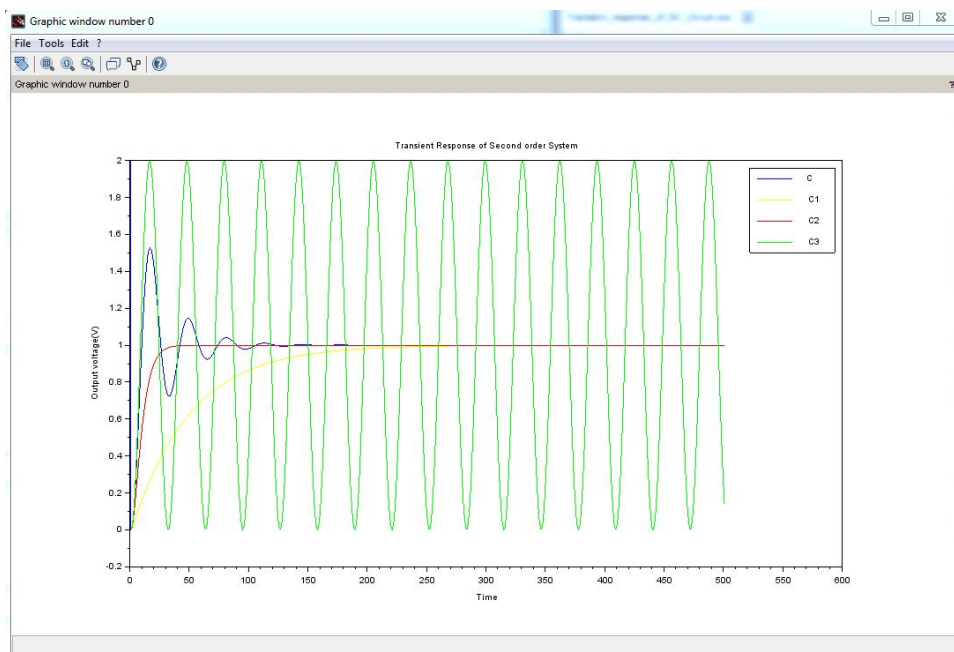


Figure 2.1: Transient response of second order system using programming

## **Experiment: 3**

### **Transient response of first order system - using Xcos**

This code can be downloaded from the website [www.scilab.in](http://www.scilab.in)

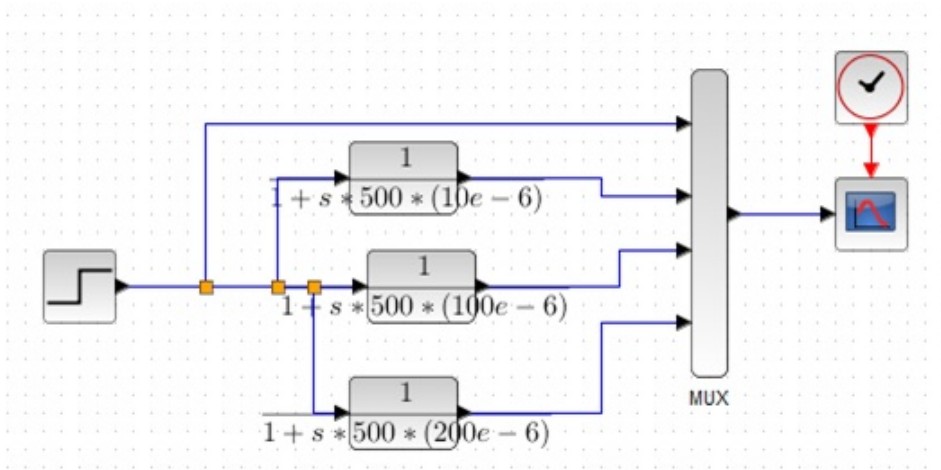


Figure 3.1: Step Response of RC Circuit using Xcos

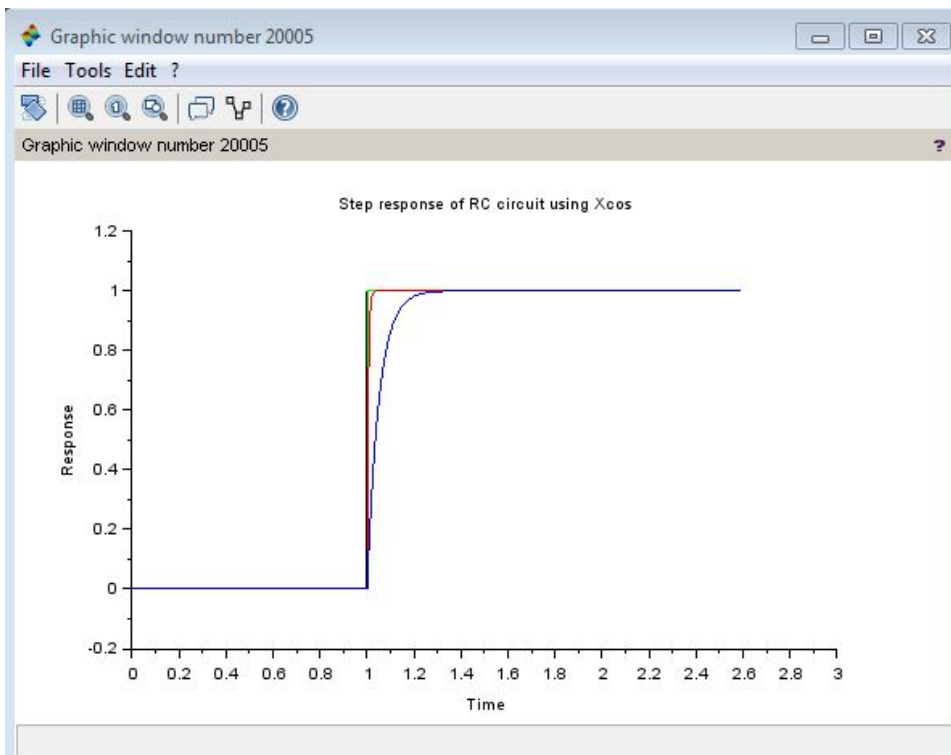


Figure 3.2: Step Response of RC Circuit using Xcos

## **Experiment: 4**

# **Transient response of second order system - using Xcos**

This code can be downloaded from the website [www.scilab.in](http://www.scilab.in)

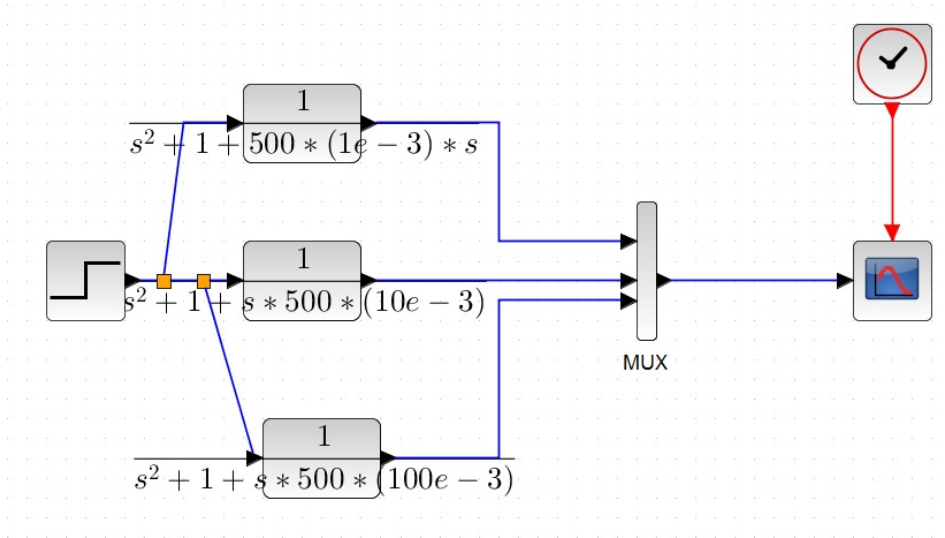


Figure 4.1: Step response of second order system using xcos

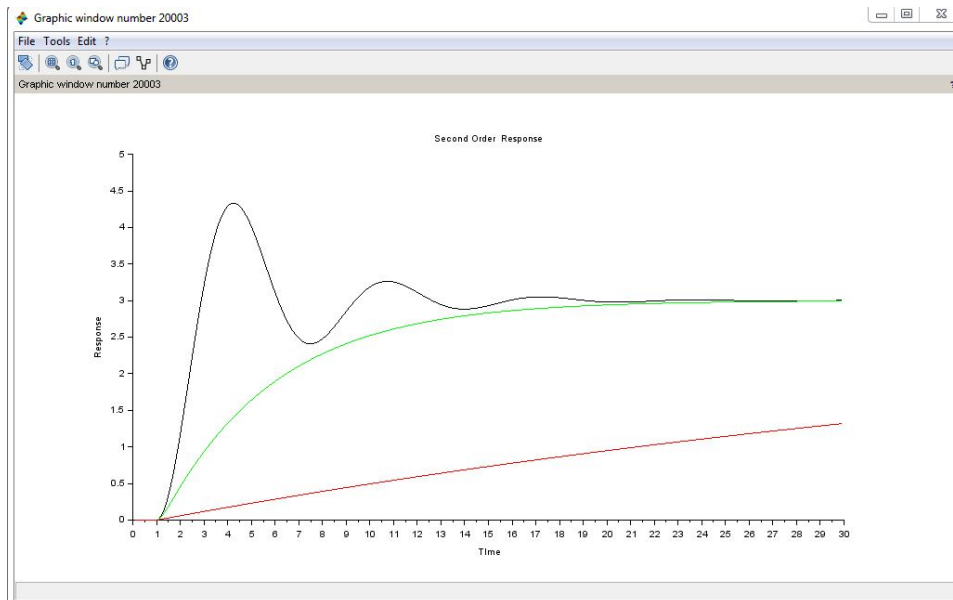


Figure 4.2: Step response of second order system using xcos

## 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
```

```
Scilab 6.0.1 Console ? ↶ ✕  
  
I1  
    0.048  
  
I2  
    0.024  
  
I3  
   -0.056  
  
VR1  
   -1.2  
  
VR2  
    2.4  
  
VR3  
    7.2  
  
VR4  
   24.  
  
VR5  
    6.  
  
Voltage across Resistances corresponding to the  
resistance matrix  
-1.2  2.4  7.2  
24.   6.   7.2  
0.   -1.2  24.
```

Figure 5.1: Current in a circuit using KVL KCL

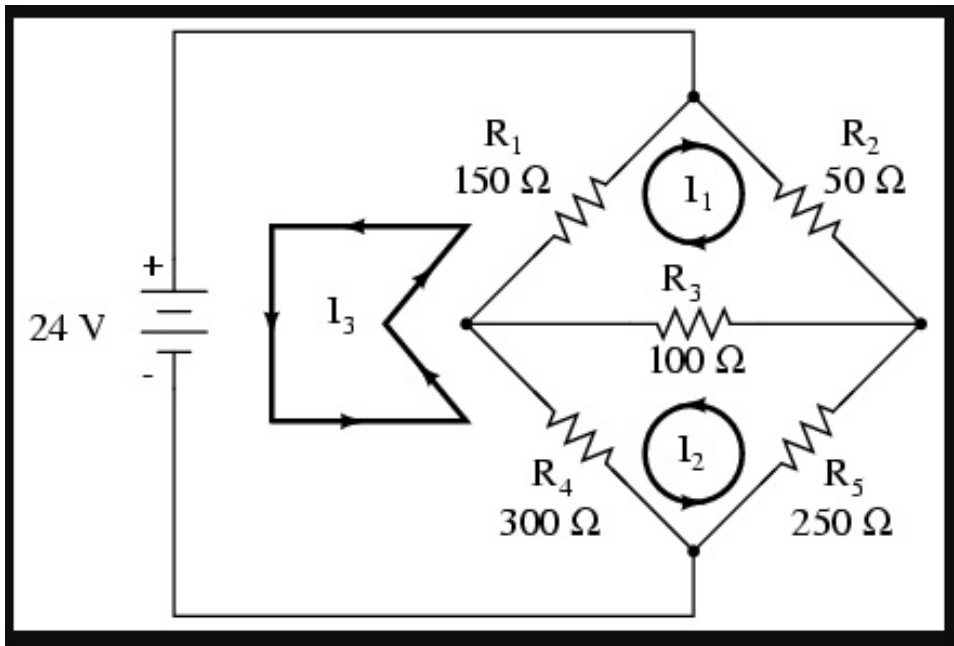


Figure 5.2: Current in a circuit using KVL KCL

```

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")
```

---