Scilab Textbook Companion for Electrical Network by R. Singh[1]

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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.

Contents

List of Scilab Codes

Chapter 1

basic circuit concept

Scilab code Exa 1.1 example1

```
//Basic Circuit Concepts
//page no-1.9
//example1.1
disp("Current through 15Ohm resistor is given by:");
disp("I1=30/15");
I1=30/15
printf("current through 15Ohm resistor = %.2f Ampere
   ", I1)
disp("Current through 5Ohm resistor is given by:")
disp("I2=5+2");
I2=5+2
printf("current through 5ohm resistor = %.2f Ampere"
   , I2)
disp("R=100-30-5*I2/I1");
R=(100-30-5*I2)/I1
printf("R = %.2f Ohm", R);
```

Scilab code Exa 1.2 example2

```
//Basic Circuit Concepts
//page no-1.10
//example1.2
disp("from the given fig:")
disp("I2-I3=13");
disp("-20*I1+8*I2=0");
disp("-12*I1-16*I3=0");
//solving these equations in the matrix form
A=[0 1 -1;-20 8 0;-12 0 -16]
B=[13 0 0]'
disp("A=")
disp(A)
disp("B=")
disp(B)
X=inv(A)*B
disp("X=")
disp(X)
disp("I1 = 4Ampere")
disp("I2 = 10Ampere")
disp("I3 = -3Ampere")
```

Scilab code Exa 1.3 `example3`

```
//Basic Circuit Concepts
//pg no-1.11
//example 1.3
disp("Iaf=x")
disp("Ife=x-30")
disp("Ied=x+40")
disp("Idc=x-80")
disp("Icb=x-20")
disp("Iba=x-80")
disp("Applying KVL to the closed path AFEDCBA:")//
   Applying KVL to the path AFEDCBA
disp("x=4.1/0.1")
```

```
x=4.1/0.1;
Iaf=x;
printf("\nIaf = %.2f Ampere", Iaf);
Ife=x-30
printf("\nIfe = %.2f Ampere", Ife);
Ied=x+40;
printf("\nIed = %.2f Ampere", Ied);
Idc=x-80;
printf("\nIdc = %.2f Ampere", Idc);
Icb=x-20;
printf("\nIcb = %.2f Ampere", Icb);
Iba=x-80;
printf("\nIba = %.2f Ampere", Iba);
```

Scilab code Exa 1.4 example4

```
//Basic Circuit Concepts
//pg no- 1.12
//example 1.4
disp("Applying KVL to the closed path OBAO");//
   Applying KVL to the closed path OBAO
disp("3*x-3*y=2");
disp("Applying KVL to the closed path ABCA");//
   Applying KVL to the closed path ABCA
disp("9*x+12*y=4");
a=[3 -3;9 12];
b=[2 4]'
disp("a=")
disp(a)
disp("b=")
disp(b)
X=inv(a)*b;
disp(X)
disp("x=0.5714286 Ampere");
disp("y=-0.095238 Ampere");
```

```
disp("Ioa=0.57A")
disp("Iob=1-0.57")
Iob=1-0.57;
printf("\nIob = %2f A", Iob);
disp("Iab = 0.095");
Iac=0.57-0.095;
printf("\nIac = %2f A", Iac);
disp("Iab=1-0.57 + 0.095")
Iab=1-0.57 + 0.095;
printf("\nIob = %2f A", Iab)
```

Scilab code Exa 1.5 `example5`

```
//Basic Circuit Concepts
//pg no-1.12
//example 1.5
I1=2/5;
printf("I1=2/5= %2f Ampere", I1)
I2=4/8;
printf("\nI2=4/8= %2f Ampere", I2)
printf("\nPotential difference between points x and
    y = Vxy = Vx-Vy")
printf("\nWriting KVL equations for the path x to y"
    )//Writing KVL equation from x to y
printf("\nVs+3*I1+4-3*I2-Vy=0")
printf("\nVs+3*(0.4) + 4- 3*(0.5) -Vy = 0")
printf("\nVs+3*I1+4-3*I2-Vy = 0")
printf("\nVx-Vy = -3.7")
printf("\nVxy = -3.7V")
```

Scilab code Exa 1.6 `example6`

```
//Basic Circuit Concepts
```

```
//pg no-1.13
//example 1.6
I1=20/15;
printf("I1=2/5= %2f Ampere", I1)
I2=15/10;
printf("\nI2=4/8= %2f Ampere", I2)
disp("Voltage between points A and B = VAB = VA-VB")
  ;
disp("Writing KVL equations for the path A to B:");
  //Writing KVL equations for the path A to B
disp("VA - 5*I1 - 5 - 15 + 6*I2 - VB = 0");
disp("VA - VB = 5*1.33 + 5 + 15 + 6*1.5");
VAB=(5*1.33)+5+15-(6*1.5);
printf("VAB = %.2f Volt", VAB)
```

Scilab code Exa 1.7 example7

```
//Basic Circuit Concepts
//page no-1.13
//example1.7
I1=5/2;
printf("I1=2/5= %2f Ampere", I1)
I2=2;
printf("\nI2=4/8= %2f Ampere", I2)
disp("Potential difference VAB = VA - VB");
disp("Writing KVL equations for path A to B")   //
  Writing KVL equations for path A to B
disp("VA - 2*I1 + 8 - 5*I2 - VB = 0");
disp("VA - VB = (2*2.5) - 8 5 + (5*2)");
VAB=(2*2.5)-8+(5*2)
printf("VAB = %.2f Volt", VAB);
```

Scilab code Exa 1.8 example8

```
//Basic Circuit Concepts
//page no-1.14
//example1.8
I1=10/8;
printf("I1=2/5= %2f Ampere", I1)
I2=5;
printf("\nI2=4/8= %2f Ampere", I2)
disp("Applying KVL to the path from A to B")  // Applying KVL to the path from A to B
disp("VA - 3*I1 - 8 + 3*I2 - VB = 0");
disp("VA - VB = 3*1.25 + 8 - 3*5")
VAB= (3*1.25)+8-(3*5);
printf("VAB = %.2f Volt", VAB);
```

Scilab code Exa 1.12 `example12`

```
//Basic Circuit Concepts
//page no-1.17
//example1.12
disp("Applying KVL to the circuit :");
disp("50 - 5*I - 1.2*I - 16 = 0")
I=(50-16)/6.2;
printf("I= %.2f Amp", I);
P=50*I;
printf("\nPower delivered 50 V source = 50 * 5.48= %.2f W", P);
```

Scilab code Exa 1.13 `example13`

```
//Basic Circuit Concepts
//page no-1.18
//example1.13
disp("By Current Division formula ;");
```

```
I4=4*(2/(2+4));
printf("I4 = 4 * (2/(2+4)) = %.2f Amp", I4);
```

Scilab code Exa 1.14 example14

```
//Basic Circuit Concepts
//page no-1.19
//example1.14
disp("Applying KVL to the mesh");
disp("15 - 50*I - 50*I - 5*I");
I=15/105;
printf("I=15/105 = %.2f Amp", I);
V=15-(50*0.143);
printf("\nVoltage at node 2 = 15 - 50*I = %.2f Volt"
    , V);
```

Scilab code Exa 1.15 example15

```
//Basic Circuit Concepts
//pg no.-1.20
//example 1.15
r1=3;
r2=2.33;
r3=6;
v1=18;
v2=5.985;
mprintf("\nApplying KCL at the node, \n(Va-18)/3+(Va
    -5.985)/2.33+Va/6 = 0");
Va=((v1*r2*r3)+(v2*r1*r3))/((r2*r3)+(r1*r3)+(r1*r2))
    ;
printf("\nSolving the equation,we get, \nVa = %.2f V
    ",Va);
```

Chapter 2

Network Theorem 1

Scilab code Exa 2.1 `example1`

```
//Network Theorem-1
//pg no.-2.4
//example2.1
printf("\nConverting the two delta networks formed
   by resistors 4.5 Ohm, 3Ohm, and 7.5Ohm into
   equivalent star networks");
a=4.5;
b=3;
c=7.5;
R1= (a*c)/(a+b+c);
R2= (c*b)/(c+b+a);
R3= (a*b)/(a+b+c);
mprintf("\nR1=R6 = %.2f Ohm \nR2=R5 = %.1f Ohm \nR3=
   R4 = %.1f Ohm",R1,R2,R3);
```

Scilab code Exa 2.2 `example2`

```
//Network Theorem-1
```

```
//pg no.-2.2
//example2.5
//converting delta network to star network
a=10;
b=10;
c=10;
R=(a*b)/(a+b+c);
printf("\nConverting the delta formed by three
    resistors of 10 Ohm into an equivalent star
    network");
mprintf("\nR1=R2=R3= %.3f Ohm",R);
```

Scilab code Exa 2.3 example3

```
//Network Theorem-1
//pg no.-2.7
//example2.3
a=4;
b=3;
c=6;
//star to delta conversion
R1=c+a+((a*c)/b);
R2=c+b+((c*b)/a);
R3=a+b+((a*b)/c);
x=1.35;
y=0.9;
RAB=(c*(x+y))/(c+x+y);
printf("\nR1 = %.f Ohm",R1);
printf("\nR2 = %.1f Ohm",R2);
printf("\nR3 = %.f Ohm",R3);
printf("\nThe network can be simplified as, \nRAB =
   %.2f Ohm",RAB);
```

Scilab code Exa 2.5 example5

```
//Network Theorem-1
//pg no.-2.9
//example2.5
//converting delta network to star network
a=25;
b=20;
c=35;
R1=(b*c)/(a+b+c);
R2=(a*b)/(a+b+c);
R3=(a*c)/(a+b+c);
printf("\nConverting the delta formed by resistors
   20 Ohm ,25 Ohm, 35 Ohm  into an equivalent star
   network");
printf("\nR1= %.2f Ohm",R1);
printf("\nR2= %.2f Ohm",R2);
printf("\nR3= %.2f Ohm",R3);
```

Scilab code Exa 2.8 example8

```
//Network Theorem-1
//pg no.-2.15
//example2.8
a=5;
b=4;
c=3;
//Star to delta conversion
R1=a+b+((a*b)/c);
R2=c+b+((c*b)/a);
R3=a+c+((a*c)/b);
a1=6;
b1=4;
c1=8;
//Satr to delta conversion
```

```
R4=a1+b1+((a1*b1)/c1);
R5=c1+b1+((c1*b1)/a1);
R6=a1+c1+((a1*c1)/b1);
x=6.17;
y=9.78;
RAB=(x*y)/(x+y);
printf("\nConverting star network formed by 3 Ohm,4 Ohm ,5 Ohm into equivalent delta network ");
mprintf("\nR1= %.2f Ohm \nR2= %.1f Ohm \nR3 = %.2f Ohm",R1,R2,R3);
printf("\nSimilarly, converting star network formed by 6 Ohm,4 Ohm ,8 Ohm into equivalent delta network");
mprintf("\nR4= %.f Ohm \nR5= %.2f Ohm \nR6 = %.f Ohm ",R4,R5,R6);
printf("\n Simplifying the parallel networks, we get \nRAB = %.2f Ohms",RAB);
```

Scilab code Exa 2.9 `example9`

```
//Network Theorem 1
//page no-2.18
//example2.9
disp("Applying KVL to mesh 1");
disp("10*I1-3*I2-6*I3=0");....//equation 1
disp("Applying KVL to mesh 2");
disp("-3*I1+10*I2=-5");....//equation 2
disp("Applying KVL to mesh 3");
disp("-6*I1+10*I3=25");....//equation 3
disp("Solving the three equations");
A=[10 -3 -6;-3 10 0;-6 0 10]//solving the equations in matrix form
B=[10 -5 25]'
X=inv(A)*B;
disp(X);
```

```
disp("I1=4.27 A");
disp("I2=0.78 A");
disp("I3=5.06 A");
disp("I5ohm=4.27 A");
```

Scilab code Exa 2.10 `example10`

```
//Network Theorem 1
//page no-2.19
//example 2.10
disp("Applying KVL to mesh 1");
disp("7*I1-I2=10");....//equation 1
disp("Applying KVL to mesh 2");
disp("-I1+6*I2-3*I3=0");....//equation 2
disp("Applying KVL to mesh 3");
disp("-3*I2+13*I3=-20");....//equation 3
disp("Solving the three equations");
A=[7 -1 0;-1 6 -3;0 -3 13];//solving the equations
    in matrix form
B=[10 0 -20]'
X=inv(A)*B;
disp(X);
disp("I1=1.34 A");
disp("I1=-0.62 A");
disp("I3=-1.68 A");
disp("I2ohm=1.34 A");
```

Scilab code Exa 2.11 `example11`

```
//Network Theorem 1
//page no-2.20
//example 2.11
disp("Applying KVL to mesh 1");
```

```
disp("3*I1-I2-2*I3=8");....//equation 1
disp("Applying KVL to mesh 2");
disp("-I1+8*I2-3*I3=10");....//equation 2
disp("Applying KVL to mesh 3");
disp("-2*I1-3*I2+10*I3=12");....//equation 3
disp("Solving the three equations");
A=[3 -1 -2;-1 8 -3;-2 -3 10];//solving the equations
    in matrix form
B=[8 10 12]'
X=inv(A)*B;
disp(X);
disp("I1=6.01 A");
disp("I1=3.27 A");
disp("I3=3.38 A");
disp("I5ohm=3.38 A");
```

Scilab code Exa 2.12 `example12`

```
//Network Theorem 1
//page no-2.21
//example 2.12
disp("Applying KVL to mesh 1");
disp("8*I1-I2-4*I3=4");....//equation 1
disp("Applying KVL to mesh 2");
disp("-I1+8*I2-5*I3=0");....//equation 2
disp("Applying KVL to mesh 3");
disp("-4*I1-5*I2+15*I3=0");....//equation 3
disp("Solving the three equations");
A=[8 -1 -4;-1 8 -5;-4 -5 15];//solving the equations
    in matrix form
B=[4 0 0]'
X=inv(A)*B;
disp(X);
disp("I1=0.66");
disp("I1=0.24 A");
```

```
disp("I3=0.26 A");
disp("current supplied by the battery = 0.66 A");
```

Scilab code Exa 2.13 `example13`

```
//Network Theorem 1
//page no-2.22
//example 2.13
disp("Applying KVL to mesh 1");
disp("V+13*I1-2*I2-5*I3=20");...//mesh equation 1
disp("Applying KVL to mesh 2");
disp("2*I1-6*I2+I3=0");//mesh equation 2
disp("Applying KVL to mesh 3");
disp("V+5*I1+I2-10*I3=0");//mesh equation 3
disp("putting I1=0 in equation 1, 2 and 3 we get");
disp("V-2*I2-5*I3=20");....//equation 1
disp("-6*I2+I3=0");....//equation 2
disp("V+I2-10*I3=0");....//equation 3
disp("Solving the three equations");
A=[1 -2 -5;0 -6 1;1 1 -10];//solving the equations
    in matrix form
B=[20 0 0]'
X=inv(A)*B;
disp(X);
disp("V=43.7 V")
```

Scilab code Exa 2.14 `example14`

```
//Network Theorem 1
//page no-2.13
//example2.14
disp("Mesh 1 contains a current source of 6A.Hence,
    we cannot write KVL equation for Mesh 1.direction
```

```
    of current source and mesh current I1 are same,"
   );
disp("I1=6A");....//equation 1
disp("Applying KVL to mesh 2");
disp("18*I2-6*I3=108");....//equation 2
disp("Applying KVL to mesh 3");
disp("6*I2-11*I3=9");....//equation 3
disp("Solving the three equations");
A=[18 -6;6 -11];...//solving the equations in matrix
    form
B=[108 9]'
X=inv(A)*B;
disp(X);
disp("I3 = 3A");
disp("I2ohm = 3A");
```

Scilab code Exa 2.15 example15

```
//Network Theorem 1
//page no-2.23
//example2.15
disp("from the fig,");
disp("IA=I1");....//equation 1
disp("IB=I2");....//equation 2
disp("Applying Kvl to mesh 1:");
disp("5-5*I1-10*IB-10*(I1-I2)-5*IA=0");
disp("5-5*I1-10*I2-10*I1+10*I2-5*I1=0");
disp("-20*I1=-5");
I1=5/20;
printf("I1= %.2f A", I1);....//equation 3
disp("Applying Kvl to mesh 2:");
disp("15*I1-15*I2=10");....//equation 4
disp("Put I1=0.25 A in equation 4");
disp("-6.25=15*I2");
I2=-6.25/15;
```

```
printf("I2= %.2f A", I2);
```

Scilab code Exa 2.17 example17

```
//Network Theorem 1
//page no-2.25
//example2.17
disp("from the fig,");
disp("V1=-5*I1");....//equation 1
disp("V2=2*I2");....//equation 2
disp("Applying Kvl to mesh 1:");
disp("20*I1+3*I2=-5");....//equation 3
disp("Applying Kvl to mesh 2:");
disp("11*I1-3*I2=10");...//equation 4
disp("Solving equations 3 and 4");...//solving
    equations in matrix form
A=[20 3;11 -3];
B=[-5 10]'
X=inv(A)*B;
disp(X);
disp("I1=0.161 A");
disp("I2=-2.742 A");
```

Scilab code Exa 2.18 example18

```
//Network Theorem-1
//pg no.-2.25
//example2.18
disp("from the fig,");
disp("Iy=I1");....//equation 1
disp("Ix=I1-I2");....//equation 2
disp("Applying Kvl to mesh 1:");
disp("-10*I1+3*I2=5");....//equation 3
```

```
disp("Applying Kvl to mesh 2:");
disp("-I1-3*I2=10");...//equation 4
disp("Solving equations 3 and 4");...//solving equations in matrix form
A=[-10 3;-1 -3];
B=[5 10]'
X=inv(A)*B;
disp(X);
disp("I1=-1.364 A");
disp("I2=-2878 A");
x=-1.364;
y=-2.878;
Ix=x-y;
mprintf("\nIy = %.3f A \nIx = %.3f A",x,Ix);
```

Scilab code Exa 2.19 `example19`

```
//Network Theorem 1
//page no-2.26
//example2.19
disp("Applying KVL to mesh 1:");
disp("11*I1-10*I2=2");....//equation 1
disp("Writing current equation to supermesh:")
disp("I3-I2=4");....//equation 2
disp("Applying KVL to outer path of supermesh:");
disp("2*I1-3*I2-3*I3=0");....//equation 3
disp("solving these equations we get :");...//solving equations in matrix form
A=[11 -10 0;0 -1 1;2 -3 -3];
B=[2 4 0]'
X=inv(A)*B;
disp(X);
I1=-2.35
I2=-2.78
I3=1.22
```

```
I4=I1-I2;
printf("\ncurrent through the 10 ohm resistor = I1−
    I2 = %.2f A", I4);
```

Scilab code Exa 2.20 example20

```
//Network Theorem 1
//page no−2.26
//example2.20
disp("writing equation for supermesh,");
disp("I1−I3=7");....//equation 1
disp("Applying Kvl to the outer path of the
    supermesh:");
disp("−I1+4∗I2−4∗I3 = −7");....//equation 2
disp("Applying Kvl to mesh 2:");
disp("I1−6∗I2+3∗I3 = 0");...//equation 3
disp("Solving equations 1 ,2 and 3");...//solving
    equations in matrix form
A=[1 0 -1;-1 4 -4;1 -6 3];
B=[7 -7 0]'
X=inv(A)*B;
disp(X);
disp("I1=9 A");
disp("I2=−2.5 A");
disp("I3=−2 A");
x=2.5;
y=2;
z=x-y;
mprintf("\nCurrent through the 3−Ohm resistor = I2−
    I3 =%.1f A",z);
```

Scilab code Exa 2.21 example21

```
//Network Theorem 1
//page no-2.27
//example2.21
disp("Applying KVL to mesh 1:");
disp("15*I1-10*I2-5*I3=50");....//equation 1
disp("Writing current equation to supermesh:")
disp("I2-I3=2 A");....//equation 2
disp("Applying KVL to outer path of supermesh:");
disp("-15*I1+12*I2+6*I3=0");....//equation 3
disp("solving these equations we get :");...//
    solving equations in matrix form
A=[15 -10 -5;0 1 -1;-15 12 6];
B=[50 2 0]'
X=inv(A)*B;
disp(X);
I1=20
I2=17.33
I3=15.33
I4=I1-I3;
printf("\ncurrent through the 5 ohm resistor = I1-I3
    = %.2f A", I4);
```

Scilab code Exa 2.22 `example22`

```
//Network Theorem 1
//page no-2.28
//example2.22
disp("from the fig,");
disp("I4=40");....//equation 1
disp("\nmeshes 2 and 3 form a supermesh. current
    equation for supermesh,")
disp("-I1+2*I2-I3 = 0");....//equation 2
disp("Applying Kvl to supermesh:");
disp(" -1/5(I2-I1)-1/20*I2-1/15*I3-1/2(I3-I4)=0")
    ;....//equation 3
```

```
disp("applying KVL to mesh 1");
disp("-1/10*I1 -1/5(I1-I2)-1/6(I1-I4)=6");...//
    equation 4
disp("Solving equations 1 ,2 ,3 and 4");...//solving
     equations in matrix form
A=[0 0 0 1;-1 2 -1 0;0.2 -0.25 -17/30 0.5;-7/15 0.2
    0 1/6];
B=[40 0 0 6]'
X=inv(A)*B;
disp(X);
disp("I1=10 A");
disp("I2=-20 A");
disp("I3=30 A");
disp("I4=40 A");
```

Scilab code Exa 2.24 `example24`

```
//Network Theorem 1
//page no-2.29
//example2.24
disp("Applying KCL to node 1:");
disp("2*V1-V2 = 2");....//equation 1
disp("Applying KCL to node 2:");
disp("3*V2-V1 = 4");...//equation 2
disp("Solving equations 1 and 2");...//solving
    equations in matrix form
A=[2 -1;-1 3];
B=[2 4]'
X=inv(A)*B;
disp(X);
disp("V1= 2 V");
disp("V2=-2 V");
```

Scilab code Exa 2.25 `example25`

```
//Network Theorem 1
//page no-2.30
//example2.25
disp("Applying KCL to node 1:");
disp("8*VA-2*VB = 50");....//equation 1
disp("Applying KCL to node 2:");
disp("-3*VA+9*VB = 85");...//equation 2
disp("Solving equations 1 and 2");...//solving
    equations in matrix form
A=[8 -2;-3 9];
B=[50 85]'
X=inv(A)*B;
disp(X);
disp("VA= 9.39 V");
disp("VB= 12.58 V");
```

Scilab code Exa 2.26 `example26`

```
//Network Theorem 1
//page no-2.30
//example2.26
disp("Applying KCL to node 1:");
disp("5*V1-2*V2 = -24");....//equation 1
disp("Applying KCL to node 2:");
disp("10*V1-31*V2+6*V3 = 300");...//equation 2
disp("Applying KCL to node 3:");
disp("-4*V2 +9*V3 = 160");...//equation 3
disp("Solving equations 1,2 and 3");...//solving
    equations in matrix form
A=[5 -2 0;10 -31 6;0 -4 9];
B=[-24 300 160]'
X=inv(A)*B;
disp(X);
```

```
disp("V1= -8.77 V");
disp("V2= -9.92 V");
disp("V3= 13.37 V");
x=13.37;
y=-9.92;
z=(x-y)/5;
printf("\ncurrent through the 5 ohm resistor = V3-V2/5 = %.2f A",z);
```

Scilab code Exa 2.27 `example27`

```
//Network Theorem 1
//page no-2.31
//example2.27
disp("Applying KCL to node 1:");
disp("50*V1-20*V2 = 2400");....//equation 1
disp("Applying KCL to node 2:");
disp("-10*V1+19*V2 = 240");...//equation 2
disp("Solving equations 1 and 2");...//solving equations in matrix form
A=[50 -20;-10 19];
B=[2400 240]'
X=inv(A)*B;
disp(X);
disp("V1= 67.2 V");
disp("V2=-48 V");
```

Scilab code Exa 2.28 `example28`

```
//Network Theorem 1
//page no-2.32
//example2.28
disp("Applying KCL to node 1:");
```

```
disp("4*VA-2*VB = 5");....//equation 1
disp("Applying KCL to node 2:");
disp("-2*VA+3*VB = 4");...//equation 2
disp("Solving equations 1 and 2");...//solving
    equations in matrix form
A=[4 -2;-2 3];
B=[5 4]'
X=inv(A)*B;
disp(X);
disp("VA= 2.88 V");
disp("VB= 3.25 V");
```

Scilab code Exa 2.29 example29

```
//Network Theorem 1
//page no-2.33
//example2.29
disp("Applying KCL to node 1:");
disp("4*V1-2*V2-V3 = -24");....//equation 1
disp("Applying KCL to node 2:");
disp("-50*V1+71*V2-20*V3 = 0");...//equation 2
disp("Applying KCL to node 3:");
disp("-5V1-4*V2 +10*V3 = 180");...//equation 3
disp("Solving equations 1,2 and 3");...//solving
    equations in matrix form
A=[4 -2 -1;-50 71 -20;-5 -4 10];
B=[-24 0 180]'
X=inv(A)*B;
disp(X);
disp("V1= 6.35 V");
disp("V2= 11.76 V");
disp("V3= 25.88 V");
x=25.88;
y=11.76;
z=(x-y);
```

```
printf("\ncurrent through the 5 ohm resistor = V3-V2
    /5 = %.2f A",z);
```

Scilab code Exa 2.30 example30

```
//Network Theorem 1
//page no-2.34
//example2.30
disp("Applying KCL to node 1:");
disp("8*V1-V2 = 50");....//equation 1
disp("Applying KCL to node 2:");
disp("-2*V1+11*V2 = -500");...//equation 2
disp("Solving equations 1 and 2");...//solving
    equations in matrix form
A=[8 -1;-2 17];
B=[50 -500]'
X=inv(A)*B;
disp(X);
disp("V1= 2.61 V");
disp("V2=-29.1 V");
x=2.61;
y=-29.1;
I1=-x/2;
I2=(x-y)/10;//current through 10 Ohm resistor
I3=(y+50)/2;//50 volts is the supply to the circuit
mprintf("\nI1= %.2f A \nI2= %.2f A \nI3= %.2f A",I1,
    I2,I3);
```

Scilab code Exa 2.31 example31

```
//Network Theorem 1
//page no-2.34
//example2.30
```

```
disp("Applying KCL to node a:");
disp("0.5*Va-0.2*Vb = 34.2");....//equation 1
disp("Applying KCL to node b:");
disp("0.1*Va-0.4*Vb = -32.4");...//equation 2
disp("Solving equations 1 and 2");...//solving
    equations in matrix form
A=[0.5 -0.2;0.1 -0.4];
B=[34.2 -32.4]'
X=inv(A)*B;
disp(X);
disp("Va= 112 V");
disp("Vb= 109 V");
x=112;
y=109;
I1=(120-x)/0.2;
I2=(x-y)/0.3;
I3=(110-y)/0.1;
mprintf("\nI1= %.f A \nI2= %.f A \nI3= %.f A",I1,I2,
    I3);
```

Scilab code Exa 2.32 `example32`

```
//Network Theorem 1
//page no-2.35
//example2.35
disp("Applying KCL to node 1:");
disp("V1 = 50");....//equation 1
disp("Applying KCL to node 2:");
disp("-2*V1+17*V2 = 50");...//equation 2
disp("Solving equations 1 and 2");...//solving
    equations in matrix form
A=[1 0;-2 17];
B=[50 50]'
X=inv(A)*B;
disp(X);
```

```
disp("V1= 50 V");
disp("V2= 8.82 V");
x=8.82;
y=(x/10);
printf("\ncurrent in the 10-Ohm resistor =V2/10 =%.2
    f A",y);
```

Scilab code Exa 2.33 example33

```
//Network Theorem 1
//page no-2.36
//example2.33
disp("Applying KCL to node a:");
disp("6*Va-5*Vb = -20");....//equation 1
disp("Applying KCL to node b:");
disp("-10*Va+17*Vb-5*Vc = 0");...//equation 2
disp("At node c");
disp("Vc = 20");
disp("Solving equations 1,2 and 3");...//solving
    equations in matrix form
A=[6 -5 0;-10 17 -5;0 0 1];
B=[-20 0 20]'
X=inv(A)*B;
disp(X);
disp("Va= 3.08 V");
disp("Vb= 7.69 V");
x=3.08;
y=7.69;
z=20;
Va = x-y;
Vb = y-z;
mprintf("\nV1 = Va-Vb =%.2f V \nV2 = Vb-Vc =%.2f V",
    Va,Vb);
```

Scilab code Exa 2.34 `example34`

```
//Network Theorem 1
//page no-2.37
//example2.334
disp("At node A:");
disp("VA = 60");....//equation 1
disp("Applying KCL to node B:");
disp("-VA+3*VB-VC = 12");...//equation 2
disp("Applying KCL to node C:");
disp("-2*VA-5*VB+10*VC");...//equation 3
disp("Solving equations 1,2 and 3");...//solving
   equations in matrix
A=[1 0 0;-1 3 -1;-2 -5 10];
B=[60 12 24]'
X=inv(A)*B;
disp(X);
disp("VC= 31.68 V");
disp("Voltage across the 100 Ohm resistor = 31.68 V"
   );
```

Scilab code Exa 2.35 `example35`

```
//Network Theorem 1
//page no-2.38
//example2.35
disp("Applying KCL to node 1:");
disp("2.5*V1-0.5*V2 = 5");....//equation 1
disp("Applying KCL to node 2:");
disp("V1-V2 = 0");...//equation 2
disp("Solving equations 1 and 2");...//solving
   equations in matrix form
```

```
A=[2.5 -0.5;1 -1];
B=[5 0]'
X=inv(A)*B;
disp(X);
disp("V1= 2.5 V");
disp("V2=-2.5 V");
```

Scilab code Exa 2.37 example37

```
//Network Theorem 1
//page no-2.39
//example2.37
disp("Applying KCL to node 1:");
disp("2*V1+17*V2 = 0");....//equation 1
disp("Applying KCL to node 2:");
disp("V1+6V2 = 0");...//equation 2
disp("Solving equations 1 and 2");...//solving
    equations in matrix form
A=[2 17;1 6];
B=[0 0]'
X=inv(A)*B;
disp(X);
disp("V1= 0 V");
disp("V2= 0 V");
```

Scilab code Exa 2.38 example38

```
//Network Theorem 1
//page no-2.40
//example2.38
disp("Applying KCL to node a:");
disp("2*Va-0.5*Vb-0.5*Vc = 5");....//equation 1
disp("Applying KCL to node b:");
```

```
disp("−3/2∗Va+5/6∗Vb+2/3∗Vc = −1");...//equation 2
disp("Applying KCL to node c:");
disp("1/2∗Va+1/3∗Vb−31/30∗Vc = −1");...//equation 3
disp("Solving equations 1,2 and 3");...//solving
    equations in matrix form
A=[2 -0.5 -0.5;-3/2 5/6 2/3;0.5 1/3 -31/30 ];
B=[5 -1 0]'
X=inv(A)*B;
disp(X);
disp("Va= 4.303 V");
disp("Vb= 3.87 V");
disp("Vc= 3.33 V");
```

Scilab code Exa 2.39 example39

```
//Network Theorem 1
//page no−2.41
//example2.39
disp("from the figure");
disp("V4= 40 V");//equation 1
disp("nodes 2 and 3 form suoernode:");
disp("V1−2∗V2+V3 = 0");....//equation 2
disp("Applying KCL to node 1:");
disp("7/15∗V1−1/5∗V2 = 2/3");...//equation 3
disp("Applying KCL to supernode :");
disp("−23/30∗V1 +83/60∗V3 = 20");...//equation 4
disp("Solving equations 1,2,3 and 4");...//solving
    equations in matrix form
A=[0 0 0 1;1 -2 1 0;7/15 -1/5 0 0;-23/30 83/60 0 0];
B=[40 0 2/3 20]'
X=inv(A)*B;
disp(X);
disp("V1= 10 V");
disp("V2= 20 V");
disp("V3= 30 V");
```

Scilab code Exa 2.40 `example40`

```
//Network Theorem 1
//page no-2.42
//example2.40
disp("selecting central node as reference node");
disp("V1= -12 V");//equation 1
disp("Applying KCL at node 1:");
disp("-2*V1+2.5*V2-0.5V3 = 14");....//equation 2
disp("nodes 3 and 4 form a supernode");
disp("0.2*V1+V3-1.2*V4 = 0");...//equation 3
disp("Applying KCL to supernode :");
disp("0.1*V1-V2+0.5*V3+1.4*V4 = 0");...//equation 4
disp("Solving equations 1,2,3 and 4");...//solving
    equations in matrix form
A=[1 0 0 0;-2 2.5 -0.5 0;0.2 0 1 -1.2;0.1 -1 0.5
    1.4];
B=[-12 14 0 0]'
X=inv(A)*B;
disp(X);
disp("V1= -12 V");
disp("V2= -4 V");
disp("V3= 0");
disp("V4= -2 V");
```

Chapter 3

Network Theorem 2

Scilab code Exa 3.1 example1

```
//Network Theorem 2
//pg no 3.2
//example 3.1
disp("When 10-V source is acting alone:");
disp("By current-division formula :");
I1=10*(0.87/(10+0.87));
printf("I1=10*(0.87/(10+0.87))= %.2f A (down)", I1);
disp("When 4 A source is acting alone:");
disp("By current-division formula :");
I2=2.86*(0.875/(10+0.875));
printf("I2=2.86*(0.875/(10+0.875))= %.2f A (down)",
   I2);
disp("By superposition theorem:");
I=I1+I2;
printf("\nI=I1+I2=0.8+0.23= %.2f A (down)", I);
```

Scilab code Exa 3.2 example2

```
//Network Theorem 2
//pg no 3.4
//example 3.2
disp("When 4-A source is acting alone:");
disp("By current-division formula :");
I1=3.33*(3.53/(6+3.53));
printf("I1=3.33*(3.53/(6+3.53)) = %.2f A (down)", I1);
disp("When 10-V source is acting alone:");
disp("By current-division formula :");
I2=0.833*(3.53/(6+3.53));
printf("I2=0.833*(3.53/(6+3.53))= %.2f A (up)", I2);
disp("When 3-A source is acting alone:");
disp("By current-division formula :");
I3=3*(3.53/(6+3.53));
printf("I3=3*(3.53/(6+3.53))= %.2f A (down)", I3);
disp("By superposition theorem:");
I=I1-I2+I3;
printf("\nI=I1-I2+I3=1.23-0.31+1.11= %.2f A (down)", I);
```

Scilab code Exa 3.3 `example3`

```
//Network Theorem 2
//pg no 3.5
//example 3.3
disp("When 4-A source is acting alone:");
disp("By current-division formula :");
I1=4/(2+1);
printf("I1=4/(2+1) = %.2f A (down)", I1);
disp("When 3-A source is acting alone:");
disp("By current-division formula :");
I2=3*(2/(2+1));
printf("I2=3*(2/(2+1)) = %.2f A (down)", I2);
disp("When 1-A source is acting alone:");
```

```
disp("By current-division formula :");
I3=1*(2/(2+1));
printf("I3=1*(2/(2+1)) = %.2f A (down)", I3);
disp("By superposition theorem:");
I=I1+I2+I3;
printf("\nI=I1+I2+I3=1.33+2+0.66= %.2f A (down)", I)
    ;
```

Scilab code Exa 3.4 example4

```
//Network Theorem 2
//pg no 3.
//example 3.4
disp("When 6-V source is acting alone:");
VAB1=6;
printf("VAB1 = %.2f V", VAB1);
disp("When 10-V source is acting alone:");
disp("Since the resistor of 5 ohm is shorted,the
    voltage across it is zero")
VAB2=10;
printf("VAB2= %.2f V", VAB2);
disp("When 5-A source is acting alone:");
disp("Due to short circuit in both the parts");
VAB3=0;
printf("VAB3 = %.2f V", VAB3);
disp("By superposition theorem:");
VAB=VAB1+VAB2+VAB3;
printf("\nVAB=VAB=VAB1+VAB2+VAB3= %.2f V", VAB);
```

Scilab code Exa 3.5 example5

```
//Network Theorem 2
//pg no 3.7
```

```
//example 3.5
disp("When 5-A source is acting alone:");
disp("By current-division formula :");
I1=5*(2/(2+4));
printf("I1=5*(2/(2+4)) = %.2f A (down)", I1);
disp("When 2-A source is acting alone:");
disp("By current-division formula :");
I2=2*(2/(2+4));
printf("I2=2*(2/(2+4)) = %.2f A (down)", I2);
disp("When 6-V source is acting alone:");
disp("Applying KVL to the mesh");
disp("-2*I3-6-4*I3=0");
disp("I3=-1");
I3=-1;
printf("I3=-1 A= %.2f A (down)", I3);
disp("By superposition theorem:");
I=I1+I2+I3;
printf("\nI=I1+I2+I3=1.67+0.67-1= %.2f A (down)", I);
```

Scilab code Exa 3.6 `example6`

```
//Network Theorem 2
//pg no 3.8
//example 3.6
a=15/38;
b=10/38;
x=a+b;
mprintf("\nApplying KCL at node 1, \nI1 = %.3f",a); //When the 15 V source is acting alone
mprintf("\nApplying KCL at node 1, \nI1 = %.3f",b); //When the 10 V source is acting alone
mprintf("\nBy superposition theorem, \nI = I1+I2 = %.3f A",x);
```

Scilab code Exa 3.7 example7

```
//Network Theorem 2
//pg no 3.8
//example 3.7
a=3;
b=2;
x=a+b;
mprintf("\napplying KCL at node 1, \nIx1 = %.f A",a)
   ;//when the 30 V source is acting alone
mprintf("\napplying KCL at the mesh, \nIx2 = %.f A",
   b);//when the 20 V source is acting alone
mprintf("\nBy superposition theorem, Ix = Ix1+Ix2 =
   %.f A",x);
```

Scilab code Exa 3.8 example8

```
//Network Theorem 2
//pg no 3.10
//example 3.8
//when 5 V source is acting alone
disp("Vx+10I1=5");//equation 1
disp("Applying KVL to mesh,");
disp("4Vx+12I1=5");//equation 2
A=[1 10;4 12];//solving equation in matrix form
B=[5 5]'
X=inv(A)*B;
disp(X);
disp("I1 = 0.535 A");
//when the 2 A source is acting alone
disp("Vx+10I2=0");//equation 1
disp("Applying KCL at Node x,");
```

```
disp("Vx=-10/7");//equation 2
A=[1 10;1 0];//solving equation in matrix form
B=[0 -10/7]'
X=inv(A)*B;
disp(X);
disp("I2 = 0.1428 A");
a=0.535;
b=0.1428;
x=a+b;
printf("\nBy superposition theorem, \nI = I1+I2 = %
    .3f A ",x);
```

Scilab code Exa 3.9 example9

```
//Network Theorem 2
//pg no 3.10
//example 3.9
//when 100 V source is acting alone
disp("Vx-5I1=0");//equation 1
disp("Applying KVL to mesh,");
disp("10Vx-15I1=-100");//equation 2
A=[1 -5;10 -15];//solving equation in matrix form
B=[0 -100]'
X=inv(A)*B;
disp(X);//negative because of opposite direction
disp("I1 = 2.857 A");
//when the 10 A source is acting alone
disp("9Vx+10I2=0");//equation 1
disp("Applying KCL at Node 1,");
disp("Vx=-100/7");//equation 2
A=[9 10;1 0];//solving equation in matrix form
B=[0 -100/7]'
X=inv(A)*B;
disp(X);
disp("I2 = 12.857 A");
```

```
a=2.857;
b=12.857;
x=a+b;
printf("\nBy superposition theorem, \nI = I1+I2 = %
    .3f A ",x);
```

Scilab code Exa 3.10 `example10`

```
//Network Theorem 2
//pg no 3.11
//example 3.10
//when 17 V source is acting alone
disp("Vx+2I1=0");//equation 1
disp("Applying KVL to mesh,");
disp("−5Vx−5I1=17");//equation 2
A=[1 2;-5 -5];//solving equation in matrix form
B=[0 17]'
X=inv(A)*B;
disp(X);
disp("I1 = 3.4 A");
//when the 1 A source is acting alone
disp("4Vx+3I2=0");//equation 1
disp("Applying KCL at Node x,");
disp("Vx=−6/5");//equation 2
A=[4 3;1 0];//solving equation in matrix form
B=[0 -6/5]'
X=inv(A)*B;
disp(X);
disp("I2 = 1.6 A");
a=3.4;
b=1.6;
x=a+b;
printf("\nBy superposition theorem, \nI = I1+I2 = %.
    f A ",x);
```

Scilab code Exa 3.11 example11

```
//Network Theorem 2
//pg no 3.12
//example 3.11
//when 5 A source is acting alone
disp("-V1+4I=0");//equation 1
disp("Applying KCL to node 1,");
disp("1.25V1-4I=5");//equation 2
A=[-1 4;1.25 -4];//solving equation in matrix form
B=[0 5]'
X=inv(A)*B;
disp(X);
disp("V1 = 20 V");
//when the 20 V source is acting alone
disp("from the figure,");
disp("V2-3I=0");//equation 1
disp("Applying KVL to the mesh,");
disp("I=-20");//equation 2
A=[1 -3;0 1];//solving equation in matrix form
B=[0 -20]'
X=inv(A)*B;
disp(X);
disp("V2 = -60 V");
a=20;
b=-60;
x=a+b;
mprintf("\nBy superposition theorem, \n V = V1+V2 =
    %.f V ",x);
```

Scilab code Exa 3.12 example12

```
//Network Theorem 2
//pg no 3.13
//example 3.12
//when 18 V source is acting alone
disp("Vx+I1=0");//equation 1
disp("Applying KVL to mesh,");
disp("3Vx-6I1=-18");//equation 2
A=[1 1;3 -6];//solving equation in matrix form
B=[0 -18]'
X=inv(A)*B;
disp(X);
disp("I1 = 2 A");
//when the 3 A source is acting alone
disp("from the figure,");
disp("Vx=2 V");//equation 1
disp("Applying KCL at node 1,");
disp("3Vx-6I2=0");//equation 2
A=[1 0;3 -6];//solving equation in matrix form
B=[2 0]'
X=inv(A)*B;
disp(X);
disp("I2 =1 V");
a=2;
b=1;
x=a+b;
mprintf("\nBy superposition theorem, \n I = I1+I2 =
    %.f A ",x);
```

Scilab code Exa 3.13 `example13`

```
//Network Theorem 2
//pg no 3.14
//example 3.13
//when 120 V source is acting alone
disp("Applying KVL to mesh,");
```

```
disp("Iy1=5.45 A");
//when the 12 A source is acting alone
disp("from the figure,");
disp("V1+4Iy2=0");//equation 1
disp("Applying KCL at node 1,");
disp("-V1/8 +9/4Iy2=-12");//equation 2
A=[1 4;-1/8 9/4];//solving equation in matrix form
B=[0 -12]'
X=inv(A)*B;
disp(X);
disp("Iy2 =-4.36 A");
//when 40 V source is acting alone
disp("Applying KVL to mesh,");
disp("Iy3=-1.82 A");
a=5.45;
b=-4.36;
c=-1.82;
x=a+b+c;
mprintf("\nBy superposition theorem, \n I = Iy1+Iy2+
   Iy3 = %.2f A ",x);
```

Scilab code Exa 3.14 `example14`

```
//Network Theorem 2
//pg no 3.15
//example 3.14
//when 18 V source is acting alone
disp("Vx1-3I=0");//equation 1
disp("Applying KVL to mesh,");
disp("-3Vx1-9I=-18");//equation 2
A=[1 -3;-3 -9];//solving equation in matrix form
B=[0 -18]'
X=inv(A)*B;
disp(X);
disp("Vx1 = 3 V");
```

```
//when the 5 A source is acting alone
disp("from the figure,");
disp("V1+Vx2=0");//equation 1
disp("Applying KCL at node 1,");
disp("1/2V1-1/2Vx2=5");//equation 2
A=[1 1;1/2 -1/2];//solving equation in matrix form
B=[0 5]'
X=inv(A)*B;
disp(X);
disp("Vx2= -5 V");
//when the 36 V source is acting alone
disp("from the figure,");
disp("Vx3+3I=0");//equation 1
disp("Applying KVL to the mesh,");
disp("3Vx3-9I=-36");//equation 2
A=[1 3;3 -9];//solving equation in matrix form
B=[0 -36]'
X=inv(A)*B;
disp(X);
disp("Vx3= -6 V");
a=3;
b=-5;
c=-6;
x=a+b+c;
mprintf("\nBy superposition theorem, \n Vx = Vx1+Vx2
    +Vx3 = %.f V ",x);
```

Scilab code Exa 3.15 `example15`

```
//Network Theorem 2
//pg no 3.16
//example 3.15
a=10;
b=2;
c=(5*a)-(20*b);
```

```
x=20;
y=30;
z=5;
r=z+((x*y)/(x+y));
i=c/(r+c);
//Calculation of Vth(Thevenin's voltage)
disp("removing the 10 ohm resistor from the circuit"
    );
printf("\nFor mesh 1, \nI1 = %.f A",a);
printf("\nApplying KVL to mesh 2,, \nI2 = %.f A",b);
printf("\nWriting Vth equation, \n Vth = %.f V",c);
//Calculation of Rth(Thevenin's Resistance)
disp("replacing the current source of 10 A with an
    open circuit  and voltage source of 100 V with a
    short circuit,");
printf("\nRth = %.f Ohm",r);
//Calculation of IL(load current)
printf("\nIL = %.2f A",i);
```

Scilab code Exa 3.16 `example16`

```
//Network Theorem 2
//pg no 3.17
//example 3.16
a=30;
b=20;
c=50;
d=5;
e=24;
v=220;
x=(v/(a+c));
y=(v/(b+d));
z=(20*y)-(30*x);
r=((a*c)/(a+c))+((b*d)/(b+d));
i=z/(r+e);
```

```
//Calculation the Vth (Thevenin's voltage)
disp("removing the 24 Ohm resistor from the network"
   );
printf("\nI1 = %.2f A",x);
printf("\nI2 = %.1f A",y);
printf("\nWriting Vth equation, \n Vth = %.1f V",z);
//Calculation of Rth (Thevenin's resistance)
disp("replacing the 220 V source with short circuit"
   );
printf("\nRth = %.2f Ohm",r);
//Calculation of IL (load current)
printf("\nIL = %.f A",i);
```

Scilab code Exa 3.17 `example17`

```
//Network Theorem 2
//pg no 3.18
//example 3.17
disp("removing the 3 Ohm resistor from the network")
   ;
disp("Applying KVL to mesh 1");
disp("11*I1-9*I2=50");....//equation 1
disp("Applying KVL to mesh 2");
disp("-9*I1+18*I2=0");....//equation 2
A=[11 -9;-9 18];//solving the equations in matrix
   form
B=[50  0]'
X=inv(A)*B;
disp(X);
disp("I1=7.69 A");
disp("I2=3.85 A");
//Calculation of Vth (Thevenin's voltage)
a=7.69;
b=3.85;
v=-((5*b)+(8*(b-a)));//the B terminal is positive w.
```

```
r.t A
printf("\nWriting Vth equation, \n Vth = %.1f V",v);
//Calculation of Rth (Thevenin's resistance)
x=4;
y=2;
z=5;
//delta into star network
r1=((x*y)/(x+y+z));
r2=((x*z)/(x+y+z));
r3=((z*y)/(x+y+z));
mprintf("\nR1 = %.2f Ohm \nR2 = %.2f Ohm \nR3 = %.2f Ohm",r1,r2,r3);
m=1.73;
n=8.91;
r=(r2+(m*n)/(m+n));
printf("\nRth = %.2f Ohm",r);
//Claculation of IL (Load Current)
i=v/(r+3);
printf("\nIL = %.2f A",i);
```

Scilab code Exa 3.18 `example18`

```
//Network Theorem 2
//pg no 3.21
//example 3.18
disp("removing the 20 Ohm resistor from the network");
disp("Applying KVL to mesh 1");
disp("30*I1-15*I2=-75");....//equation 1
disp("Applying KVL to mesh 2");
disp("-15*I1+20*I2=20");....//equation 2
A=[30 -15;-15 20];//solving the equations in matrix form
B=[-75 20]'
X=inv(A)*B;
```

```
disp(X);
disp("I1=-3.2 A");
disp("I2=-1.4 A");
//Calculation of Vth (Thevenin's voltage)
a=-3.2;
b=-1.4;
v=45;
v1=45-10*(a-b);
printf("\nWriting Vth equation, \n Vth = %.f V",v1);
//Calculation of Rth (Thevenin's resistance)
x=10;
y=5;
z=5;
//delta into star network
r1=((x*y)/(x+y+z));
r2=((x*z)/(x+y+z));
r3=((z*y)/(x+y+z));
mprintf("\nR1 = %.1f Ohm \nR2 = %.1f Ohm \nR3 = %.1f
    Ohm",r1,r2,r3);
m=16.25;
r=((m*r1)/(m+r1))+r1;
printf("\nRth = %.2f Ohm",r);
//Claculation of IL (Load Current)
i=v1/(r+20);
printf("\nIL = %.2f A",i);
```

Scilab code Exa 3.19 example19

```
//Network Theorem 2
//pg no 3.22
//example 3.19
disp("removing the 3 Ohm resistor from the network")
    ;
disp("Applying KVL to mesh 1");
disp("I1=6");....//equation 1
```

```
disp("Applying KVL to mesh 2");
disp("-12*I1+18*I2=42");....//equation 2
A=[1 0;-12 18];//solving the equations in matrix
   form
B=[6  42]'
X=inv(A)*B;
disp(X);
disp("I2= 6.33 A");
//Calculation of Vth (Thevenin's voltage)
a=6.33;
v=6*a;
printf("\nWriting Vth equation, \n Vth = %.f V",v);
//Calculation of Rth (Thevenin's resistance)
disp("replacing the voltage source with short
   circuit and current source by open circuit");
x=6;
y=12;
r=(x*y)/(x+y);
printf("\nRth = %.f Ohm",r);
//Calculation of IL (load current)
i=v/(r+3);
printf("\nIL = %.2f A",i);
```

Scilab code Exa 3.20 example20

```
//Network Theorem 2
//pg no 3.23
//example 3.20
disp("removing the 30 Ohm resistor from the network"
   );
disp("Applying KVL to supermesh ");
disp("-I1+I2=13");....//equation 1
disp("15*I1+100*I2=150");....//equation 2
//Calculation of Vth (Thevenin's voltage)
a=3;
```

```
v=(40*a)-50;
printf("\nWriting Vth equation , \n Vth = %.f V",v);
//Calculation of Rth (Thevenin's resistance)
disp("replacing the voltage source with short
    circuit and current source by open circuit");
r=(75*40)/(75+40);
printf("\nRth = %.2f Ohm",r);
//Calculation of IL (load current)
i=v/(r+30);
printf("\nIL = %.2f A",i);
```

Scilab code Exa 3.21 `example21`

```
//Network Theorem 2
//pg no 3.25
//example 3.21
//Calculation of Vth
v=100;
r=20;
x=v/r;
disp("Removing the 20 Ohm resistor from the network"
    );
printf("\nVth = %.f V ",v);
//calculation of Rth
disp("replacing the voltage source with short
    circuit and current source by open circuit");
disp("Rth = 0");
//calculation of IL
printf("\nIL = %.f A",x);
```

Scilab code Exa 3.22 `example22`

```
//Network Theorem 2
```

```
//pg no 3.25
//example 3.22
disp("removing the 10 Ohm resistor from the network");
disp("Applying KVL to mesh 1");
disp("4*I1-I2=-25");....//equation 1
disp("Applying KVL to mesh 2");
disp("-I1+4*I2=10");....//equation 2
A=[4 -1;-1 4];//solving the equations in matrix form
B=[-25  10]'
X=inv(A)*B;
disp(X);
disp("I1=-6 A");
disp("I2=1 A");
//Calculation of Vth (Thevenin's voltage)
a=-6;
b=1;
v=-((2*a)+(2*b));//the terminal B is positive w.r.t A
printf("\nWriting Vth equation, \n Vth = %.f V",v);
//Calculation of Rth (Thevenin's resistance)
x=2;
y=2;
z=1;
//star into delta network
r1=x+y+((x*y)/z);
r2=x+z+((x*z)/y);
r3=z+y+((z*y)/x);
mprintf("\nR1 = %.f Ohm \nR2 = %.f Ohm \nR3 = %.f Ohm",r1,r2,r3);
//Claculation of IL (Load Current)
r=1.33;
i=v/(r+v);
printf("\nIL = %.2f A",i);
```

Scilab code Exa 3.23 example23

```
//Network Theorem 2
//pg no 3.28
//example 3.23
disp("removing the 1 Ohm resistor from the network")
    ;
disp("writing current equation for meshes 1 & 2 ");
disp("I1= -3 A");....//equation 1
disp("I2=1 A");....//equation 2
//Calculation of Vth (Thevenin's voltage)
a=-3;
b=1;
r=2;
v=4-2*(a-b);
printf("\nWriting Vth equation , \n Vth = %.f V",v);
//Calculation of Rth (Thevenin's resistance)
disp("replacing the voltage source with short
    circuit and current source by open circuit");
disp("Rth = 2 Ohm");
//Calculation of IL (load current)
i=v/(r+1);
printf("\nIL = %.f A",i);
```

Scilab code Exa 3.24 example24

```
//Network Theorem 1
//page no-3.29
//example3.24
//calculation of Isc (short-circuit current)
disp("Applying KVL to mesh 1:");
disp("I1=2");....//equation 1
disp("Writing current equation to supermesh:");//
    meshes 2 & 3 will form a supermesh
disp("I3-I2=4");....//equation 2
```

```
disp("Applying KVL to supermesh:");
disp("-5I2-15I3=0");....//equation 3
disp("solving these equations we get :");...//solving equations in matrix form
A=[1 0 0;0 -1 1;0 -5 -15];
B=[2 4 0]'
X=inv(A)*B;
disp(X);
disp("I1 = 2 A");
disp("I2 = -3 A");
disp("I3 = 1 A");
a=2;
b=-3;
x=a-b;
printf("\nIsc = %.f A",x);
//calculation of Rn (norton's resistance)
disp("replacing the voltage source with short circuit and current source by open circuit");
c=1;
m=15;
y=(c*(m+x))/(c+m+x);
printf("\nRn = %.2f Ohm",y);
//calculation of IL (load current)
z=10;
i=x*(y/(z+y));
printf("\nIL = %.2f A",i);
```

Scilab code Exa 3.25 `example25`

```
//Network Theorem 1
//page no-3.30
//example3.25
//calculation of Isc (short-circuit current)
disp("Applying KVL to mesh 1:");
disp("7*I1-2*I2=20");....//equation 1
```

```
disp("Applying KVL to mesh 2,");
disp("-2*I1+10*I2=-12");....//equation 2
disp("solving these equations we get :");...//
    solving equations in matrix form
A=[7 -2;-2 10];
B=[20 -12]'
X=inv(A)*B;
disp(X);
disp("I2 = -0.67 A");
a=-0.67;
printf("\nIsc = I2 = %.2f A",a);
//calculation of Rn (norton's resistance)
disp("replacing the voltage source with short
    circuit ");
b=5;
c=2;
d=8;
y=((b*c)/(b+c))+d;
printf("\nRn = %.2f Ohm",y);
//calculation of IL (load current)
z=10;
i=-a*(y/(10+y));
printf("\nIL = %.2f A",i);
```

Scilab code Exa 3.26 example26

```
//Network Theorem 1
//page no-3.31
//example3.26
//calculation of Isc (short-circuit current)
disp("Applying KVL to mesh 1:");
disp("7*I1-I2=10");....//equation 1
disp("Applying KVL to mesh 2:");
disp("-I1+6*I2-3*I3=0");....//equation 2
disp("Applying KVL to mesh 3:");
```

```
disp("3*I2-3*I3=20");....//equation 3
disp("solving these equations we get :");...//
    solving equations in matrix form
A=[7 -1 0;-1 6 -3;0 3 -3];
B=[10 0 20]'
X=inv(A)*B;
disp(X);
disp("I1 = -13.17 A");
a=13.17;
printf("\nIsc = -%.2f A",a);
//calculation of Rn (norton's resistance)
disp("replacing the voltage source with short
    circuit ");
c=1;
b=6;
x=(c*b)/(c+b);
y=x+2;
z=(y*3)/(y+3);
printf("\nRn = %.2f Ohm",z);
//calculation of IL (load current)
n=10;
i=a*(z/(z+n));
printf("\nIL = %.2f A",i);
```

Scilab code Exa 3.27 example27

```
//Network Theorem 1
//page no-3.32
//example3.27
//calculation of Isc (short-circuit current)
disp("Applying KVL to mesh 1:");
disp("20*I1-20*I2=10");....//equation 1
disp("Applying KVL to mesh 2:");
disp("-20*I1+60*I2-20*I3=40");....//equation 2
disp("Applying KVL to mesh 3:");
```

```
disp("-20*I2+50*I3=-100");....//equation 3
disp("solving these equations we get :");...//
    solving equations in matrix form
A=[20 -20 0;-20 60 -20;0 -20 50];
B=[10 40 -100]'
X=inv(A)*B;
disp(X);
disp("I1 = 0.81A");
a=0.81;
printf("\nIsc = -%.2f A",a);
//calculation of Rn (norton's resistance)
disp("replacing the voltage source with short
    circuit ");
c=20;
b=30;
x=(c*b)/(c+b);
y=x+c;
z=(y*c)/(y+c);
printf("\nRn = %.1f Ohm",z);
//calculation of IL (load current)
n=10;
i=a*(z/(z+n));
printf("\nIL = %.2f A",i);
```

Scilab code Exa 3.28 `example28`

```
//Network Theorem 1
//page no-3.33
//example3.28
//calculation of Isc (short-circuit current)
disp("Applying KVL to mesh 1:");
disp("90*I1-60*I2=120");....//equation 1
disp("Applying KVL to mesh 2:");
disp("-60*I1+100*I2-30*I3=40");....//equation 2
disp("Applying KVL to mesh 3:");
```

```
disp("30*I2 -30*I3=-10");....//equation 3
disp("solving these equations we get :");...//
    solving equations in matrix form
A=[90 -60 0;-60 100 -30;0 30 -30];
B=[120 40 -10]'
X=inv(A)*B;
disp(X);
disp("I3 = 4.67A");
a=4.67;
printf("\nIsc = %.2f A",a);
//calculation of Rn (norton's resistance)
disp("replacing the voltage source with short
    circuit ");
c=30;
b=60;
x=(c*b)/(c+b);
y=x+10;
z=(y*c)/(y+c);
printf("\nRn = %.f Ohm",z);
```

Scilab code Exa 3.29 example29

```
//Network Theorem 1
//page no-3.34
//example3.29
//calculation of Isc (short-circuit current)
disp("Writing current equation for supermesh :");
disp("I2-I1=2");....//equation 1
disp("Applying KVL to supermesh ,");
disp("12*I1= 55");....//equation 2
disp("solving these equations we get :");...//
    solving equations in matrix form
A=[-1 1;12 0];
B=[2 55]'
X=inv(A)*B;
```

```
disp(X);
disp("I1 = 4.58 A");
disp("I2 = 6.58 A");
a=6.58;
printf("\nIsc = I2 = %.2f A",a);
//calculation of Rn (norton's resistance)
disp("replacing the voltage source with short
   circuit and current source with open circuit ");
b=12;
c=4;
y=((b*c)/(b+c));
printf("\nRn = %.f Ohm",y);
//calculation of IL (load current)
z=8;
i=a*(y/(z+y));
printf("\nIL = %.2f A",i);
```

Scilab code Exa 3.30 example30

```
//Network Theorem 1
//page no-3.35
//example3.30
//calculation of Isc (short-circuit current)
disp("Applying KVL to mesh 1:");
disp("5*I1-2*I2=-2");....//equation 1
disp("Applying KVL to mesh 2:");
disp("4*I2-2*I3=-1");....//equation 2
disp("Applying KVL to mesh 3:");
disp("-2*I1-2*I2+4*I3=0");....//equation 3
disp("solving these equations we get :");...//
   solving equations in matrix form
A=[5 -2 0;0 4 -2 ;-2 -2 4];
B=[-2 -1 0]'
X=inv(A)*B;
disp(X);
```

```
disp("I1 = -0.64A");
disp("I2 = -0.55A");
disp("I3 = -0.59A");
a=-0.64;
b=-0.55;
c=-0.59;
printf("\nIsc = I3 = %.2f A",a);
//calculation of Rn (norton's resistance)
disp("replacing the voltage source with short circuit ");
z=2.2;
printf("\nRn = %.1f Ohm",z);
//calculation of IL (load current)
n=1;
i=-c*(z/(z+n));
printf("\nIL = %.2f A",i);
```

Scilab code Exa 3.31 `example31`

```
//Network Theorem 1
//page no-3.39
//example3.31
//calculation of Vth (Thevenin's voltage)
a=0.25;
v=(10*a)+(8*a);
disp("Writing Vth equation,");
printf("\nVth = %.f V",v);
//calculation of Isc (short-circuit current)
disp("Applying KVL to mesh 1:");
disp("4*I1-2*I2 = 1");....//equation 1
disp("Applying KVL to mesh 2:");
disp("-18*I1-11*I2=0");....//equation 2
A=[4 -2;18 -11];
B=[1 0]'
X=inv(A)*B;
```

```
disp(X);
disp("I2 = 2.25 A");
a=2.25;
printf("\nIsc = I2 = %.2f A",a);
//Calculation of Rth
x=v/a;
printf("\nRth = %.f Ohm",x);
```

Scilab code Exa 3.33 `example33`

```
//Network Theorem 1
//page no-3.39
//example3.33
//calculation of Vth (Thevenin's voltage)
a=0.25;
v=(10*a)+(8*a);
disp("Writing Vth equation,");
printf("\nVth = %.f V",v);
//calculation of Isc (short-circuit current)
disp("Applying KVL to mesh 1:");
disp("4*I1-2*I2 = 1");....//equation 1
disp("Applying KVL to mesh 2:");
disp("-18*I1-11*I2=0");....//equation 2
A=[4 -2;18 -11];
B=[1 0]'
X=inv(A)*B;
disp(X);
disp("I2 = 2.25 A");
a=2.25;
printf("\nIsc = I2 = %.2f A",a);
//Calculation of Rth
x=v/a;
printf("\nRth = %.f Ohm",x);
```

Scilab code Exa 3.41 `example41`

```
//Network Theorem 1
//page no-3.47
//example3.41
//calculation of Vth
disp("Removing the variable resistor RL from the
    network:");
disp("I2-I1=4");....//equation 1
disp("Applying KVL at the outerpath:");
disp("-6*I1-5*I2=2");....//equation 2
A=[-1 1;-6 -5];
B=[4 2]'
X=inv(A)*B;
disp(X);
disp("I1 = -2 A");
disp("I2 = 2 A");
disp("Writing Vth equation,");
a=-2;
v=8-a;
printf("\nVth = %.f V",v);
//calculation of Rth
disp("replacing the voltage source with short
    circuit and current source by an open circuit ");
x=(v*1)/(v+1);
printf("\nRth = %.2f Ohm",x);
//calculation of RL
disp("For maximum power transfer");
printf("\nRth = RL =%.2f Ohm",x);
//calculation of Pmax
m=(v^2)/(4*x);
printf("\nPmax = %.2f W",m);
```

Scilab code Exa 3.42 `example42`

```
//Network Theorem 1
//page no-3.48
//example3.42
//calculation of Vth
disp("Removing the variable resistor RL from the
    network:");
disp("I1=50");....//equation 1
disp("Applying KVL to mesh 2:");
disp("5*I1-10*I2=0");....//equation 2
A=[1 0;5 -10];
B=[50 0]'
X=inv(A)*B;
disp(X);
disp("I2 = 25 A");
disp("Writing Vth equation,");
a=25;
v=3*a;
printf("\nVth = %.f V",v);
//calculation of Rth
disp("replacing the current source of 50 A by an
    open circuit ");
x=7;
y=3;
m=(x*y)/(x+y);
printf("\nRth = %.1f Ohm",m);
//calculation of RL
disp("For maximum power transfer");
printf("\nRth = RL =%.1f Ohm",m);
//calculation of Pmax
n=(v^2)/(4*m);
printf("\nPmax = %.2f W",n);
```

Scilab code Exa 3.43 `example43`

```
//Network Theorem 1
//page no-3.49
//example3.43
//calculation of Vth
disp("Removing the variable resistor RL from the
    network:");
disp("Writing the current equation for the supermesh
    ");
disp("I2-I1=6");....//equation 1
disp("Applying KVL to the supermesh :");
disp("5*I1+2*I2=10");....//equation 2
A=[-1 1;5 1];
B=[6 10]'
X=inv(A)*B;
disp(X);
disp("I1 = -0.29 A");
disp("I2 = 5.71 A");
disp("Writing Vth equation ,");
a=5.71;
v=2*a;
printf("\nVth = %.f V",v);
//calculation of Rth
disp("replacing the current source of 50 A by an
    open circuit ");
x=5;
y=2;
m=((x*y)/(x+y))+3+4;
printf("\nRth = %.2f Ohm",m);
//calculation of RL
disp("For maximum power transfer");
printf("\nRth = RL =%.2f Ohm",m);
//calculation of Pmax
```

```
n=(v^2)/(4*m);
printf("\nPmax = %.2f W",n);
```

Scilab code Exa 3.44 `example44`

```
//Network Theorem 1
//page no-3.50
//example3.44
//calculation of Vth
disp("Removing the variable resistor RL from the
    network:");
disp("Applying KVL to mesh 1");
disp("15*I1-5*I2=120");....//equation 1
disp("Applying KVL to the mesh 2:");
disp("I2=-6");....//equation 2
A=[15 -5;0 1];
B=[120 -6]'
X=inv(A)*B;
disp(X);
disp("I1 = 6 A");
disp("Writing Vth equation,");
a=6;
v=120-(10*a);
printf("\nVth = %.f V",v);
//calculation of Rth
disp("replacing the current source of 50 A by an
    open circuit ");
x=10;
y=5;
m=((x*y)/(x+y));
printf("\nRth = %.2f Ohm",m);
//calculation of RL
disp("For maximum power transfer");
printf("\nRth = RL =%.2f Ohm",m);
//calculation of Pmax
```

```
n=(v^2)/(4*m);
printf("\nPmax = %.2f W",n);
```

Scilab code Exa 3.45 example45

```
//Network Theorem 1
//page no-3.51
//example3.45
//calculation of Vth
disp("Removing the variable resistor RL from the
    network:");
disp("I1=3 A");....//equation 1
disp("Applying KVL to the mesh 2:");
disp("-25*I1+41*I2=0");....//equation 2
A=[1 0;-25 41];
B=[3 0]'
X=inv(A)*B;
disp(X);
disp("I2 = 1.83 A");
disp("Writing Vth equation,");
a=1.83;
v=-20+(10*a)+(6*a);
printf("\nVth = %.2f V",v);
//calculation of Rth
disp("replacing the current source of 50 A by an
    open circuit ");
x=25;
y=16;
m=((x*y)/(x+y));
printf("\nRth = %.2f Ohm",m);
//calculation of RL
disp("For maximum power transfer");
printf("\nRth = RL =%.2f Ohm",m);
//calculation of Pmax
n=(v^2)/(4*m);
```

```
printf("\nPmax = %.2f W",n);
```

Scilab code Exa 3.46 example46

```
//Network Theorem 1
//page no-3.52
//example3.46
//calculation of Vth
disp("Removing the variable resistor RL from the
    network:");
disp("I2-I1=2");....//equation 1
disp("I2=-3 A");....//equation 2
A=[-1 1;0 1];
B=[2 -3]'
X=inv(A)*B;
disp(X);
disp("I1 = -5 A");
disp("Writing Vth equation,");
a=-5;
b=-3;
v=8-(2*a)-b-6;
printf("\nVth = %.f V",v);
//calculation of Rth
disp("replacing the voltage source with short
    circuit and current source by an open circuit ");
m=5;
printf("\nRth = %.f Ohm",m);
//calculation of RL
disp("For maximum power transfer");
printf("\nRth = RL =%.f Ohm",m);
//calculation of Pmax
n=(v^2)/(4*m);
printf("\nPmax = %.2f W",n);
```

Scilab code Exa 3.47 `example47`

```
//Network Theorem 1
//page no-3.52
//example3.46
//calculation of Vth
disp("Removing the variable resistor RL from the
   network:");
disp("By star-delta transformation");
a=5;
b=20;
c=9;
v=100;
i=v/(a+a+b+c+c);
disp("Writing Vth equation,");
vth=v-(14*i);
printf("\nVth = %.2f V",vth);
//calculation of Rth
disp("replacing the voltage source with short
   circuit ");
m=23.92;
printf("\nRth = %.2f Ohm",m);
//calculation of RL
disp("For maximum power transfer");
printf("\nRth = RL =%.2f Ohm",m);
//calculation of Pmax
n=(vth^2)/(4*m);
printf("\nPmax = %.2f W",n);
```

Scilab code Exa 3.48 `example48`

```
//Network Theorem 1
```

```
//page no-3.55
//example3.48
//calculation of Vth
disp("Removing the variable resistor RL from the
    network:");
disp("Applying KVL to the mesh 1:");
disp("35*I1-30*I2=60");....//equation 1
disp("Applying KVL to the mesh 2:");
disp("I2=2");....//equation 2
A=[35 -30;0 1];
B=[60 2]'
X=inv(A)*B;
disp(X);
disp("I1 = 3.43 A");
disp("Writing Vth equation,");
a=3.43;
b=2;
v=20*(a-b)+20;
printf("\nVth = %.2f V",v);
//calculation of Rth
disp("replacing the voltage source with short
    circuit and current source by an open circuit ");
x=15;
y=20;
m=((x*y)/(x+y));
printf("\nRth = %.2f Ohm",m);
//calculation of RL
disp("For maximum power transfer");
printf("\nRth = RL =%.2f Ohm",m);
//calculation of Pmax
n=(v^2)/(4*m);
printf("\nPmax = %.1f W",n);
```

Scilab code Exa 3.49 `example49`

```
//Network Theorem 1
//page no-3.56
//example3.49
//calculation of Vth
disp("Removing the variable resistor RL from the
    network:");
x=100;
a=10;
b=20;
c=30;
d=40;
i1=x/(a+c);
i2=x/(b+d);
printf("\nI1 = %.1f A",i1);
printf("\ni2 = %.2f A",i2);
disp("Writing Vth equation,");
x=2.5;
y=1.66;
v=(20*y)-(10*x);
printf("\nVth = %.1f V",v);
//calculation of Rth
disp("replacing the voltage source of 100V with
    short circuit ");
m=((a*c)/(a+c))+((b*d)/(b+d));
printf("\nRth = %.2f Ohm",m);
//calculation of RL
disp("For maximum power transfer");
printf("\nRth = RL =%.2f Ohm",m);
//calculation of Pmax
n=(v^2)/(4*m);
printf("\nPmax = %.2f W",n);
```

Scilab code Exa 3.50 `example50`

```
//Network Theorem 1
```

```
//page no-3.57
//example3.50
//calculation of Vth
disp("Removing the variable resistor RL from the
   network:");
disp("Applying KVL to the mesh 1:");
disp("9*I1-3*I2=72");....//equation 1
disp("Applying KVL to the mesh 2:");
disp("-3*I1+9*I2=0");....//equation 2
A=[9 -3;-3 9];
B=[72 0]'
X=inv(A)*B;
disp(X);
disp("I1 = 9 A");
disp("I2 = 3 A");
disp("Writing Vth equation,");
a=9;
b=3;
v=(6*a)+(2*b);
printf("\nVth = %.f V",v);
//calculation of Rth
disp("replacing the voltage source with short
   circuit and current source by an open circuit ");
x=6;
y=2;
z=4;
m=((x*b)/(x+b))+2;
l=((m*z)/(m+z));
printf("\nRth = %.f Ohm",l);
//calculation of RL
disp("For maximum power transfer");
printf("\nRth = RL =%.f Ohm",l);
//calculation of Pmax
n=(v^2)/(4*l);
printf("\nPmax = %.f W",n);
```

Scilab code Exa 3.51 `example51`

```
//Network Theorem 1
//page no-3.58
//example3.51
//Calculation of Vth
disp("from the figure");
disp("Vth=4*I");
disp("Applying KVL to the mesh");
disp("0.5*Vth-8*I=-12");
A=[1 -4;0.5 -8];
B=[0 -12]'
X=inv(A)*B;
disp(X);
disp("Vth=8 V");
//Calculation of Isc
v=8;
i=12/4;
printf("\nIsc = %.f A",i);
//Calculation of Rth
r=v/i;
printf("\nRth = Vth/Isc = %.3f Ohm",r);
//calculation of RL
disp("For maximum power transfer");
printf("\nRth = RL =%.3f Ohm",r);
//calculation of Pmax
x=v/(2*r);
printf("\nIL = %.1f A",x);
n=(x^2)*r;
printf("\nPmax = %.f W",n);
```

Chapter 4

AC Circuits

Scilab code Exa 4.1 `example1`

```
//AC Circuits:example 4.1:(pg4.4)
i=15;
t=3.375*10^-3;
f=40;
pi=3.14;
Im=(i/sin(2*pi*f*t));
disp("i=15 Amp");
disp("t=3.375 ms");
disp("f=40 Hz");
disp("i=Im*sin(2*pi*f*t)");
printf("Im=%.fAmp",Im);
```

Scilab code Exa 4.2 `example2`

```
//AC Circuits:example 4.2:(pg4.4)
f=50;
Im=100;
i1=86.6;
```

```
t=(1/600);
pi=3.14;
disp("f=50 c/s");
disp("Im=100 A");
// part(a)
disp("i=Im*sin(2*pi*f*t)");
i=Im*sin(2*pi*f*t);
printf("i=%.f A",i);
// part (b)
disp("i=Im*sin(2*pi*f*t1)");
t1=(asind(i1/Im)/(2*pi*f));
printf("t1=%.e second",t1);
```

Scilab code Exa 4.3 example3

```
//AC Circuits:example 4.3:(pg4.5)
f=50;
I=20;
t1=0.0025;
t2=0.0125;
I1=14.14;
pi=3.14;
disp("f=50 c/s");
disp("I=20 A");
mprintf("Im=I*sqrt(2)");
Im=(sqrt(2)*I);
printf("\nIm=%.2f A",Im);
mprintf("\nEquation of current, \ni=Im*sin(2*pi*f*t)
   ");
disp("=28.28sin(2*pi*f*t)=28.28sin(100*pi*t)");
disp("(a)At              t=0.0025 seconds");
i=(Im*sin(2*pi*f*t1));
printf("i=%.f A",i); //when t=0.0025seconds
disp("(b)At              t=0.0125 seconds");
i=(Im*sin(2*pi*f*t2));
```

```
printf("i=%.f A",i); //when t=0.0125seconds
disp("(c)                    i=28.28sin(100*pi*t) ");
t=(asind(I1/Im)/(2*pi*f));
printf("t=%.e second",t);// when I=14.14A
```

Scilab code Exa 4.4 example4

```
//AC Circuits : example 4.4 :pg(4.5)
pi=3.14;
Vm=200;
disp("v=200sin314t");
disp("v=Vmsin(2*pi*f*t)");
disp("(2*pi*f)=314");
f=(314/(2*pi));
printf("f=%.f Hz",f);
Vavg=((2*Vm)/pi);
Vrms=(Vm/sqrt(2));
mprintf('\nFor a sinusoidal waveform, \nVavg=(2*Vm/pi) \nVrms=(Vm/sqrt(2))');
kf=(Vrms/Vavg);
kc=(Vm/Vrms);
mprintf('\nform fator=%.2f',kf);
mprintf('\ncrest factor=%.2f',kc);
```

Scilab code Exa 4.5 example5

```
//AC Circuits : example 4.5 :(pg 4.6)
kf=1.2;
kp=1.5;
Vavg=10;
disp("kf=1.2");
disp("kp=1.5");
disp("Vavg=10");
```

```
disp("form factor kf=(Vrms/Vavg)");
Vrms=(kf*Vavg);
printf("\nVrms=%.f V",Vrms);
disp("peak factor kp=(Vm/Vrms)");
Vm=(kp*Vrms);
printf("\nVm=%.f V",Vm);
```

Scilab code Exa 4.14 `example14`

```
//AC Circuits: example 4.14 :(pg 4.11)
v1=0;
v2=40;
v3=60;
v4=80;
v5=100;
t=8;
Vavg=((v1+v2+v3+v4+v5+v4+v3+v2)/t);
Vrms=sqrt((v1^2+v2^2+v3^2+v4^2+v5^2+v4^2+v3^2+v2^2)/
    t);
disp("Vavg=((0+40+60+80+100+80+60+40)/8)");
printf("\nVavg=%.1f V",Vavg);
disp("Vrms=sqrt((0+(40)^2+(60)^2+(80)^2+(100)^2+(80)
    ^2+(60)^2+(40)^2)/8)");
printf("\nVrms=%.2f V",Vrms);
```

Scilab code Exa 4.15 `example15`

```
//AC Circuits : example 4.15 :pg(4.11 & 4.12)
v1=0;
v2=10;
v3=20;
t=3;
Vavg=((v1+v2+v3)/t);
```

```
Vrms=(sqrt((v1^2+v2^2+v3^2)/t));
disp("Vavg=((0+10+20)/3)");
printf("Vavg=%.f V",Vavg);
disp("Vrms=(((0)^2+(10)^2+(20)^2)/3)");
printf("Vrms=%.1f V",Vrms);
```

Scilab code Exa 4.33 example33

```
//AC Circuits : example 4.33 :pg(4.27)
Vm=177;
Im=14.14;
phi=30;
V=(Vm/sqrt(2));
I=(Im/sqrt(2));
pf=cosd(30);
P=(V*I*pf);
disp("v(t)=177sin(314t+10)");// value of 10 is in
    degrees
disp("i(t)=14.14sin(314t-20)");//value of 20 is in
    degrees
mprintf("\nCurrent i(t) lags behind voltage v(t) by
    30degrees");
disp("phi=30degrees");
printf("Power factor        pf=cos(30)=%.3f (lagging)
    ",pf);
printf("\nPower consumed     P=V*I*cos(phi)=%.1f W",P
    );
```

Scilab code Exa 4.42 example42

```
//AC Circuits : example 4.42 :pg(4.32 & 4.33)
PR=1000;
VR=200;
```

```
Pcoil=250;
Vcoil=300;
R=((VR^2)/PR);
I=(VR/R);
r=((Pcoil/(I^2)));
Zcoil=(Vcoil/I);
XL=sqrt((Zcoil^2)-(r^2));
RT=(R+r);
ZT=sqrt((RT^2)+(XL^2));
V=(ZT*I);
printf("\nPR=1000 W \nVR=200 V \nPcoil=250 W \nVcoil=300 V \nPR=(VR^2/R)");
printf("\nR=%.f Ohms",R);
printf("\nVR=R*I \nI=%.f A",I);
disp("Pcoil=(I^2)*r");
printf("\nResistance of coil         r=%.f Ohm",r);
printf("\nImpedance of coil          Zcoil=(Vcoil/I)=%.f Ohms",Zcoil);
printf("\nReactance of coil          XL=sqrt((Zcoil^2)-(r^2)) =%.1f Ohms",XL);
printf("\nCombined resistance        RT=R+r=%.f Ohms",RT);
printf("\nCombined impedance         ZT=sqrt(((R+r)^2)+(XL^2)) =%.1f Ohms",ZT);
printf("\nSupply voltage             V=ZT*I=%.1f V",V);
```

Scilab code Exa 4.47 `example47`

```
//AC Circuits : example 4.47 :pg(4.47)
f1=60;
V=200;
P=600;
I=5;
f=50;
Z=V/I;
```

```
r=(P/(I^2));
XL=sqrt((Z^2)-(r^2));
L=(XL/(2*%pi*f));
XL1=(2*%pi*f1*L);
Z1=sqrt((r^2)+(XL1^2));
I=(V/Z1);
printf("\nI=5 A \nV=200 V \nP=600 W \nFor f=50 Hz,");
printf("\nZ=V/I =%.f Ohms",Z);
printf("\nP=((I^2)*r) \nr=%.f Ohms",r);
printf("\nXL=sqrt((Z^2)-(r^2)) \nXL=%.f Ohms",XL);
printf("\nXL=(2*pi*f*L)\nL=%.4f H",L);
printf("\nFor f=60 Hz \nXL=%.1f Ohm",XL1);
printf("\nr=24 Ohms \nZ=sqrt((r^2)+(XL^2))=%.2f Ohms",Z1);
printf("\nI=V/Z=%.3f A",I);
```

Scilab code Exa 4.48 example48

```
//AC Circuits : example 4.48 :(pg 4.37)
f=50;
pi=3.14;
Vdc=12;
Idc=2.5;
Vac=230;
Iac=2;
Pac=50;
R=(Vdc/Idc);
Z=(Vac/Iac);
Pi=(Pac-((Iac^2)*R));
RT=(Pac/(Iac^2));
XL=sqrt((Z^2)-(RT^2));
L=(XL/(2*pi*f));
pf=(RT/Z);
i=(Pi/(Iac^2));
```

```
printf("\nFor dc        V=12 V,        I=2.5 A  \nFor ac
          V=230 V,       I=2 A,       P=50 W");
printf("\nIn an iron-cored coil, there are two types
    of losses \n(i)Losses in core known as core or
    iron loss \n(ii)Losses in winding known as copper
     loss");
printf("\nP=(I^2)*R+Pi \nP/(I^2)=R+((Pi)/(I^2)) \nRT
    =R+(Pi/(I^2)) \nwhere R is the resistance of the
    coil and (Pi/I^2) is the resistance which is
    equivalent to the effect of iron loss");
printf("\nFor dc supply,    f=0 \nXL=0");
printf("\nR=%.1f Ohm",R);
printf("\nFor ac supply \nZ=%.f Ohms",Z);
printf("\nIron loss      Pi=P-I^2*R=%.1f W",Pi);
printf("\nRT=(P/I^2)=%.1f Ohm",RT);
printf("\nXL=sqrt((Z^2)-(RT^2))=%.1f Ohm",XL);
printf("\nXL=2*pi*L \nInductance      L=%.3f H",L);
printf("\nPower factor       =RT/Z=%.3f (lagging)",pf
    );
printf("\nThe series resistance equivalent to the
    effect of iron loss= Pi/(I^2)=%.1f Ohms",i);
```

Scilab code Exa 4.49 example49

```
//AC Circuits : example 4.49 :(pg 4.37 & 4.38)
f=50;
I1=4;
pf1=0.5;
V1=200;
I2=5;
pf2=0.8;
V2=40;
Z1=(V2/I2);
R=(Z1*pf2);
XL1=sqrt((Z1^2)-(R^2));
```

```
L1=(XL1/(2*%pi*f));
Z2=(V1/I1);
RT=(Z2*pf1);
XL2=sqrt((Z2^2)-(RT^2));
L2=(XL2/(2*%pi*f));
Pi=(V1*I1*pf1-(I1^2)*R);
printf("\nWith iron core     I=4 A     pf=0.5,     V=200 V \nWithout iron core     I=5 A     pf=0.8,     V=40 V \nWhen the iron-core is removed,");
printf("\nZ=V/I=%.f Ohms",Z1);
printf("\npf=R/Z \nR=%.1f Ohms",R);
printf("\nXL=sqrt((Z^2)-(RT^2))=%.1f Ohms",XL1);
printf("\nXL=(2*pi*f*L) \nInductance     L=%.4f H",L1);
printf("\nWith iron core, \nZ=%.f Ohms",Z2);
printf("\npf=RT/Z \nRT=%.f Ohm",RT);
printf("\nXL=sqrt((Z^2)-(RT^2))=%.2f Ohm",XL2);
printf("\nXL=(2*pi*f*L) \nInductance          L=%.4f H",L2);
printf("\nIron loss        Pi=P=(I^2)*R \n=VIcos(phi)-I^2*R \n=%.1f W",Pi);
```

Scilab code Exa 4.51 example51

```
//AC Circuits : example 4.51 :(pg 4.40 & 4.41)
P=2000;
pf=0.5;
V=230;
S=(P/pf);
phi=acosd(pf);
I=(P/(V*pf));
Q=(V*I*sind(phi));
disp("P=2000 W");
disp("pf=0.5 (leading)");
disp("V=230 V");
```

```
disp("P=V*I*cos(phi)");
printf("\nI=%.2f A",I);
printf("\nS=V*I=P/cos(phi)=%.f VA",S);
printf("\nphi=%.f degrees",phi);
printf("\nQ=V*I*sin(phi)=%.f VAR",Q);
```

Scilab code Exa 4.52 example52

```
//AC Circuits : example 4.52 :(pg 4.41)
V=240;
VR=100;
P=300;
f=50;
R=((VR^2)/P);
I=sqrt(P/R);
Z=V/I;
XC=sqrt((Z^2)-(R^2));
C=(1/(2*%pi*f*XC));
VC=sqrt((V^2)-(VR^2));
VCmax=(VC*sqrt(2));
Qmax=(C*VCmax);
Emax=((1/2)*C*(VCmax^2));
printf("\nV=240 V \nVR=100 V \nP=300 W \nf=50 Hz");
printf("\nP=(VR^2)/R \nR=((VR^2)/P)=%.2f Ohm",R);
printf("\nP=(I^2)*R \nI=sqrt((P/R)) \nI=%.f A",I);
printf("\nZ=V/I=%.f Ohm",Z);
printf("\nXC=sqrt((Z^2)-(R^2))=%.2f Ohm",XC);
printf("\nXC=1/2*pi*f*C \nC=%.2e F",C);
printf("\nVoltage across capacitor VC=sqrt((V^2)-(VR
    ^2))=%.2f V",VC);
printf("\nMaximum value of max charge \nVC=%.2f V \
    nQmax=C*VCmax=%.4f C",VCmax,Qmax);
printf("\nMax stored energy Emax=((1/2)*C*(VCmax^2))
    \n=%.2f J", Emax);
```

Scilab code Exa 4.53 `example53`

```
//AC Circuits : example 4.53 :(pg 4.42)
C=35*10^-6;
f=50;
XC=(1/(2*%pi*f*C));
R=sqrt(3*(XC^2));
R^2=(3*(XC^2));
printf("\nC=35*10^-6 F \nf=50 Hz \nVC=1/2.V \nXC
    =1/(2*pi*f*C)=%.3f Ohm",XC);
printf("\nVC=1/2.V \nXC.I=1/2.Z.I \nXC=1/2.Z \nZ=2.
    XC \nZ=sqrt((R^2)+(XC^2)) \n(2XC)^2=(R^2)+(XC^2)
    \n3XC^2=R^2");
mprintf("\nR^2=3*XC^2=%.2f Ohm \nR=%.1f Ohm",R^2,R);
```

Scilab code Exa 4.54 `example54`

```
//AC Circuits : example 4.54 :(pg 4.42)
V=125;
I=2.2;
P=96.8;
f=50;
Z=V/I;
R=(P/(I^2));
Xc=sqrt((Z^2)-(R^2));
C=(1/(2*%pi*f*Xc));
printf("\nV=125 V \nP=96.8 W \nI=2.2 A \nf=50 Hz");
printf("\nZ=V/I=%.2f A",Z);
printf("\nP=(I^2)*R \nR=%.f Ohm",R);
printf("\nXc=sqrt((Z^2)-(R^2))=%.2f Ohm",Xc);
printf("\nXc=1/(2*pi*f*C) \n C=%.2e F",C);
```

Scilab code Exa 4.57 Series RLC circuit

```
//AC Circuits :example 4.57 :(pg 4.46)
j=%i;
f=50;
L=0.22;
R1=3;
Z=3.8+j*6.4;
XL=2*%pi*f*L;
R2=3.8;
R=R2-R1;
X=6.4;
XC=XL-X;
C=(1/(2*%pi*f*XC));
printf("\nZ=(3.8+j*6.4) Ohm");
printf("\nXL=2*pi*f*L=%.2f Ohm",XL);
printf("\nZ=(3+j69.12+R-jXC) \n=(3+R)+j(69.12-XC)");
printf("\n3+R=3.8 \nR=%.1f Ohm",R);
printf("\nXC=%.2f Ohm",XC);
printf("\nXC=1/2.pi.f.C \nC=%.e F",C);
```

Scilab code Exa 4.58 Series RLC circuit

```
//AC Circuits : example 4.58 :(pg 4.46)
R=20;
phi=45;
Z=R/cosd(phi);
XC=sqrt((Z^2)-(R^2));
XL=(2*XC);
w=1000;
L=(XL/w);
C=(1/(w*XC));
```

```
printf("\nvL=300sin(1000t) \nR=20 Ohm \nphi=45 \nVL(max)=2Vcc(max) \nsqrt(2)*VL=2*sqrt(2)*VC \nI*XL=2*I*XC \nXL=2*XC \ncos(phi)=R/Z");
printf("\nZ=%.2f Ohm",Z);
printf("\nZ=sqrt((R^2)+(XL-XC)^2) \nXC=%.f Ohm",XC);  //for series R-L-C ckt
printf("\nXL=2*XC =%.f Ohm",XL);
printf("\nXL=w*L \nL=%.2f H",L);
printf("\nXC=1/w*C \nC=%.e F",C);
```

Scilab code Exa 4.59 Series RLC circuit

```
//AC Circuits : example 4.59 :(pg 4.47)
pf=0.5;
C=79.59*10^-6;
f=50;
XC=(1/(2*%pi*f*C));
R=pf*XC;
Zcoil=XC;
XL=sqrt((Zcoil^2)-(R^2));
L=(XL/(2*%pi*f));
printf("\npf=0.5 \nC=79.57uF \nf=50 Hz \nVcoil=VC ");
printf("\nXC=1/2*pi*f*C =%.f Ohm",XC);
printf("\nVcoil=VC \nZcoil=XC=%.f Ohm",XC);
printf("\npf of coil=cos(phi)=R/Zcoil \nResistance of coil R=%.f Ohm",R);
printf("\nXL=sqrt((Zcoil^2)-(R^2))=%.2f Ohm",XL);
printf("\nXL=2*pi*f*L \nInductance of coil=%.2f H",L);
```

Scilab code Exa 4.60 Series RLC Circuit

```
//AC Circuits : example 4.60 :(pg 4.48)
f=50;
V=250;
R=5;
L=9.55;
Vcoil=300;
XL=2*%pi*f*L;
Zcoil=(sqrt((R^2)+(XL^2)));
I=Vcoil/Zcoil;
Z=V/I;
XC1=Zcoil-Z;
XC2=Zcoil+Z;
C1=(1/(2*%pi*f*XC1));
C2=(1/(2*%pi*f*XC2));
printf("\nV=250 V \nR=5 Ohm \nL=9.55 H \nVcoil=300 V
    ");
printf("\nXL=2*pi*f*L =%.f Ohm",XL);
printf("\nZcoil=sqrt(R^2)+(XL^2) =%.f Ohm",Zcoil);
printf("\nI=Vcoil/Zcoil =%.1f A",I);
printf("\nZ=V/I =%.f Ohm",Z);//total impedance
printf("\nZ=sqrt((R^2)+(XL-XC)^2) \nXC=%.f Ohm",XC1)
    ;//when XL>XC
printf("\nC=1/2*pi*f*XC =%.e F",C1);
printf("\nZ=sqrt((R^2)+(XC-XL)^2) \nXC=%.f Ohm",XC2)
    ;//when XC>XL
printf("\nC=%.e F",C2);
```

Scilab code Exa 4.79 Series Resonance

```
//AC Circuits : example 4.79 :(pg 4.64)
R=10;
L=0.01;
C=100*10^-6;
f0=(1/(2*%pi*sqrt(L*C)));
BW=(R/(2*%pi*L));
```

```
f1=f0-(BW/2);
f2=f0+(BW/2);
printf("\nR=10 Ohm \nL=0.01H \nC=100uF");
printf("\nf0=1/2*pi*sqrt(L*C)=%.2f Hz",f0);//resonant frequency
printf("\nBW=R/2*pi*L =%.2f Hz",BW); //bandwidth
printf("\nf1=f0-BW/2 \n=%.2f Hz",f1); //lower frequency
printf("\nf2=f0+BW/2 =%.2f Hz",f2); //higher frequency
```

Scilab code Exa 4.80 Series Resonance

```
//AC Circuits : example 4.80 :(pg 4.65)
R=10;
L=0.2;
C=40*10^-6;
V=100;
f0=(1/(2*%pi*sqrt(L*C)));
I0=(V/R);
P0=((I0^2)*R);
pf=1;
Vr=(R*I0);
Vl=((2*%pi*f0*L)*I0);
Vc=((1/(2*%pi*f0*C))*I0);
Q=((1/R)*sqrt(L/C));
f1=(f0-(R/(4*%pi*L)));
f2=(f0+(R/(4*%pi*L)));
printf("\nR=10 Ohm \nL=0.2 H \nC=40uF \nV=100 V");
printf("\n(i) f0= 1/2*pi*sqrt(LC) =%.1f Hz",f0); //resonant frequency
printf("\n(ii) I0= V/R =%.f A",I0); //current
printf("\n(iii) P0=(I0^2)*R =%.f W",P0);//power
printf("\n(iv) pf=1");//power factor
printf("\n(v) Rv = R.I =%.f V",Vr);//voltage across
```

```
    resistor
printf("\n Lv = XL.I =%.1f V",Vl);//voltage across inductor
printf("\n Cv = XC.I =%.1f V",Vc); //voltage across capacitor
printf("\n(vi) Q =1/R*sqrt(L/C)=%.2f",Q);//Quality factor
printf("\n(vii)f1 = f0-R/4.pi.L = %.2f Hz",f1); //half power points
printf("\nf2=f0+R/4.pi.L = %.1f Hz",f2);
// x initialisation
x=[-1:0.1:2*%pi];
//simple plot
plot(sin(x))
```

Scilab code Exa 4.81 Series Resonance

```
//AC Circuits : example 4.81 :(pg 4.66)
V=200;
Vc=5000;
I0=20;
C=4*10^-6;
R=V/I0;
Xco=Vc/I0;
f0=(1/(2*%pi*Xco*C));
L=(Xco/(2*%pi*f0));
printf("\nV=200 V \nI0= 20 A \nVc=5000 V \nC=4uF");
printf("\nR=V/I0 =%.f Ohm",R);//resistance
printf("\nXco=Vco/Io =%.f Ohm",Xco);
printf("\nXco=1/2*pi*f0*C \nf0=1/2*pi*Xco*C =%.2f Hz",f0);
printf("\nat resonance Xco=Xlo \nXlo=%.f Ohm",Xco);
printf("\nXlo=2*pi*f0*L \nL=%.2f H",L);
```

Scilab code Exa 4.82 Series Resonance

```
//AC Circuits : example 4.82 :(pg 4.66)
V=230;
f0=50;
I0=2;
Vco=500;
R=V/I0;
Xco=Vco/I0;
C=(1/(2*%pi*f0*Xco));
L=(Xco/(2*%pi*f0));
printf("\nV = 230 V \nf0 = 50 Hz \nI0 = 2A \nVco = 500 V");
printf("\nR=V/I0 =%.f Ohm",R);
printf("\nXco=Vco/I0 =%.f Ohm",Xco);
printf("\nXco=1/2.pi.f0.C \nC= %.e F",C);//capacitance
printf("\nXco=Xlo \nXlo=%.f Ohm",Xco);//at resonance
printf("\nXlo=2.pi.f0.L \nL=%.3f H",L);//inductance
```

Scilab code Exa 4.83 Series Resonance

```
//AC Circuits : example 4.82 :(pg 4.66)
R=2;
L=0.01;
V=200;
f0=50;
C=(1/(4*(%pi)^2*L*(f0^2)));
I0=V/R;
Vco=I0*(1/(2*%pi*f0*C));
printf("\nR= 2 Ohm \nL= 0.01 H \nV=200 V \nf0=50 Hz \nf0=1/(2.pi.sqrt(LC)");
```

```
printf("\nC = %.e F",C);//capacitance
printf("\nI0= V/R =%.f A",I0);//current
printf("\nVco=I0.Xco \n=%.2f V",Vco); //voltage
    across capacitor
```

Scilab code Exa 4.84 Series Resonance

```
//AC Circuits : example 4.84 :(pg 4.67)
BW=400;
Vco=500;
R=100;
Vm=10;
V=(Vm/sqrt(2));
I0=V/R;
L=R/BW;
Q0=Vco/V;
C=(L/(Q0*R)^2);
f0=(1/(2*%pi*sqrt(L*C)));
f1=(f0-(R/(4*%pi*L)));//lower cut-off frequency
f2=(f0+(R/(4*%pi*L)));//upper cut-off frequency
printf("\nv(t)=10sinwt \nVco=5000V \nBW=400rad/s \nR
    =100 Ohm");
printf("\nV=%.2f V",V);
printf("\nI0=V/R=%.4f A",I0);
printf("\nBW=R/L \nL=%.2f H",L);
printf("\nQ0=Vco/V =%.2f",Q0);
printf("\nQ0=1/R*sqrt(L/C) \nC=%.e F",C);
printf("\nf0=1/2.pi.sqrt(LC)=%.2f Hz",f0);
printf("\nf1=f0-R/4.pi.L =%.2f Hz",f1);//lower cut-
    off frequency
printf("\nf2=f0+R/4.pi.L =%.2f Hz",f2); //upper cut-
    off frequency
```

Scilab code Exa 4.85 Series Resonance

```
//AC Circuits : example 4.85 :(pg 4.68)
R=500;
f1=100;
f2=10*10^3;
BW=f2-f1;
f0=((f1+f2)/2);
L=(R/(2*%pi*BW));
XL0=(2*%pi*f0*L);
C=(1/(2*%pi*f0*XL0));
Q0=((1/R)*(sqrt(L/C)));
printf("\nR= 500 Ohm \nf1 = 100 Hz \nf2=10kHz \nBW=
    f2-f1 =%.f Hz",BW);
printf("\nf1=f0-BW/2 -------(i) \nf2=f0+BW/2 -------(
    ii) \nf1+f2 =2f0 \nf0=(f1+f2)/2 =%.f Hz",f0);
printf("\nBW=R/2.pi.f0.L \nL=%.6f H",L);
printf("\nXL0=2.pi.f0.L =%.2f Ohm",XL0);
printf("\nXL0=XC0 =%.2f Ohm",XL0);//at resonance
printf("\nXC0 =1/2.pi.f0.C \nC=%.e F",C);
printf("\nQ0=(1/R*sqrt(L/C)) =%.4f",Q0);
```

Scilab code Exa 4.87 Series Resonance

```
//AC Circuits : example 4.87 :(pg 4.69 & 4.70)
f0=10^6;
C1=500*10^-12;
C2=600*10^-12;
C=500*10^-12;
x=((2*%pi*f0)^2);
L=(1/(x*C));
XL=(2*%pi*f0*L);
y=2*%pi*f0*C2;
XC=(1/y);
R=sqrt(((XL-XC)^2)/3);
```

```
x=sqrt(L/C);
Q0=((1/R)*x);
printf("\nf0= 1MHz \nC1=500pF \nC2=600pF \nC=500pF");//At resonance
printf("\nf0=1/2.pi.sqrt(LC)\nL=%.12f H",L);
printf("\nXL=2.pi.f0.L =%.2f Ohm",XL);
printf("\nXC=1/2.pi.f0.C \nXC=%.2f Ohm",XC);
printf("\nI=1/2.I0 \nV/Z=1/2.V/R \nZ=2R");
printf("\nsqrt((R^2)-(XL-XC)^2)=2R \nR=%.2f Ohm",R); //Resistance of Inductor
printf("\nQ0=1/R.sqrt(L/C) \n=%.f",Q0);
```

Scilab code Exa 4.88 Parallel Resonance

```
//AC Circuits : example 4.88 :(pg 4.72)
R=20;
C=100*10^-6;
L=0.2;
DR=(L/(C*R));
x=(1/(L*C));
y=((R/L)^2);
f0=((1/(2*%pi))*sqrt(x-y));
DR=(L/(C*R));
printf("\nR=20 Ohm \nL=0.2 H \nC=100uF");
printf("\nf0=1/2.pi.sqrt(1/LC-R^2/L^2) \n=%.2f Hz",f0);
printf("\n dynamic resistance =L/CR \n= %.f Ohm",DR);
```

Scilab code Exa 4.89 Parallel Resonance

```
//AC Circuits : example 4.89 :(pg 4.72 & 4.73)
R=20;
```

```
L=200*10^-6;
f=10^6;
V=230;
Rs=8000;
XL=2*%pi*f*L;
x=((2*%pi*f)^2);
y=((R/L)^2);
C=(1/((x+y)*L));
Q=((2*%pi*f*L)/R);
Z=(L/(C*R));
ZT=(Rs+Z);
IT=(V/ZT);
printf("\nR=20 Ohm \nL=200uH \nf=10^6 \nV=230 V \nRs
    =8000 Ohm \nXL=2.pi.f.L =%.1f Ohm",XL);
printf("\nf0=1/2.pi.sqrt(1/LC-R^2/L^2) \nC=%.e F",C)
    ;
printf("\nQ0=2.pi.f.L/R =%.2f",Q);//quality factor
printf("\nZ=L/CR \n=%.f Ohm",Z);//dynamic impedance
printf("\nZt=%.f Ohm",ZT);//total equivalent Z at
    resonance
printf("\nIt=%.e A",IT);//total ckt current
```

Chapter 5

Steady State AC Analysis

Scilab code Exa 5.1 example1

```
//Steady-State AC Analysis
//page no - 5.1
//example 5.1
// A = p2z(R,Theta) - Convert from polar to complex
   form.
//     R is a matrix containing the magnitudes
//     Theta is a matrix containing the phase angles
   (in degrees).
function [A] = p2z(R,Theta)
 if argn(2) <> 2 then
    error("incorrect number of arguments.");
 end
 if ~and(size(R) == size(Theta)) then
   error("arguments must be of the same dimension.")
       ;
 end
 A = R.*exp(%i*%pi*Theta/180.);
endfunction

A=p2z(100,45);//converting from polar to rectangular
disp(A);
```

```
disp("Applying KVL to Mesh 1 we get :");
disp("(3+j14)I1-j10I2=70.710678+j70.710678");//
    Equation 1
disp("Applying KVL to Mesh 2 we get :");
disp("I1=0")//equation 2
disp("putting equation 2 in equation 1:")//putting
    equation 2 in equation 1
disp("I2=(70.710678+j70.710678)/-j10");
I2=A/10*%i;
disp(I2);
function [r,th]=rect2pol(x,y)
//rectangle to polar coordinate conversion
//based on "Scilab from a Matlab User's Point of
    View", Eike Rietsch,
2002
  r=sqrt(x^2+y^2);
  th = atan(y,x)*180/%pi;
endfunction
[r,th]=rect2pol(- 7.0710678,7.0710678)//converting
    back to polar form
disp(r);
disp(th);
disp("I2= mag - 10 ang - 135 A");
```

Scilab code Exa 5.2 example2

```
//Steady-State AC Analysis
//page no - 5.1
//example 5.1
// A = p2z(R,Theta) - Convert from polar to complex
    form.
//     R is a matrix containing the magnitudes
//     Theta is a matrix containing the phase angles
    (in degrees).
function [A] = p2z(R,Theta)
```

```
 if argn(2) <> 2 then
    error("incorrect number of arguments.");
 end
 if ~and(size(R) == size(Theta)) then
   error("arguments must be of the same dimension.")
       ;
 end
 A = R.*exp(%i*%pi*Theta/180.);
endfunction
A=p2z(10,30);
disp(A);    //converting to rectangular form
M=[8-2*%i, -3, 0; -3, 8+5*%i, -5; 0, -5 7-2*%i];
N=[A, 0, 0]'
O=inv(M);
X=O*N;
disp(X);
function [r,th]=rect2pol(x,y)
//rectangle to polar coordinate conversion
//based on "Scilab from a Matlab User's Point of
   View", Eike Rietsch,
2002
  r=sqrt(x^2+y^2);
  th = atan(y,x)*180/%pi;
endfunction
[r,th]=rect2pol(1.3340761,- 0.5209699)//converting
   back to polar form
```

Scilab code Exa 5.11 example11

```
//Steady-State AC Analysis
//page no - 5.10
//example 5.11
disp("when mag-50 ang-0 source is acting alone :");
function [A] = p2z(R,Theta)
 if argn(2) <> 2 then
```

```
    error("incorrect number of arguments.");
  end
  if ~and(size(R) == size(Theta)) then
    error("arguments must be of the same dimension.")
      ;
  end
  A = R.*exp(%i*%pi*Theta/180.);
endfunction
A=p2z(50,0); //converting polar to rec
disp(A);
disp("when mag-4 ang-0 source is acting alone :");
Vab2=0;
disp("By Super-position theorem :")
disp("Vab=Vab1+Vab2");
Vab=A+Vab2;
printf("Vab = %.f", Vab);
function [r,th]=rect2pol(x,y)
//rectangle to polar coordinate conversion
//based on "Scilab from a Matlab User's Point of
   View", Eike Rietsch,
2002
  r=sqrt(x^2+y^2);
  th = atan(y,x)*180/%pi;
endfunction
[r,th]=rect2pol(50,0)     //converting back to polar
   form
disp(r);
disp(th);
disp("Vab= mag-50 ang-0 V")
```

Chapter 6

Three phase Circuits

Scilab code Exa 6.8 Interconnection of Three phases

```
// Three-Phase Circuits :example 6.8 :(pg 6.14)
VL=440;
P=50*10^3;
IL=90;
Iph=IL/sqrt(3);
pf=(P/(sqrt(3)*VL*IL));
S=sqrt(3)*VL*IL;
printf("\nVL=440 V \nP=50kW \nIL=90 A");
printf("\nVL=Vph=%.f V",VL);//For delta-connected
   load
printf("\nIph=IL/sqrt(3)=%.2f A",Iph);
printf("\nP=sqrt(3)*VL*IL*cos(phi)");
printf("\ncos(phi)=%.2f (lagging)",pf);
printf("\nS=sqrt(3)*VL*IL =%.2f VA",S);
```

Scilab code Exa 6.9 Interconnection of Three phases

```
// Three-Phase Circuits :example 6.9 :(pg 6.15)
```

```
IL=15;
P=11*10^3;
S=15*10^3;
VL=S/(sqrt(3)*IL);
Vph=VL/sqrt(3);
x=P/S;
phi=acosd(P/S);
Q=sqrt(3)*VL*IL*sind(phi);
Iph=IL;
Zph=Vph/Iph;
R=Zph*cosd(phi);
XL=Zph*sind(phi);
Vph1=VL;
Iph1=(Vph1/Zph);
IL1=sqrt(3)*Iph1;
P1=sqrt(3)*VL*IL1*cosd(phi);
Q1=sqrt(3)*VL*IL1*sind(phi);
printf("\nIL=15 A \nP=11kW \nS=15kVA ");
//For a star-connected load
printf("\nS=sqrt(3)*VL*IL \nVL=%.2f V",Vph);
printf("\ncos(phi)=P/S =%.3f",x);
printf("\nphi=%.2f degrees",phi);
printf("\nQ=sqrt(3).VL.IL.sin(phi) = %.1f VAR",Q);
printf("\nIph=IL = %.f A",IL);
printf("\nZph=Vph/Iph = %.2f Ohm",Zph);
printf("\nR= Zph*cos(phi) =%.2f Ohm",R);
printf("\nXL=Zph*sin(phi)= %.2f Ohm",XL);
//If these coils are connected in Delta
printf("\nCph =VL =%.2f V",VL);
printf("\nZph= %.2f Ohm",Zph);
printf("\nIph=Vph/Zph =%.2f A ",Iph1);
printf("\nIL=sqrt(3)*Iph =%.f A",IL1);
printf("\nP=sqrt(3)*VL*IL*cos(phi) =%.2f W",P1);
printf("\nQ=sqrt(3)*VL*IL*sin(phi) =%.2f VAR",Q1);
```

Scilab code Exa 6.10 Interconnection of Three phases

```
// Three-Phase Circuits :example 6.10 :(pg 6.16)
P=1500*10^3;
pf=0.85;
VL=2.2*10^3;
phi=acosd(pf);
IL=P/(sqrt(3)*VL*pf);
Iph=IL/sqrt(3);
AC=Iph*pf;
RC=Iph*sind(phi);
IAC=IL*pf;
IRC=IL*sind(phi);
printf("\nP=1500kW \npf=0.85 (lagging) \nVL=2.2kV");
//For Delta-connected load
printf("\nP=sqrt(3)*VL*IL*cos(phi) \nIL=%.2f A",IL);
printf("\nIph=IL/sqrt(3)= %.2f A",Iph);
//AC=Active Component
printf("\nAC=Iph*cos(phi) =%.2f A",AC); //in each phase of load
//RC=Reactive Component
printf("\nRC=Iph*sin(phi) =%.2f A",RC); //in each phase of load
//For star-connected source
printf("\nIAC =%.2f A",IAC); // current of AC in each phase of source
printf("\nIRC =%.2f A",IRC); // current of RC in each phase of source
```

Scilab code Exa 6.11 Interconnection of Three phases

```
// Three-Phase Circuits :example 6.11 :(pg 6.16)
VL=208;
P=1800;
IL=10;
```

```
Vph=VL/sqrt(3);
Zph=(Vph/IL);
pf=P/(sqrt(3)*VL*IL);
phi=acosd(pf);
Rph=Zph*pf;
Xph=Zph*sind(phi);
printf("\nVL=208 V \nP=1800 W \nIL= 10 A");
//For a Wye-connected load,
printf("\nVph = VL/sqrt(3) =%.2f V",Vph);
printf("\nIph = IL =%.f A",IL);
printf("\nZph=Vph/Iph =%.2f Ohm",Zph);
printf("\nP=sqrt(3)*VL*IL*cos(phi)");
printf("\ncos(phi)=%.1f degrees",pf);
printf("\nphi=%.f degrees",phi);
printf("\nRph=Zph*cos(phi) =%.2f Ohm",Rph);
printf("\nXph=Zph*sin(phi) =%.2f Ohm",Xph);
```

Scilab code Exa 6.12 Interconnection of Three phases

```
// Three-Phase Circuits :example 6.12 :(pg 6.17)
P=100*10^3;
IL=80;
VL=1100;
f=50;
Vph=(VL/sqrt(3));
Iph=IL;
Zph=(Vph/Iph);
pf=(P/(sqrt(3)*VL*IL));
phi=acosd(pf);
Rph=Zph*pf;
Xph=Zph*sind(phi);
C=(1/(2*%pi*f*Xph));
printf("\nP=100kW \nIL=80 A \nVL=1100 V \nf=50 Hz");
//For a star-connected load
printf("\nVph =V/sqrt(3) =%.2f",Vph);
```

```
printf("\nIph=IL =%.f A",Iph);
printf("\nZph=(Vph/Iph)= %.2f Ohm",Zph);
printf("\nP=sqrt(3)*VL*IL*cos(phi)");
printf("\ncos(phi)=%.3f (leading)",pf);
printf("\nphi=%.f degrees",phi);
printf("\nRph=Zph*cos(phi) =%.2f Ohm",Rph);
printf("\nXph =Zph*sin(phi) =%.f Ohm",Xph);
// as current is leading,reactance will be
   capacitive in nature
printf("\nXC=(1/2*pi*C)");
printf("\nC=%.e F",C);
```

Scilab code Exa 6.13 Interconnection of Three phases

```
// Three-Phase Circuits :example 6.13 :(pg 6.17 &
   6.18)
VL=400;
IL=34.65;
P=14.4*10^3;
Iph=(IL/sqrt(3));
Zph=(VL/Iph);
pf=(P/(sqrt(3)*VL*IL));
phi=acosd(pf);
Rph=(Zph*pf);
Xph=(Zph*sind(phi));
printf("\nVL=400 V \nIL=34.65 A \nP=14.4kW");
//For a Delta-connected load
printf("\nVL=Vph=%.f V",VL);
printf("\nIph=IL/sqrt(3)=%.f A",Iph);
printf("\nZph=Vph/Iph =%.f Ohm",Zph);
printf("\ncos(phi)=P/sqrt(3).VL.IL =%.1f",pf);
printf("\nphi=%.2f degrees",phi);
printf("\nRph=Zph.cos(phi) =%.f Ohm",Rph);
printf("\nXph=Zph.sin(phi)=%.f Ohm",Xph);
```

Scilab code Exa 6.14 Interconnection of Three phases

```
// Three-Phase Circuits :example 6.14 :(pg 6.18)
P=10.44*10^3;
VL=200;
pf=0.5;
x=acosd(pf);
IL=(P/(sqrt(3)*VL*pf));
Iph=(IL/sqrt(3));
Zph=(VL/Iph);
Rph=(Zph*pf);
Xph=(Zph*sind(x));
Q=(sqrt(3)*VL*IL*sind(x));
printf("\nP=10.44kW \nVL=200 V \npf=0.5(leading)");
// For a delta-connected load,
printf("\nVL=Vph=%.f V",VL);
printf("\nP=qrt(3)*VL*IL*cos(phi) \nIL=%.2f A",IL);
printf("\nIph=IL/sqrt(3) =%.1f A",Iph);
printf("\nZph=Vph/Iph =%.2f Ohm",Zph);
printf("\nRph =Zph.cos(phi)=%.3f Ohm",Rph);
printf("\nXph=Zph.sin(phi)=%.2f Ohm",Xph);
printf("\nQ=sqrt(3)*VL*IL*sin(phi) = %.2f VAR",Q);
```

Scilab code Exa 6.17 Interconnection of Three phases

```
// Three-Phase Circuits :example 6.17 :(pg 6.20)
Po=200*10^3;
f=50;
VL=440;
N=0.91;
pf=0.86;
phi=acosd(pf);
```

```
Pi=(Po/N);
IL=(Pi/(sqrt(3)*VL*pf));
Iph=(IL/sqrt(3));
AC=(Iph*pf);
RC=(Iph*sind(phi));
printf("\nPo=200 kW \nf=50Hz \nVL= 440 V \nN=0.91 \
    npf=0.86");
//For a delta connected load (induction motor)
printf("\nVph =VL =%.f V",VL);
printf("\nN=(Po/Pi)");//efficiency
printf("\nPi=%.f W",Pi);//Input power
printf("\nPi=sqrt(3)*VL*IL*cos(phi) \nIL=%.1f A",IL)
    ;
printf("\nAC = (Iph*cos(phi))=%.1f A",AC);//Active
    component of phase current
printf("\nRC=(Iph*sin(phi)) =%.1f A",RC);//Reactive
    component of phase current
```

Scilab code Exa 6.18 Interconnection of Three phases

```
// Three-Phase Circuits :example 6.18 :(pg 6.20)
VL=400;
Po=112*10^3;
pf=0.86;
phi=(acosd(pf));
N=0.88; //Efficiency
Pi=(Po/N);
IL=(Pi/(sqrt(3)*VL*pf));
Iph=(IL/sqrt(3));
AC=(Iph*pf);
RC=(Iph*sind(phi));
Aac=(IL*pf);
Arc=(IL*sind(phi));
printf("\nVL=400 V \nPo=112kW \npf=0.86 \nN=0.88");
//For a mesh-connected load (induction motor)
```

```
printf("\nVph=VL=%.f V",VL);
printf("\nN=Po/Pi  \nPi=%.2f W",Pi);//Input power
printf("\nPi=sqrt(3)*VL*IL*cos(phi) \nIL=%.1f A",IL);
printf("\nIph=IL/sqrt(3) =%.2f A",Iph);
//current in star-connected load=line current drawn by motor
printf("\nIA=%.1f A",IL);//current in alternate phase
printf("\nAC=Iph*cos(phi) =%.2f A",AC);//active component in each phase of motor
printf("\nRC=Iph*sin(phi) =%.2f A",RC);//Reactive component in each phase of motor
printf("\nAac=%.1f A",Aac);//active component in each alternate phase
printf("\nArc=%.2f A",Arc);//reactive component in each alternate phase
```

Scilab code Exa 6.19 Interconnection of Three phases

```
// Three-Phase Circuits :example 6.19 :(pg 6.21 & 6.22)
VL=400;
IL=5;
Vph=(VL/sqrt(3));
Zph=(Vph/IL);
Iph=(IL/sqrt(3));
Vph1=(Iph*Zph);
printf("\nVl=400 V \nIL=5 A");
//For a star-connected load
printf("\nVph=VL/sqrt(3) =%.2f V",Vph);
printf("\nIph=IL=%.f A",IL);
printf("\nZph=Rph=Vph/Iph =%.2f Ohm",Zph);
//For a delta connected load
printf("\nIL=5 A \nRph=%.2f Ohm",Zph);
```

```
printf("\nIph=IL/sqrt(3)=%.2f A",Iph);
printf("\nVph=Iph*Rph \n=%.2f V",Vph1);
//Voltage needed is 1/3 of the star value
```

Scilab code Exa 6.20 Interconnection of Three phases

```
// Three-Phase Circuits :example 6.20 :(pg 6.22 &
    6.23)
VL=400;
Zph=100;
Vph=(VL/sqrt(3));
Iph=(Vph/Zph);
pf=1;
P=(sqrt(3)*VL*Iph*pf);
Iph1=(VL/Zph);
IL1=(sqrt(3)*Iph1);
P1=(sqrt(3)*VL*IL1*pf);
I1=(VL/200);
Pa=(VL*I1);
I2=(VL/100);
Pb=(VL*I1*I2);
printf("\nVL=400 V \nZph = 100 Ohm");
//For a star connected load
printf("\nVph=VL/sqrt(3) =%.2f V",Vph);
printf("\nIph = VL/Zph =%.2f A",Iph);
printf("\nIL=Iph =%.2f A",Iph);
printf("\ncos(phi)=1 \nP=sqrt(3).VL.IL.cos(phi) =%.2
    f W",P);
//For a delta connected load
printf("\nVph=VL=%.f V",VL);
printf("\nIph=Vph/Zph =%.f A",Iph1);
printf("\nIL=sqrt(3)*Iph =%.2f A",IL1);
printf("\nP=sqrt(3)*VL*IL*cos(phi) =%.2f W",P1);
//When resistors are open circuited
//(i)Star connection
```

```
printf("\nI= %.f A",I1);//Current in lines
printf("\nP=%.f W",Pa);//Power taken from mains
//(ii)Delta connection
printf("\nI=%.f A",I2);//Current in each phase
printf("\nP=%.f W",Pb);//Power taken from mains
```

Scilab code Exa 6.27 Measurement of three phase power

```
// Three-Phase Circuits :example 6.27 :(pg 6.30 &
    6.31)
W1=2000;
W2=500;
W3=-500;
x=(sqrt(3)*((W1-W2)/(W1+W2)));
phi=atand(x);
pf=cosd(phi);
y=(sqrt(3)*((W1-W3)/(W1+W3)));
phi1=atand(y);
pf1=cosd(phi1);
printf("\nW1 = 2000W \nW2 = 500 W");
//(i) When both readings are same
printf("\nWhen W1 &W2 are same \nW1 = 2000W \nW2 =
    500 W");
printf("\ntan(phi)= sqrt(3).(W1-W2/W1+W2) =%.3f ",x)
    ;
printf("\nphi=%.3f degrees",phi);
printf("\npf=cos(phi)=%.3f ",pf);//Power factor
//(ii) When the latter reading is obtained after
    reversing the connection to the current coil of 1
     instrument
printf("\nWhen W2 is reversed \nW1= 2000 W \nW2=
    -500 W");
printf("\ntan(phi)= sqrt(3).(W1-W2/W1+W2) =%.3f ",y)
    ;
printf("\nphi=%.2f degrees",phi1);
```

```
printf("\npf=cos(phi)=%.2f ",pf1);//Power factor
```

Scilab code Exa 6.28 Measurement of three phase power

```
// Three-Phase Circuits :example 6.28 :(pg 6.31)
W1=5*10^3;
W2=-(0.5*10^3);
P=(W1+W2);
x=(sqrt(3)*((W1-W2)/(W1+W2)));
phi=atand(x);
pf=cosd(phi);
printf("\nW1=5kW \W2=0.5kW");
// When the latter readings are obtained after the
   reversal of the current coil terminals of the
   wattmeter
printf("\nWhen W2 is reversed \nW1=5kW \nW2=-0.5kW")
   ;
printf("\nP=W1+W2 = %.1f W",P);//Power
printf("\ntan(phi)=sqrt(3)*(W1-W2/W1+W2) =%.2f",x);
printf("\nphi= %.2f degrees ",phi);
printf("\npf=cos(phi) =%.2f",pf);//Power factor
```

Scilab code Exa 6.29 Measurement of three phase power

```
// Three-Phase Circuits :example 6.29 :(pg 6.31)
S=10*10^3;
pf=0.342;
x=(S/sqrt(3));
phi=acosd(pf);
W1=x*cosd(30+phi);
W2=x*cosd(30-phi);
printf("\nS=10kVA \npf=0.342 \nS=sqrt(3)*VL*IL");
printf("\nVL*IL=%.f VA",x);
```

```
printf("\ncos(phi)=%.3f",pf);
printf("\nphi=%.f degrees",phi);
//(i)when power factor is leading
printf("\npf leading \nW1=VL.IL.cos(30+phi)= %.f W",W1);
printf("\n \nW2=VL.IL.cos(30-phi)= %.f W",W2);
//(i)when power factor is lagging
printf("\npf lagging \nW1=VL.IL.cos(30-phi)= %.f W",W2);
printf("\n \nW2=VL.IL.cos(30+phi)= %.f W",W1);
```

Scilab code Exa 6.30 Measurement of three phase power

```
// Three-Phase Circuits :example 6.30 :(pg 6.31 & 6.32)
VL=2000;
N=0.9;//efficiency
W1=300*10^3;
W2=100*10^3;
P=W1+W2;
x=(sqrt(3)*((W1-W2)/(W1+W2)));
phi=atand(x);
pf=cosd(phi);
IL=(P/(sqrt(3)*VL*pf));
printf("\nVL=2000 V \nN=0.9 \nW1=300kW \nW2=100kW");
printf("\nP=W1+W2 =%.f W",P);//Input Power
printf("\ntan(phi)=(sqrt(3)*(W1-W2/W1+W2)) =%.3f",x);
printf("\nphi=%.2f degrees ",phi);
printf("\ncos(phi)=%.2f",pf);//Power factor
printf("\nP=sqrt(3)*VL*IL*cos(phi) \nIL=%.2f A",IL);
```

Scilab code Exa 6.31 Measurement of three phase power

```
// Three-Phase Circuits :example 6.31 :(pg 6.32)
VL=220;
Po=11.2*10^3;
N=0.88;//efficiency
IL=38;
Pi=(Po/N);
x=(Pi/(sqrt(3)*VL*IL));
phi=acosd(x);
W1=(VL*IL*cosd(30-phi));
W2=(VL*IL*cosd(30+phi));
printf("\nVL=220 V \nPo=11.2kW \nN=0.88 \nIL=38A \N
    =(Po/Pi)= %.2f W",Pi);
printf("\nPi=sqrt(3)*VL*IL*cos(phi) \ncos(phi)=%.2f
    lagging",x);
printf("\nphi=%.2f degrees",phi);
printf("\nW1 =VL*IL*cos(30-phi) =%.2f W",W1);
printf("\nW2 =VL*IL*cos(30+phi) =%.2f W",W2);
```

Chapter 7

Graph Theory

Scilab code Exa 7.7 `Graph of a Network`

```
// Graph Theory : example 7.7 : (pg 7.18 & 7.19)
//Complete incidence matrix Aa
printf("\nAa=");
disp(Aa=[1 0 0 -1 1 0 0 0;-1 1 0 0 0 1 0 0;0 -1 1 0 0 0 1 0;0 0 -1 1 0 0 0 1;0 0 0 0 -1 -1 -1 -1]);
//eliminating last row from Aa
printf("\nA=");
disp(A=[1 0 0 -1 1 0 0 0;-1 1 0 0 0 1 0 0;0 -1 1 0 0 0 1 0;0 0 -1 1 0 0 0 1]);
//Tieset matrix B
printf("\ntwigs={1,3,5,7} \nlinks={2,4,6,8} \ntieset 2={2,7,5,1} \ntieset 4={4,5,7,3} \ntieset 6={6,5,1} \ntieset 8={8,7,3}");
// forward direction = 1, reverse direction = -1
printf("\nB=");
disp(B=[1 1 0 0 -1 0 1 1;0 0 1 1 1 0 -1 0;1 0 0 0 -1 1 0 0;0 0 1 0 0 0 -1 1]);
// f-cutset matrix Q
printf("\nf-cutset 1={1,6,2} \nf-cutset 3={3,4,8} \nf-cutset 5={5,4,6,2} \nf-cutset 7={7,2,8,4}");
printf("\nQ=");
```

```
disp(Q=[1 -1 0 0 0 -1 0 0;0 0 1 -1 0 0 0 -1;0 1 0 -1 1 1 0 0;0 -1 0 1 0 0 1 1]);
```

Scilab code Exa 7.8 Graph of a Network

```
// Graph Theory : example 7.8 :(pg 7.19 & 7.20)
//Complete Incidence Matrix Aa
printf("\nAa=");
disp(Aa=[1 0 -1 1;-1 1 0 0;0 -1 1 -1]);
// Reduced Incidence matrix A (by eliminating last row from Aa)
A=[1 0 -1 1;-1 1 0 0];
printf("\nA=");
disp(A=[1 0 -1 1;-1 1 0 0]);
printf("\nNumber of possible trees=|A*A^T|");//A^T=A'= transpose of A
x=(A*A');
disp(x);
printf("\n|A*A^T|=");//determinant of A
disp(det(x));
```

Scilab code Exa 7.11 Graph of a Network

```
// Graph Theory : example 7.11 :(pg 7.21 & 7.22)
printf("\nAa=");
disp(Aa=[0 -1 1 0 0;0 0 -1 -1 -1;-1 0 0 0 1;1 1 0 1 0]);//Complete incidence matrix
A=[0 -1 1 0 0;0 0 -1 -1 -1;-1 0 0 0 1];//Reduced incidence matrix
printf("\nNumber of possible trees = |A*A^T|");//A^T=A'=transpose of A
x=(A*A');
disp(x);
```

```
det(x);
printf("\n|A*A^T|=%.f",det(x));//No. of possible
    trees
//Tieset Matrix B
printf("\ntwigs={3,4,5} \nlinks={1,2} \ntieset
    1={1,4,5} \ntieset 2={2,3,4}");
printf("\nB=");
disp(B=[1 0 0 -1 1;0 1 1 -1 0]);
//f-cutset Matrix Q
printf("\nf-cutset 3={3,2} \nf-cutset 4={4,2,1} \nf-
    cutset 5={5,1}");
printf("\nQ=");
disp(Q=[0 -1 1 0 0;1 1 0 1 0;-1 0 0 0 1]);
```

Scilab code Exa 7.14 Network Equilibrium Equation

```
//Graph Theory : example 7.14 :(pg 7.37 & 7.38)
//Tieset Matrix B
printf("\ntieset1={1,4,5} \ntieset2={2,4,6} \ntieset
    ={3,5,6} \nB=");
B=[1 0 0 1 1 0;0 1 0 -1 0 -1;0 0 1 0 -1 1];
disp(B);
printf("\nThe KVL equation in matrix form \nB.Zb.(B^
    T).Il = B.Vs-B.Zb.Is");
printf("\nB.Zb.(B^T).Il = B.Vs \nZb=");//Is=0
Zb=diag([1,1,1,2,2,2]);
disp(Zb);
printf("\n(B^T)=");
disp(B');
Vs=[2;0;0;0;0;0];
printf("\nVs=");
disp(Vs);
printf("\nB.Zb=");
x=(B*Zb);
disp(x);
```

```
printf("\nB.Zb.(B^T)=");
y=(x*B');
disp(y);
printf("\nB.Vs=");
z=(B*Vs);
disp(z);
printf("\nLoad currents:");
M=[5 -2 -2;-2 5 -2;-2 -2 5];
H=inv(M);
N=[2;0;0];
X=H*N;
disp(X);
printf("\nIl1=0.857 A \nIl2=0.571 A \nIl3=0.571 A");
printf("\nBranch currents:");
P=(B')*X;
disp(P);//Currents in amperes
```

Scilab code Exa 7.15 Network Equilibrium Equation

```
//Graph Theory : example 7.15 :(pg 7.38 & 7.39)
//Tieset Matrix B
printf("\ntieset1={1,4,6} \ntieset2={2,5,6} \ntieset
   ={3,5,4} \nB=");
B=[1 0 0 1 0 1;0 1 0 0 1 -1;0 0 1 -1 -1 0];
disp(B);
printf("\nThe KVL equation in matrix form \nB.Zb.(B^
   T).Il = B.Vs-B.Zb.Is");
printf("\nB.Zb.(B^T).Il = B.Vs \nZb=");//Is=0
Zb=diag([6,4,3,4,6,2]);
disp(Zb);
printf("\n(B^T)=");
disp(B');
Vs=[12;-6;-8;0;0;0];
printf("\nVs=");
disp(Vs);
```

```
printf("\nB.Zb=");
x=(B*Zb);
disp(x);
printf("\nB.Zb.(B^T)=");
y=(x*B');
disp(y);
printf("\nB.Vs=");
z=(B*Vs);
disp(z);
printf("\nLoad currents:");
M=[12 -2 -4;-2 12 -6;-4 -6 12];
H=inv(M);
N=[12;-6;-8];
X=H*N;
disp(X);
printf("\nIl1=0.55 A \nIl2=-0.866 A \nIl3=-0.916 A")
    ;
```

Scilab code Exa 7.19 Network Equilibrium Equation

```
//Graph Theory : example 7.15 :(pg 7.34 & 7.35)
Q=[1 -1 0 0;0 -1 1 1];
printf("\nQ=");
disp(Q);
printf("\nThe KCL equation in matrix form is given
    by");
printf("\nQ.Yb.(Q^T).Vl=Q.Is-Q.Yb.Vs");
printf("\nQ.Yb.(Q^T).Vl=Q.Is");//Vs=0
Yb=diag([5,5,5,10]);
Is=[-10;0;0;0];
printf("\nYb=");
disp(Yb);
printf("\n(Q^T)=");
disp(Q');
printf("\nIs=");
```

```
disp(Is);//current entering into nodes is taken as
    negative
x=(Q*Yb);
printf("\nQ.Yb=");
disp(x);
y=(x*Q');
printf("\nQ.Yb.(Q^T)=");
disp(y);
z=(Q*Is);
printf("\nQ.Is=");
disp(z);
printf("\nLoad voltages:");
M=[10 5;5 20];
P=inv(M);
N=[-10;0];
X=(P*N);
disp(X);
printf("\nvl1=-1.14 V \nvl2=0.28 V");
```

Scilab code Exa 7.20 Network Equilibrium Equation

```
//Graph Theory : example 7.20 :(pg 7.35 & 7.36)
printf("\nf-cutset1={1,4,5,6} \nf-cutset2={2,4,5} \
    nf-cutset3={3,4,6}");
Q=[1 0 0 -1 -1 1;0 1 0 -1 -1 0;0 0 1 -1 0 1];
printf("\nQ=");
disp(Q);
printf("\nThe KCL equation in matrix form is given
    by");
printf("\nQ.Yb.(Q^T).Vl=Q.Is-Q.Yb.Vs");
printf("\nQ.Yb.(Q^T).Vl=Q.Is");//Is=0
Yb=diag([0.2,0.2,0.2,0.1,0.5,0.1]);
Vs=[910;0;0;0;0;0];
Is=[0;0;0;0;0;0];
printf("\nYb=");
```

```
disp(Yb);
printf("\nVs=");
disp(Vs);
printf("\nIs=");
disp(Is);
x=(Q*Yb);
printf("\nQ.Yb=");
disp(x);
y=(x*Q');
printf("\nQ.Yb.(Q^T)=");
disp(y);
z=(x*Vs);
printf("\nQ.Yb.Vs=");
disp(z);
printf("\nQ.Is=");
u=(Q*Is);
disp(Q*Is);
v=(u-z);
printf("\nQ.Is-Q.Yb.Vs=");
disp(v);
printf("\nLoad voltages:");
M=[0.9 0.6 0.2;0.6 0.8 0.1;0.2 0.1 0.3];
P=inv(M);
N=[-182;0;0];
X=(P*N);
disp(X);
printf("\nvl1=-460 V \nvl2=320 V \nvl3=200 V");
```

Scilab code Exa 7.21 Network Equilibrium Equation

```
//Graph Theory : example 7.22 :(pg 7.38 & 7.39)
printf("\ntwigs={1,2} \nf-cutset1={1,4} \nf-cutset2
    ={2,3}");
Q=[1 0 0 -1;0 1 -1 0];
printf("\nQ=");
```

```
disp(Q);
printf("\nThe KCL equation in matrix form is given
    by");
printf("\nQ.Yb.(Q^T).Vl=Q.Is-Q.Yb.Vs");
Yb=diag([0.25,0.5,0.25,0.5]);
Vs=[1;1;0;0];
Is=[0;0;0.5;-0.5];
printf("\nYb=");
disp(Yb);
printf("\n(Q^T)=");
disp(Q');
printf("\nVs=");
disp(Vs);
printf("\nIs=");
disp(Is);
x=(Q*Yb);
printf("\nQ.Yb=");
disp(x);
y=(x*Q');
printf("\nQ.Yb.(Q^T)=");
disp(y);
printf("\nQ.Is=");
u=(Q*Is);
disp(Q*Is);
z=(x*Vs);
printf("\nQ.Yb.Vs=");
disp(z);
v=(u-z);
printf("\nQ.Is-Q.Yb.Vs=");
disp(v);
printf("\nLoad voltages:");
M=[0.75 0;0 0.75];
P=inv(M);
N=[0.25;-1];
X=(P*N);
disp(X);
printf("\nvl1=0.33 V \nvl2=-1.33 V");
vl2=-1.33;
```

```
v=1+vl2;
printf("\nV=%.2f",v);
```

Chapter 8

Transient Analysis

Scilab code Exa 8.13 example13

```
//Transient analysis
//pg no - 8.17
//example no - 8.13
a=((10*30)/(10+30));
d=5/a;
b=0;
c=5*(20/30);
printf("iL(0-) = %.2f A", d);
printf("\nvb(0-) = %.f", b);
printf("\nva(0-) = %.2f V", c);
disp("Applying Kcl equations at t=0+");
disp("((va(0+)-5)/10)+(va(0+)/10)+(va(0+)-vb(0+))/20
    = 0");          //equation 1
disp("((vb(0+)-va(0+))/20)+((vb(0+)-5)/10)+(2/3) = 0
   ");              //equation 2
//solving 1 and 2
M=[0.25, -0.05; -0.05, 0.15];
N=[0.5, -0.167]';
O=inv(M);
X=O*N;
disp(X);
```

```
disp("va(0+)= 1.9 A");
disp("vb(0+)= -0.477 A");
```

Scilab code Exa 8.14 `example14`

```
//Transient analysis
//pg no - 8.17
//example no - 8.13
disp("va(0+) = 5V");
disp("vb(0+) = 5V");
disp("vb(0+) = 5V");
disp("Writing KCL Equation at t=0+");
disp("0.25*va(0+) = 0.75");
x=(0.75)/(0.25);
printf("va(0+) = %.f V", x);
```

Chapter 10

Network Functions

Scilab code Exa 10.35 Determination of Residue

```
// Network Functions : example 10.35 : (pg 10.35)
m=(2/(sqrt(2)*sqrt(10)));
a=90;
x=(a-atand(3)-atand(1));
printf("\nF(s) =(4s/s^2+2s+2) = 4s/(s+1-j)*(s+1-j)");
printf("\n At s=j2");
//pmag = phasor magnitudes
printf("\n|F(j2)|=Product of pmag from all zeros to j2/Product of pmag from all poles to j2");
printf("\n = %.3f",m);
printf("\nf(w) = atand(2/0)-atand(3)-atand(1)= %.2f degrees",x);
```

Scilab code Exa 10.36 Determination of Residue

```
// Network Functions : example 10.36 : (pg 10.35 & 10.36)
```

```
m=((5*sqrt(17))/(sqrt(20)*4));
a=90;
w=(atand(4)+atand(4/3)-(a)-atand(4/2));
printf("\nF(s) = (s+1)(s+3)/s(s+2))");
printf("\nAt s=j4");
//vmag = vector magnitudes
printf("\nPrduct of vmag from all zeros to j4/
    Product of vmag from all poles to j4");
printf("\n =%.2f",m);
printf("\nphi(w)= atand(4)+atand(4/3)-atand(4/0)-
    atand(4/2)");
printf("\n = %.2f degrees",w);
```

Chapter 11

Two Port Networks

Scilab code Exa 11.16 Two Port Parameters

```
//Two-Port Networks : example 11.16 :(pg11.39 )
V1s=25;
I1s=1;
I2s=2;
V1o=10;
V2o=50;
I2o=2;
h11=(V1s/I1s);
h21=(I2s/I1s);
h12=(V1o/V2o);
h22=(I2o/V2o);
printf("\nh11 = V1/I1 = %.f Ohm",h11);//when V2=0
printf("\nh21= I2/I1 = %.f",h21);//when V2=0
printf("\nh12 = V1/V2 = %.1f",h12);//when I1=0
printf("\nh22 = I2/V2 = %.2f mho",h22);//when I1=0
printf("\nth h-parameters are");
disp([h11 h12;h21 h22]);
```

Scilab code Exa 11.19 Interrelationships between parameters

```
//Two-Port Networks : example 11.19 :(pg11.49 & 11.50)
Z11=20;
Z22=30;
Z12=10;
Z21=10;
dZ=((Z11*Z22)-(Z12*Z21));
Y11=(Z22/dZ);
Y12=(-Z12/dZ);
Y21=(-Z21/dZ);
Y22=(Z11/dZ);
A=(Z11/Z21);
B=(dZ/Z21);
C=(1/Z21);
D=(Z22/Z21);
printf("\nY-parameters");
printf("\nY11 = Z22/dZ = %.2f mho",Y11);
printf("\nY12 = -Z12/dZ = %.2f mho",Y12);
printf("\nY21 = -Z21/dZ = %.2f mho",Y21);
printf("\nY22 = Z11/dZ = %.2f mho",Y22);
printf("\n Y-parameters are:");
disp([Y11 Y12;Y21 Y22]);//Y-parameters in matrix form
printf("\nABCD parameters");
printf("\nA = Z11/Z21 = %.f",A);
printf("\nB = dZ/Z21 = %.f",B);
printf("\nC = 1/Z21 = %.1f",C);
printf("\nD = Z22/Z21 = %.f",D);
printf("\n ABCD parameters are:");
disp([A B;C D]);//ABCD parameters in matrix form
```

Scilab code Exa 11.20 Interrelationships between parameters

```
//Two-Port Networks : example 11.20 :(pg11.50 & 11.51)
```

```
a=0.5;
b=-0.2;
d=1
printf("\nI1 =0.5V1-0.2V2 \nI2=-0.2V1+V2");
printf("\n Y11 =I1/V1 =%.1f mho",a);//when V2 is 0 in the 1st eqn
printf("\n Y21 =I2/V1 =%.1f mho",b);//when V2 is 0 in the 1st eqn
printf("\n Y12 =I1/V2 =%.1f mho",b);//when V1 is 0 in the 2nd eqn
printf("\n Y22 =I2/V2 =%.f mho",d);//when V1 is 0 in the 2nd eqn
printf("\nY-parameters are");
disp([a b;b d]);
dY=((a*d)-(b*b));
Z11=(d/dY);
Z12=(-b/dY);
Z21=(-b/dY);
Z22=(a/dY);
A=(-d/b);
C=(-dY/b);
D=(-a/b);
printf("\ndY=Y11.Y22-Y12.Y21 =%.2f",dY);
printf("\nZ11 = Y22/dY = %.3f Ohm",Z11);
printf("\nZ12 = -Y12/dY = %.3f Ohm",Z12);
printf("\nZ21 = -Y21/-dY = %.3f Ohm",Z21);
printf("\nZ22 = Y11/dY = %.3f Ohm",Z22);
printf("\nZ-parameters :");
disp([Z11 Z12;Z21 Z22]);
printf("\nA =-Y22/Y21 =%.f",A);
printf("\nB = -1/Y21 =%.f",A);
printf("\nC = -dY/Y21 =%.1f",C);
printf("\nD = -Y11/Y21 =%.1f",D);
printf("\nABCD parameters :");
disp([A A;C D]);
```

Scilab code Exa 11.22 Interrelationships between parameters

```
//Two-Port Networks : example 11.22 :(pg11.52 &
    11.53)
printf("\nApplying KVL to Mesh 1 \nV1 = I1 - I3 - -
    - -(i)");
printf("\nApplying KVL to Mesh 2 \nV2 = -4I2 + 2I3 -
     - - -(ii)");
printf("\nApplying KVL to Mesh 3 \nI3 = (1/5)I1 +
    (4/5)I2 - - - -(iii)");
//substituting (iii) in (i) & (ii),we get
printf("\nV1 = (4/5)I1 - (4/5)I2 \nV2 = (2/5)I1 -
    (12/5)I2");
printf("\nZ-parameters:");
a=4/5;b=-4/5;c=2/5;d=-12/5;
disp([a b;c d]);
dZ=(a*d)-(b*c);
Y11=(d/dZ);
Y12=(-b/dZ);
Y21=(-c/dZ);
Y22=(a/dZ);
printf("\nY-parameters are:");
printf("\ndZ = Z11.Z22 - Z12.Z21 = %.1f",dZ);
printf("\nY11 = Z22/dZ = %.1f mho",Y11);
printf("\nY12 = -Z12/dY = %.1f mho",Y12);
printf("\nY21 = -Z21/-dY = %.1f mho",Y21);
printf("\nY22 = Z11/dY = %.1f mho",Y22);
disp([Y11 Y12;Y21 Y22]);
```

Scilab code Exa 11.23 Interrelationships between parameters

```
//Two-Port Networks : example 11.23 :(pg11.53 &
    11.54)
printf("\nApplying KVL to Mesh 1 \nV1 = 4I1 - 2I3 -
    - - -(i)");
printf("\nApplying KVL to Mesh 2 \nV2 = 4I2 + 2I3 -
    - - -(ii)");
printf("\nApplying KVL to Mesh 3 \n-2I3 = I1 + I2 -
    - - -(iii)");
//substituting (iii) in (i) & (ii),we get
printf("\nV1 = 5I1 + I2 \nV2 = -I1 + 3I2");
printf("\nZ-parameters:");
a=5;b=1;c=-1;d=3;
disp([a b;c d]);
dZ=(a*d)-(b*c);
h11=(dZ/d);
h12=(b/d);
h21=(-c/d);
h22=(1/d);
printf("\ndZ = Z11.Z22 - Z12.Z21 = %.1f",dZ);
printf("\nh11 = dZ/Z22 = %.1f ",h11);
printf("\nh12 = Z12/Z22 = %.1f ",h12);
printf("\nh21 = -Z21/Z22 = %.1f ",h21);
printf("\nh22 = 1/Z22 = %.1f ",h22);
printf("\nh-parameters are:");
disp([h11 h12;h21 h22]);
```

Scilab code Exa 11.24 Interrelationships between parameters

```
//Two-Port Networks : example 11.24 :(pg11.54 &
    11.55)
printf("\nApplying KCL to Node 3 \nV3 = V2/3 - - -
    -(i)");
printf("\nI1 = 2V1 - (2/3)V2 - - - -(ii)");
printf("\nI2 = 3V2 - (V2/3) = (8/3)V2 - - - -(iii)")
    ;
```

```
//Comparing (iii) & (ii) ,we get
printf("\nY-parameters:");
a=2;b=(-2/3);c=0;d=(8/3);
disp([a b;b d]);
dY=((a*d)-(b*c));
Z11=(d/dY);
Z12=(-b/dY);
Z21=(c/dY);
Z22=(a/dY);
printf("\ndY=Y11.Y22-Y12.Y21 =%.1f",dY);
printf("\nZ11 = Y22/dY = %.1f Ohm",Z11);
printf("\nZ12 = -Y12/dY = %.1f Ohm",Z12);
printf("\nZ21 = -Y21/-dY = %.f Ohm",Z21);
printf("\nZ22 = Y11/dY = %.1f Ohm",Z22);
printf("\nZ-parameters :");
disp([Z11 Z12;Z21 Z22]);
```

Scilab code Exa 11.25 Interrelationships between parameters

```
//Two-Port Networks : example 11.25 :(pg11.55 & 11.56)
printf("\nApplying KCL to Node 1 \nI1 = (-3/2)V1 - V2- - -(i)");
printf("\nApplying KCL to Node 2 \nI2 = 2V1 + 2V2 - - - -(ii)");
//observing (i) & (ii)
printf("\nY-parameters:");
a=(-3/2);b=(-1);c=2;d=2;
disp([a b;c d]);
dY=((a*d)-(b*c));
Z11=(d/dY);
Z12=(-b/dY);
Z21=(-c/dY);
Z22=(a/dY);
printf("\ndY=Y11.Y22-Y12.Y21 =%.f",dY);
```

```
printf("\nZ11 = Y22/dY = %.f Ohm",Z11);
printf("\nZ12 = -Y12/dY = %.f Ohm",Z12);
printf("\nZ21 = -Y21/-dY = %.f Ohm",Z21);
printf("\nZ22 = Y11/dY = %.1f Ohm",Z22);
printf("\nZ-parameters :");
disp([Z11 Z12;Z21 Z22]);
```

Scilab code Exa 11.26 `Interrelationships between parameters`

```
//Two-Port Networks : example 11.22 :(pg11.52 &
    11.53)
printf("\nApplying KVL to Mesh 1 \nV1 = 2I1 + I2 - -
    - -(i)");
printf("\nApplying KVL to Mesh 2 \nV2 = 10I1 + 11I2
    - - - -(ii)");
//observing (i) & (ii)
printf("\nV1 = (4/5)I1 - (4/5)I2 \nV2 = (2/5)I1 -
    (12/5)I2");
printf("\nZ-parameters:");
a=2;b=1;c=10;d=11;
disp([a b;c d]);
dZ=(a*d)-(b*c);
Y11=(d/dZ);
Y12=(-b/dZ);
Y21=(-c/dZ);
Y22=(a/dZ);
printf("\nY-parameters are:");
printf("\ndZ = Z11.Z22 - Z12.Z21 = %.1f",dZ);
printf("\nY11 = Z22/dZ = %.1f mho",Y11);
printf("\nY12 = -Z12/dY = %.1f mho",Y12);
printf("\nY21 = -Z21/-dY = %.1f mho",Y21);
printf("\nY22 = Z11/dY = %.1f mho",Y22);
disp([Y11 Y12;Y21 Y22]);
h11=(dZ/d);
h12=(b/d);
```

```
h21=(-c/d);
h22=(1/d);
printf("\ndZ = Z11.Z22 - Z12.Z21 = %.1f",dZ);
printf("\nh11 = dZ/Z22 = %.1f Ohm ",h11);
printf("\nh12 = Z12/Z22 = %.1f ",h12);
printf("\nh21 = -Z21/Z22 = %.1f ",h21);
printf("\nh22 = 1/Z22 = %.1f mho",h22);
printf("\nh-parameters are:");
disp([h11 h12;h21 h22]);
```

Scilab code Exa 11.27 Interrelationships between parameters

```
//Two-Port Networks : example 11.27 :(pg11.58)
printf("\nApplying KCL to Node 1 \nI1 = 4V1 - 3V2- - -(i)");
printf("\nApplying KCL to Node 2 \nI2 = -3V1 + 1.5V2 - - - -(ii)");
//observing (i) & (ii)
printf("\nY-parameters:");
a=4;b=(-3);c=(-3);d=1.5;
disp([a b;c d]);
dY=((a*d)-(b*c));
Z11=(d/dY);
Z12=(-b/dY);
Z21=(-c/dY);
Z22=(a/dY);
printf("\ndY=Y11.Y22-Y12.Y21 =%.f",dY);
printf("\nZ11 = Y22/dY = %.f Ohm",Z11);
printf("\nZ12 = -Y12/dY = %.f Ohm",Z12);
printf("\nZ21 = -Y21/-dY = %.f Ohm",Z21);
printf("\nZ22 = Y11/dY = %.1f Ohm",Z22);
printf("\nZ-parameters :");
disp([Z11 Z12;Z21 Z22]);
```

Scilab code Exa 11.28 Interrelationships between parameters

```
//Two-Port Networks : example 11.28 :(pg11.58 &
    11.59)
printf("\nApplying KCL to Node 1 \nI1 = 1.5V1 - 0.5
   V2- - -(i)");
printf("\nApplying KCL to Node 2 \nI2 = 4V1 - 0.5V2
   - - - -(ii)");
//observing (i) & (ii)
printf("\nY-parameters:");
a=1.5;b=(-0.5);c=(4);d=(-0.5);
disp([a b;c d]);
dY=((a*d)-(b*c));
Z11=(d/dY);
Z12=(-b/dY);
Z21=(-c/dY);
Z22=(a/dY);
printf("\ndY=Y11.Y22-Y12.Y21 =%.f",dY);
printf("\nZ11 = Y22/dY = %.f Ohm",Z11);
printf("\nZ12 = -Y12/dY = %.f Ohm",Z12);
printf("\nZ21 = -Y21/-dY = %.f Ohm",Z21);
printf("\nZ22 = Y11/dY = %.1f Ohm",Z22);
printf("\nZ-parameters :");
disp([Z11 Z12;Z21 Z22]);
```

Scilab code Exa 11.29 Interrelationships between parameters

```
//Two-Port Networks : example 11.29 :(pg11.59 &
    11.60)
printf("\nApplying KCL to Node 1 \nI1 = 3V1 - 2V2- -
     -(i)");
```

```
printf("\nApplying KCL to Node 2 \nI2 = 3V2 - V3 - - - -(ii)");
printf("\nApplying KCL to Node 3 \nV3 = (1/3)V2 - - - -(ii)");
//substituting (iii) in (i) & (ii),we get
printf("\nI1 = 3V1 - (2/3)V2 \nI2 = 0V1 + (8/3)V2");
printf("\nY-parameters:");
a=3;b=(-2/3);c=(0);d=(8/3);
disp([a b;c d]);
dY=((a*d)-(b*c));
Z11=(d/dY);
Z12=(-b/dY);
Z21=(c/dY);
Z22=(a/dY);
printf("\ndY=Y11.Y22-Y12.Y21 =%.f",dY);
printf("\nZ11 = Y22/dY = %.1f Ohm",Z11);
printf("\nZ12 = -Y12/dY = %.1f Ohm",Z12);
printf("\nZ21 = -Y21/-dY = %.f Ohm",Z21);
printf("\nZ22 = Y11/dY = %.1f Ohm",Z22);
printf("\nZ-parameters :");
disp([Z11 Z12;Z21 Z22]);
```

Scilab code Exa 11.30 Interrelationships between parameters

```
//Two-Port Networks : example 11.30 :(pg11.60 & 11.561)
printf("\nApplying KVL to Mesh 1 \nV1 = 4I1 + (0.05)I2 - - - -(i)");
printf("\nApplying KVL to Mesh 2 \nV2 = 2I1 - 10I2 - - - -(ii)");
//substituting (i) in (ii),
printf("\nV2 = -40I1 + (1.5)I2");
printf("\nZ-parameters:");
a=4;b=0.05;c=-40;d=1.5;
disp([a b;c d]);
```

```
dZ=(a*d)-(b*c);
Y11=(d/dZ);
Y12=(b/dZ);
Y21=(-c/dZ);
Y22=(a/dZ);
printf("\nY−parameters are:");
printf("\ndZ = Z11.Z22 − Z12.Z21 = %.1f",dZ);
printf("\nY11 = Z22/dZ = %.1f mho",Y11);
printf("\nY12 = −Z12/dY = %.f mho",Y12);
printf("\nY21 = −Z21/−dY = %.1f mho",Y21);
printf("\nY22 = Z11/dY = %.1f mho",Y22);
disp([Y11 Y12;Y21 Y22]);
```

Scilab code Exa 11.31 Interrelationships between parameters

```
//Two−Port Networks : example 11.31 :(pg11.61 &
    11.62)
printf("\nApplying KVL to Mesh 1 \nV1 = 3I1 + 5I2 −
    − − −(i)");
printf("\nApplying KVL to Mesh 2 \nV2 = 2I1 + 4I2 −
    2I3 − − − −(ii)");
printf("\nApplying KVL to Mesh 3 \nI3 = 2V3 − − − −(
    iii)");
//substituting (iii) in (i) & (ii),we get
printf("\n2V3 = 4I1 + 4I2 \nV2 = −6I1 + 4I2");
printf("\nZ−parameters:");
a=3;b=5;c=-6;d=-4;
disp([a b;c d]);
dZ=(a*d)-(b*c);
Y11=(d/dZ);
Y12=(-b/dZ);
Y21=(-c/dZ);
Y22=(a/dZ);
printf("\nY−parameters are:");
printf("\ndZ = Z11.Z22 − Z12.Z21 = %.1f",dZ);
```

```
printf("\nY11 = Z22/dZ = %.1f mho",Y11);
printf("\nY12 = -Z12/dY = %.1f mho",Y12);
printf("\nY21 = -Z21/-dY = %.1f mho",Y21);
printf("\nY22 = Z11/dY = %.1f mho",Y22);
disp([Y11 Y12;Y21 Y22]);
```

Chapter 12

Network Synthesis

Scilab code Exa 12.2 Hurwitz Polynomials

```
// Network Synthesis : example 12.2 : (pg 12.2)
s=poly(0,'s');
p1=((s^4)+(5*(s)^2)+4);
p2=((s^3)+(3*s));
[r,q]=pdiv(p1,p2);
[r1,q1]=pdiv(p2,r);
[r2,q2]=pdiv(r,r1);
[r3,q3]=pdiv(r1,r2);
printf("\nEven part of P(s) = (s^4)+(5s^3)+4");
printf("\nOdd part of P(s) = (s^3)+(3s)");
printf("\nQ(s)= m(s)/n(s)");
// values of quotients in continued fraction
   expansion
disp(q);
disp(q1);
disp(q2);
disp(q3);
printf("\nSince all the quotient terms are positive,
    P(s) is hurwitz");
```

Scilab code Exa 12.3 `Hurwitz Polynomial`

```
// Network Synthesis : example 12.3 : (pg 12.2 &
    12.3)
s=poly(0,'s');
p1=((s^3)+(5*(s)));
p2=((4*s^2)+(2));
[r,q]=pdiv(p1,p2);
[r1,q1]=pdiv(p2,r);
[r2,q2]=pdiv(r,r1);
printf("\nEven part of P(s) = ((4*s^2)+(2))");
printf("\nOdd part of P(s) = ((s^3)+(5*(s)))");
printf("\nQ(s)= n(s)/m(s)");
// values of quotients in continued fraction
    expansion
disp(q);
disp(q1);
disp(q2);
printf("\nSince all the quotient terms are positive,
    P(s) is hurwitz");
```

Scilab code Exa 12.4 `Hurwitz Polynomials`

```
// Network Synthesis : example 12.4 : (pg 12.3)
s=poly(0,'s');
p1=((s^4)+(3*(s)^2)+12);
p2=((s^3)+(2*s));
[r,q]=pdiv(p1,p2);
[r1,q1]=pdiv(p2,r);
[r2,q2]=pdiv(r,r1);
[r3,q3]=pdiv(r1,r2);
```

```
printf("\nEven part of P(s) = ((s^4)+(3*(s)^2)+12)");
printf("\nOdd part of P(s) = ((s^3)+(2*s))");
printf("\nQ(s)= m(s)/n(s)");
// values of quotients in continued fraction expansion
disp(q);
disp(q1);
disp(q2);
disp(q3);
printf("\nSince two quotient terms are negative, P(s) is  not hurwitz");
```

Scilab code Exa 12.5 `Hurwitz Polynomials`

```
// Network Synthesis : example 12.5 : (pg 12.3 & 12.4)
s=poly(0,'s');
p1=((s^4)+(2*(s)^2)+2);
p2=((s^3)+(3*s));
[r,q]=pdiv(p1,p2);
[r1,q1]=pdiv(p2,r);
[r2,q2]=pdiv(r,r1);
[r3,q3]=pdiv(r1,r2);
printf("\nEven part of P(s) = ((s^4)+(2*(s)^2)+2)");
printf("\nOdd part of P(s) = (s^3)+(3s)");
printf("\nQ(s)= m(s)/n(s)");
// values of quotients in continued fraction expansion
disp(q);
disp(q1);
disp(q2);
disp(q3);
printf("\nSince two terms are negative, P(s) is  not hurwitz");
```

Scilab code Exa 12.6 Hurwitz Polynomials

```
// Network Synthesis : example 12.6 : (pg 12.4)
s=poly(0,'s');
p1=((2*(s^4))+(6*(s)^2)+1);
p2=((5*(s^3))+(3*s));
[r,q]=pdiv(p1,p2);
[r1,q1]=pdiv(p2,r);
[r2,q2]=pdiv(r,r1);
[r3,q3]=pdiv(r1,r2);
printf("\nEven part of P(s) = ((2*s^4)+(6*(s)^2)+1)"
   );
printf("\nOdd part of P(s) = ((5*s^3)+(3*s))");
printf("\nQ(s)= m(s)/n(s)");
// values of quotients in continued fraction
   expansion
disp(q);
disp(q1);
disp(q2);
disp(q3);
printf("\nSince all the quotient terms are positive,
    P(s) is hurwitz");
```

Scilab code Exa 12.7 Hurwitz Polynomials

```
// Network Synthesis : example 12.7 : (pg 12.4 &
   12.5)
s=poly(0,'s');
p1=((s^4)+(6*(s)^2)+8);
p2=(7*(s^3)+(21*s));
[r,q]=pdiv(p1,p2);
```

```
[r1,q1]=pdiv(p2,r);
[r2,q2]=pdiv(r,r1);
[r3,q3]=pdiv(r1,r2);
printf("\nEven part of P(s) = ((s^4)+(6*(s)^2)+8)");
printf("\nOdd part of P(s) = (7*(s^3)+(21*s))");
printf("\nQ(s)= m(s)/n(s)");
// values of quotients in continued fraction
   expansion
disp(q);
disp(q1);
disp(q2);
disp(q3);
printf("\nSince all the quotient terms are positive,
    P(s) is hurwitz");
```

Scilab code Exa 12.8 Hurwitz Polynomials

```
// Network Synthesis : example 12.8 : (pg 12.5)
s=poly(0,'s');
p1=((s^4)+(5*(s)^2)+10);
p2=(5*(s^3)+(4*s));
[r,q]=pdiv(p1,p2);
[r1,q1]=pdiv(p2,r);
[r2,q2]=pdiv(r,r1);
[r3,q3]=pdiv(r1,r2);
printf("\nEven part of P(s) = ((s^4)+(5*(s)^2)+10)")
   ;
printf("\nOdd part of P(s) = (5*(s^3)+(4*s))");
printf("\nQ(s)= m(s)/n(s)");
// values of quotients in continued fraction
   expansion
disp(q);
disp(q1);
disp(q2);
disp(q3);
```

```
printf("\nSince two terms are negative, P(s) is not
    hurwitz");
```

Scilab code Exa 12.9 Hurwitz Polynomials

```
// Network Synthesis : example 12.9 : (pg 12.6)
s=poly(0,'s');
p1=((s^5)+(3*(s^3))+(2*s));
p2=((5*(s^4))+9*(s^2)+2);
[r,q]=pdiv(p1,p2);
[r1,q1]=pdiv(p2,r);
[r2,q2]=pdiv(r,r1);
[r3,q3]=pdiv(r1,r2);
[r4,q4]=pdiv(r2,r3);
printf("\n P(s) = ((s^5)+(3*(s^3))+(2*s))");
printf("\n d/ds.P(s)= ((5*(s^4))+9*(s^2)+2)");
printf("\nQ(s)=P(s)/d/ds.P(s)");
// values of quotients in continued fraction
    expansion
disp(q);
disp(q1);
disp(q2);
disp(q3);
disp(q4);
printf("\nSince all the quotient terms are positive,
     P(s) is hurwitz");
```

Scilab code Exa 12.10 Hurwitz Polynomials

```
// Network Synthesis : example 12.10 : (pg 12.6 &
    12.7)
s=poly(0,'s');
p1=((s^5)+((s^3))+(s));
```

```
p2=((5*(s^4))+3*(s^2)+1);
[r,q]=pdiv(p1,p2);
[r1,q1]=pdiv(p2,r);
[r2,q2]=pdiv(r,r1);
[r3,q3]=pdiv(r1,r2);
[r4,q4]=pdiv(r2,r3);
printf("\n P(s) = ((s^5)+((s^3))+(s))");
printf("\n d/ds.P(s)= ((5*(s^4))+3*(s^2)+1)");
printf("\nQ(s)=P(s)/d/ds.P(s)");
// values of quotients in continued fraction expansion
disp(q);
disp(q1);
disp(q2);
disp(q3);
disp(q4);
printf("\nSince two quotient terms are negative, P(s) is not hurwitz");
```