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

```
//windows OS(10/7/8.1) . Scilab 6.0.1 (64-bit)
//toolbox null

// Transient response of RC Network using output
   equation method

clc
clear

R=500                                          // Resistance
   in a network
Ei=5                                           // Amplitude
   of input step signal
t=0:0.001:1;

//Case-1:
C1=10e-6                                       // Capacitance
   value in RC circuit 10uF provided by user
```

```
Y1=R*C1
E1=Ei*(1-exp(-t/Y1))                    // Formula for output voltage across capacitor
xlabel('Time')                          //Leveling x axis as time
ylabel('Output voltage(V)')             //Leveling y axis as output voltage
title('Transient Response of RC circuit at Different Capacitance')    //Title of Graph
plot(t,E1)                              //Output Response with respect to time
plot(E1,"b")                            //Blue colour at C1

//Case -2:
C2=100e-6                               //Cacitance value in RC circuit 100uF provided by user
Y2=R*C2
E2=Ei*(1-exp(-t/Y2))                    // For output voltage across capacitor
xlabel('Time(s)')                       //Leveling x axis as time
ylabel('Output voltage(V)')             //Leveling y axis as output voltage
plot(t,E2)
plot(E2,"g")                            //Green colour at C2

//Cse -3:
C3=200e-6                               // Cacitance value in RC circuit 200uF provided by user
Y3=R*C3
E3=Ei*(1-exp(-t/Y3))                    // For output voltage across capacitor
xlabel('Time(s)')                       //Leveling x axis as time
ylabel('Output voltage(V)')             //Leveling y axis as output voltage
```

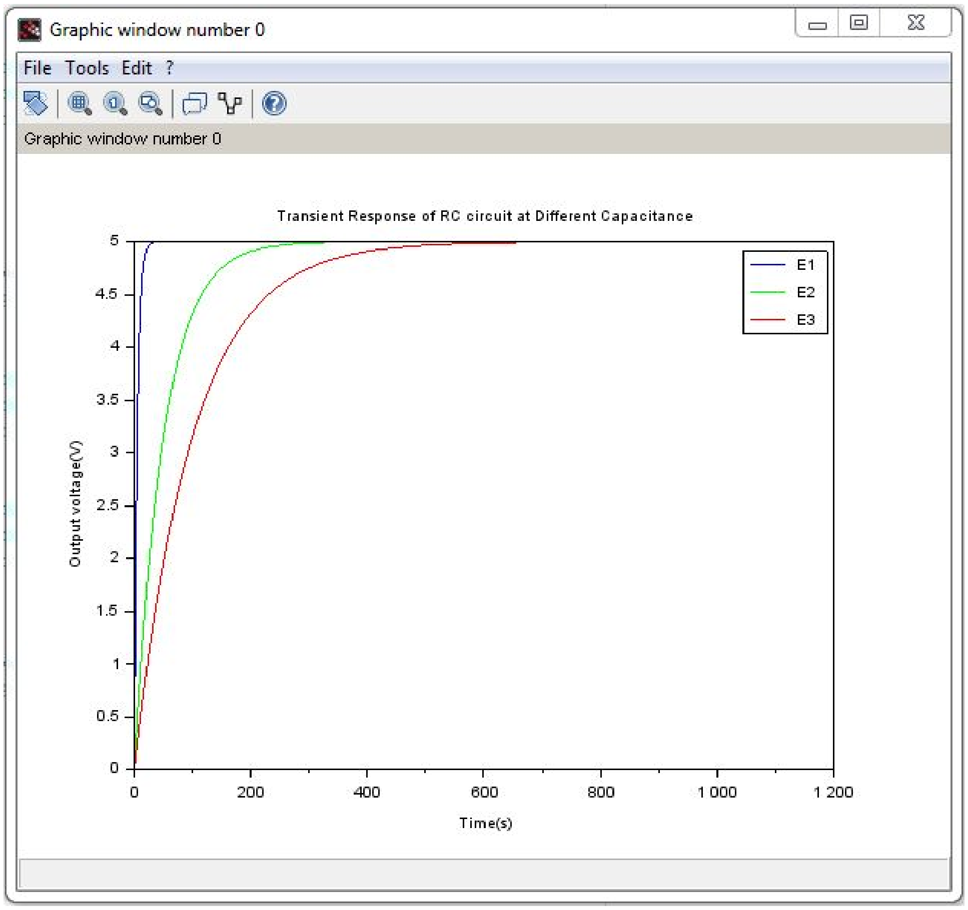

Figure 1.1: Transient response of first order system using programming

```
plot(t,E3)
plot(E3,"r")                                    //Red
   colour at C3

legends(['E1';'E2';'E3'],[2,3,5],opt=1)         //Legend
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

```
//windows 10 . Scilab 6.0.1 (64-bit)
//toolbox null

//Transient resoponse of second order system example
   RLC circuit
//zeta is damping ratio given by user
//If 0< zeta <1,  Damped System
//If zeta=1, Critically Damped System
//If zeta>1, Over Damped System
//If zeta=o, Undamped System
//wn is the system's natural frequency provided by
   user


clc
clear
```

```
t=0:0.002:1
wn=100;

xlabel('Time')                          //Leveling x axis as time
ylabel('Output voltage(V)')             //Leveling y axis as output voltage
title('Transient Response of Second order System')    //Title of Graph
//for under damped system
zeta=0.2
    phi=acos(zeta);
    b=sin((wn*sqrt(1-zeta^2)*t)+phi);
    C=1-(1/sqrt(1-zeta^2))*(exp(-zeta*wn*t).*b)    //output equation
    plot(t,C);
    plot(C,"b")                  // ouput waveform in blue colour


//for over damped system
zeta1=5
    phi1=acos(zeta1);
    b1=sin((wn*sqrt(1-zeta1^2)*t)+phi1);
    C1=1-(1/sqrt(1-zeta1^2))*(exp(-zeta1*wn*t).*b1)
    plot(t,C1);
    plot(C1,"y")                   //ouput waveform in yellow colour


//for critically damped system
zeta2=0.999999
    phi2=acos(zeta2);
    b2=sin((wn*sqrt(1-zeta2^2)*t)+phi2);
    C2=1-(1/sqrt(1-zeta2^2))*(exp(-zeta2*wn*t).*b2)
    plot(t,C2);
    plot(C2,"r")                   //ouput waveform in red colour
```

```
//for undamped system
zeta3=0
    phi3=acos(zeta3);
    b3=sin((wn*sqrt(1-zeta3^2)*t)+phi3);
    C3=1-(1/sqrt(1-zeta3^2))*(exp(-zeta3*wn*t).*b3)
    plot(t,C3);
    plot(C3,"g")                    //ouput waveform in green colour


legends(['C';'C1';'C2';'C3'],[2,7,5,3],opt=1)      //Legend
//xgrid(1)                                        //Grid
```

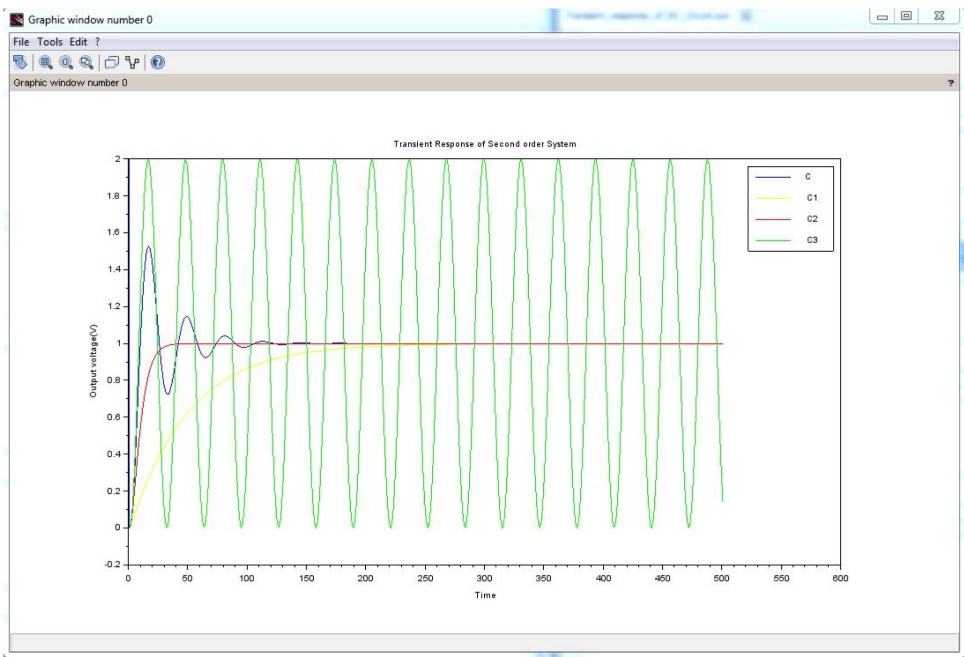

Figure 2.1: Transient response of second order system using programming

Experiment: 3

Transient response of first order system - using Xcos

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

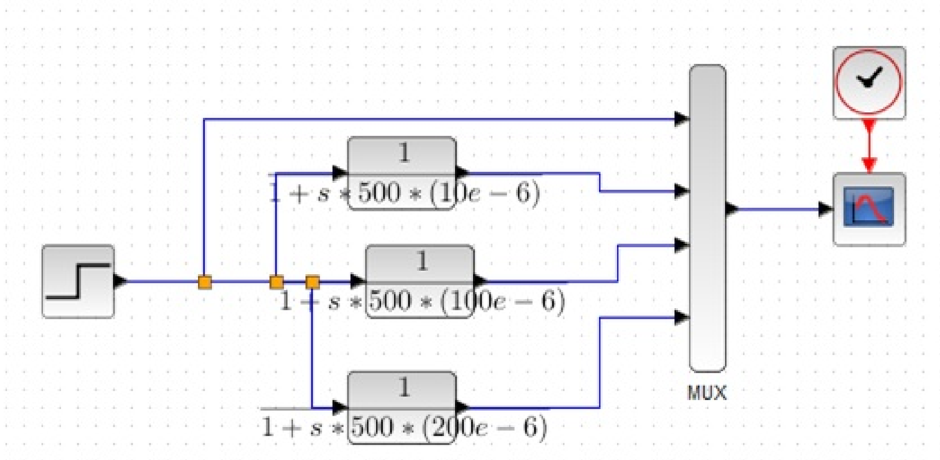

Figure 3.1: Step Response of RC Circuit using Xcos

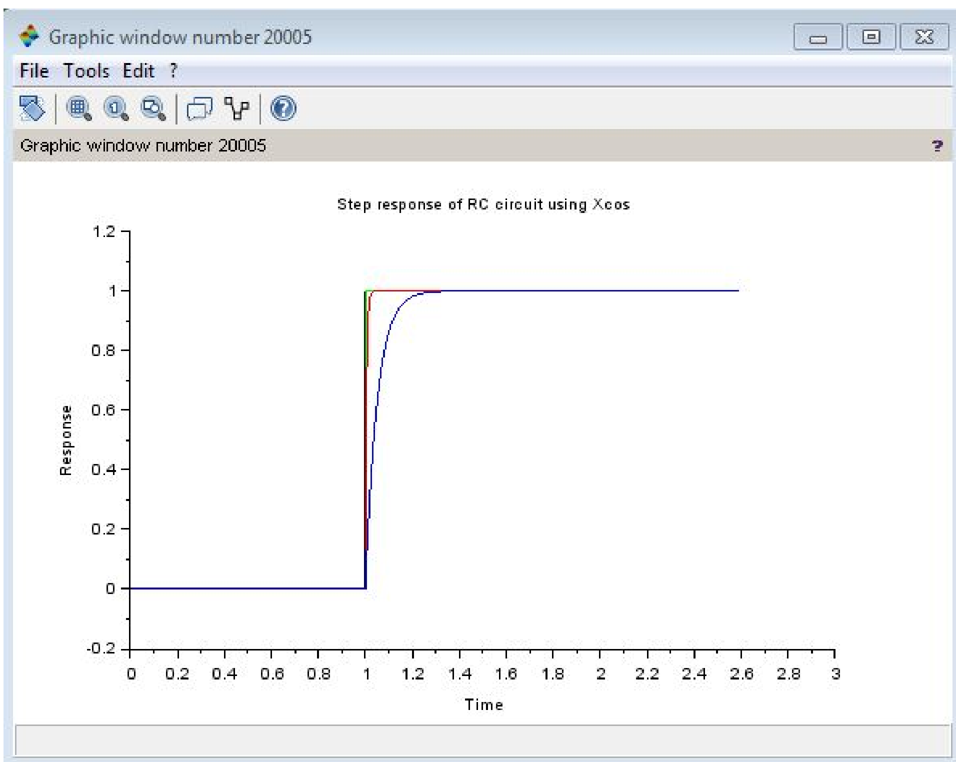

Figure 3.2: Step Response of RC Circuit using Xcos

Experiment: 4

Transient response of second order system - using Xcos

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

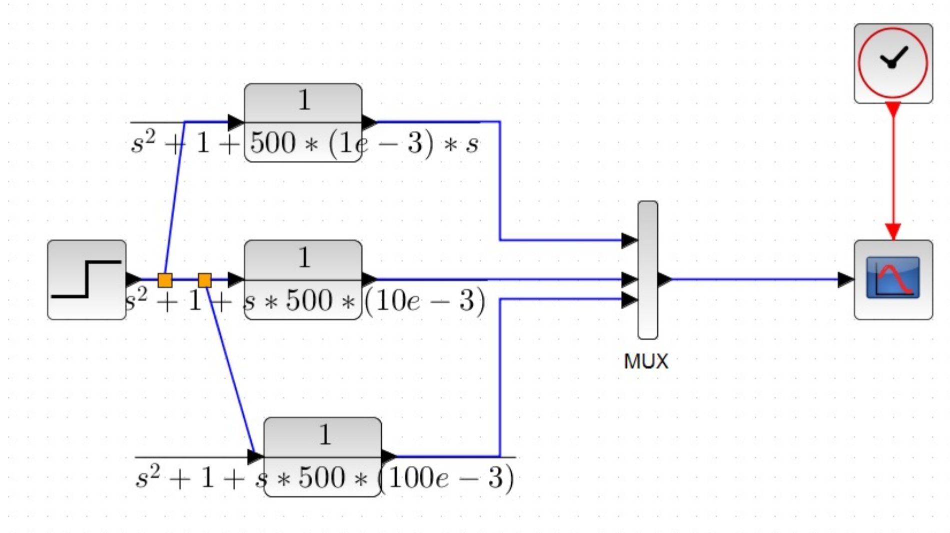

Figure 4.1: Step response of second order system using xcos

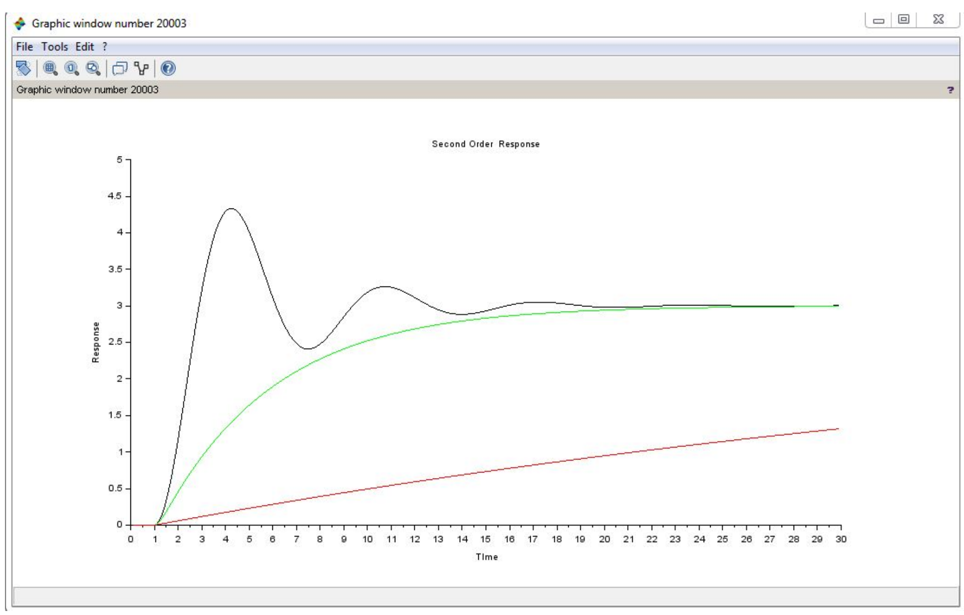

Figure 4.2: Step response of second order system using xcos

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

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


clc
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

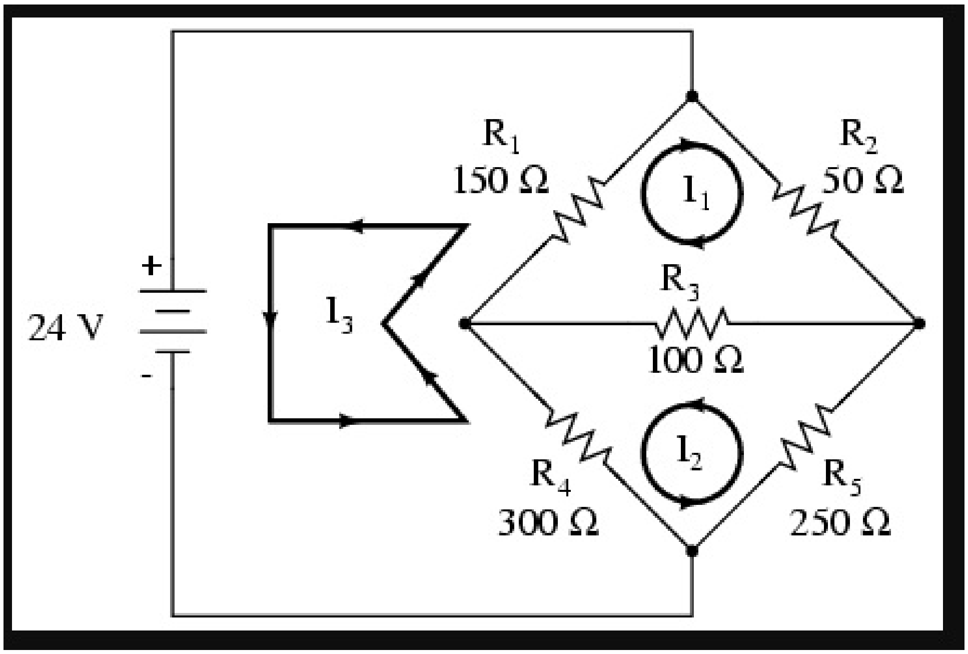

Figure 5.2: Current in a circuit using KVL KCL

```
V=[0;0;24]
R=[150 50 100;-300 250 100;0 150 -300]
I=inv(R)*V;
d=det(R);
d1=[0 0 24;-300 250 100;0 150 -300];
d2=[150 50 100;0 0 24;0 150 -300];
d3=[150 50 100;-300 250 100;0 0 24];
I1=det(d1)/d                                        //current in loop1
disp([I1],"I1")
I2=det(d2)/d                                        //current in loop3
disp([I2],"I2")
I3=det(d3)/d                                        //current in loop3
disp([I3],"I3")

//Calculating  Voltage across each resistor
```

```
VR1=(I1+I3)*150;
disp([VR1],"VR1")
VR2=(I1)*50;
disp([VR2],"VR2")
VR3=(I1+I2)*100;
disp([VR3],"VR3")
VR4=(I2-I3)*300;
disp([VR4],"VR4")
VR5=(I2)*250;
disp([VR5],"VR5")
Vout=[VR1 VR2 VR3;VR4 VR5 VR3;0 VR1 VR4]        //
   Voltage across Resistances corresponding to the
   resistance matrix
disp([Vout],"Voltage across Resistances
   corresponding to the resistance matrix")
```