

Scilab Textbook Companion for
Electric Circuits
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Book Description

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Scilab numbering policy used in this document and the relation to the above book.

Exa Example (Solved example)

Eqn Equation (Particular equation of the above book)

AP Appendix to Example(Scilab Code that is an Appednix to a particular Example of the above book)

For example, Exa 3.51 means solved example 3.51 of this book. Sec 2.3 means a scilab code whose theory is explained in Section 2.3 of the book.

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Chapter 1

Introduction

Scilab code Exa 1.1 Force Work and Power

```
1  clc
2  disp("Example 1.1")
3  printf("\n")
4  printf("Given")
5  disp("Acceleration is 2.0m/s^2")
6  disp("Mass is 10kg")
7  m=10;a=2;
8  disp("a")
9  disp("F=m*a")
10 F=m*a
11 printf("Force is %dN\n",F)
12 disp("b")
13 printf("time=4s\n")
14 t=4;
15 x=(a*t*t)/2
16 KE=(F*x)
17 P=KE/t
18 printf("Position is %dm\n",x)
19 printf("Kinetic energy =%3.1fJ\n",KE)
20 printf("Power =%3.1fW\n",P)
```

Scilab code Exa 1.2 Electric Charge and Current

```
1 clc
2 disp(" Example 1.2")
3 printf(" \n")
4 printf(" Given")
5 disp(" Current flow is 5A")
6 disp(" Time is 1 minute")
7 i=5;
8 //As electroms/min is asked so we need to convert A(
   C/s) to C/min
9 i1=5*60;
10 //Let e be electronic charge
11 e=1.602*10^-19
12 n=(i1/e)
13 printf(" Number of electrons =%3.2f electrons/min\n",
   n)
```

Scilab code Exa 1.3 Electric Potential

```
1 clc
2 disp(" Example 1.3")
3 printf(" \n")
4 printf(" Given")
5 disp(" Energy is 9.25uJ")
6 disp(" Charge to be transferred is 0.5uC")
7 E=9.25*10^-6;q=0.5*10^-6;
8 //1 volt is 1 joule per coulomb
9 V=E/q;
10 printf(" Potential difference between two points a
   and b is %3.1fV\n",V)
```

Scilab code Exa 1.4 Energy and Electrical Power

```
1  clc
2  disp("Example 1.4")
3  printf("\n")
4  printf("Given")
5  disp("Potential difference is 50V")
6  disp("Charge per minute is 120C/min")
7  V=50;x=120;
8  //As Electrical energy is to be calculated charge
   per minute is to be converted in charge per
   second
9  //Charge per second is nothing but the current
10 i=x/60;
11 P=i*V;
12 //Since 1W=1J/s
13 printf("Rate of energy conversion is %dJ/s\n",P)
```

Chapter 2

Circuit Concepts

Scilab code Exa 2.1 Resistance

```
1
2 disp("Example 2.1")
3 printf("\n")
4 printf("Given")
5 disp("Resistance used is 4 ohm")
6 disp("Current flow is  $i=2.5*\sin(w*t)$ ")
7 disp("Angular frequency (w)=500 rad/s")
8
9 R=4;
10 iamp=2.5;w=500;
11 t=0:0.001:0.012566
12 i=2.5*sin(w*t)
13
14
15 Vamp=iamp*R;
16 printf("v=%d*sin(%d*t)(V)\n",Vamp,w)
17
18 pamp=iamp*iamp*R;
19 printf("p=%d(sin(%d*t))^2(W)\n",pamp,w)
20 p=pamp*sin(w*t)^2;
21
```

```

22 //On integrating p with respect to t
23 W=25*(t/2-sin(2*w*t)/(4*w))
24
25 function p=f(t),p=pamp*sin(w*t)^2, endfunction
26 w1=intg(0,2*%pi/w,f);
27
28
29 subplot(221)
30 plot(t,i)
31 xtitle('i vs wt','wt','i ');
32
33 subplot(222)
34 plot(t,p)
35 xtitle('p vs wt','wt','p ');
36
37
38
39 subplot(223)
40 plot(t,W)
41 xtitle('w vs wt','wt','w ');

```

Scilab code Exa 2.2 Inductance

```

1 clc
2 disp("Example 2.2")
3 printf("\n")
4 printf("Given")
5 disp("Inductance used is 30mH")
6 disp("Current flow is i=10*sin(50*t)")
7 L=30*10^-3;iamp=10;
8 t=0:0.01:0.06283;
9 i=10*sin(50*t)
10 //v=L*d/dt(i)

```

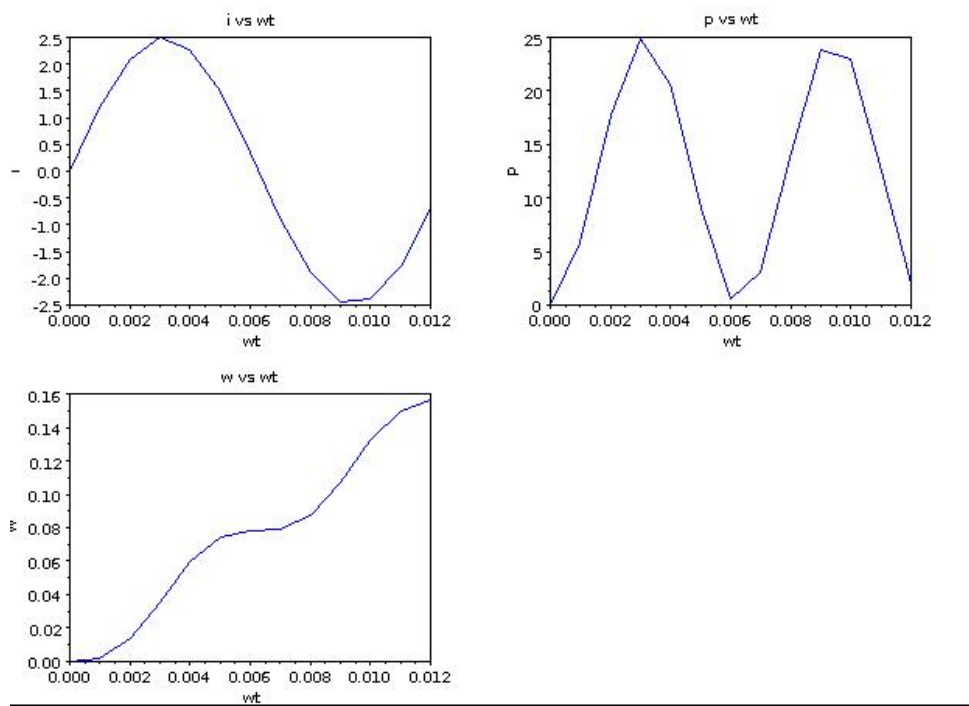


Figure 2.1: Resistance


```

11 //d/dt(sin 50t)=50*cos t
12 vamp=L*iamp*50;
13 v=vamp*cos(50*t)
14
15 //sinA*cosB=(sin(A+B)+sin(A-B))/2
16
17 pamp=vamp*iamp/2;
18 p=pamp*sin(100*t)
19 //On integrating 'p' w.r.t t
20
21 wL=0.75*(1-cos(100*t));
22
23
24 subplot(221)
25 plot(t,i)
26 xtitle('i vs wt','wt','i');
27
28 subplot(222)
29 plot(t,v)
30 xtitle('v vs wt','wt','v ');
31
32 subplot(223)
33 plot(t,p)
34 xtitle('p vs wt','wt','p ');
35
36 subplot(224)
37 plot(t,wL)
38 xtitle('wL vs wt','wt','wL ');

```

Scilab code Exa 2.3 Capacitance

```

1 clc
2 disp("Example 2.3")

```

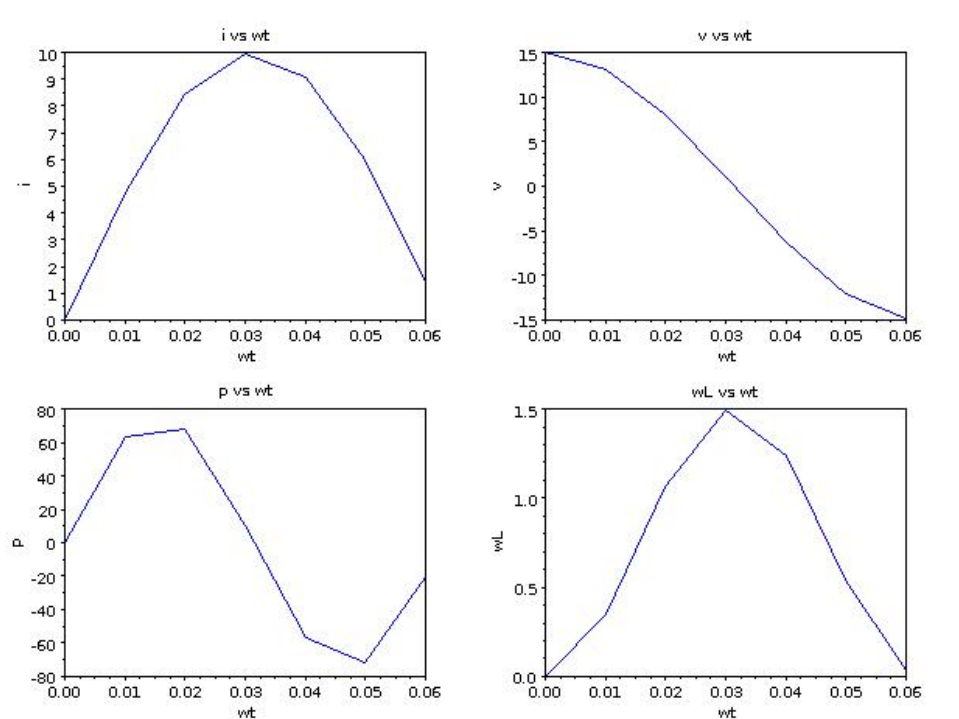


Figure 2.2: Inductance

```

3 printf("\n")
4 printf(" Given")
5 disp(" Capacitance used is 20uF")
6 disp(" Voltage is v=50*sin(200*t)")
7 C=20*10^-6;
8 // Given that v=50*sin(200*t);
9 vamp=50;
10 t=0:0.001:0.015;
11 //q=C*v
12 qamp=vamp*C
13 q=qamp*sin(200*t)
14 //i=C*d/dt(v)
15 //d/dt(sin 200t)=200*cos t
16 iamp=C*vamp*200;
17 i=iamp*cos(200*t)
18
19 //sinA*cosB=(sin(A+B)+sin(A-B))/2
20
21 pamp=vamp*iamp/2;
22 p=pamp*sin(400*t)
23
24 //On integrating 'p' w.r.t t
25
26 wC=12.5*(1-cos(400*t));
27
28 figure
29 a= gca ();
30 plot(t,wC)
31 xtitle('wC vs wt','wt','wC (mJ)');
32 a. thickness = 2;

```

Scilab code Exa 2.4 Nonlinear Resistors

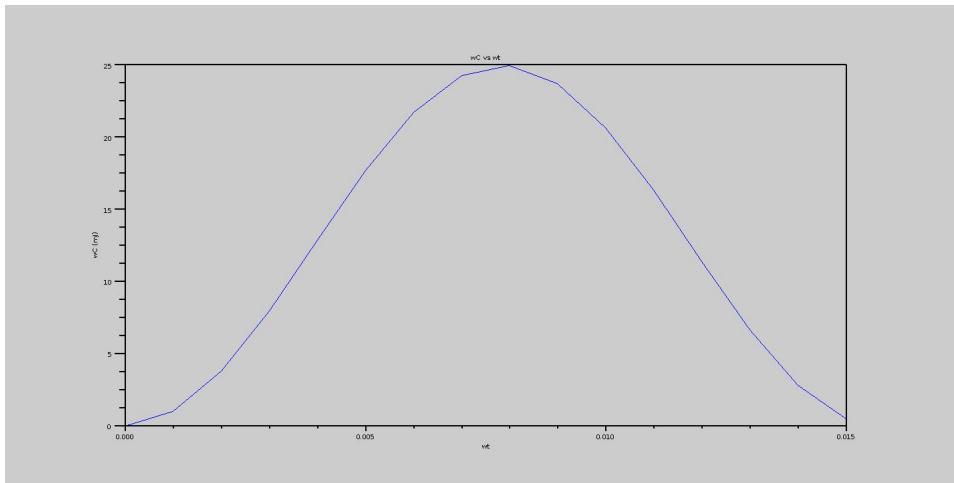


Figure 2.3: Capacitance

```

1  clc
2  disp(" Example 2.4 ")
3  printf("\n")
4  printf(" Given ")
5  disp(" Current through diode is 30mA ")
6  //From the table the nearest value is at v=0.74V
7  V=0.74; I=28.7*10^-3;
8  R=V/I;
9  delV=0.75-0.73
10 delI=42.7*10^-3-19.2*10^-3
11 r=delV/delI
12 p=(V*I)*10^3
13 printf("\n \n Static resistance is %3.2fohm\n",R)
14 printf(" Dynamic resistance is %3.2fohm\n",r)
15 printf(" Power consumption is %3.2fmW\n",p)

```

Scilab code Exa 2.5 Nonlinear Resistors

```

1  clc
2  disp(" Example 2.5 ")

```

```

3 printf("\n")
4 printf(" Given")
5 disp(" a)")
6 disp(" Current through diode is 10mA")
7 //From the table the value is at v=2.5V
8 V=2.5; I=10*10^-3;
9 R=V/I;
10 delV=3-2
11 delI=11*10^-3-9*10^-3
12 r=delV/delI
13 p=(V*I)*10^3
14 printf("\n \n Static resistance is %3.2fohm\n",R)
15 printf("Dynamic resistance is %3.2fohm\n",r)
16 printf("Power consumption is %3.2fmW\n",p)
17
18 disp(" b)")
19 disp(" Current through diode is 15mA")
20 //From the table the value is at v=5V
21 V=5; I=15*10^-3;
22 R=V/I;
23 delV=5.5-4.5
24 delI=16*10^-3-14*10^-3
25 r=delV/delI
26 p=(V*I)*10^3
27 printf("\n \n Static resistance is %3.2fohm\n",R)
28 printf("Dynamic resistance is %3.2fohm\n",r)
29 printf("Power consumption is %3.2fmW\n",p)

```

Chapter 3

Circuit Laws

Scilab code Exa 3.3 Circuit elements in series

```
1 clc
2 disp("Example 3.3")
3 printf("\n")
4 printf("Given")
5 disp("Equivalent resistance of three resistors is
      750 ohm")
6 disp("values of two resistors are 40 ohm and 410 ohm
      ")
7 Req=750;R1=40;R2=410;
8
9 //For series resistance
10 disp("Req=R1+R2+R3")
11 //On solving for R3
12 R3=Req-R1-R2
13 printf("Value of third ohmic resistor is %dohm\n",R3
      )
```

Scilab code Exa 3.4 Circuit elements in series

```

1  clc
2  disp(" Example 3.4")
3  printf("\n")
4  printf(" Given")
5  disp(" values of two capacitors are 2uF and 10uF")
6  C1=2*10^-6;C2=10*10^-6;
7  //For two capacitors in series
8  disp(" Ceq=(C1*C2)/(C1+C2)")
9  //On solving for Ceq
10 Ceq=((C1*C2)/(C1+C2))*10^6
11 printf(" Value of equivalent capacitance is %3.2fuF\n
        ",Ceq)
12
13 disp(" If C2=10pF")
14 C2=10*10^-12;
15
16 Ceq=((C1*C2)/(C1+C2))*10^12
17 printf(" Value of equivalent capacitance is %3.2fpF\n
        ",Ceq)

```

Scilab code Exa 3.5 Circuit elements in parallel

```

1  clc
2  disp(" Example 3.5")
3  printf("\n")
4  printf(" Given")
5  disp(" a")
6  disp(" values of two resistors are 60 ohm and 60 ohm")
7  R1=60;R2=60;
8  disp(" If resistors are parallel")
9  Req=(R1*R2)/(R1+R2)
10 printf(" Value of equivalent resistance is %dohm\n",
        Req)
11

```

```

12 disp("b)")
13 disp(" values of three equal resistors are 60 ohm")
14 R1=60;R2=60;R3=60;
15 disp(" If resistors are parallel")
16 x=1/R1+1/R2+1/R3
17 Req=1/x;
18 printf(" Value of equivalent resistance is %dohm\n",
        Req)

```

Scilab code Exa 3.6 Circuit elements in parallel

```

1 clc
2 disp(" Example 3.6")
3 printf("\n")
4 printf(" Given")
5
6 disp(" values of two inductors are 3mH and 6 mH")
7 L1=3*10^-3;L2=6*10^-3;
8 disp(" If inductors are parallel")
9 Leq=((L1*L2)/(L1+L2))*10^3
10 printf(" Value of equivalent inductance is %3.1fmH\n",
        ,Leq)

```

Scilab code Exa 3.7 Voltage division

```

1 clc
2 disp(" Example 3.7")
3 printf("\n")
4 printf(" Given")
5 disp(" Total resistance of three resistors is 50 ohm")
6 R=50;

```



```

7  disp("Output voltage is 10 percent of the input
      voltage")
8  //Let v be input voltage and v1 be output voltage
9  //Let v1/v=V
10 V=0.1;
11 //As V=R1/(Total resistance)
12 //Solving for R1
13 R1=V*R;
14 //As R=R1+R2
15 //Solving for R2
16 R2=R-R1;
17 printf("R1=%dohm\n R2=%dohm\n",R1 ,R2)

```

Scilab code Exa 3.8 Current division

```

1  clc
2  disp("Example 3.8")
3  printf("\n")
4  printf("Given")
5  disp("Total current is 30mA")
6  disp("Branch currents are 20mA and 10mA")
7  disp("Equivalent resistance is equal to or greater
      than 10 ohm")
8
9  //From Fig 3.6
10 //Current flowing through R1 be i1 and let it be
    equal to 10mA
11 //Current flowing through R2 be i2 and let it be
    equal to 20mA
12 i1=10*10^-3; i2=20*10^-3;
13 i=30*10^-3;
14
15 //Let R1/(R1+R2)=X1           (1)
16 //Let R2/(R1+R2)=X2           (2)
17 X1=i1/i;

```

```
18 X2=i2/i;
19 //Let R1*R2(R1+R2)=Y          (3)
20 //Given that
21 printf("\n Given")
22 disp("R1*R2(R1+R2)>=10")
23 //Solving (1),(2) and (3) we get
24 printf("R1>=%dohm\nR2>=%dohm\n",15,30)
```

Chapter 5

Analysis Methods

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

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

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

Scilab code Exa 5.8 Thevenin and Norton theorem

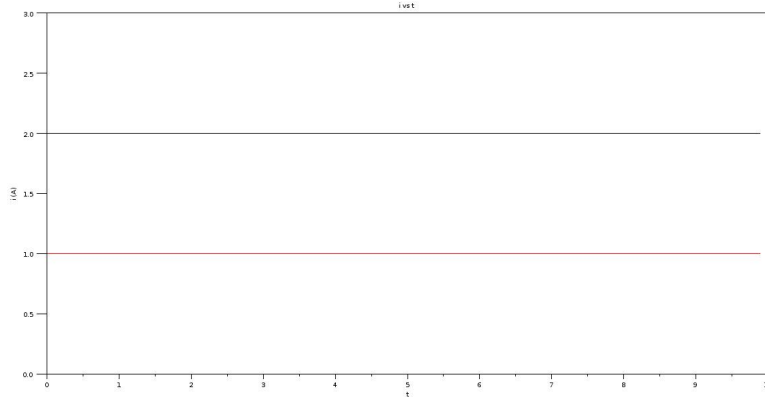


Figure 5.1: The branch current method

```

1  clc
2  //From figure 5.13(a)
3  //Applying KVL equation to the loop
4  I=(20+10)/(3+6)
5  //As current will not flow in upper 3 ohm resistor
   so Thevenin voltage is equal to either of the two
   parallel branches
6  V1=20-I*3
7  printf("Thevenin voltage = %dV\n",V1)
8
9  // Left 3 ohm and 6 ohm resistor are in parallel and
   their equivalent is in series with 3 ohm
10 R1=3+(3*6)/(3+6)
11 printf("Thevenin resistance =%dohm\n",R1)
12
13 //Now to find Norton's equivalent
14 I1=V1/R1
15 printf(" \n Norton current =%dA\n",I1)
16 disp("The value of resistance in Norton equivalent
   will not change but will come in parallel with
   current source")

```

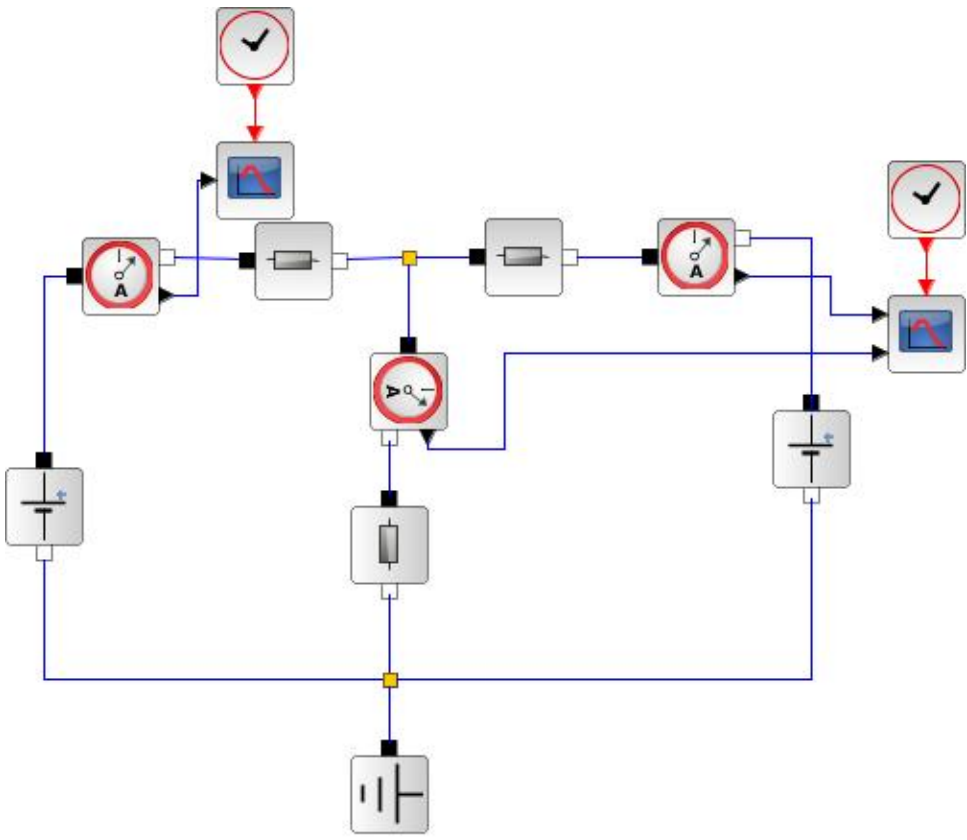


Figure 5.2: The branch current method

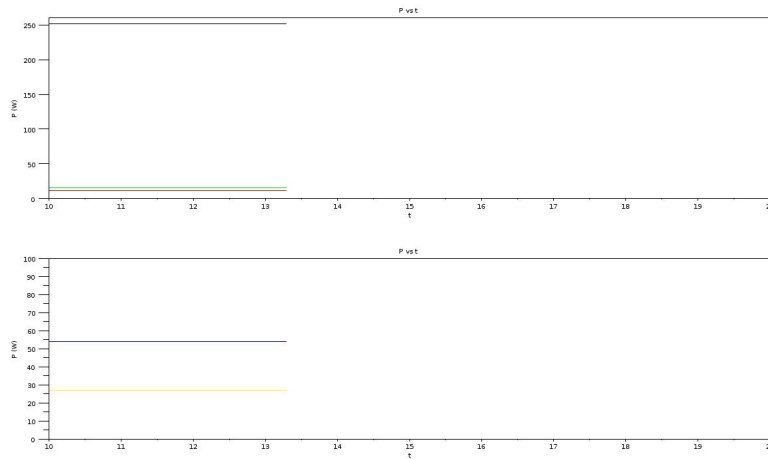


Figure 5.3: Network reduction

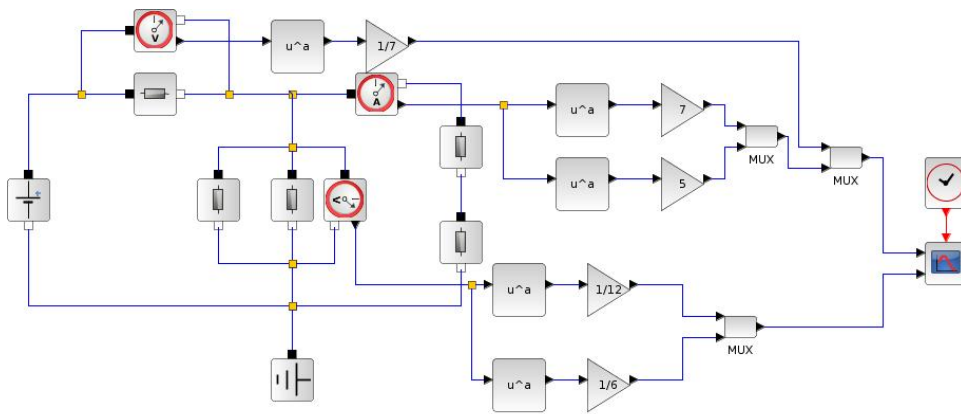


Figure 5.4: Network reduction

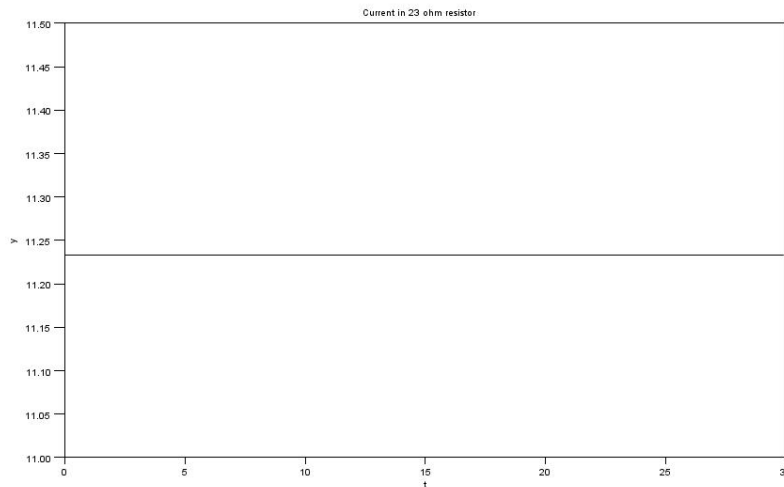


Figure 5.5: Superposition

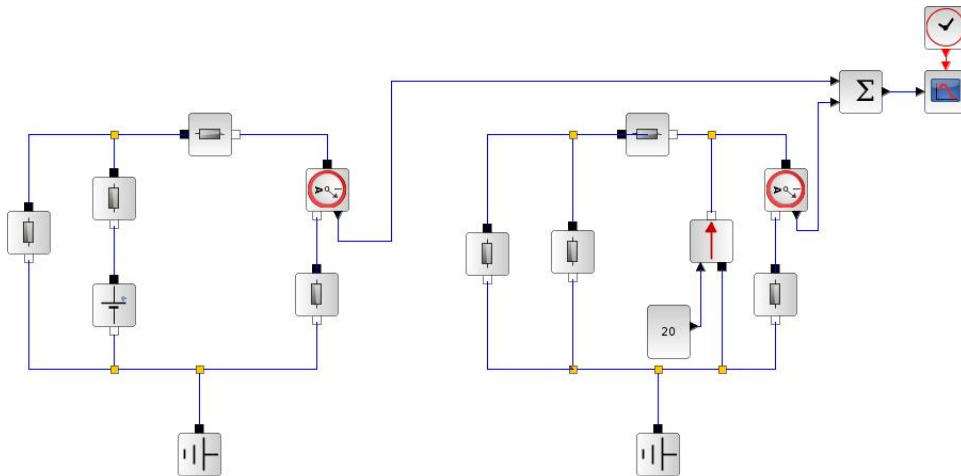


Figure 5.6: Superposition

Chapter 6

Amplifiers and Operational Amplifiers

Scilab code Exa 6.8 Operational amplifiers

```
1  clc
2  disp(" Example 6.8 ")
3  printf(" Given ")
4  disp(" R1= 10kohm R2=50kohm Ri=500kohm R0=0 ")
5  disp(" Open loop gain (A)=10^5 ")
6  A=10^5; R1=10*10^3; R2=50*10^3; Ri=500*10^3;
7  //From figure 6.11
8  //Applying KCL equation at node B
9  disp(" (v1+vd)/10+ (v2+vd)/50+ vd/500=0          (1) ")
10 )
11 //Since R0=0
12 disp(" v2=A*vd ")
13 //Solving for vd
14 disp(" vd=10^-5*v2          (2) ")
15 //Substituting (2) in (1) we get
16 printf(" v2/v1=%d\n" , -5)
```

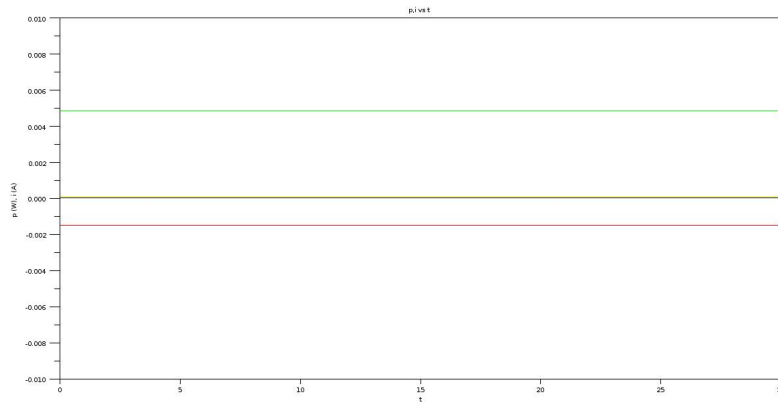


Figure 6.1: Analysis of circuits containing ideal op amps

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

Scilab code Exa 6.10 Summing circuit

```

1  clc
2  printf(" Given")
3  disp(" R1=1 ohm;R2=1/2 ohm;R3=1/4 ohm;R4=1/8 ohm")
4  disp(" Rf=1 ohm")
5  //From figure 6.14
6  //THE output of summing circuit can be written as
7  disp(" v0=-((Rf/R1)*v1+(Rf/R2)*v2+(Rf/R3)*v3 + .....")
8  //From above equation
9  disp(" v0=-((8v4+4v3+2v2+v1)-----(1) )")
10 disp(" a")

```

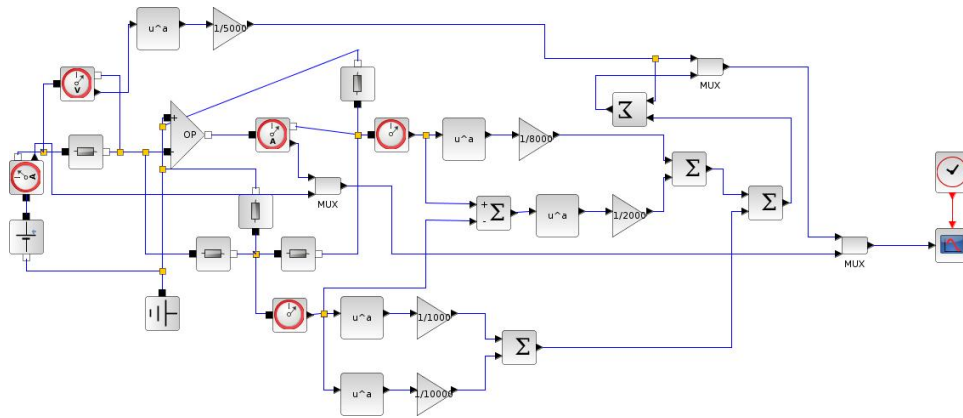


Figure 6.2: Analysis of circuits containing ideal op amps

```

11 v1=1;v2=0;v3=0;v4=1;
12 //Substituting in equation (1)
13 v0=-(8*v4+4*v3+2*v2+v1)
14 printf("v0=%dV\n",v0);
15
16 disp("b")
17 v1=0;v2=1;v3=1;v4=1;
18 //Substituting in equation (1)
19 v0=-(8*v4+4*v3+2*v2+v1)
20 printf("v0=%dV\n",v0);

```

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

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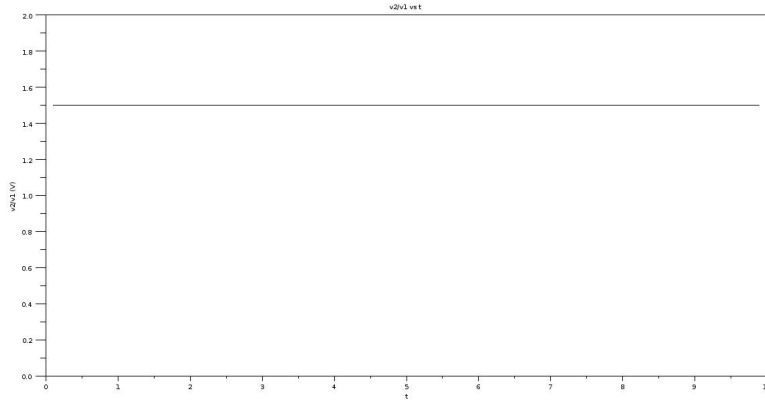


Figure 6.3: Noninverting circuit

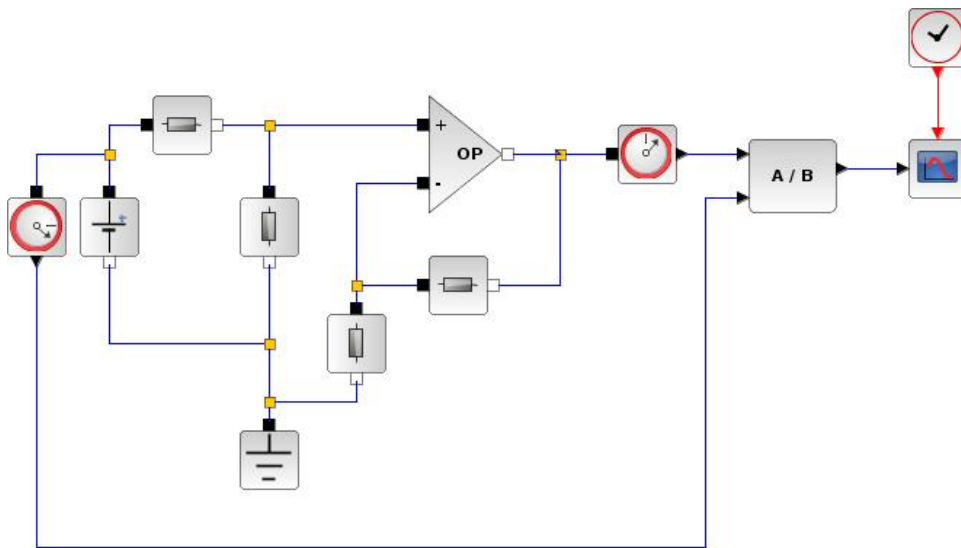


Figure 6.4: Noninverting circuit

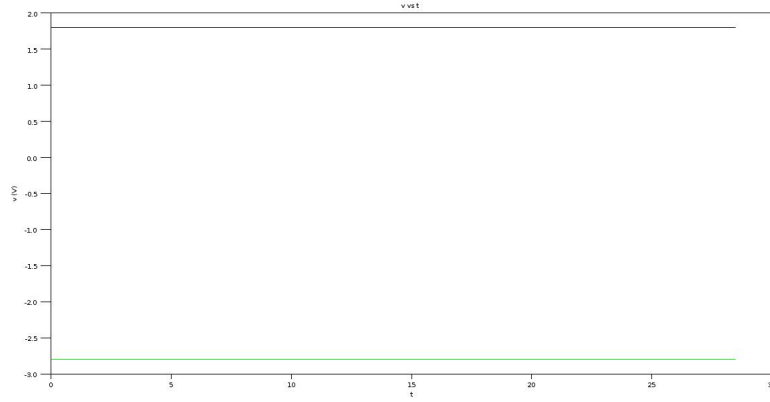


Figure 6.5: Circuits containing several Op amps

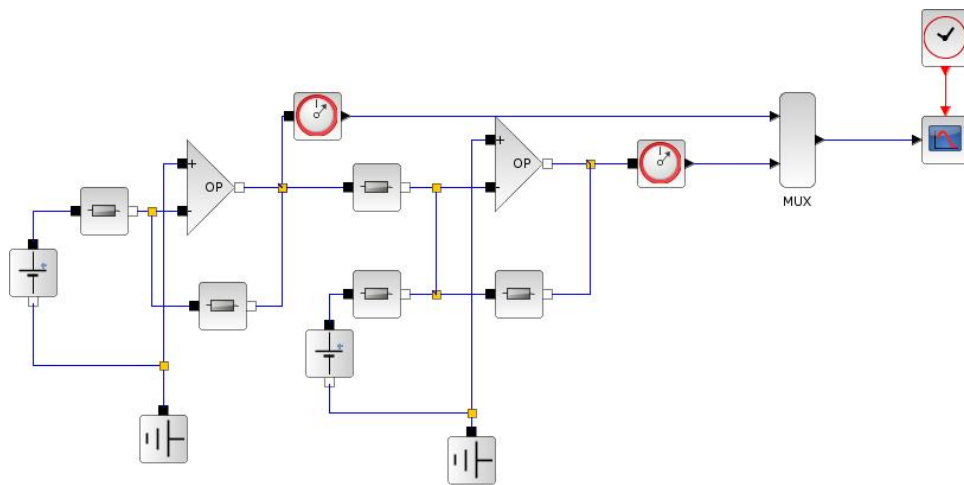


Figure 6.6: Circuits containing several Op amps

Chapter 7

Waveforms and Signals

Scilab code Exa 7.1 Sinusoidal Functions

```
1  clc
2  disp("Example 7.1")
3  printf("\n")
4
5  t1=-5:0.5:8
6  v1=cos (t1)
7  figure
8  a= gca ();
9  plot(t1,v1)
10 xtitle ('v1 vs t1 ', 't1 ', 'v1 ');
11 a. thickness = 2;
12 //From the graph
13 printf("Time period1= %3.3 fs\n Frequency 1=%0.3 fHz\n
        ",6.2832,0.159)
14
15 t2=-4:0.5:10
16 v2=sin (t2)
17 figure
18 a= gca ();
19 plot(t2,v2)
20 xtitle ('v2 vs t2 ', 't2 ', 'v2 ');
```

```

21 a. thickness = 2;
22 //From the graph
23 printf("Time period 2= %3.3 fs\n Frequency 2=%0.3 fHz\n
      n" ,6.2832,0.159)
24
25 t3=-1:0.05:1.5
26 v3=2*cos (2*%pi*t3)
27 figure
28 a= gca ();
29 plot(t3,v3)
30 xtitle ('v3 vs t3 ', 't3 ', 'v3 ');
31 a. thickness = 2;
32 //From the graph
33 printf("Time period 3= %ds\n Frequency 3=%dHz\n"
      ,1,1)
34
35 t4=-5:0.5:12
36 v4=2*cos (%pi*t4/4-%pi/4)
37 figure
38 a= gca ();
39 plot(t4,v4)
40 xtitle ('v4 vs t4 ', 't4 ', 'v4 ');
41 a. thickness = 2;
42 //From the graph
43 printf("Time period 4= %ds\n Frequency 4=%0.3 fHz\n"
      ,8,0.125)
44
45 t5=-1:0.005:1
46 v5=5*cos (10*t5+%pi/3)
47 figure
48 a= gca ();
49 plot(t5,v5)
50 xtitle ('v5 vs t5 ', 't5 ', 'v5 ');
51 a. thickness = 2;
52 //From the graph
53 printf("Time period 5= %0.3 fs\n Frequency 5=%3.2 fHz\n
      n" ,.62832,1.59)

```

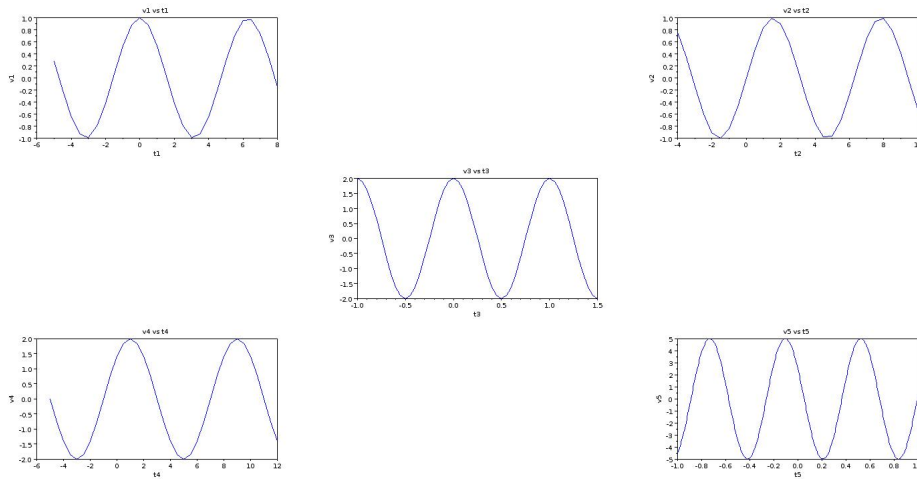


Figure 7.1: Sinusoidal Functions

Scilab code Exa 7.2 Sinusoidal Functions

```

1  clc
2  disp(" Example 7.2")
3  printf("\n")
4
5  //Let wt=q
6  q=-8:0.5:8
7  v=5*cos (q)
8  figure
9  a= gca ();
10 plot(q,v)
11 xtitle ('v vs wt', 'wt', 'v ');
12 a. thickness = 2;

```

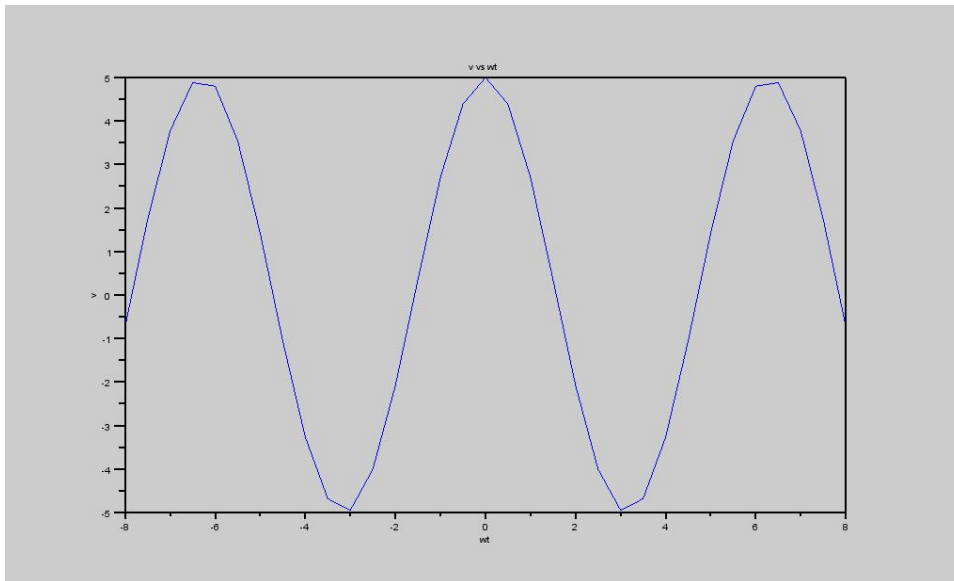


Figure 7.2: Sinusoidal Functions

Scilab code Exa 7.3 Time Shift and Phase Shift

```

1  clc
2  disp(" Example 7.3")
3  printf("\n")
4
5  t1=-10:0.05:10
6  v=5*cos (%pi*t1/6+%pi/6)
7  figure
8  a= gca ();
9  plot(t1,v)
10 xtitle ('v vs %pi*t/6 ', '%pi*t/6 ', 'v ');
11 a. thickness = 2;

```

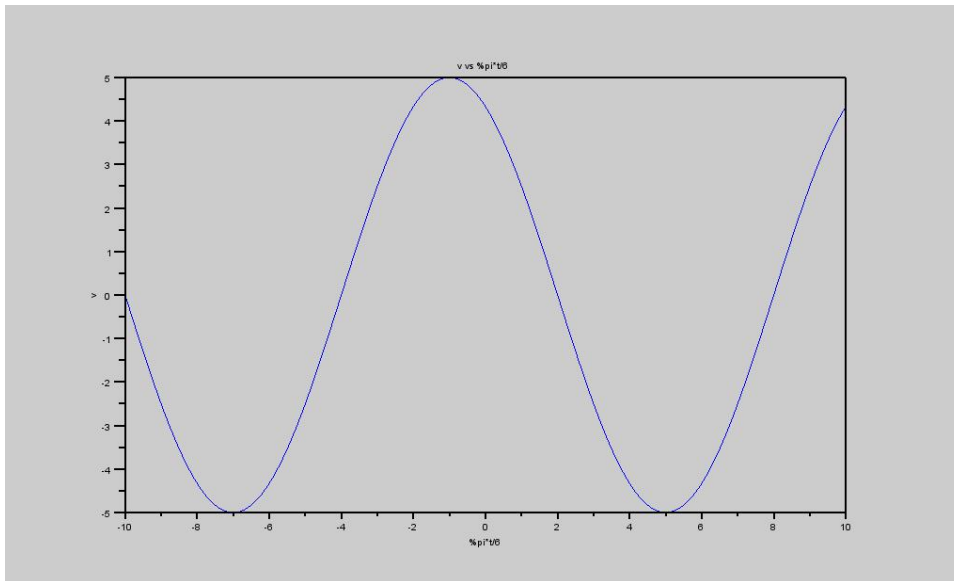


Figure 7.3: Time Shift and Phase Shift

Scilab code Exa 7.5 Combinations of Periodic Functions

```

1  clc
2  disp(" Example 7.5 ")
3  printf("\n")
4
5  printf(" Given ")
6  disp(" v(t)=cos5t+3sin(3t+45)")
7  //Finding the periods of individual terms
8  disp(" Period of cos5t=2*%pi/5")
9  disp(" Period of 3*sin(3t+45)=2*%pi/3")
10 // If T=2*%pi
11 T=2*%pi;
12 disp(" Now T=5*T1=3*T2")
13 //Now the relation for T is the smallest common
    integral multiple of T1 and T2

```

```
14 printf("Period = %3.2 fs\n",T)
```

Scilab code Exa 7.13 The Average and Effective RMS values

```
1 clc
2 disp("Example 7.13")
3 printf("\n")
4
5 printf("Given")
6 disp("Capacitance is 1uF")
7 C=1*10^-6;
8 disp("a)")
9 //Let k=1 which results in t=5ms
10 t=5*10^-3;
11 vac=(integrate('.004','t',0,0.003)-integrate('.002',
    't',0.003,0.005))/C;
12 printf("vac=%dV\n",vac);
13
14 //In general
15 disp("At t=5k voltage follows as v=8k ms")
16
17 disp("b)")
18 //As vdc=1/C*integrate(Idc*dt)
19 //On solving for Idc
20 vdc=vac
21 Idc=(1/((integrate('1/vac','t',0,0.005))/C))*10^3
22 printf("Idc=%3.2fmA\n",Idc);
23 disp("Idc is equal to <i(t)> in the period of 5ms")
```

Scilab code Exa 7.17 The Unit Impulse Function

```
1 clc
2 disp("Example 7.17")
```

```

3 printf("\n")
4
5 printf(" Given")
6 disp(" Capacitance is 100nF")
7 disp("The voltage across capacitor increases
      linearly from 0 to 10V")
8 C=100*10^-9;
9 //From figure 7.10(a)
10 disp(" a)")
11 //At t=T voltage across capacitor =10V
12 vc=10;
13 Q=C*vc;
14 printf(" Charge across capacitor is %fC\n",Q)
15 disp(" b)")
16 //The waveform shown in fig 7.10(a) can be written
      as
17 disp(" 0                t<0")
18 disp(" I0=10^-6/T        0<t<T")
19 disp(" 0                t>T")
20
21
22 //For T=1s;
23 T=1;
24 I0=10^-6/T;
25 printf(" I0 (1 s)=%fA\n", I0);
26
27 //For T=1ms;
28 T=1*10^-3;
29 I0=10^-6/T;
30 printf(" I0 (1 ms)=%0.3fA\n", I0);
31
32 //For T=1us;
33 T=1*10^-6;
34 I0=10^-6/T;
35 printf(" I0 (1 us)=%dA", I0);

```

Scilab code Exa 7.22 The Exponential Function

```
1 clc
2 disp(" Example 7.22")
3 printf("\n")
4
5 //The general equation of exponential decay function
   is given by
6 disp("v(t)=A*e(-t/T)+B")
7 //We need to solve A and B
8 //At t=0 we get v(0)=A+B      (1)
9 //at t=inf we get B=1         (2)
10 //Solving (1) and (2)
11 A=4;B=1;
12 T=3;
13 t=0:0.05:10
14 v=4*exp(-t/T)+1;
15 figure
16 a= gca ();
17 plot(t,v)
18 xtitle('v vs t','t','v');
19 a. thickness = 2;
```

Scilab code Exa 7.23 The Exponential Function

```
1 clc
2 disp(" Example 7.23")
3 printf("\n")
4
5 //Sketch voltage 'v'
```

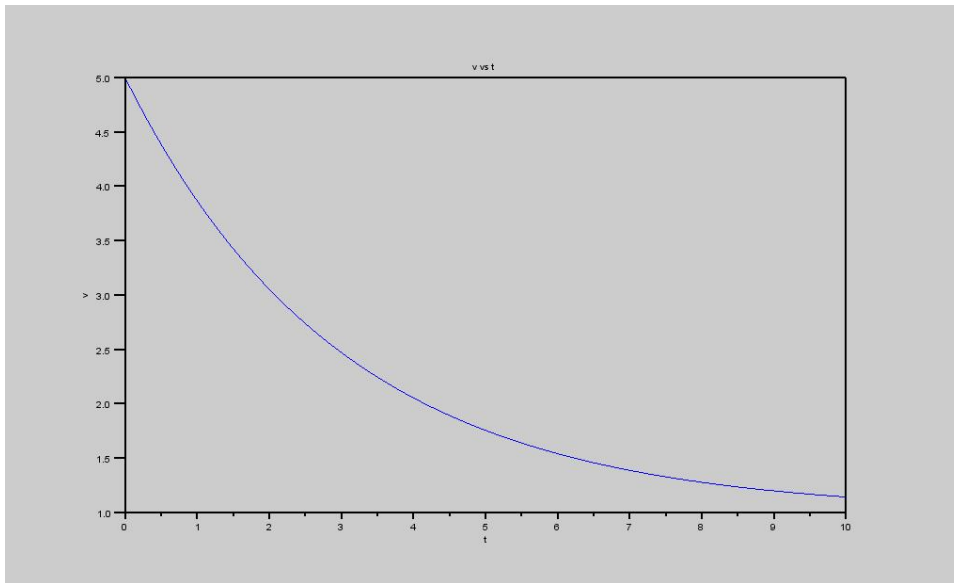


Figure 7.4: The Exponential Function

```

6 t=-.001:0.00005:0
7 t1=0:0.00005:.001
8 T=1*10^-3;
9 V0=10;
10 v=V0*exp(t/T)
11 v1=V0*exp(-t1/T)
12 figure
13 a= gca ();
14 plot(t,v)
15 plot(t1,v1)
16 xtitle ('v vs t', 't (ms)', 'v ');
17 a. thickness = 2;
18
19 //Sketch current 'i'
20 t=-.001:0.00005:0
21 t1=0:0.00005:.001
22 T=1*10^-3;
23 I0=10*10^-3;
24 i=I0*exp(t/T)

```

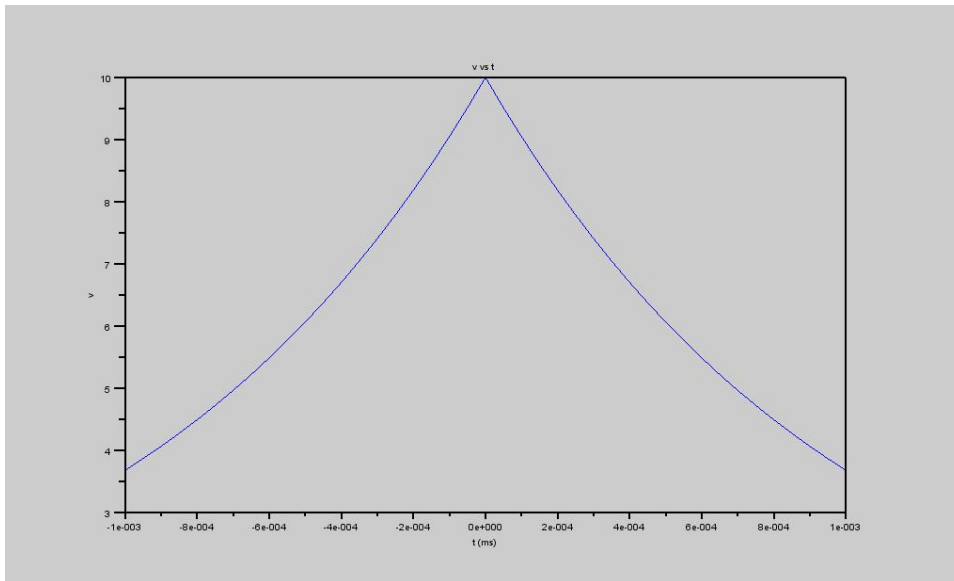


Figure 7.5: The Exponential Function

```

25 i1=-I0*exp(-t1/T)
26 figure
27 a= gca ();
28 plot(t,i)
29 plot(t1,i1)
30 xtitle ('i vs wt', 't (ms)', 'i (mA)');
31 a. thickness = 2;

```

Scilab code Exa 7.25 Random Signals

```

1 clc
2 disp(" Example 7.25")
3 printf("\n")

```

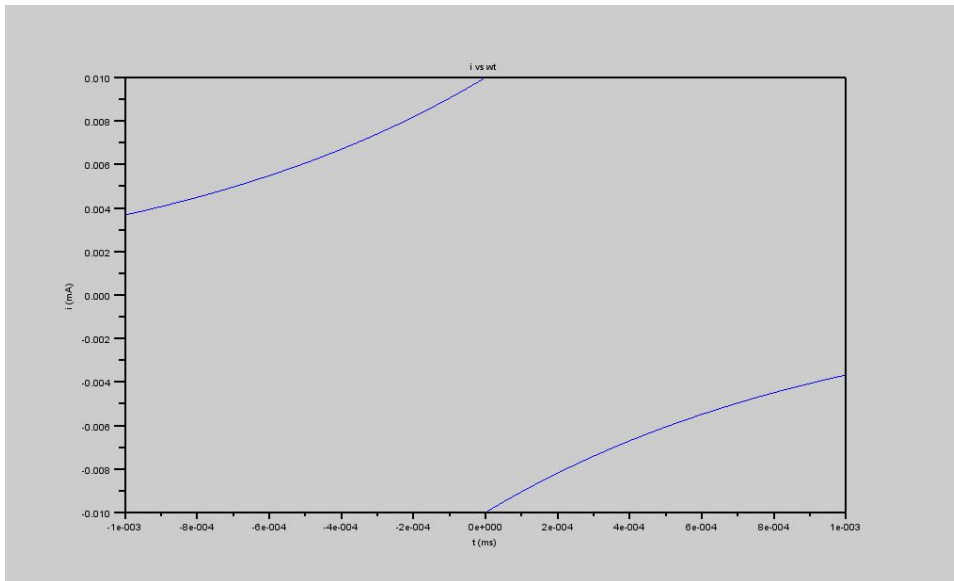


Figure 7.6: The Exponential Function

```

4
5 Xavg=(2+4+11+5+7+6+9+10+3+6+8+4+1+3+5+12)/16;
6 //Let X=X^2 eff
7 X
      =(2^2+4^2+11^2+5^2+7^2+6^2+9^2+10^2+3^2+6^2+8^2+4^2+1^2+3^2+5^2+12^2)
      /16
8 Xeff=sqrt(X);
9 printf(" Xavg=%d\n Xeff=%3.2 f\n", Xavg, Xeff)

```

Scilab code Exa 7.26 Random Signals

```

1 clc
2 disp(" Example 7.26")
3 printf("\n")
4
5 printf(" Given")
6 disp(" Period =10s")

```



```

7 disp("Interval is 1ms")
8 disp("Voltage of binary signal is either 0.5 or -0.5
      ")
9 T=10;
10 //During 10s period there are 10000 intervals of 1ms
      each
11 //For calculating average equal number of intervals
      are considered at 0.5V and -0.5V
12 vavg=(0.5*5000-0.5*5000)/10000
13 //The effective value of v(t) is
14 //Let  $V=V^2_{eff}$ 
15  $V=(0.5^2*5000+(-0.5)^2*5000)/10000$ 
16  $V_{eff}=\text{sqrt}(V)$ 
17 printf("vavg=%dV\nVeff=%3.2fV\n",vavg,Veff)

```

Chapter 8

First order Circuits

Scilab code Exa 8.1 Capacitor Discharge in a Resistor

```
1  clc
2  disp("Example 8.1")
3  printf("\n")
4
5  printf("Given")
6  disp("Capacitance is 1uF")
7  disp("Resistance is 1Mohm")
8  disp("Voltage across capacitor is 10V")
9  R=1*10^6;C=1*10^-6;V=10
10 //Let T be time constant
11 T=R*C
12 //v(t)=V*exp(-t/T)
13 disp("v(t)=10*exp(-t)          (1)")
14 //Substituting value of t=5 in (1)
15 v5=10*exp(-5)
16 printf("Time constant is %ds\n",T)
17 printf("v(5)=%0.3fV\n",v5)
```

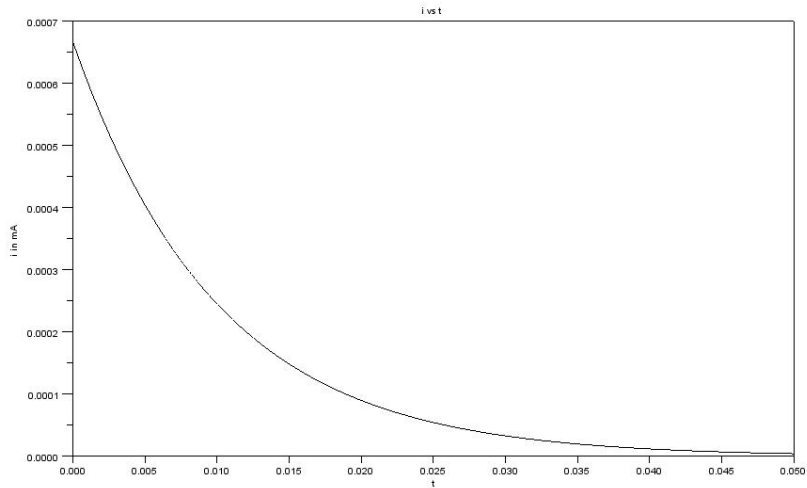


Figure 8.1: Capacitor Discharge in a Resistor

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

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

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

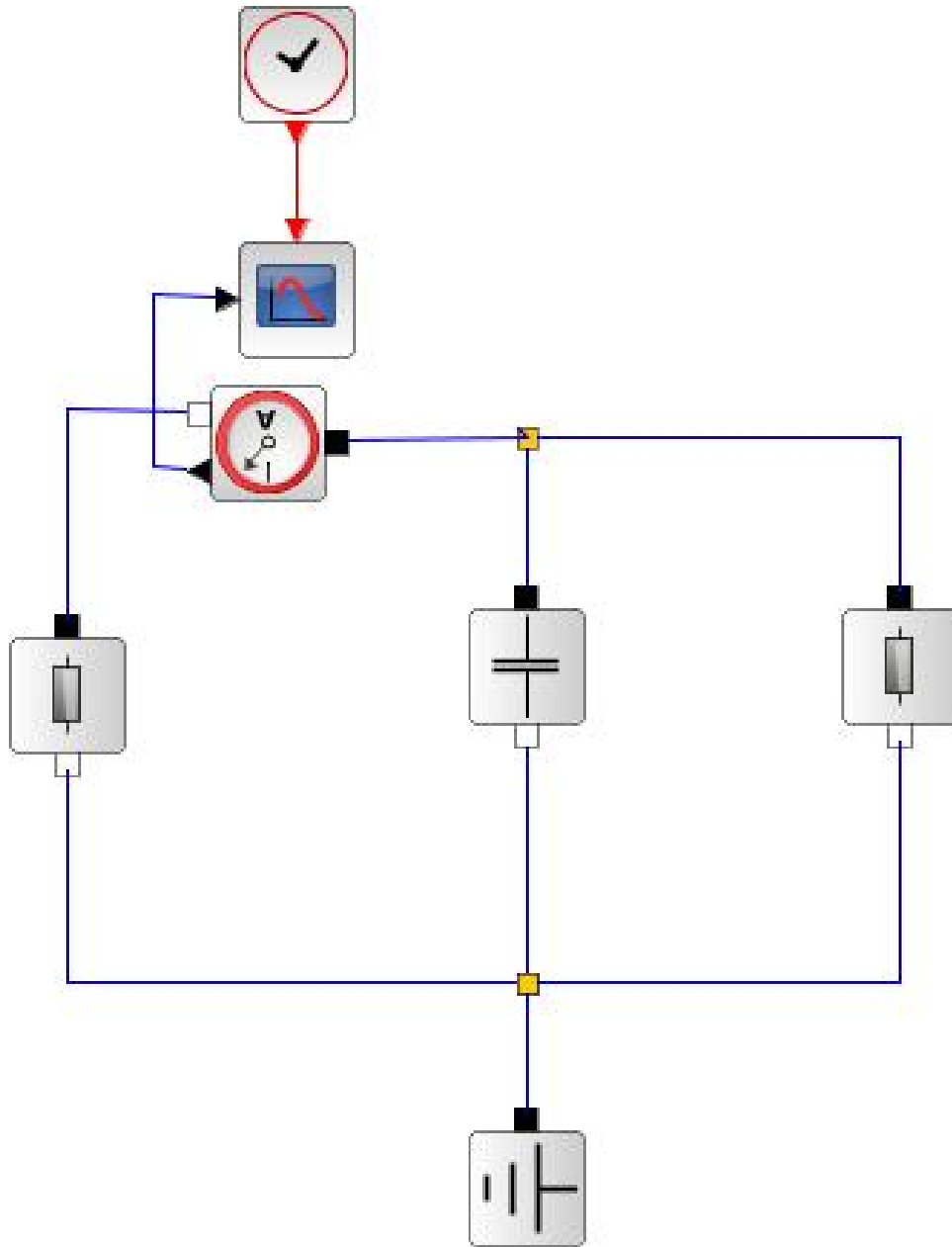


Figure 8.2: Capacitor Discharge in a Resistor

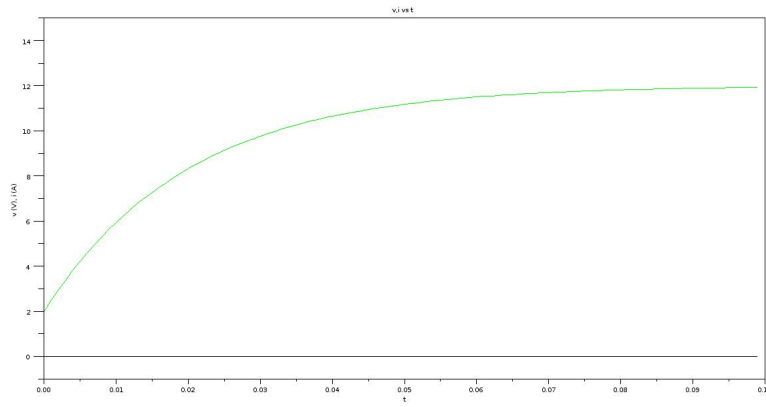


Figure 8.3: Establishing a DC Voltage across a Capacitor

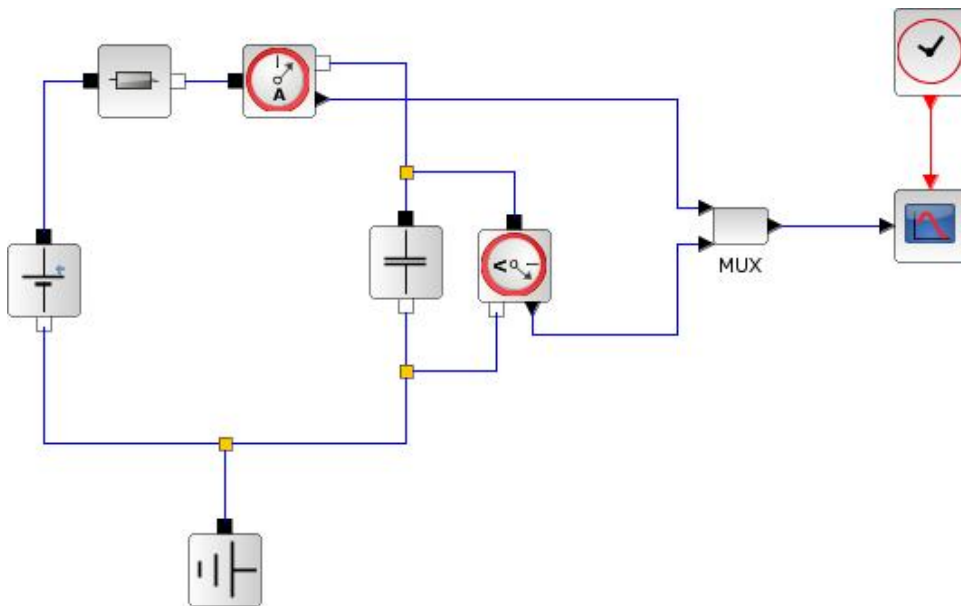


Figure 8.4: Establishing a DC Voltage across a Capacitor

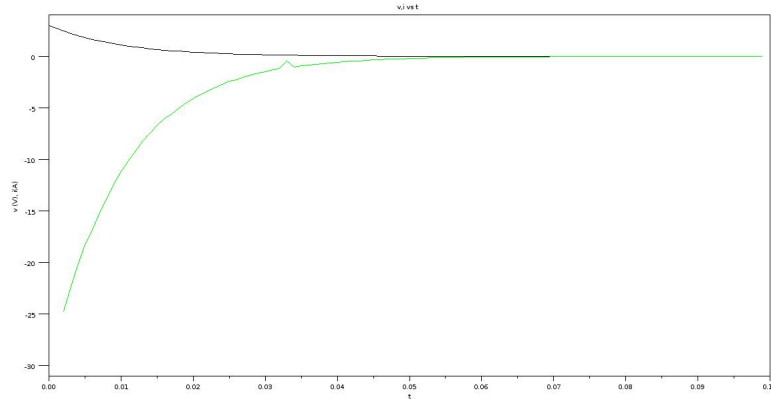


Figure 8.5: The Source free RL Circuit

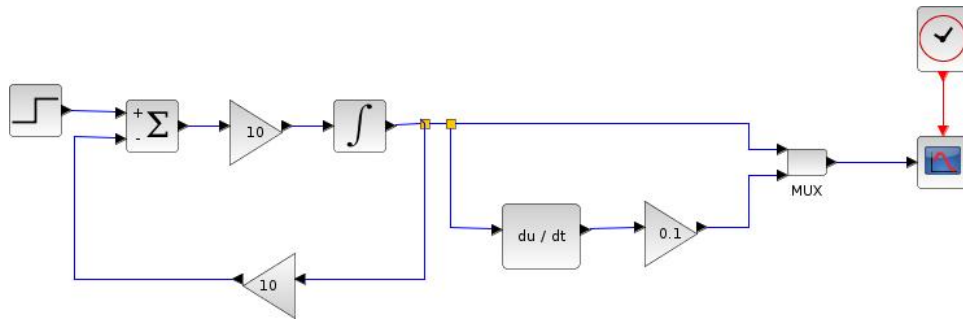


Figure 8.6: The Source free RL Circuit

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

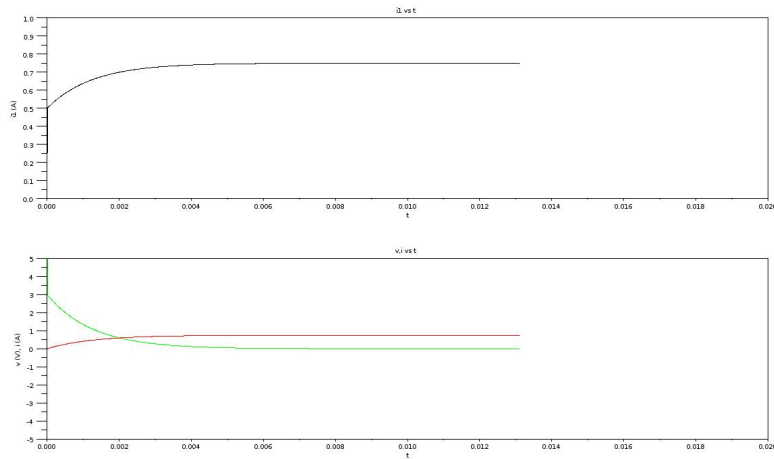


Figure 8.7: Complex first order RL and RC Circuits

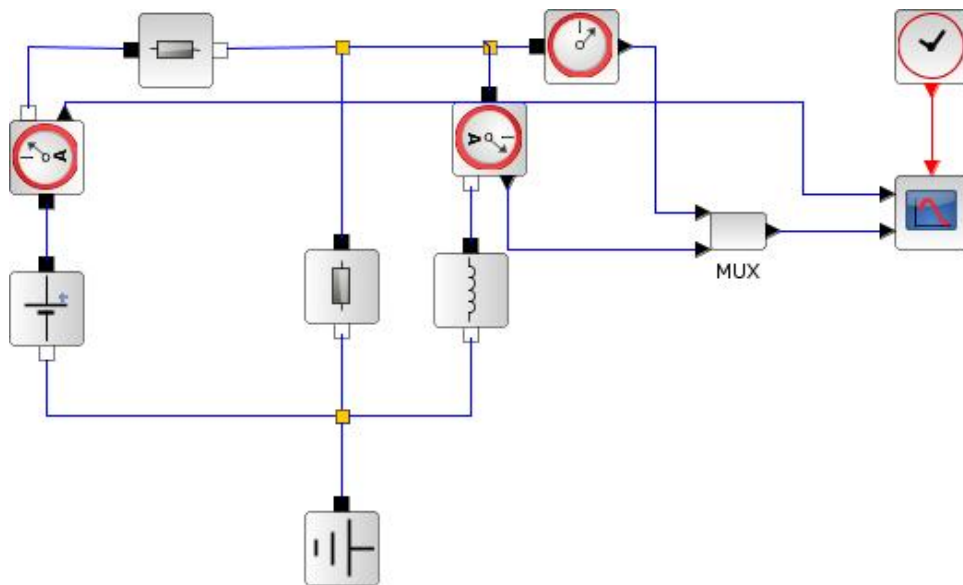


Figure 8.8: Complex first order RL and RC Circuits

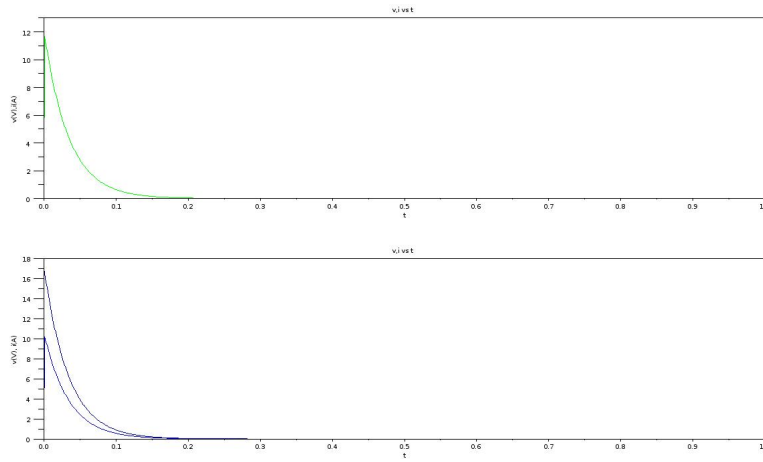


Figure 8.9: Complex first order RL and RC Circuits

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

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

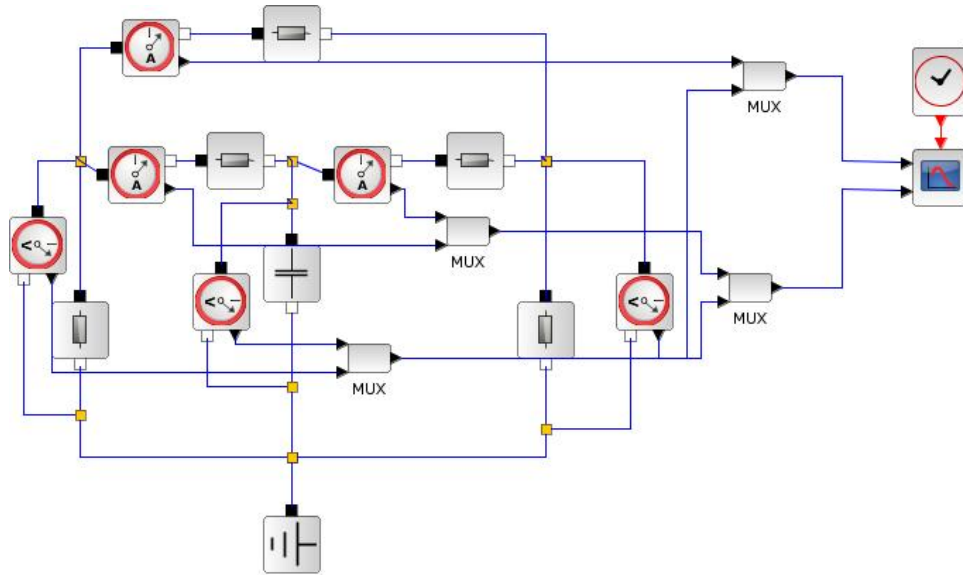


Figure 8.10: Complex first order RL and RC Circuits

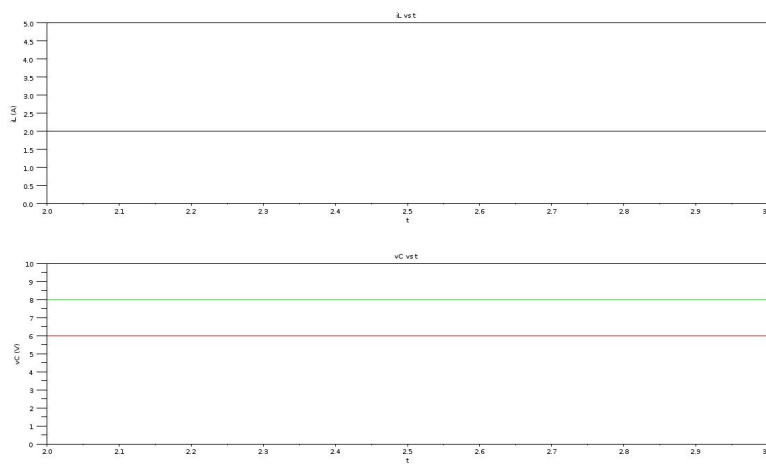


Figure 8.11: DC Steady state in Inductors and Capacitors

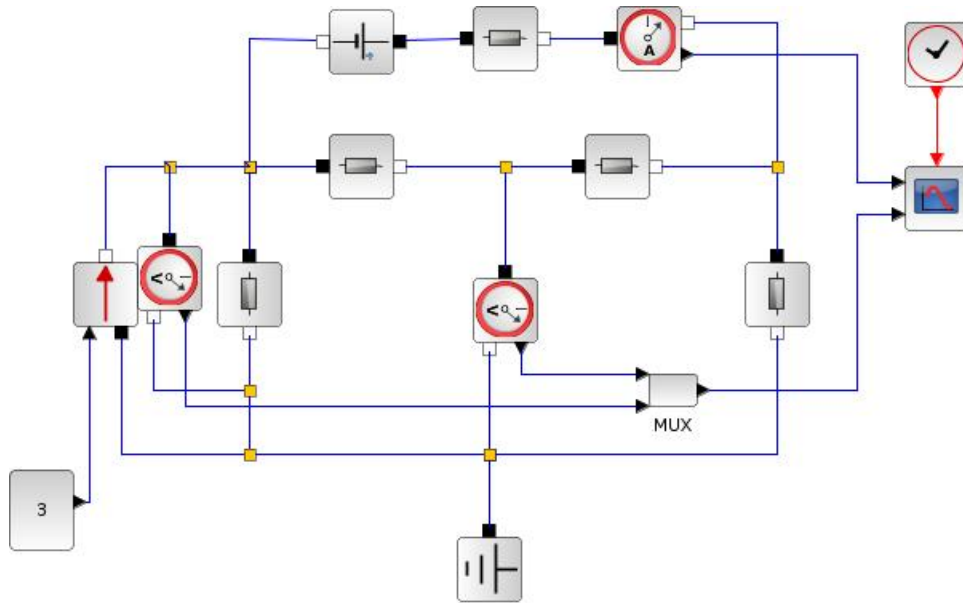


Figure 8.12: DC Steady state in Inductors and Capacitors

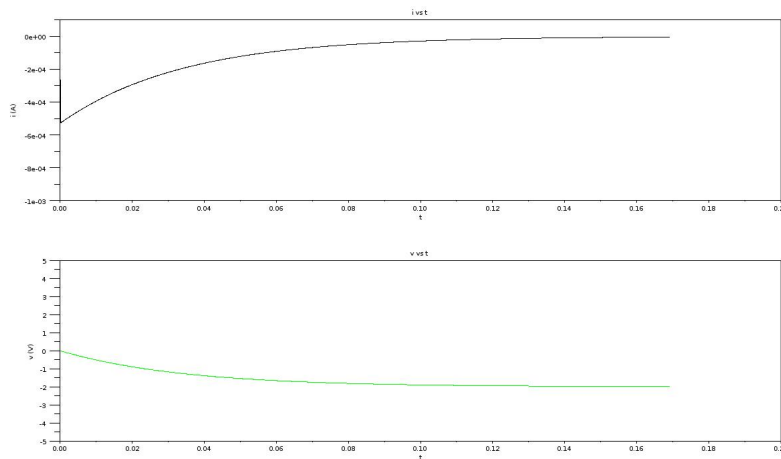


Figure 8.13: DC Steady state in Inductors and Capacitors

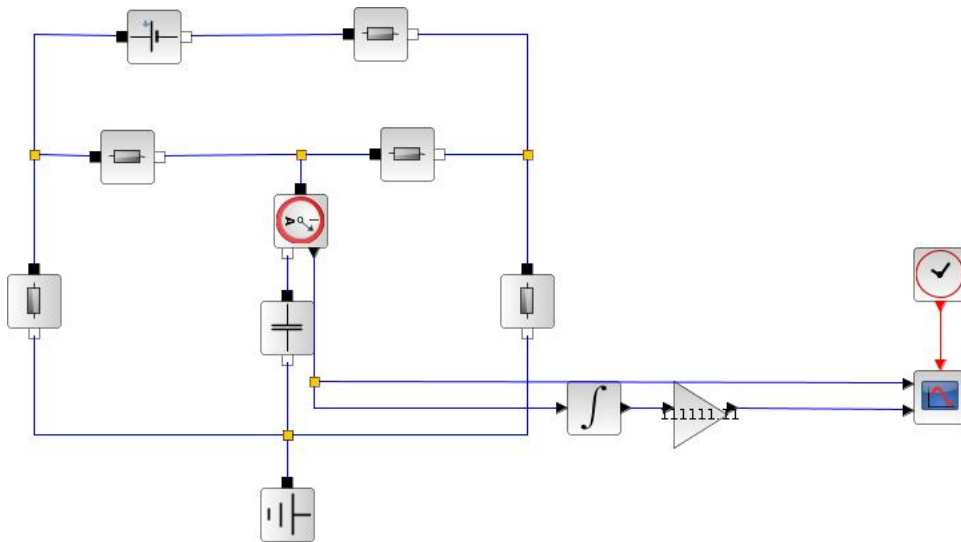


Figure 8.14: DC Steady state in Inductors and Capacitors

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

Scilab code Exa 8.10 Transitions at Switching Time

```

1  clc
2  disp(" Example 8.10 ")
3  printf("\n")
4
5  printf(" Given ")
6  disp(" vs= 5V          t < 0 ")
7  disp(" vs=5*sin(w*t)   t > 0 ")

```

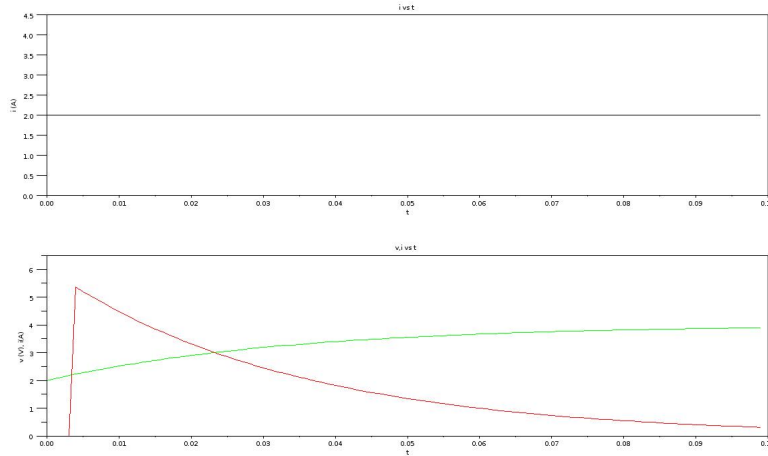


Figure 8.15: Transitions at Switching Time

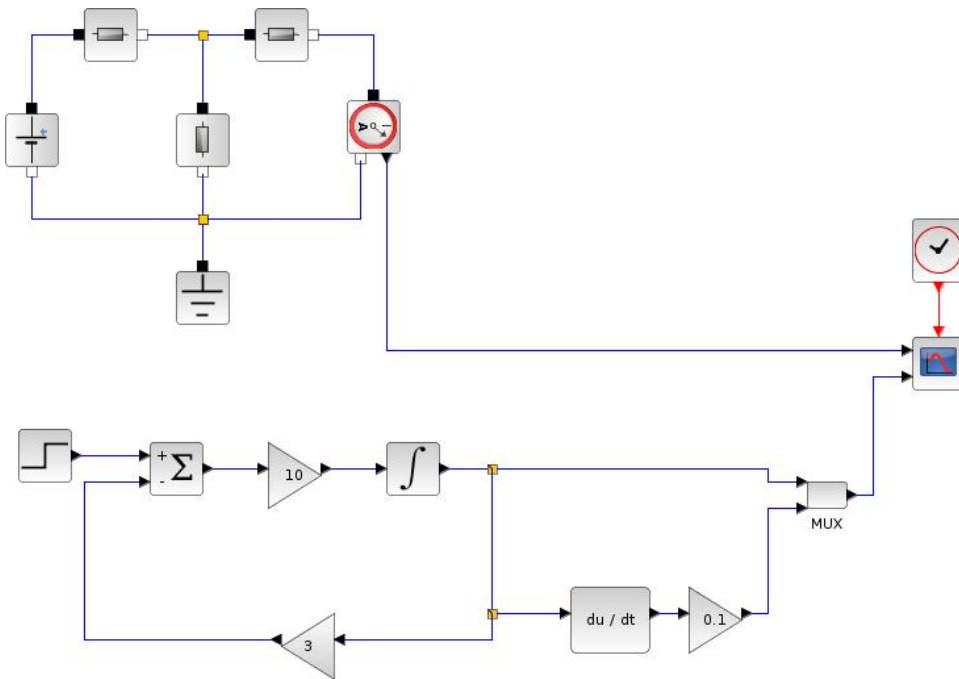


Figure 8.16: Transitions at Switching Time

```

8 vs=5;
9 R=5;L=10*10^-3;
10 //At t<0
11 //Inductor behaves as a short circuit
12 //Let i(0-)=i
13 i=vs/R;
14 printf("i(0-)=%dA\n",i)
15 //During the transition from t=0- to t=0+
16 //Let i(0+)=i1
17 i1=i
18 printf("i(0+)=%dA\n",i1)
19 //Applying KVL equation to the loop
20 disp("vs=i*R+v")
21 //Let v(0+)=v1 ; vs(0+)=vs1
22 //From given vs(0+)=0
23 vs1=0;
24 v1=vs1-i*R
25 printf("\nv(0+)=%dV\n",v1)

```

Chapter 9

Higher order circuits and Complex frequency

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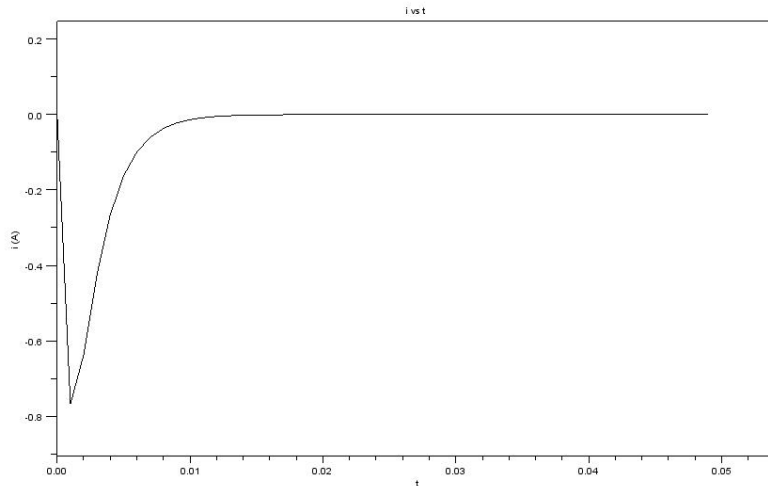


Figure 9.1: Series RLC Circuit

Scilab code Exa 9.6 Generalized Impedance RLC in s domain

```

1  clc
2  disp(" Example 9.6")
3  printf(" \n")
4
5  printf(" Given")
6  disp(" Resistance is 10ohm and inductance is 2H")
7  disp(" Applied voltage is 10*exp(-2*t)*cos(10*t+30)")
8  s=%s;
9  //For a RL circuit
10 //Applying KVL equation
11 //v=i*R+L*d/dt(i)      (1)
12 //As v=10(30 deg)      (2)
13 //Equating (1) and (2)
14 // Let i=I*exp(s*t)    (3)
15 // 10(30 deg)*exp(s*t)=10*I*exp(s*t)+2*s*I*exp(s*t)
16 //Solving for I

```

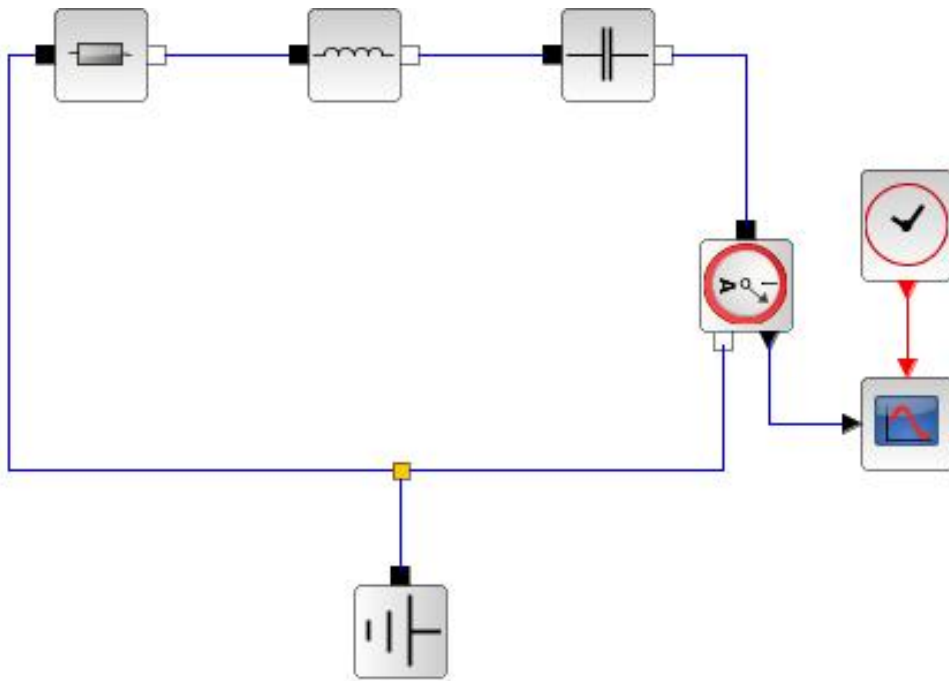


Figure 9.2: Series RLC Circuit

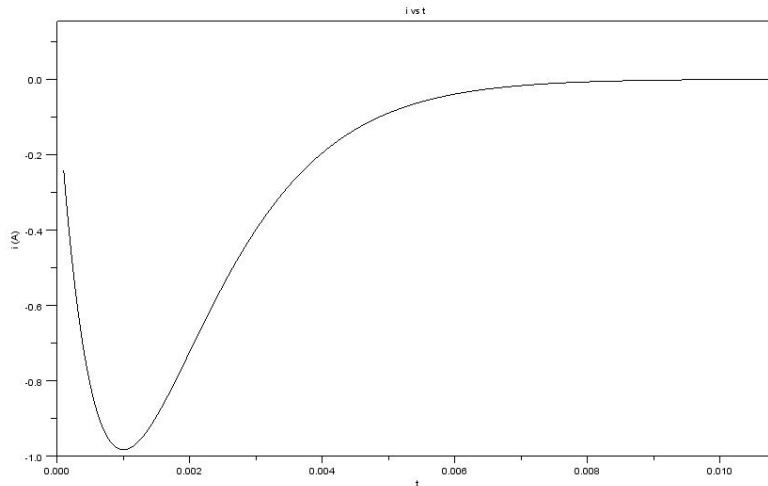


Figure 9.3: Series RLC Circuit

```

17 disp(" I=10(30 deg)/10+2*s")
18 s=-2+%i*10
19 a=10+2*s
20 x=10*cos((30*%pi)/180);
21 y=10*sin((30*%pi)/180);
22 z=complex(x,y)
23 I=z/a
24 b=real(I);
25 c=imag(I);
26 magn=sqrt(b^2+c^2)
27 ph=(atan(c/b)*180)/%pi
28 //From (3)
29 printf("\ni=%0.2 f*exp(-2*t)*cos(10t%3.1 f deg) (A)\n"
, magn , ph);

```

Scilab code Exa 9.7 Generalized Impedance RLC in s domain

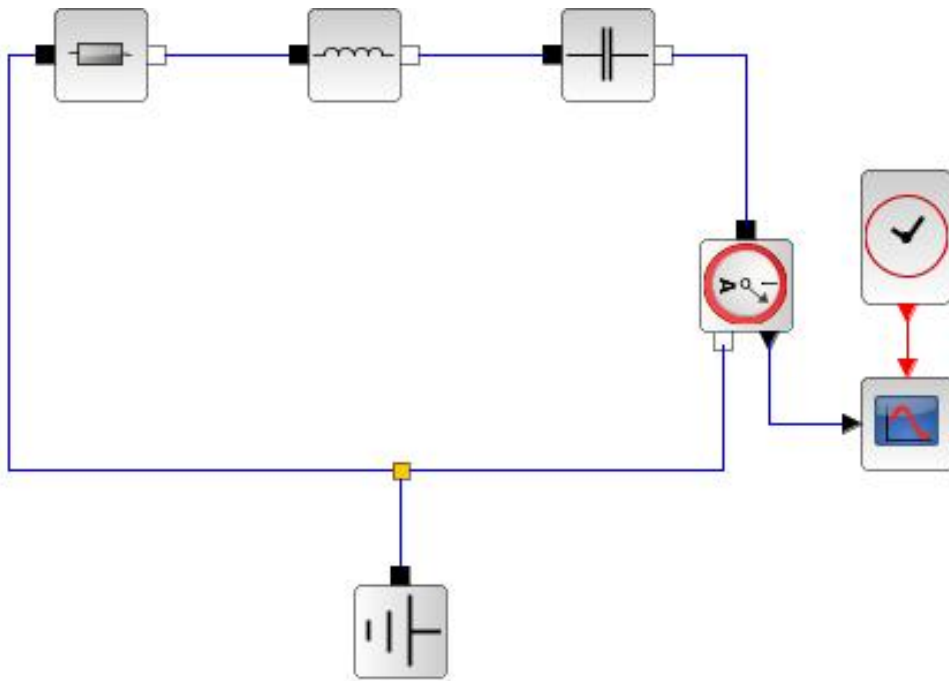


Figure 9.4: Series RLC Circuit

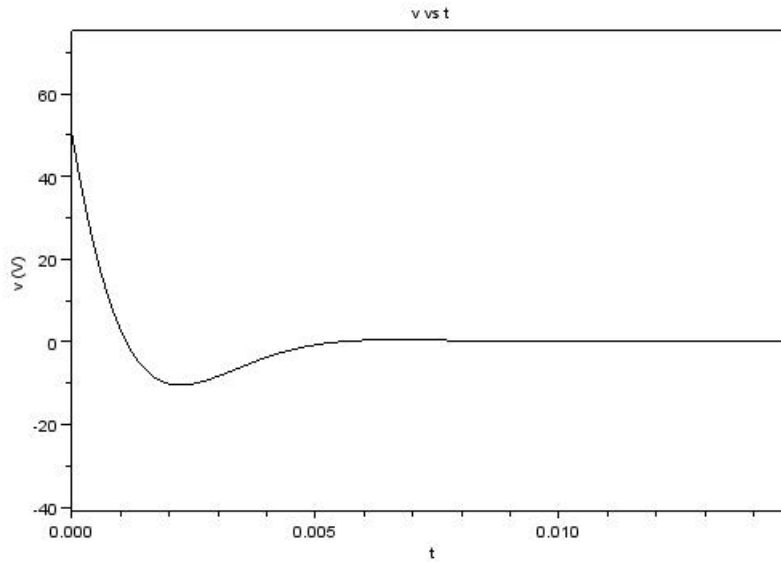


Figure 9.5: Parallel RLC circuit

```

1  clc
2  disp(" Example 9.7")
3  printf("\n")
4
5  printf(" Given")
6  disp(" Resistance is 10ohm and Capacitance is 0.2F")
7  disp(" Applied voltage is 10*exp(-2*t)*cos(10*t+30)")
8  s=%s;
9  //For a RC circuit
10 //Applying KVL equation
11 //v=i*R+(1/C)*integrate(i*dt)      (1)
12 //As v=10(30 deg)      (2)
13 //Equating (1) and (2)
14 // Let i=I*exp(s*t)      (3)
15 // 10(30 deg)*exp(s*t)=10*I*exp(s*t)+(5/s)*I*exp(s*t)
16 //Solving for I
17 disp(" I=10(30 deg)/10+(5/s)")

```

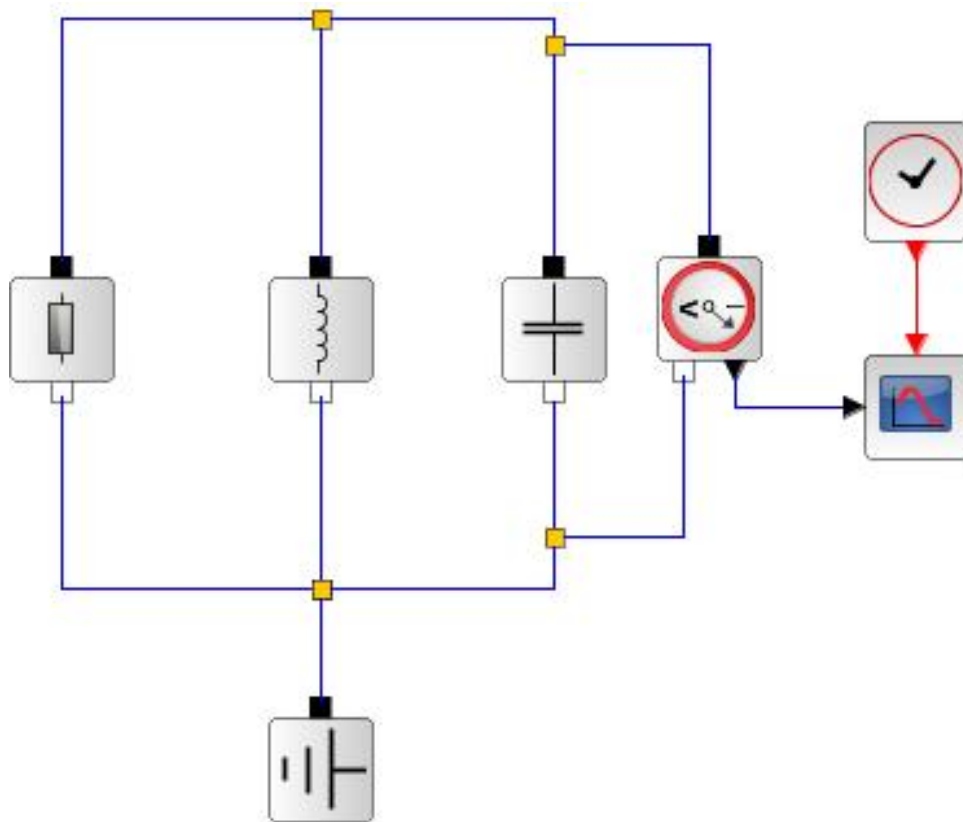


Figure 9.6: Parallel RLC circuit

```

18 s=-2+%i*10
19 a=10+(5/s)
20 x=10*cos((30*%pi)/180);
21 y=10*sin((30*%pi)/180);
22 z=complex(x,y)
23 I=z/a
24 b=real(I);
25 c=imag(I);
26 magn=sqrt(b^2+c^2)
27 ph=(atan(c/b)*180)/%pi
28 //From (3)
29 printf("\ni=%0.2 f*exp(-2*t)*cos(10 t+%3.1 f deg) (A)\n
      ",magn,ph);

```

Scilab code Exa 9.8 Network function and Pole zero plots

```

1  clc
2  disp(" Example 9.8")
3  printf("\n")
4
5  s=%s ;
6
7  //From figure 9.13
8  disp("Z(s)=(2.5+((5*s/3)*(20/s)))/(5*s/3+20/s)")
9  //On solving
10 z1=poly([12 8 1], 's', 'coeff')
11 z2=poly([12 0 1], 's', 'coeff')
12 Z=2.5*(z1/z2)
13 disp(Z,"Z(s)")
14 //H(s)=I(s)/Z(s)
15 //Let I(s)=1 the H(s)=1/Z(s)
16 H=(1/2.5)*(z2/z1)
17 disp(H,"H(s)")

```

Scilab code Exa 9.9 The Forced Response

```
1  clc
2  disp(" Example 9.9")
3  printf("\n")
4
5  s=%s ;
6  H=syslin ( 'c' ,(0.4*(s^2+12))/((s+2)*(s+6) ) ) ;
7  evans (H,1)
8  // If s=1Np/s
9  H1=0.4*(1+12)/((1+2)*(1+6))
10 printf("H(1)=%0.3 f\n" ,H1)
```

Scilab code Exa 9.11 The Natural Response

```
1  clc
2  disp(" Example 9.11")
3  printf("\n")
4
5  //From figure 9.16
6  //H(s)=V(s)/I(s)=Z(s)
7  //Let V(s)=1 the H(s)=Z(s)
8  s=%s
9  z1=(1/2.5)+(3/(5*s))+(s/20)
10 Z=1/z1
11 Dem=Z('den')
12 //The roots are
13 q=roots(Dem)
14 disp(q," Poles are")
```

Chapter 10

Sinusoidal Steady state Circuit Analysis

Scilab code Exa 10.4 Phasors

```
1  clc
2  disp("Problem 10.4")
3  printf("\n")
4
5  //For V1
6  Ro1=25
7  Theta1=143.13
8  //For V1
9  Ro2=11.2
10 Theta2=26.57
11 //We need to find V1/V2
12 //Let V=V1/V2
13 Vmag=(Ro1/Ro2)
14 Vph=Theta1-Theta2
15 x=Vmag*cos((Vph*%pi)/180);
16 y=Vmag*sin((Vph*%pi)/180);
17 z=complex(x,y)
18 //Let V1+V2=V12
19 x1=Ro1*cos((Theta1*%pi)/180);
```

```

20 y1=Ro1*sin((Theta1*pi)/180);
21 z1=complex(x1,y1)
22 x2=Ro2*cos((Theta2*pi)/180);
23 y2=Ro2*sin((Theta2*pi)/180);
24 z2=complex(x2,y2)
25 V12=z1+z2
26 [R,Theta]=polar(V12)
27 printf("V1/V2=%0.2f+i*%0.2f \nV1+V2=%0.2f(%0.2f deg)
      ",x,y,R,(Theta*180)/pi)

```

Scilab code Exa 10.5 Impedance and Admittance

```

1  clc
2  disp("Problem 10.5")
3  printf("\n")
4
5  printf("Given")
6  disp("Voltage is 100(45 deg)")
7  disp("Current is 5(15 deg)")
8  //For V
9  Ro1=100
10 Theta1=45
11 //For I
12 Ro2=5
13 Theta2=15
14 //We need to find V/I=Z
15
16 Zmag=(Ro1/Ro2)
17 Zph=Theta1-Theta2
18 x=Zmag*cos((Zph*pi)/180);
19 y=Zmag*sin((Zph*pi)/180);
20 z=complex(x,y)
21 //Let Y=1/Z
22 Ymag=(Ro2/Ro1)
23 Yph=Theta2-Theta1

```



```

24 x1=Ymag*cos((Yph*%pi)/180);
25 y1=Ymag*sin((Yph*%pi)/180);
26 z1=complex(x1,y1)
27
28 printf("R=%3.2 fohm XL=%3.2 fH \nG=%0.3 fS BL=%0.3 fS",x
        ,y,x1,abs(y1));

```

Scilab code Exa 10.7 Superposition of AC sources

```

1 clc
2 disp(" Problem 10.7")
3 printf("\n")
4
5 printf(" Voltage v1=5*cos(w1*t)")
6 printf(" Voltage v2=10*cos(w2*t+60)")
7 //The circuit is modeled as
8 disp(" Resistance is 10ohm and inductance is 5mH")
9 R=10;L=5*10^-3;
10 disp(" a")
11 w1=2000;w2=2000;
12 //Let Z be the impedance of the coil
13 Z1=R+%i*L*w1
14 Z2=R+%i*L*w2
15 //Let V be phasor voltage between the terminals
16 Vmag=10;
17 Vph=60;
18 x=Vmag*cos((Vph*%pi)/180);
19 y=Vmag*sin((Vph*%pi)/180);
20 z=complex(x,y)
21 v=5-z;
22 //Let I be the current
23 I=v/Z1
24 [R,Theta]=polar(I)
25 printf(" i=%0.2 f*cos(%dt%d deg)",R,w1,(Theta*180)/%pi
        );

```

```

26
27 disp("b")
28 R=10;L=5*10^-3;
29 w1=2000;w2=4000;
30 //Let Z be the impedance of the coil
31 Z1=R+%i*L*w1
32 Z2=R+%i*L*w2
33 V1=5;
34 //By applying superposition i=i1-i2
35 I1=V1/Z1
36 [R,Theta]=polar(I1)
37 printf(" i1=%0.2 f*cos(%dt%d deg)\n",R,w1,(Theta*180)/
    %pi);
38 V2mag=10;V2ph=60;
39 I2=z/Z2
40 [R1,Theta1]=polar(I2)
41 printf(" i2=%0.2 f*cos(%dt%3.2 f deg)\n",R1,w2,(Theta1
    *180)/%pi);
42 // i=i1-i2
43 printf(" i=%0.2 f*cos(%dt%d deg)-%0.2 f*cos(%dt%3.2 f
    deg)\n",R,w1,(Theta*180)/%pi,R1,w2,(Theta1*180)/
    %pi)

```

Chapter 11

AC Power

Scilab code Exa 11.1 Power in time domain

```
1 clc
2 disp("Problem 11.1")
3 printf("\n")
4
5 printf("Given")
6 disp("Resistance =1000ohm")
7 t=0:0.5:1;
8 i=1;i1=-1;
9 figure
10 a=gca()
11 plot(t,i,t+1,i1,t+2,i,t+3,i1)
12 xtitle("i vs t", 't in ms', 'i in mA')
13 i=1*10^-3;R=1000;
14 //p=i^2*R
15 p=i^2*R;
16 figure
17 a=gca()
18 plot(t,p)
19 xtitle("p vs t", 't in ms', 'p in mW')
```

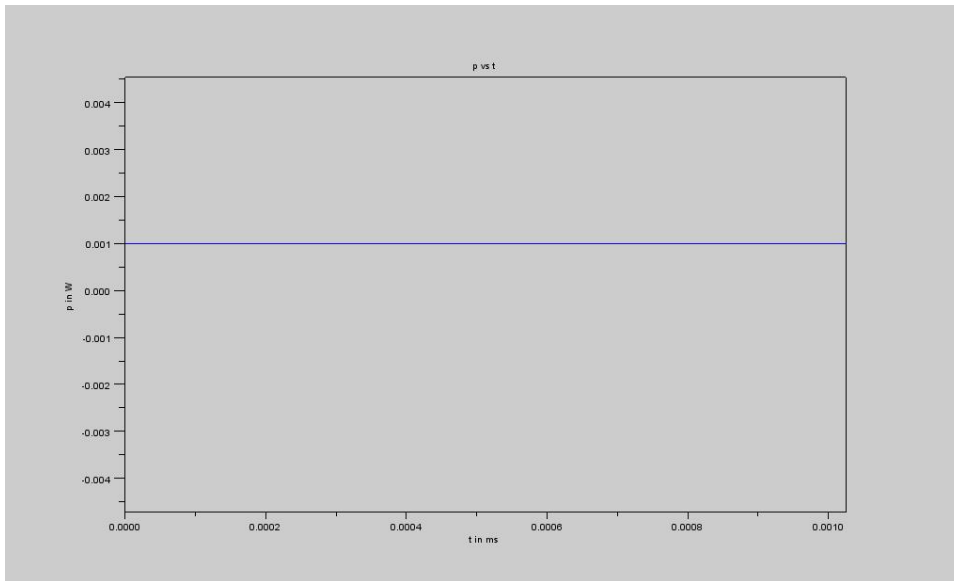


Figure 11.1: Power in time domain

Scilab code Exa 11.2 Power in time domain

```

1  clc
2  disp(" Problem  11.2")
3  printf(" \n")
4
5  t=0:0.5:1;
6  i=1;i1=-1;
7  figure
8  a=gca()
9  plot(t,i,t+1,i1)
10 xtitle("i vs t", 't in ms', 'i in mA')

```

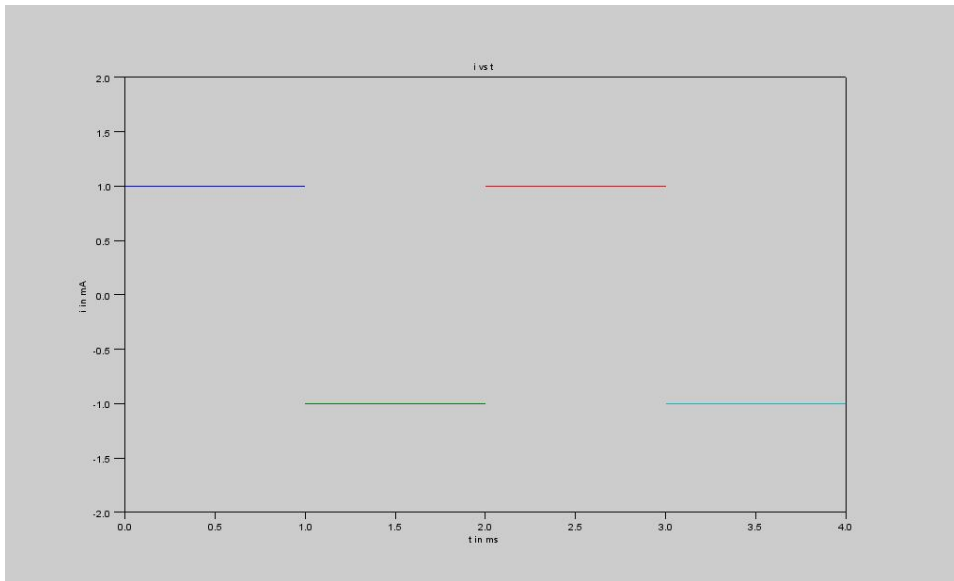


Figure 11.2: Power in time domain

```

11 //Voltage across capacitor vC=(1/C)*integrate(i*dt)
12 //On integration
13 t=0:0.0005:0.001
14 v=2000*t
15 v1=2-v;
16 figure
17 a=gca()
18 plot(t,v,t+0.001,v1,t+0.002,v,t+0.003,v1)
19 xtitle("v vs t", 't in ms', 'v in V')
20
21 //Power is p=v*i
22 t=0:.0005:.001
23 p=2000*t
24 p1=p-2;
25 figure
26 a=gca()
27 plot(t,p,t+0.001,p1,t+0.002,p,t+0.003,p1)
28 xtitle("p vs t", 't in ms', 'p in W')
29

```

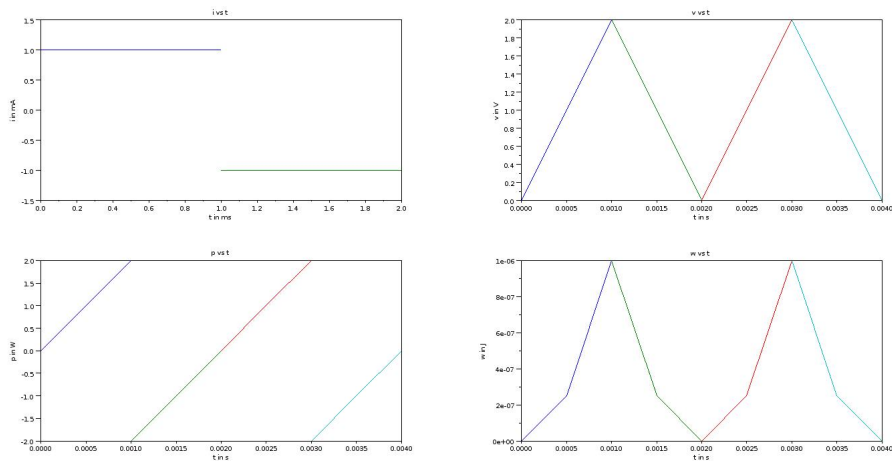


Figure 11.3: Power in time domain

```

30 //Work is (C*v^2)/2
31 t=0:.0005:.001
32 w=t^2
33 w1=t^2+1*10^-6-(2*10^-3*t);
34 figure
35 a=gca()
36 plot(t,w,t+0.001,w1,t+0.002,w,t+0.003,w1)
37 xtitle("w vs t", 't in ms', 'w in J')

```

Scilab code Exa 11.4 Average or Real Power

```

1 clc
2 disp(" Problem 11.4")
3 printf("\n")
4
5 printf(" Given")
6 disp(" Veff=110V Z=10+i8 ohm")
7 Veff=110;

```

```

8 Z=10+%i*8
9 Zmag=sqrt(10^2+8^2)
10 Zph=(atan(8/10)*180)/%pi
11 P=(Veff^2*R)/(Zmag^2)
12 pf=cos((Zph*%pi)/180)
13
14 disp(pf,"Power factor is")

```

Scilab code Exa 11.5 Reactive Power

```

1 clc
2 disp("Problem 11.5")
3 printf("\n")
4
5 printf("Given")
6 disp("Veff=110V Ieff=20(-50 deg)")
7 Imagn=20;Iph =-50;
8 Veff=110;
9
10 P=Veff*Imagn*cos((abs(Iph)*%pi)/180)
11 Q=Veff*Imagn*sin((abs(Iph)*%pi)/180)
12 printf("Average power is %3.1fW\n",P)
13 printf("Reactive power is %3.1fvar\n",Q)

```

Scilab code Exa 11.10 Complex power Apparent power and Power triangle

```

1 clc
2 disp("Problem 11.10")
3 printf("\n")
4
5 printf("Given")
6 disp("Veff=10V v=10*sqrt(2)*cos(w*t)");

```

```

7 Veff=10;vmag=10*1.414
8
9 disp(" a")
10 Z1=1+%i
11 [R,Theta]=polar(Z1)
12 printf(" i1=%d*cos(w*t-%d)\n", (vmag/R),Theta)
13 I1eff=(vmag/R)/1.414
14 //p1(t)=100*sqrt(2)*cos(wt)*cos(wt-45)
15 //On solving
16 disp(" p1(t)=50+50*sqrt(2)*cos(2*w*t-45) W")
17 P1=Veff*I1eff*cos(Theta)
18 Q1=Veff*I1eff*sin(Theta)
19 S1=P1+%i*Q1
20 S1mag=sqrt(P1^2+Q1^2)
21 pf1=P1/S1mag
22 printf(" P1=%dW\nQ1=%dvar\npf1=%0.4f(lag)\n",P1,Q1,
    pf1)
23
24
25 disp(" b")
26 Z2=1-%i
27 [R,Theta]=polar(Z2)
28 printf(" i2=%d*cos(w*t%d)\n", (vmag/R),Theta)
29 I2eff=(vmag/R)/1.414
30 //p2(t)=100*sqrt(2)*cos(wt)*cos(wt+45)
31 //On solving
32 disp(" p2(t)=50+50*sqrt(2)*cos(2*w*t+45) W")
33 P2=Veff*I2eff*cos(Theta)
34 Q2=Veff*I2eff*sin(Theta)
35 S2=P2+%i*Q2
36 S2mag=sqrt(P2^2+Q2^2)
37 pf2=P2/S2mag
38 printf(" P2=%dW\nQ2=%dvar\npf2=%0.4f(lag)\n",P2,Q2,
    pf2)
39
40 disp(" c")
41 Zmag=(Z1*Z2)/(Z1+Z2)
42 printf(" i=%d*cos(w*t)\n", (vmag/Zmag))

```



```

43 Ieff=(vmag/Zmag)/1.414
44 //p(t)=100*sqrt(2)*sqrt(2)*cos(wt)*cos(wt)
45 //On solving
46 disp("p2(t)=200*cos(w*t)^2 W")
47 P=Veff*Ieff
48 Q=0
49 S=P+%i*Q
50 Smag=sqrt(P^2+Q^2)
51 pf=P/Smag
52 printf("P=%dW\nQ=%dvar\npf=%0.4f\n",P,Q,pf)

```

Scilab code Exa 11.11 Complex power Apparent power and Power triangle

```

1  clc
2  disp("Problem 11.11")
3  printf("\n")
4
5  printf("Given")
6  disp("v=42.5*cos(1000*t+30 deg)V Z=3+i4 ohm")
7  Vmag=42.5;
8  Z=3+%i*4;
9  R=sqrt(3^2+4^2)
10 Theta=atan(4/3)*(180/%pi)
11 Veffm=Vmag/sqrt(2)
12 Veffph=30
13 Ieffm=Veffm/R
14 Ieffph=30-Theta
15
16 Smag=Veffm*Ieffm
17 Sph=Veffph*Ieffph
18 x=Smag*cos((Sph*%pi)/180)
19 y=Smag*sin((Sph*%pi)/180)
20 z=complex(x,y)
21 pf=cos((Theta*%pi)/180);

```

```

22
23 printf("Real Power is %fW\n",x)
24 printf("Reactive Power is %fvar(inductive)\n",y)
25 printf("Complex Power is %fVA\n",Smag)
26 printf("Power factor is %3.1f(lag)\n",pf)

```

Scilab code Exa 11.12 Parallel connected Networks

```

1  clc
2  disp("Problem 11.12")
3  printf("\n")
4
5  printf("Given")
6  disp(" pf1=1 ; pf2=0.5 ; pf3=0.5")
7  disp(" P1=10kW;P2=20kW;P3=15kW")
8  disp(" Power supply is 6kV")
9  P1=10000;P2=20000;P3=15000;
10 Veff=6000;
11 pf1=1 //implifies that theta1=0
12 t1=0
13 Q1=P1*t1
14
15 pf2=0.5 //implifies that theta1=60
16 t2=1.73;
17 Q2=P2*t2
18
19 pf3=1 //implifies that theta1=53.13
20 t3=1.33;
21 Q3=P3*t3
22
23 PT=P1+P2+P3
24 QT=Q1+Q2+Q3
25 ST=sqrt(PT^2+QT^2)
26 pfT=PT/ST
27 Ieff=ST/Veff

```

```

28 Ieffph=acos(pfT)*(180/%pi)
29 printf("PT=%dW\nQT=%dvar\nST=%dVA\npf=%0.2f(lag)\nIeff=%3.1f(%3.2f deg)\n",PT,QT,ST,pfT,Ieff,Ieffph)

```

Scilab code Exa 11.13 Power factor improvement

```

1 clc
2 disp("Problem 11.13")
3 printf("\n")
4
5 printf("Given")
6 disp("Power factor is 0.95(lag)")
7 vmag=240;Zmag=3.5;Zph=25;
8 I1mag=vmag/Zmag;iph=0-Zph;
9 //Smag=Veff*Ieff
10 Smag=(vmag/sqrt(2))*(I1mag/sqrt(2))
11 Sph=0+abs(iph)
12 x=Smag*cos((Sph*%pi)/180)
13 y=Smag*sin((Sph*%pi)/180)
14 z=complex(x,y)
15 pf=0.95
16 theta=acos(0.95)*(180/%pi)
17 //From fig 11.11
18 //Solving for Qc
19 Qc=y-(tan((theta*%pi)/180)*x)
20 printf("\n Qc=%dvar(Capacitive )\n",Qc)

```

Scilab code Exa 11.14 Power factor improvement

```

1 clc
2 disp("Problem 11.14")
3 printf("\n")

```

```

4
5 printf(" Given")
6 disp(" Power =1000kW ; pf=0.5(lag)")
7 disp(" Voltage source is 5kV")
8 disp(" Improved power factor is 0.8")
9
10 // Before improvement
11 P=1000*10^3;
12 pf=0.5;V=5*10^3;
13 S=(P/pf)*10^-3
14 I=S/V
15
16 // After improvement
17 P=1000*10^3;
18 pf=0.8;V=5*10^3;
19 S=(P/pf)*10^-3
20 I1=S/V
21
22 disp(" Current is reduced by ")
23 red=((I-I1)/I)*100
24 printf(" Percentage reduction in current is %3.1
        fpercent\n",red)

```

Scilab code Exa 11.16 Maximum power transfer

```

1 clc
2 disp(" Problem 11.16")
3 printf("\n")
4
5 printf(" Given")
6 disp(" Vg=100V(rms)")
7 disp(" Zg=1+i Z1=2")
8 Vg=100;
9
10 disp(" a)")

```

```

11 Zg=1+%i;
12 Z1=2
13 Z=Z1+Zg
14 Zmag=sqrt(real(Z)^2+imag(Z)^2)
15 I=Vg/Zmag
16 PZ1=real(Z1)*(I^2)
17 Pg=real(Zg)*(I^2)
18 PT=PZ1+Pg
19 printf("PZ=%dW\n Pg=%dW\n PT=%dW\n",PZ1,Pg,PT);
20
21 disp("b)")
22 // If Z2=a+i*b
23 //Zg*=1-i
24 //Given that
25 //(Z1*Z2)/(Z1+Z2)=1-i
26 //As Z1=2 and solving for Z2
27     disp(-%i,"Z2=")
28
29 disp("c)")
30 //If Z2 is taken the value as calculated in b) then
    Z=1-i
31 Zg=1+%i;
32 Z1=2;
33 Z=1-%i;
34 Zt=Z+Zg
35 Zmag=sqrt(real(Zt)^2+imag(Zt)^2)
36 I=Vg/Zmag
37 PZ=real(Z)*(I^2)
38 Pg=real(Zg)*(I^2)
39 //To calculate PZ1 and PZ2 we need to first
    calculate IZ1 nad IZ2
40 VZ=I*(1-%i)
41 IZ1=VZ/Z1
42 IZ1mag=sqrt(real(IZ1)^2+imag(IZ1)^2)
43 PZ1=real(Z1)*(IZ1mag^2)
44 PZ2=PZ-PZ1
45 PT=PZ1+PZ2+Pg
46 printf("PZ=%dW\n Pg=%dW\n PT=%dW\n",PZ,Pg,PT);

```

Scilab code Exa 11.17 Superposition of average powers

```
1  clc
2  disp(" Problem  11.17")
3  printf("\n")
4
5  printf(" Given")
6  disp(" v1=5*cos(w1*t)   v2=10*cos(w2*t+60)")
7  //The circuit is modeled as
8  disp(" Resistance is 10ohm and inductance is 5mH")
9  R=10;L=5*10^-3;
10 //Let V be phasor voltage between the terminals
11 Vmag=10;
12 Vph=60;
13 x=Vmag*cos((Vph*%pi)/180);
14 y=Vmag*sin((Vph*%pi)/180);
15 z=complex(x,y)
16
17 disp(" a")
18 w1=2000;w2=4000;
19 //Let Z be the impedance of the coil
20 Z1=R+%i*L*w1
21 Z2=R+%i*L*w2
22 V1=5;
23 //By applying superposition i=i1-i2
24 I1=V1/Z1
25 [R1,Theta]=polar(I1)
26 printf(" i1=%0.2 f*cos(%dt%d deg)\n",R1,w1,(Theta*180)
        /%pi);
27 P1=(R*R1^2)/2
28
29 V2mag=10;V2ph=60;
30 I2=z/Z2
31 [R2,Theta1]=polar(I2)
```

```

32 printf(" i2=%0.2 f*cos (%dt%3.2 f deg)\n",R2,w2,(Theta1
    *180)/%pi);
33 P2=(R*R2^2)/2
34
35 // i=i1-i2
36 printf(" i=%0.2 f*cos (%dt%d deg)-%0.2 f*cos (%dt%3.2 f
    deg)\n",R1,w1,(Theta*180)/%pi,R2,w2,(Theta1*180)/
    %pi)
37
38 printf(" P1=%0.3fW\nP2=%3.1fW\nTotal power (P)=%3.3fW\n
    n",P1,P2,(P1+P2))
39
40 disp(" b")
41 //From problem 10.7
42 imagn=0.61
43 P=(R*imagn^2)/2
44 printf(" Power dissipated in the coil=%3.3fW\n",P)
45
46 disp(" c")
47 w1=2000;w2=1414;
48 //Let Z be the impedance of the coil
49 Z1=R+%i*L*w1
50 Z2=R+%i*L*w2
51 V1=5;
52 //By applying superposition i=i1-i2
53 I1=V1/Z1
54 [R1,Theta]=polar(I1)
55 printf(" i1=%0.2 f*cos (%dt%d deg)\n",R1,w1,(Theta*180)
    /%pi);
56 P1=(R*R1^2)/2
57
58 V2mag=10;V2ph=60;
59 x1=V2mag*cos((V2ph*%pi)/180);
60 y1=V2mag*sin((V2ph*%pi)/180);
61 z1=complex(x1,y1)
62 I3=z1/Z2
63 [R3,Theta3]=polar(I3)
64 printf(" i2=%0.2 f*cos (%dt+%3.2 f deg)\n",R3,w2,(Theta3

```

```

        *180)/%pi);
65 P3=(R*R3^2)/2
66
67 // i=i1-i2
68 printf(" i=%0.2 f*cos(%dt%d deg)-%0.2 f*cos(%dt+%3.2 f
        deg)\n",R1,w1,(Theta*180)/%pi,R3,w2,(Theta3*180)/
        %pi)
69
70 printf(" P1=%0.3fW\nP2=%3.1fW\nTotal power (P)=%3.3fW\n
        n",P1,P3,(P1+P3))

```

Chapter 12

Polyphase Circuits

Scilab code Exa 12.2 Balanced Delta connected load

```
1  clc
2  disp("Example 12.2")
3  printf("\n")
4
5  printf("Given")
6  disp("The system ABC is DELTA connected")
7  disp("Effective line voltage is 120V")
8  disp("The three impedances are 5(45 deg)")
9  Zmag=5; Zph=45;
10 //Let maximum line voltage is Vmax
11 Vmax=120*sqrt(2)
12 //From fig 12.7(a)
13 //VAB=Vmax(120 deg)
14 //VBC=Vmax(0 deg)
15 //VCA=Vmax(240 deg)
16
17 //From figure 12.8
18 IABmag=Vmax/Zmag
19 IABph=120-Zph
20 printf("IAB=%3.2 f(%d deg)\n", IABmag, IABph);
21
```

```

22 IBCmag=Vmax/Zmag
23 IBCph=0-Zph
24 printf("IBC=%3.2 f(%d deg)\n", IBCmag, IBCph);
25
26 ICAmag=Vmax/Zmag
27 ICaph=240-Zph
28 printf("ICA=%3.2 f(%d deg)\n", ICAmag, ICaph);
29
30 //Applying KCL equation
31 //IA=IAB+IAC
32 //IB=IBC+IBA
33 //IC=ICA+ICB
34
35 x=IABmag*cos((IABph*%pi)/180);
36 y=IABmag*sin((IABph*%pi)/180);
37 z=complex(x,y)
38
39 x1=ICAmag*cos((ICaph*%pi)/180);
40 y1=ICAmag*sin((ICaph*%pi)/180);
41 z1=complex(x1,y1)
42
43 x2=IBCmag*cos((IBCph*%pi)/180);
44 y2=IBCmag*sin((IBCph*%pi)/180);
45 z2=complex(x2,y2)
46
47 IA=z-z1;
48 [RA,ThetaA]=polar(IA)
49
50 IB=z2-z;
51 [RB,ThetaB]=polar(IB)
52
53 IC=z1-z2
54 [RC,ThetaC]=polar(IC)
55
56 disp("Therefore")
57
58 printf("\nIA=%3.2 f(%d deg)A\n", RA, ThetaA*(180/%pi));
59 printf("\nIB=%3.2 f(%d deg)A\n", RB, ThetaB*(180/%pi));

```

```
60 printf("\nIC=%3.2 f (%d deg)A\n", IC, ThetaC*(180/%pi));
```

Scilab code Exa 12.5 Unbalanced Delta connected load

```
1  clc
2  disp(" Example 12.5")
3  printf("\n")
4
5  printf(" Given")
6  disp("The system ABC is DELTA connected")
7  disp("Maximum line voltage is 339.4V")
8  disp("The three impedances are 10(0 deg),10(30 deg)
      ,15(-30 deg)")
9
10 ZABmag=10; ZABph=0;
11 ZBCmag=10; ZBCph=30;
12 ZCmag=15; ZCph=-30;
13 //Let maximum line voltage is Vmax
14 Vmax=339.4
15 //From fig 12.7(a)
16 //VAB=Vmax(120 deg)
17 //VBC=Vmax(0 deg)
18 //VCA=Vmax(240 deg)
19
20 //From figure 12.15
21 IABmag=Vmax/ZABmag
22 IABph=120-ZABph
23 printf("IAB=%3.2 f (%d deg)\n", IABmag, IABph);
24
25 IBCmag=Vmax/ZBCmag
26 IBCph=0-ZBCph
27 printf("IBC=%3.2 f (%d deg)\n", IBCmag, IBCph);
28
29 ICmag=Vmax/ZCmag
30 ICph=240-ZCph
```

```

31 printf("ICA=%3.2 f(%d deg)\n", ICAmag, ICaph);
32
33 //Applying KCL equation
34 //IA=IAB+IAC
35 //IB=IBC+IBA
36 //IC=ICA+ICB
37
38 x=IABmag*cos((IABph*%pi)/180);
39 y=IABmag*sin((IABph*%pi)/180);
40 z=complex(x,y)
41
42 x1=ICAmag*cos((ICaph*%pi)/180);
43 y1=ICAmag*sin((ICaph*%pi)/180);
44 z1=complex(x1,y1)
45
46 x2=IBcmag*cos((IBCph*%pi)/180);
47 y2=IBcmag*sin((IBCph*%pi)/180);
48 z2=complex(x2,y2)
49
50 IA=z-z1;
51 [RA,ThetaA]=polar(IA)
52
53 IB=z2-z;
54 [RB,ThetaB]=polar(IB)
55
56 IC=z1-z2
57 [RC,ThetaC]=polar(IC)
58
59 disp(" Therefore")
60
61 printf("\nIA=%3.2 f(%d deg)A\n",RA,ThetaA*(180/%pi));
62 printf("\nIB=%3.2 f(%d deg)A\n",RB,ThetaB*(180/%pi));
63 printf("\nIC=%3.2 f(%d deg)A\n",RC,ThetaC*(180/%pi));

```

Scilab code Exa 12.6 Unbalanced Wye connected load

```

1  clc
2  disp(" Example 12.6")
3  printf("\n")
4
5  printf(" Given")
6  disp("The system CBA is WYE connected")
7  disp("Maximum line voltage is 150V")
8  disp("The three impedances are 6(0 deg),6(30 deg)
      ,5(45 deg)")
9  ZAmag=6;ZAph=0;
10 ZBmag=6;ZBph=30;
11 ZCmag=5;ZCph=45;
12 //Let maximum line voltage is Vmax
13 Vmax=150
14 //Let the line to neutral voltage magnitude be Vn
15 Vn=Vmax/sqrt(3)
16 //From fig 12.7(b)
17 //VAN=Vn(-90 deg)
18 //VBN=Vn(30 deg)
19 //VCN=Vn(150 deg)
20
21 //From figure 12.16
22 IAmag=Vn/ZAmag
23 IAph=-90-ZAph
24 printf("\nIA=%3.2 f(%d deg)A\n",IAmag,IAph);
25
26 IBmag=Vn/ZBmag
27 IBph=30-ZBph
28 printf("\nIB=%3.2 f(%d deg)A\n",IBmag,IBph);
29
30 ICmag=Vn/ZCmag
31 ICph=150-ZCph
32 printf("\nIC=%3.2 f(%d deg)A\n",ICmag,ICph);
33
34 //Now to calculate IN
35 //IN=-(IA+IB+IC)
36 x=IAmag*cos((IAph*pi)/180);
37 y=IAmag*sin((IAph*pi)/180);

```

```
38 z=complex(x,y)
39
40 x1=ICmag*cos((ICph*%pi)/180);
41 y1=ICmag*sin((ICph*%pi)/180);
42 z1=complex(x1,y1)
43
44 x2=IBmag*cos((IBph*%pi)/180);
45 y2=IBmag*sin((IBph*%pi)/180);
46 z2=complex(x2,y2)
47
48 IN=-(z+z1+z2)
49
50 [R,Theta]=polar(IN)
51
52 printf("\nIN=%3.2 f (%d deg)A\n",R,Theta*(180/%pi));
```

Chapter 13

Frequency Response Filters and Resonance

Scilab code Exa 13.2 High pass and Low pass networks

```
1  clc
2  disp(" Problem  13.2")
3  printf("\n")
4
5  printf(" Given")
6  disp(" |Hv|=1/sqrt(2)                (1)")
7  disp(" Resistance R1=5kohm")
8  R1=5000;
9  disp(" Hv(w)=1/1+%i*(w/wx)          (2)")
10 //wx=1/(R1*C2)
11 //On solving we get
12 disp(" wx=2*10^-4/C2                (3)")
13
14 disp(" a)")
15 C2=10*10^-9;
16 //Taking modulus of (2)
17 disp(" |Hv(w)|=1/sqrt(1+(w/wx)^2)")
18 //Equating (1) and (2)
19 wx=2*10^-4/C2;
```

```

20 fx=(wx/(2*%pi))*10^-3
21 printf("Frequency(a) is %3.2 kHz\n",fx)
22
23 disp("b)")
24 C2b=1*10^-9;
25 //As frequency is inversely proportional to C2 (from
    (3))
26 fx1=(C2/C2b)*fx
27 printf("Frequency(b) is %3.2 kHz\n",fx1)

```

Scilab code Exa 13.7 Bandpass filters and Resonance

```

1  clc
2  disp("Problem 13.7")
3  printf("\n")
4
5  s=%s;
6  printf("Given")
7  H=(10*s)/(s^2+300*s+10^6)
8  disp(H,"H(s)=")
9  //From the above transfer function
10 //Comparing the denominator with s^2+a*s+b with w=
    sqrt(b)
11 a=300;b=10^6;
12 //Therefore center frequency is
13 w0=sqrt(10^6)
14 //The lower and upper frequencies are
15 w1=sqrt(a^2/4+b)-a/2
16 wh=sqrt(a^2/4+b)+a/2
17 B=wh-w1 //It can be inferred that B=a
18 Q=sqrt(b)/a
19 printf("\nCenter frequency= %drad/s\n",w0);
20 printf("Low power frequency = %3.2 frad/s\nHigh power
    frequency = %3.2 frad/s\n",w1,wh);
21 printf("Bandwidth= %drad/s\nQuality factor =%3.2 f\n")

```


,B,Q)

Scilab code Exa 13.8 Bandpass filters and Resonance

```
1  clc
2  disp(" Problem 13.8")
3  printf("\n")
4
5  s=%s;
6  printf(" Given")
7  H=(10*s)/(s^2+30*s+10^6)
8  disp(H,"H(s)=")
9  //From the above transfer function
10 //Comparing the denominator with s^2+a*s+b with w=
    sqrt(b)
11 a=30;b=10^6;
12 //Therefore center frequency is
13 w0=sqrt(10^6)
14 //The lower and upper frequencies are
15 w1=sqrt(a^2/4+b)-a/2
16 wh=sqrt(a^2/4+b)+a/2
17 B=wh-w1
18 Q=sqrt(b)/a
19 printf("\nCenter frequency= %drad/s\n",w0);
20 printf("Low power frequency = %3.2 frad/s\nHigh power
    frequency = %3.2 frad/s\n",w1,wh);
21 printf("Bandwidth= %drad/s\nQuality factor =%3.2 f\n"
    ,B,Q)
```

Chapter 14

Two Port Networks

Scilab code Exa 14.1 Z parameters

```
1  clc
2  disp("Example 14.1")
3  printf("\n")
4
5  s=%s;
6  //Applying KVL equation to the two loops we get
7  //V1=2*I1+s*(I1+I2)
8  //V2=3*I2+s*(I1+I2)
9
10 //On solving we get
11 disp("(s+2)*I1+s*I2=V1          (1)");
12 disp("s*I1+(s+3)*I2=V2        (2)");
13
14 //The equations which contain Z parameters are
15 //V1=Z11*I1+Z12*I2
16 //V2=Z21*I1+Z22*I2
17
18 //On comparing (1) and (2) with above equations
19 Z11=s+2;
20 Z12=s;
21 Z21=s;
```

```

22 Z22=s+3;
23
24 disp(Z11,"Z11=")
25 disp(Z12,"Z12=")
26 disp(Z21,"Z21=")
27 disp(Z22,"Z22=")

```

Scilab code Exa 14.2 Reciprocal and non reciprocal networks

```

1  clc
2  disp("Example 14.2")
3  printf("\n")
4
5  s=%s;
6  //Applying KVL equation to the two loops we get
7  //V1=2*I1+s*(I1+I2)-I2
8  //V2=3*I2+s*(I1+I2)
9
10 //On solving we get
11 disp("(s+2)*I1+(s-1)*I2=V1      (1)");
12 disp("s*I1+(s+3)*I2=V2        (2)");
13
14 //The equations which contain Z parameters are
15 //V1=Z11*I1+Z12*I2
16 //V2=Z21*I1+Z22*I2
17
18 //On comparing (1) and (2) with above equations
19 Z11=s+2;
20 Z12=s-1;
21 Z21=s;
22 Z22=s+3;
23
24 disp(Z11,"Z11=")
25 disp(Z12,"Z12=")
26 disp(Z21,"Z21=")

```

```
27 disp(Z22, "Z22=")
```

Scilab code Exa 14.4 Y parameters

```
1  clc
2  disp(" Example 14.4")
3  printf("\n")
4
5  s=%s;
6  Ya=3/(5*s+6);
7  Yb=2/(5*s+6);
8  Yc=s/(5*s+6);
9
10 //Writing KCL equations
11 disp(" I1=(Ya+Yc)*V1-Yc*V2           (1)")
12 disp(" I2=-Yc*V1+(Yb+Yc)*V2       (2)")
13
14 //The equations which contain Y parameters are
15 //I1=Y11*V1+Y12*V2
16 //I2=Y21*V1+Y22*V2
17
18 //On comparing (1) and (2) with above equations
19 disp(" Y11=Ya+Yc")
20 disp(" Y12=-Yc=Y21")
21 disp(" Y22=Yb+Yc")
22
23 //Substituting Ya , Yb and Yc
24 Y11=Ya+Yc
25 Y12=-Yc
26 Y21=-Yc
27 Y22=Yb+Yc
28
29 disp(Y11, "Y11=")
30 disp(Y12, "Y12=")
31 disp(Y21, "Y21=")
```

```
32 disp(Y22, "Y22=")
```

Scilab code Exa 14.6 Conversion between Z and Y parameters

```
1 clc
2 disp("Example 14.6")
3 printf("\n")
4
5 s=%s;
6 //From example 14.4
7
8 Y11=(3 + s)/(5*s+6)
9 Y12=- s/(6 + 5*s)
10 Y21=- s/(6 + 5*s)
11 Y22=(2+s)/(6+5*s)
12
13 DYY=Y11*Y22-Y12*Y21
14
15 Z11=Y22/DYY;
16 Z12=-Y12/DYY;
17 Z21=-Y21/DYY;
18 Z22=Y11/DYY;
19
20 disp(Z11, "Z11=")
21 disp(Z12, "Z12=")
22 disp(Z21, "Z21=")
23 disp(Z22, "Z22=")
```

Scilab code Exa 14.7 H parameters

```
1 clc
2 disp("Example 14.7")
3 printf("\n")
```

```

4
5 //From figure 14.9
6 disp("V1=50*I1          (1)");
7 disp("I2=300*I1        (2)");
8
9 //The equations which contain h parameters are
10 //V1=h11*I1+h12*V2
11 //I2=h21*I1+h22*V2
12
13 //On comparing (1) and (2) with above equations
14
15 printf("\nh11=%d\n",50);
16 printf("h12=%d\n",0);
17 printf("h21=%d\n",300);
18 printf("h22=%d\n",0);

```

Scilab code Exa 14.8 g parameters

```

1 clc
2 disp("Example 14.8")
3 printf("\n")
4
5 //From figure 14.10
6 //By inspection
7 //V1=10^9*I1
8 //V2=10(I2-10^-3*V1)
9
10
11 //On solving we get
12 disp("I1=10^-9*V1          (1)");
13 disp("V2=10*I2-10^-2*V1    (2)");
14
15
16 //The equations which contain g parameters are
17 //I1=g11*V1+g12*I2

```

```

18 //V2=g21*V1+g22*I2
19
20 //On comparing (1) and (2) with above equations
21
22 printf("\ng11=%2.1e\n",10^-9);
23 printf("g12=%d\n",0);
24 printf("g21=%2.1e\n",-10^-2);
25 printf("g22=%d\n",10);

```

Scilab code Exa 14.10 Choice of parameter type

```

1  clc
2  disp(" Example 14.10")
3  printf("\n")
4
5  s=%s;
6  //Applying KVL equation to the two loops we get
7  //V1=3*I1+3*(I1+I2)
8  //V2=7*I1+3*(I1+I2)+2*I2
9
10 //On solving we get
11 disp(" 6*I1+3*I2=V1          (1)");
12 disp("10*I1+5*I2=V2         (2)");
13
14 //The equations which contain Z parameters are
15 //V1=Z11*I1+Z12*I2
16 //V2=Z21*I1+Z22*I2
17
18 //On comparing (1) and (2) with above equations
19 Z11=6;
20 Z12=3;
21 Z21=10;
22 Z22=5;
23
24 disp(Z11," Z11=")

```

```
25 disp(Z12,"Z12=")
26 disp(Z21,"Z21=")
27 disp(Z22,"Z22=")
28
29 disp("As DZZ results in zero(0) therefore Y
      parameters are not defined ")
```

Chapter 15

Mutual Inductance and Transformers

Scilab code Exa 15.4 Energy in a pair of coupled coils

```
1  clc
2  disp(" Example 15.4")
3  printf("\n")
4
5  printf(" Given")
6  disp(" L1=0.1H L2=0.2H")
7  disp(" i1=4A i2=10A")
8  L1=0.1;L2=0.2
9  i1=4;i2=10;
10 //The energy stored in coupled coils is
11 disp("W=(L1*i1^2)/2+(L2*i2^2)/2+M*i1*i2")
12
13 disp(" a)")
14 M=0.1;
15 W=(L1*i1^2)/2+(L2*i2^2)/2+M*i1*i2;
16 printf(" Total Energy in the coils=%3.2 fJ\n",W);
17
18 disp(" b)")
19 M=sqrt(2)/10;
```

```

20 W=(L1*i1^2)/2+(L2*i2^2)/2+M*i1*i2;
21 printf("Total Energy in the coils=%3.2 fJ\n",W);
22
23 disp(" c")
24 M=-0.1;
25 W=(L1*i1^2)/2+(L2*i2^2)/2+M*i1*i2;
26 printf("Total Energy in the coils=%3.2 fJ\n",W);
27
28 disp(" a")
29 M=-sqrt(2)/10;
30 W=(L1*i1^2)/2+(L2*i2^2)/2+M*i1*i2;
31 printf("Total Energy in the coils=%3.2 fJ\n",W);

```

Scilab code Exa 15.7 Ampere Turn Dot rule

```

1  clc
2  disp(" Example 15.7")
3  printf("\n")
4
5  printf(" Given")
6  disp(" N1=20 N2=N3=10")
7  disp(" I2=10(-53.13 deg) I3=10(-45 deg)")
8  N1=20; N2=10; N3=10;
9  I2mag=10; I2ph=-53.13;
10 I3mag=10; I3ph=-45;
11 //From figure 15.14
12 disp(" N1*I1 -N2*I2 -N3*I3=0")
13 //Solving for I1
14 Xmag=N2*I2mag
15 Xph=I2ph
16 x=Xmag*cos((Xph*%pi)/180);
17 y=Xmag*sin((Xph*%pi)/180);
18 z=complex(x,y)
19
20 Ymag=N3*I3mag

```

```

21 Yph=I3ph
22 x1=Ymag*cos((Yph*%pi)/180);
23 y1=Ymag*sin((Yph*%pi)/180);
24 z1=complex(x1,y1)
25
26 I1=(z+z1)/N1
27 [R,Theta]=polar(I1);
28 printf(" I1=%3.2 f(%3.2 f deg) A\n",R,(Theta*180)/%pi);

```

Scilab code Exa 15.8 Reflected Impedance

```

1  clc
2  disp(" Example 15.8")
3  printf("\n")
4
5  printf(" Given")
6  disp(" L1=0.2H L2=0.1H")
7  disp(" M=0.1H R=10ohm")
8  disp(" v1=142.3*sin(100*t)")
9  L1=0.2;L2=0.1
10 M=0.1;R=10;
11 v1mag=142.3;
12 w=100;
13 //Let Input impedance be Z1 and can be calculated as
14 //From the equations in 15.10
15 disp(" Z1=%i*w*L1+((M*w)^2)/(Z2+%i*w*L2)")
16 Z1=%i*w*L1+((M*w)^2)/(R+%i*w*L2)
17 [R,Theta]=polar(Z1)
18 //If I1 is the input current
19 I1mag=v1mag/R
20 I1ph=-(Theta*180)/%pi
21 //In time domain form
22 printf(" i1=%3.1 f*sin(%d*t%3.1 f deg) (A)",I1mag,w,
        I1ph);

```

Scilab code Exa 15.9 Reflected Impedance

```
1  clc
2  disp(" Example 15.9")
3  printf("\n")
4
5  s=%s;
6  printf(" Given")
7  disp(" L1=0.2H L2=0.1H")
8  disp(" M=0.1H R=10ohm")
9  disp(" v1=u(t) a unit step function")
10 L1=0.2;L2=0.1
11 M=0.1;R=10;
12 v1=1;
13 w=100;
14 //Let Input impedance be Z1 and can be calculated as
15 //From the equations in 15.10
16 disp(" Z1(s)=L1*s - ((M*s)^2)/(R+L2*s)")
17 Z1=L1*s - ((M*s)^2)/(R+L2*s)
18 //Proper rearranging of co-efficients
19 Num=Z1('num')/0.01
20 Den=Z1('den')*100
21
22 disp(Num/Den," Z1(s)")
23 Y1=1/Z1
24 disp(Den/Num," Y1(s)")
25
26 //As the input is unit step function the value is 1V
    for t>0
27 //In exponential form the value is represented as
    exp(s*t) with s=0 as the pole of Y1(s)
28
29 //Therefore forced response
30 k=1/L1;
```

```
31 printf("Forced response i1 , f=(%d*t) (A)\n",k);
```

Chapter 17

The Laplace Transform Method

check Appendix [AP 2](#) for dependency:

```
ch17_2.sce
```

Scilab code Exa 17.2 Convergence of the integral

```
1 syms t s ;
2 x=laplace ( '3*%e^(2*t)' , t , s ) ;
3 disp ( x , " X(s)=" )
```

check Appendix [AP 1](#) for dependency:

```
ch17_4.sce
```

Scilab code Exa 17.4 Partial Fractions Expansions

```
1 clc
2 syms t
3 s=%s;
4 //Factorizing the denominator
5 I=(s-10)/((s^2)*(s-%i)*(s+%i));
```

```

6  disp(I," I(s)=")
7  //The principal part at s=0 is
8  //B1/s+B2/s^2
9  //Taking the limit s->0 to (s-10)/((s-%i)*(s+%i))
10
11 B2=-10
12
13 //Taking the limit s->0 to (s*(s-10))/(s^2)*(s^2+1)
    +(10/s)
14
15 B1=1
16
17 //The principal part at s=%i is
18 //A/(s-%i)
19 //Taking the limit s->%i to (s-10)/((s^2)*(s+%i))
20
21 A=(-0.5-%i*5)
22
23 //As the other co-efficient is conjugate of the
    above we can write the partial fraction expansion
    of I(s)
24 I=(1/s)-(10/s^2)-(0.5+%i*5)/(s-%i)-(0.5-%i*5)/(s+%i)
    ;
25 //Taking inverse of each term
26 I1=ilaplace('1/s',s,t)
27 I2=ilaplace('10/s^2',s,t)
28 I3=ilaplace('(0.5+%i*5)/(s-%i)',s,t)
29 I4=ilaplace('(0.5-%i*5)/(s+%i)',s,t)
30 I=I1-I2-I3-I4
31 disp(I," i(t)=")

```

Appendix

Scilab code AP 1 Partial Fractions Expansions

```
1  clc
2  syms t
3  s=%s;
4  //Factorizing the denominator
5  I=(s-10)/((s^2)*(s-%i)*(s+%i));
6  disp(I," I(s)=")
7  //The principal part at s=0 is
8  //B1/s+B2/s^2
9  //Taking the limit s->0 to (s-10)/((s-%i)*(s+%i))
10
11 B2=-10
12
13 //Taking the limit s->0 to (s*(s-10))/(s^2)*(s^2+1)
    +(10/s)
14
15 B1=1
16
17 //The principal part at s=%i is
18 //A/(s-%i)
19 //Taking the limit s->%i to (s-10)/((s^2)*(s+%i))
20
21 A=(-0.5-%i*5)
22
23 //As the other co-efficient is conjugate of the
    above we can write the partial fraction expansion
    of I(s)
```



```

24 I=(1/s) - (10/s^2) - (0.5+%i*5)/(s-%i) - (0.5-%i*5)/(s+%i)
    ;
25 //Taking inverse of each term
26 I1=ilaplace('1/s',s,t)
27 I2=ilaplace('10/s^2',s,t)
28 I3=ilaplace('(0.5+%i*5)/(s-%i)',s,t)
29 I4=ilaplace('(0.5-%i*5)/(s+%i)',s,t)
30 I=I1-I2-I3-I4
31 disp(I,"i(t)=")

```

Scilab code AP 2 Convergence of the integral

```

1 syms t s ;
2 x=laplace ('3*%e^(2*t)', t , s ) ;
3 disp (x , " X(s)=" )

```
