Scilab Manual for
POWER SYSTEM
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Contents

List of Experiments

List of Figures

Experiment: 1

To Calculate the performance parameters for a short transmission line for a specific given quantities.

Scilab code Solution 1.1 To Calculate the performance parameters for a short transmission line for a specific given quantities

```
//To Calculate the performance parameters for a
   short transmission line for a specific given
   quantities.
// A single phase overhead transmission line
   delivers 1100kW at 33kV at 0.8 pf lagging.The
   total resistance and inductive reactance of the
   line are 10ohm and 15 ohm respectively. Determine
    i) Sending end voltage ii)Sending end power
   factor iii)efficiency
//Windows 10
//5.4.1
//
```

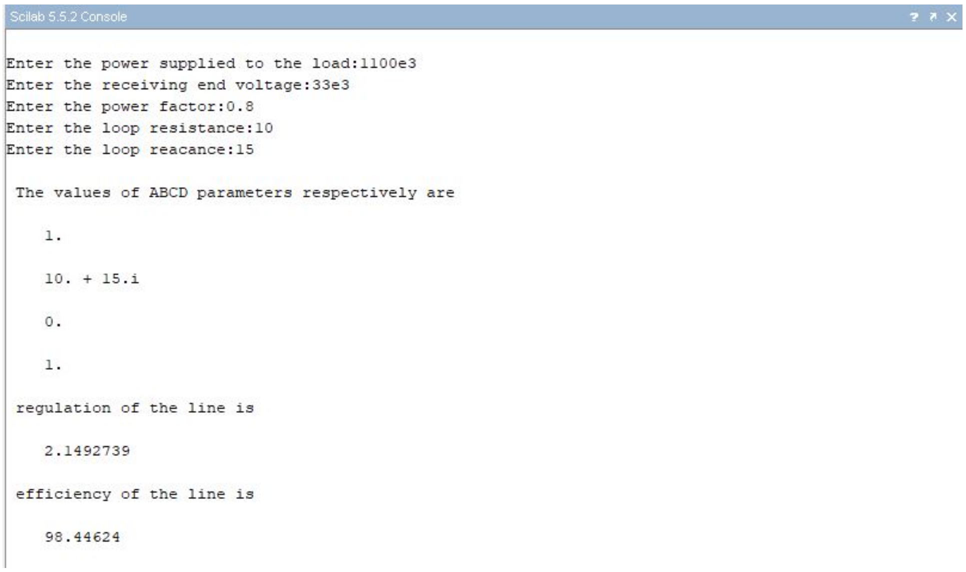


Figure 1.1: To Calculate the performance parameters for a short transmission line for a specific given quantities

```
clc;
clear;
sup=input('Enter the power supplied to the load:');
vr=input('Enter the receiving end voltage:');
cosphi=input('Enter the power factor:');
sinphi=sin(acos(cosphi));
r=input('Enter the loop resistance:');
xl=input('Enter the loop reacance:');
z= r+%i*xl;
A=1;
B=z;
C=0;
D=A;
disp(D,C,B,A,'The values of ABCD parameters
    respectively are');
ir=(sup/(vr*cosphi));
irv=ir*(cosphi-%i*sinphi);
vsph=(A*vr+B*irv);
vsh=abs(vsph);
```

```
reg=((abs(vsh/A)-abs(vr))/vr)*100;
disp(reg,'regulation of the line is');
loss=((abs(ir))^2*r);
output=sup+loss;
eff=(sup/output)*100;
disp(eff,'efficiency of the line is');
```

Experiment: 2

To Calculate the performance parameters for a medium T-network transmission line for a specific given quantities.

Scilab code Solution 2.2 To Calculate the performance parameters for a medium T network transmission line for a specific given quantities

```
//To Calculate the performance parameters for a
   medium T—network transmission line for a specific
    given quantities
// Determine efficiency and regulation of 3 phase
   100km 50 hz, transmission line delivering 20 MW
   at a pf of 0.8 lagging and 66 kV to a balance
   load.The conductors are copper each having
   resistance 0.1 ohm per km, 1.5 cm outside dia,
   spaced equilaterally 2 mts between centres.
   Neglect leakage and use Nominal T method. ( C L
   Wadhwa, Ch—4 ex.4.5)
//Windows 10
```

```
enter the value of recieving end voltage66e3
enter the supply power20e6
enter the power factor0.8

 receiving end current magnitude

    218.95253
enter the resistance10
enter the reactance35.1
enter the capcitive susceptance0.9954e-6

 sending end current

    210.82874

 sending end voltage

    44551.269

 powerfactor sendingend

    0.7606371

 input power is

    21433280.

 efficiency is

    93.312829

 regulation of the line is

    16.778328
```

Figure 2.1: To Calculate the performance parameters for a medium T network transmission line for a specific given quantities

```
//5.5.2
clc;
clear;
vr=input('enter the value of recieving end voltage')
    ;
vrph=vr/1.73;
p=input('enter the supply power');
pf=input('enter the power factor');
spf=sin(acos(pf));
ir=p/(1.73*vr*pf);
disp(ir,'receiving end current magnitude');
spf=sin(acos(pf));
r=input('enter the resistance');
xl=input('enter the reactance');
xc=input('enter the capcitive susceptance');
z=r+%i*xl;
imp2=z/2
ad=%i*(314*xc);
irv=ir*(pf-%i*spf);
v1=vrph+(irv*imp2);
ic=ad*v1;
is=ic+irv;
isa=abs(is);
disp(isa,'sending end current');
vs=v1+(is*(z/2));
vsh=abs(vs);
disp(vsh,'sending end voltage');
e=phasemag(vs);
f=phasemag(is);
os=e-f;
pfs=cosd(os);
disp(pfs, 'powerfactor sendingend');
op=3*vsh*pfs*isa;
disp(op, 'input power is');
eff=(p/op)*100;
disp(eff,'efficiency is');
reg=((vsh-vrph)/vrph)*100;
disp(reg,'regulation of the line is');
```

Experiment: 3

To Calculate the performance parameters for a medium pi-network transmission line for a specific given quantities.

Scilab code Solution 3.3 To Calculate the performance parameters for a medium pi network transmission line for a specific given quantities

```
//Windows 10
//5.5.2
//To Calculate the performance parameters for a
   medium pi- network transmission line for a
   specific given quantities.
// A 3 phase  50Hz, 150km line has a resistance ,
   inductive reactance and capacitive shunt
   admittance of 0.1,0.5, and 3e-6 S per km. If the
   line delivers 50MW at 110kV and 0.8 pf determine
   Volatge regulation & efficiency of line using pi
   method.
clc;
```

```
Enter the power supplied to the load:50e6
enter the receiving end volatge:110e3
Enter the power factor:0.8
Enter the resistance per phase0.1
Enter the inductive reactance per phase0.5
Enter the shunt admittance value:3e-6
Enter the length of line150

 sending end voltage

    82885.561

 Sending end current is

    306.38482

 Regulation of the line is

    30.510912

 efficiency of the line is

    91.57757
```

Figure 3.1: To Calculate the performance parameters for a medium pi network transmission line for a specific given quantities

```
clear;
pl=input('Enter the power supplied to the load:');
vr=input('enter the receiving end volatge:');
pf=input('Enter the power factor:');
spf=sin(acos(pf));
r=input('Enter the resistance per phase');
xl=input('Enter the inductive reactance per phase');
y=input('Enter the shunt admittance value:');
lg=input('Enter the length of line');
R=r*lg;
Xl=xl*lg;
Z=R+%i*Xl;
Y=y*lg;
Y1=Y/2;
vrph=vr/sqrt(3);
ir=pl/(sqrt(3)*vr*pf);
irv=ir*(pf-%i*spf);
ic1=vrph*Y1;
il=irv+%i*ic1;
ilz=il*Z;
vsph=vrph+(il*Z);
vsh=abs(vsph);
disp(vsh,'sending end voltage');
ic2=vsph*Y1;
Is=il+(%i*ic2);
Ish=abs(Is);
disp(Ish,'Sending end current is');
reg=((abs(vsh)-abs(vrph))/vrph)*100;
disp(reg,'Regulation of the line is');
e=phasemag(vsph);
f=phasemag(Is);
phis=e-f;
cosine=cosd(phis);
inppl=3*vsh*Ish*cosine;
eff=(pl/inppl)*100;
disp(eff,'efficiency of the line is');
```

Experiment: 4

To Calculate the performance parameters for a medium T-network transmission line using ABCD parameters.

Scilab code Solution 4.4 To Calculate the performance parameters for a medium T network transmission line using ABCD parameters

```
//To Calculate the performance parameters for a
   medium T-network transmission line using ABCD
   parameters.
// A 3phase 50Hz overhaed transmission line 100 km
   long has the following constants ; r=0.1 ohm/km/
   phase ;xl=0.2/km/phase;xc=0.04e-4 siemen.
   Determine i)Sending end voltage ii) sending end
   power factor iii) transmission efficiency when
   supplying a balnced load of 10000kW at 66kV, pf
   0.8 lagging using nominal T method.
//Windows 10
//5.5.2
```

```
Enter the power supplied to the load:10000e3
enter the receiving end volatge:66e3
Enter rhe power factor:0.8
Enter the series impedance value of single conductor:10+%i*20
Enter the shunt admittance value:0.04e-4

 The values of ABCD parameters respectively are

    1.00002 + 0.00004i

    9.9997 + 20.0004i

    0.000004

    1.00002 + 0.00004i

 Regulation of the line is

    5.7781376

 efficiency of the line is

    96.537204
```

Figure 4.1: To Calculate the performance parameters for a medium T network transmission line using ABCD parameters

```
clc;
clear;
pl=input('Enter the power supplied to the load:');
vr=input('enter the receiving end volatge:');
pf=input('Enter rhe power factor:');
spf=sin(acos(pf));
z=input('Enter the series impedance value of single conductor:');
r=real(z);
y=input('Enter the shunt admittance value:');
e=((z*y)/2);
a=(1+e);
b=z*(1+e/2);
c=y;
d=a;
disp(d,c,b,a,'The values of ABCD parameters respectively are');
vrph=vr/sqrt(3);
ir=pl/(sqrt(3)*vr*pf);
irv=ir*(pf-%i*spf);
vsph=(a*vrph+b*irv);
vsh=abs(vsph);
reg=((abs(vsh/a)-abs(vrph))/vrph)*100;
disp(reg,'Regulation of the line is');
loss= 3*(ir^2)*r;
inppl=pl+loss;
eff=(pl/inppl)*100;
disp(eff,'efficiency of the line is');
```

Experiment: 5

To Calculate the performance parameters for a medium pi-network transmission line using ABCD parameters.

Scilab code Solution 5.5 To Calculate the performance parameters for a medium pi network transmission line using ABCD parameters

```
// A 100 km long line  3 phase 50 Hz transmisison
   line has following line constants r/phase/km =0.1
    ohm; xl/km/phase = 0.5 ohm; Sussceptance/phase/
   km =10e-6. If the line supplies load of 20MW at
   0.9 pf lagging at 66kV at the receving end,
   calculate by nominal pi method i) sending end
   power factor, ii)regulation iii) transmission
   efficiency
//Windows 10
//5.5.2

clc;
```

```
Enter the power supplied to the load:20e6
enter the receiving end volatge:66e3
Enter rhe power factor:0.9
Enter the series impedance value of single conductor:10+%i*50
Enter the shunt admittance value:10e-4

 The values of ABCD parameters respectively are

    1.005 + 0.025i

    10. + 50.i

    0.0010025 + 0.0000125i

    1.005 + 0.025i

 The value of Vs is

    45158.204

 Regulation of the line is

    17.883484

 efficiency of the line is

    94.635711
```

Figure 5.1: To Calculate the performance parameters for a medium pi network transmission line using ABCD parameters

```
clear;
pl=input('Enter the power supplied to the load:');
vr=input('enter the receiving end volatge:');
pf=input('Enter rhe power factor:');
spf=sin(acos(pf));
z=input('Enter the series impedance value of single conductor:');
r=real(z);
y=input('Enter the shunt admittance value:');
e=((z*y)/2);
a=(1+e);
b=z;
c=y*(1+e/2);
d=a;
disp(d,c,b,a,'The values of ABCD parameters respectively are');
vrph=vr/sqrt(3);
ir=pl/(sqrt(3)*vr*pf);
irv=ir*(pf-%i*spf);
vsph=(a*vrph+b*irv);
vsh=abs(vsph);
disp(abs(vsph),'The value of Vs is');
reg=((abs(vsh/a)-abs(vrph))/vrph)*100;
disp(reg,'Regulation of the line is');
loss= 3*(ir^2)*r;
inppl=pl+loss;
eff=(pl/inppl)*100;
disp(eff,'efficiency of the line is');
```

Experiment: 6

To Calculate the performance parameters for a Long transmission line using rigorous method solution.

Scilab code Solution 6.6 To Calculate the performance parameters for a Long transmission line using rigorous method solution

```
//Windows 10
//5.5.2
//To Calculate the performance parameters for a Long
    transmission line using rigorous method solution
   .
//Given r=0.2 per km,L=1.3mH per km, C=0.01
   microfarad ,power factor =0.8, length of line =120
    km, recivening end power=40MW, receiving end
   voltage =132kV. Calculate efficiency of line using
    rigrous solution.
clear;
clc;
```

```
Zc=

   370.65158 - 85.922023i

sending end voltage

   86602.848 - 11007.334i

Sending end current

   228.26796 + 23.218333i

   60072683. - 1505543.8i

efficiency of line is

   66.565103
```

Figure 6.1: To Calculate the performance parameters for a Long transmission line using rigorous method solution

```
R=0.2;
L=1.3e-3;
C=0.01e-6;
z=R+%i*L*314;
y=%i*314*C;
cimp=(z/y);
Zc=sqrt(cimp);
disp(Zc,'Zc=');
adm=y*z;
Y=sqrt(adm);
Yl=Y*120;
alpha=real(Yl);
Beta=imag(Yl);
Vr=(132*1000)/sqrt(3);
Ir=(40*1000)/(sqrt(3)*(132*0.8));
Irv=Ir*(0.8-%i*0.6);
Vsp=((Vr+Irv*Zc)/2)*exp(alpha)*exp(Beta);
Vsn=((Vr-Irv*Zc)/2)*exp(-alpha)*exp(-Beta);
Vs=Vsp+Vsn;
disp(Vs,'sending end voltage');
Is=(Vsp/Zc)+(Vsn/Zc);
disp(Is,'Sending end current');
spl=3*Vs*Is
disp(spl);
splm=abs(spl);
eff=(40*1000000/splm)*100;
disp(eff,'efficiency of line is');
```

Experiment: 7

To Calculate the performance parameters for a Long transmission line using ABCD parameters.

Scilab code Solution 7.7 To Calculate the performance parameters for a Long transmission line using ABCD parameters

```
//Windows 10
//5.5.2
//To Calculate the performance parameters for a Long
    transmission line using ABCD parameters.
//Given r=0.2 per km,L=1.3mH per km, C=0.01
   microfarad ,power factor =0.8, length of line =120
    km, recivening end power=40MW, receiving end
   voltage =132kV. Calculate efficiency of using ABCD
    parameters calcuation.
clear;
clc;
R=0.2;
```

```
The values of ABCD parameters respectively are

   0.9990772 + 0.0004520i

   23.985236 + 48.972549i

 - 5.678D-09 + 0.0000377i

   0.9990772 + 0.0004520i

the value of sending end voltage is

   86.762221 + 5.4551767i

the value of sending end current is

   174.85207 - 128.14509i

Regulation of the line is

   14.176127

efficiency of the line is

   70.750291
```

Figure 7.1: To Calculate the performance parameters for a Long transmission line using ABCD parameters

```
L=1.3e-3;
C=0.001e-6;
z=R+%i*L*314;
y=%i*314*C;
cimp=(z/y);
Zc=sqrt(cimp);
adm=y*z;
Y=sqrt(adm);
lg=120;
Vr=(132)/sqrt(3);
Ir=(40*1000)/(sqrt(3)*132*0.8);
cosine=cosh(Y*lg);
sine=sinh(Y*lg);
a=cosine;
b=Zc*sine;
c=((1/Zc)*sine);
d=a;
disp(d,c,b,a,'The values of ABCD parameters
    respectively are');
irv=Ir*(0.8-%i*0.6);
irvinKA=irv*10^-3;
vs=((a*Vr)+(b*irvinKA ));
disp(vs,'the value of sending end voltage is');
vsh=abs(vs);
is=c*Vr*1000+d*irv;
disp(is,'the value of sending end current is');
pis=polar(is);
reg=(((vsh/a)-abs(Vr))/Vr)*100;
mreg=abs(reg);
disp(mreg,'Regulation of the line is');
spl=3*vsh*is;
splab=abs(spl);
eff=(40*1000/splab)*100;
disp(eff,'efficiency of the line is');
```

Experiment: 8

Short circuit study of a balanced three phase system.

Scilab code Solution 8.8 Short circuit study of a balanced three phase system

```
//Short circuit study of a balanced three phase system
//Windows 10
//5.5.2
// A station operating at 33 kV is divided into sections A and B. Section A consists of three generators 15 MVA each having a reactance of 15% and section B is fed from the grid through a 75 MVA transformer of 8% reactance. The circuit breakers have each a rupturing capacity of 750 MVA. Determine the reactance of the reactor to prevent the breakers being overloaded if a symmetrical short circuit occurs on an outgoing feeder connected to A.

clear;
```

```
The base MVA of the system is75
The base kV of the system is33
The pu reactance of generator on its base is0.15
The base of generator original is15
The pu reactance of transformer on its base is0.08

 The value of reactor in pu is

    0.0870536

 The actual value of reactance of the reactor in pu is

    1.2640179
```

Figure 8.1: Short circuit study of a balanced three phase system

```
clc;
Sb=input('The base MVA of the system is');
bkv=input('The base kV of the system is');
greac=input('The pu reactance of generator on its base is');
bgen=input('The base of generator original is');
treac=input('The pu reactance of transformer on its base is');
Xpu=(greac*Sb)/bgen;
//The calculated value of X
X=9.75/112;
disp(X,'The value of reactor in pu is');
Xa=(X*(bkv^2))/Sb;
disp(Xa,'The actual value of reactance of the reactor in pu is');
```

Experiment: 9

Calculation of Symmetrical components of specified unbalanced system.

Scilab code Solution 9.9 Calculation of Symmetrical components of specified unbalanced system

```
//Windows 10
//5.5.2
//Calculation of Symmetrical components of specified
    unbalanced system.
//In a 3 phase 4 wire system the currents inR, Y and
    B lines are under abnormal condition of loading
    are as under: Ir=86.6+50j, Iy=25-43.3j,Ib=-30.
    Calculate positive negative and zero sequence
    currents in R line and return current in the
    neuatral wire.

clear;
clc;
Ir=input('enter the value of Ir');
```

```
enter the value of Ir86.6+%i*50
enter the value of Iy25-%i*43.3
enter the value of Ib-30+%i*0

 The Input values in RYB are

    86.6 + 50.i
    25. - 43.3i
  - 30.

    1.    1.                   1.
    1.  - 0.5 + 0.866i       - 0.499956 - 0.866i
    1.  - 0.499956 - 0.866i  - 0.5 + 0.866i

    0.3333236 - 5.551D-17i    0.3333382 + 5.551D-17i    0.3333382
    0.3333382 + 5.551D-17i  - 0.1666764 - 0.2886836i  - 0.1666618 + 0.2886836i
    0.3333382               - 0.1666618 + 0.2886836i  - 0.1666764 - 0.2886836i

 Values of symmetrical components of current are

    27.199129 + 2.2326327i
    17.200032 + 8.006403i
    42.200839 + 39.760964i

 Value of current in the neutral wire

    81.6 + 6.7i
```

Figure 9.1: Calculation of Symmetrical components of specified unbalanced system

```
Iy=input('enter the value of Iy');
Ib=input('enter the value of Ib');
a=-0.5+0.866*%i;
Iryb=[Ir;Iy;Ib];
disp(Iryb,'The Input values in RYB are');
A=[1 1 1;1 a a^2;1 a^2 a];
disp(A);
ainv=inv(A);
disp(ainv);
IA012=inv(A)*Iryb;
disp(IA012,'Values of symmetrical components of
    current are');
In=Ir+Iy+Ib;
disp(In,'Value of current in the neutral wire');
```

Experiment: 10

Calculation of fault current in Line to ground fault.

Scilab code Solution 10.10 Calculation of fault current in Line to ground fault

```
////Windows 10
//5.5.2
//Calculation of fault current in Line to ground
    fault.
//A 30 MVA, 13.8 kV, 3-phase alternator has a
    subtransient reactance of 15% and negative and
    zero sequence reactances of 15% and 5%
    respectively. The alternator supplies two motors
    over a transmission line having transformers at
    both ends as shown on the one-line diagram. The
    motors have rated inputs of 20 MVA and 10 MVA
    both 12.5 kV with 20% subtransient reactance and
    negative and zero sequence reactances are 20% and
     5% respectively. Current limiting reactors of
    2.0 ohms each are in the neutral of the
    alternator and the larger motor. The 3-phase
```

```
Enter the positve sequence , negative sequence and zero sequence of the generator in matrix form[0.15 0.15 0.995]
Enter the positve sequence , negative sequence and zero sequence of the Motor 1 in matrix form[0.492 0.492 1.006]
Enter the positve sequence , negative sequence and zero sequence of the Motor 2 in matrix form[0.246 0.246 0.123]
Enter the positve sequence , negative sequence and zero sequence of the transformer 1 in matrix form[0.0784 0.0784 0.0784]
Enter the positve sequence , negative sequence and zero sequence of the transformer 2 in matrix form[0.0784 0.0784 0.0784]
Enter the positve sequence , negative sequence and zero sequence of the transmission line in matrix form[0.167 0.167 0.416]
Enter the value of base KVA30000
Enter the value of base KV13.8

 equivalent value of P,N,Z of system is

   0.6378

   0.6378

   1.6773996

 The fault current in amperes is

   1275.1232
```

Figure 10.1: Calculation of fault current in Line to ground fault

```
   transformers are both rated 35 MVA, 13.2    -115Y
    kV with leakage reactance of 10%. Series
   reactance of the line is 80 ohms. The zero
   sequence reactance of the line is 200 ohms.
   Determine the fault current when (i) L-G (ii) L-L
   , and (iii) L-L-G fault takes place at point P.
   Assume Vf = 120 kV.//
clc ;
clear;
G=input('Enter the positve sequence , negative
   sequence and zero sequence of the generator in
   matrix form');
PG=G(:,1);
NG=G(:,2);
ZG=G(:,3);
M1=input('Enter the positve sequence , negative
   sequence and zero sequence of the Motor 1 in
   matrix form');
PM1=M1(:,1);
NM1=M1(:,2);
ZM1=M1(:,3);
M2=input('Enter the positve sequence , negative
   sequence and zero sequence of the Motor 2 in
   matrix form');
PM2=M2(:,1);
```

```
NM2=M2(:,2);
ZM2=M2(:,3);
T1=input('Enter the positve sequence , negative
   sequence and zero sequence of the transformer 1
   in matrix form');
PT1=T1(:,1);
NT1=T1(:,2);
ZT1=T1(:,3);
T2=input('Enter the positve sequence , negative
   sequence and zero sequence of the transformer 2
   in matrix form');
PT2=T2(:,1);
NT2=T2(:,2);
ZT2=T2(:,3);
L=input('Enter the positve sequence , negative
   sequence and zero sequence of the transmission
   line in matrix form');
PL=L(:,1);
NL=L(:,2);
ZL=L(:,3);
KVAB=input('Enter the value of base KVA');
KVB=input('Enter the value of base KV');
IB=KVAB/(KVB*1.732);
P=PG+PT1+PL+PT2+((PM1*PM2)/(PM1+PM2));
N=NG+NT1+NL+NT2+((NM1*NM2)/(NM1+NM2));
Z=ZG+ZT1+ZL+ZT2+((ZM1*ZM2)/(ZM1+ZM2));
disp(Z,N,P,'equivalent value of P,N,Z of system is')
   ;
IF=3/(P+N+Z);
FAULTCURRENT=IF*IB;
disp(FAULTCURRENT ,'The fault current in amperes is'
   );
```

Experiment: 11

Calculation of fault current in Line to line to ground fault.

Scilab code Solution 11.11 Calculation of fault current in Line to line to ground fault

```
////Windows 10
//5.5.2
//Calculation of fault current in Line to line fault
```

```
Enter the positve sequence , negative sequence and zero sequence of the generator in matrix form[0.15 0.15 0.995]
Enter the positve sequence , negative sequence and zero sequence of the Motor 1 in matrix form[0.492 0.492 1.006]
Enter the positve sequence , negative sequence and zero sequence of the Motor 2 in matrix form[0.246 0.246 0.123]
Enter the positve sequence , negative sequence and zero sequence of the transformer 1 in matrix form[0.0784 0.0784 0.0784]
Enter the positve sequence , negative sequence and zero sequence of the transformer 2 in matrix form[0.0784 0.0784 0.0784]
Enter the positve sequence , negative sequence and zero sequence of the transmission line in matrix form[0.167 0.167 0.416]
Enter the value of base KVA30000
Enter the value of base KV13.8

 equivalent value of P,N,Z of system is

    0.6378

    0.6378

    1.6773996

 The fault current is

  - 1944.1406
```

Figure 11.1: Calculation of fault current in Line to line to ground fault

```
.
//A 30 MVA, 13.8 kV, 3−phase alternator has a
   subtransient reactance of 15% and negative and
   zero sequence reactances of 15% and 5%
   respectively. The alternator supplies two motors
   over a transmission line having transformers at
   both ends as shown on the one−line diagram. The
   motors have rated inputs of 20 MVA and 10 MVA
   both 12.5 kV with 20% subtransient reactance and
   negative and zero sequence reactances are 20% and
    5% respectively. Current limiting reactors of
   2.0 ohms each are in the neutral of the
   alternator and the larger motor. The 3−phase
   transformers are both rated 35 MVA, 13.2    −115Y
    kV with leakage reactance of 10%. Series
   reactance of the line is 80 ohms. The zero
   sequence reactance of the line is 200 ohms.
   Determine the fault current when (i) L−G (ii) L−L
   , and (iii) L−L−G fault takes place at point P.
   Assume Vf = 120 kV.//
clc ;
clear;
G=input('Enter the positve sequence , negative
   sequence and zero sequence of the generator in
   matrix form');
PG=G(:,1);
NG=G(:,2);
ZG=G(:,3);
M1=input('Enter the positve sequence , negative
   sequence and zero sequence of the Motor 1 in
   matrix form');
PM1=M1(:,1);
NM1=M1(:,2);
ZM1=M1(:,3);
M2=input('Enter the positve sequence , negative
   sequence and zero sequence of the Motor 2 in
   matrix form');
PM2=M2(:,1);
```

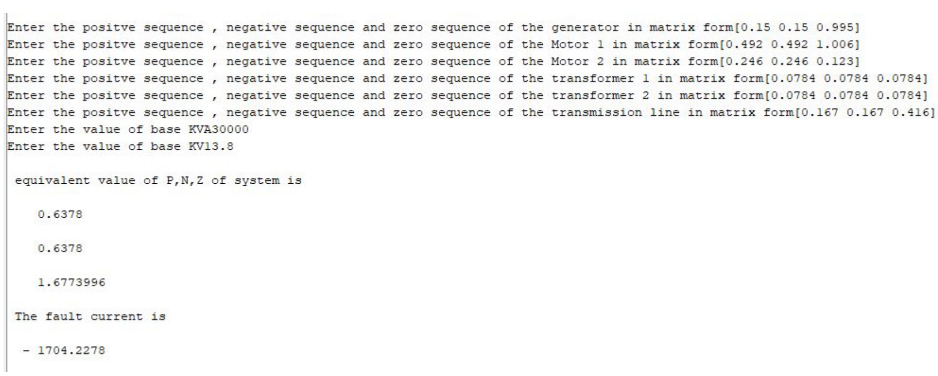
```
NM2=M2(:,2);
ZM2=M2(:,3);
T1=input('Enter the positve sequence , negative
   sequence and zero sequence of the transformer 1
   in matrix form');
PT1=T1(:,1);
NT1=T1(:,2);
ZT1=T1(:,3);
T2=input('Enter the positve sequence , negative
   sequence and zero sequence of the transformer 2
   in matrix form');
PT2=T2(:,1);
NT2=T2(:,2);
ZT2=T2(:,3);
L=input('Enter the positve sequence , negative
   sequence and zero sequence of the transmission
   line in matrix form');
PL=L(:,1);
NL=L(:,2);
ZL=L(:,3);
KVAB=input('Enter the value of base KVA');
KVB=input('Enter the value of base KV');
IB=KVAB/(KVB*1.732);
P=(PG+PT1+PL+PT2)+((PM1*PM2)/(PM1+PM2));
N=(NG+NT1+NL+NT2)+((NM1*NM2)/(NM1+NM2));
Z=(ZG+ZT1+ZL+ZT2)+((ZM1*ZM2)/(ZM1+ZM2));
disp(Z,N,P,'equivalent value of P,N,Z of system is')
   ;
fz=(Z*N)/(Z+N);
I1=(1)/(P+fz);
I2=(-I1*Z)/(N*Z);
I0=I1+I2
IF=3*I0;
FAULTCURRENT=IF*IB;
disp(FAULTCURRENT ,'The fault current is');
```

Experiment: 12

Calculation of fault current in Line to line fault.

Scilab code Solution 12.12 Calculation of fault current in Line to line fault

```
////Windows 10
//5.5.2
//Calculation of fault current in Line to line fault
```



```
Enter the positve sequence , negative sequence and zero sequence of the generator in matrix form[0.15 0.15 0.995]
Enter the positve sequence , negative sequence and zero sequence of the Motor 1 in matrix form[0.492 0.492 1.006]
Enter the positve sequence , negative sequence and zero sequence of the Motor 2 in matrix form[0.246 0.246 0.123]
Enter the positve sequence , negative sequence and zero sequence of the transformer 1 in matrix form[0.0784 0.0784 0.0784]
Enter the positve sequence , negative sequence and zero sequence of the transformer 2 in matrix form[0.0784 0.0784 0.0784]
Enter the positve sequence , negative sequence and zero sequence of the transmission line in matrix form[0.167 0.167 0.416]
Enter the value of base KVA30000
Enter the value of base KV13.8

 equivalent value of P,N,Z of system is

    0.6378

    0.6378

    1.6773996

 The fault current is

  - 1704.2278
```

Figure 12.1: Calculation of fault current in Line to line fault

```
.
//A 30 MVA, 13.8 kV, 3-phase alternator has a
   subtransient reactance of 15% and negative and
   zero sequence reactances of 15% and 5%
   respectively. The alternator supplies two motors
   over a transmission line having transformers at
   both ends as shown on the one-line diagram. The
   motors have rated inputs of 20 MVA and 10 MVA
   both 12.5 kV with 20% subtransient reactance and
   negative and zero sequence reactances are 20% and
    5% respectively. Current limiting reactors of
   2.0 ohms each are in the neutral of the
   alternator and the larger motor. The 3-phase
   transformers are both rated 35 MVA, 13.2    -115Y
    kV with leakage reactance of 10%. Series
   reactance of the line is 80 ohms. The zero
   sequence reactance of the line is 200 ohms.
   Determine the fault current when (i) L-G (ii) L-L
   , and (iii) L-L-G fault takes place at point P.
   Assume Vf = 120 kV.//
clc ;
clear;
G=input('Enter the positve sequence , negative
   sequence and zero sequence of the generator in
   matrix form');
PG=G(:,1);
NG=G(:,2);
ZG=G(:,3);
M1=input('Enter the positve sequence , negative
   sequence and zero sequence of the Motor 1 in
   matrix form');
PM1=M1(:,1);
NM1=M1(:,2);
ZM1=M1(:,3);
M2=input('Enter the positve sequence , negative
   sequence and zero sequence of the Motor 2 in
   matrix form');
PM2=M2(:,1);
```

```
NM2=M2(:,2);
ZM2=M2(:,3);
T1=input('Enter the positve sequence , negative sequence and zero sequence of the transformer 1 in matrix form');
PT1=T1(:,1);
NT1=T1(:,2);
ZT1=T1(:,3);
T2=input('Enter the positve sequence , negative sequence and zero sequence of the transformer 2 in matrix form');
PT2=T2(:,1);
NT2=T2(:,2);
ZT2=T2(:,3);
L=input('Enter the positve sequence , negative sequence and zero sequence of the transmission line in matrix form');
PL=L(:,1);
NL=L(:,2);
ZL=L(:,3);
KVAB=input('Enter the value of base KVA');
KVB=input('Enter the value of base KV');
IB=KVAB/(KVB*1.732);
P=(PG+PT1+PL+PT2)+((PM1*PM2)/(PM1+PM2));
N=(NG+NT1+NL+NT2)+((NM1*NM2)/(NM1+NM2));
Z=(ZG+ZT1+ZL+ZT2)+((ZM1*ZM2)/(ZM1+ZM2));
disp(Z,N,P,'equivalent value of P,N,Z of system is');
IF=(-1.732)/(P+N)
FAULTCURRENT=IF*IB;
disp(FAULTCURRENT ,'The fault current is');
```

Experiment: 13

Calculate variable load parameters on a power system.

Scilab code Solution 13.13 Calculate variable load parameters on a power system

```
//Calculate variable load parameters on a power
   system.
//Windows 10
//5.5.2
// A generating station has a connected load of 43
   MW and a maximum demand of 20 MW, units generated
    per annum being 61.5e6. Caculate i) Demand
   factor ii) Load factor( V K Mehta, Ex. 3.2)
clc;
clear;
cl=input('Enter the connected load');
md=input('Enter the maximum demand');
ug=input('Enter the units generated per annum');
df=md/cl;
disp(df,'The demand factor of the system is');
ad=ug/8760;
```

```
Enter the connected load43e6
Enter the maximum demand20e6
Enter the units generated per annum61.5e6

 The demand factor of the system is

    0.4651163

 The average demand of the system  in kwis

    7020.5479

 The load factor of the system is

    35.10274
```

Figure 13.1: Calculate variable load parameters on a power system

```
disp(ad,'The average demand of the system  in kwis')
    ;
lf=(ad*1000/md)*100;
disp(lf,'The load factor of the system is');
```

Experiment: 14

Calculate cost of generation of a given specific power system.

Scilab code Solution 14.14 Calculate cost of generation of a given specific power system

```
//Calculate cost of generation of a given specific
   power system.
//Windows 10
//5.5.2
//  A generating station has a maximum demand of
   50,000kW. Calculate the cost of generation from
   the following data: Capital cost=Rs. 95e6, annual
    load factor=40%, annual cost of fuel and oil =
   Rs 9e6; Taxes wages and salries=Rs. 7.5e6;
   Intrest and depriciation = 12%.
clc;
clear;
md=input('Enter the maximum demand on the generating
    station');
cc=input('Enter the capital cost of the generating
   station');
```

```
Enter the maximum demand on the generating station50000e3
Enter the capital cost of the generating station95e6
Enter the annual load factor0.4
Enter the annual cost of fuel & oil9e6
Enter the taxes, wages salaries7.5e6
Enter the Intrest and depriciation0.12

 The units generated per annum is

    1.752D+11

 Annual fixed cost is

    11400000.

 Annual running charges

    16500000.

 Total Annual charges

    27900000.

 Cost per unit is

    0.1592466
```

Figure 14.1: Calculate cost of generation of a given specific power system

```
alf=input('Enter the annual load factor');
acfl=input('Enter the annual cost of fuel & oil');
tws=input('Enter the taxes, wages salaries');
id=input('Enter the Intrest and depriciation');
ugperannuam=(md*alf*8760);
disp(ugperannuam,'The units generated per annum is')
    ;
afc=(id*cc);
disp(afc,'Annual fixed cost is');
arc=acfl+tws;
disp(arc,'Annual running charges');
tac=afc+arc;
disp(tac,'Total Annual charges');
gencost=(tac*1000)/ugperannuam;
disp(gencost,'Cost per unit is');
```

Experiment: 15

Calculate Critical disruptive voltage for a given line.

Scilab code Solution 15.15 Calculate Critical disruptive voltage for a given line

```
//Calculate Critical disruptive voltage for a given
   line.
//Windows 10
//5.5.2
// Calculate the critical disruptive voltage &
   corona power loss for a conductor of dia 1.5 cm
   and the separtion between conductors is 3.
   Breakdown strength is 21.1 kv/cm, Air density
   correction factor is given 1.05.
clear;
clc;
D=input('Enter the diameter:');
g0=input('Enter the breakdown strength:');
del=input('Enter the air density factor:');
d=input('Enter the seperation between two conductor:
   ');
```

```
Enter the diameter:1.5
Enter the breakdown strength:21.1
Enter the air density factor:1.05
Enter the seperation between two conductor:300
Enter the irregularity factor:1

 critical distruptive voltage:

    99.555673
Enter the line voltage:220
 Enter the frequency :50

 corona loss:

    6.5622594
```

Figure 15.1: Calculate Critical disruptive voltage for a given line

```
m0=input('Enter the irregularity factor:');
r=D/2;
x=d/r;
y=log(x);
V0=r*g0*del*m0*y;
disp(V0,'critical distruptive voltage:');
//to find corona loss
Vl=input('Enter the line voltage:');
Vp=Vl/1.73;
f=input(' Enter the frequency :');
z=sqrt(1/x);
P=241*10^-5*(f+25)/del*z*(Vp-V0)^2;
disp(P,'corona loss:');
```