POWER FLOW ANALYSIS USING GAUSS-SEIDEL METHOD

EXP.NO:3

AIM:

To understand, in particular, the mathematical formulation of power flow model in complex form and a simple method of solving power flow problems of small system using Gauss-Seidel iterative algorithm

SOFTWARE REQUIRED: MIPOWER / MATLAB

THEORY

The GAUSS – SEIDEL method is an iterative algorithm for solving a set of non- linear load flow equations The non-linear load flow equation is given by

$$V_p^{k+1} = \frac{1}{Y_{pp}}\left[\frac{P_p - jQ_p}{(V_p^k)^*} - \sum_{q=1}^{p-1} Y_{pq} V_q^{k+1} - \sum_{q=p+1}^{n} V_q^k\right]$$

The reactive power of bus-p is given by

$$Q_P^{k+1} = \left[(-1) \times \mathrm{Im} \quad (V_p^k)^* \sum Y_{pq} V_q^{k+1} + \sum Y_{pq} V_q^k\right]$$

PROBLEM:

1.The following is the system data for a load flow solution: the line admittances:

bus code	admittance
1-2	2-j8.0
1-3	1-j4.0
2-3	0.666-j2.664
2-4	1-j4.0
3-4	2-j8.0

the schedule of active and reactive powers:

bus code	p	q	v		remarks
1	-	-	1.06	1.06	slack
2	0.5	0.2	1+j0.0	1+j0.0	pq
3	0.4	0.3	1+j0.0	1+j0.0	pq
4	0.3	0.1	1+j0.0	1+j0.0	pq

determine the voltages at the end of first iteration using gauss –seidel method. take α =1.6 verify the result using matlab.or Mipower

PROCEDURE :

1. Enter the command window of the MATLAB.
2. Create a new M – file by selecting File - New – M – File
3. Type and save the program.
4. Execute the program by either pressing Tools – Run.
5. View the results.

Program1

```
% Load Flow Solution by Gauss Seidal Method
nb=input('enter the no of buses');
nl=input('enter the no of lines');
y=zeros(nl,nl);
a=zeros(nb,nl);
ybus=zeros(nb,nb);
for i=1:nl
   ln=input('enter line number');
   y(ln,ln)=input('enter line admittance');
   sb=input('enter the starting bus no');
   eb=input('enter the ending bus no');
   if(sb~=0)
      a(ln,sb)=-1
   end
   if(eb~=0)
      a(ln,eb)=1
   end
end
y=a'*y*a;
acc=input('enter accelarating factor');
for i=1:nb
   pg(i)=input('enter gen active power');
```

```
    qg(i)=input('enter gen reactive power');
    pl(i)=input('enter load active power in mw');
    ql(i)=input('enter load reactive powerin mva');
    v(i)=input('enter input voltage');
    p(i)=pg(i)-pl(i);
    q(i)=qg(i)-ql(i);
end
cc=1;
k=0;
while cc>0.1
    for m=2:nb
        c(m)=0;
        for n=1:nb
            if (m~=n)
                c(m)=c(m)+(y(m,n)*v(n));
            end
        end
        u(m)=v(m);
        v(m)=(p(m)-q(m)-(c(m)*conj(v(m))))/(y(m,m)*conj(v(m)));
        v(m)=u(m)+(acc*(v(m)-u(m)));
        cc(m)=abs(v(m)-u(m));
    end
    k=k+1;
end
y
cc
```

(OR)

MIPOWER PROCEDURE:

1.Select menu option database –configure

2.Click browse button.

3.Configure data base

4.Configure –base voltage

5(a).**Procedure to draw first element –bus**

6.Click bus enter bus Id and Bus name

7.After entering data click save

8(b).**Procedure to draw the transmission line**

9.Click on transmission line -enter element id number and click ok

10.Enter structure Ref no as.1 and click transmission line library

11.After entering data save and close.

12.Procedure to draw generator

13.Click generator icon enter element id and number

14.After entering data save and close.

15.Procedure to enter load data

16.Click load icon enter element id and number

17.Solve –Load flow analysis

18.Select Gauss-seidal method and enter acceleration factor

19.Execute load flow analysis

20.Click report

RESULT :

Thus the mathematical formation of power flow model in complex form and simple method of solving power flow problems of small sized system using Gauss-Seidal iterative algorithm Or Mipower was understood.

POWER FLOW ANALYSIS USING

NEWTON-RAPHSON METHOD

Expt.No :4

Date :

AIM :

To determine the power flow analysis using Newton – Raphson method

SOFTWARE REQUIRED : MATLAB / MIPOWER

THEORY :

The Newton Raphson method of load flow analysis is an iterative method which approximates the set of non-linear simultaneous equations to a set of linear simultaneous equations using Taylor's series expansion and the terms are limited to first order approximation.

The load flow equations for Newton Raphson method are non-linear equations in terms of real and imaginary part of bus voltages.

$$P_P = \sum_{q=1}^{n} \{ e_p (e_q G_{pq} + f_q B_{pq}) + f_p (f_q G_{pq} - e_q B_{pq}) \}$$

$$Q_P = \sum_{q=1}^{n} \{ f_p (e_q G_{pq} + f_q B_{pq}) - e_p (f_q G_{pq} - e_q B_{pq}) \}$$

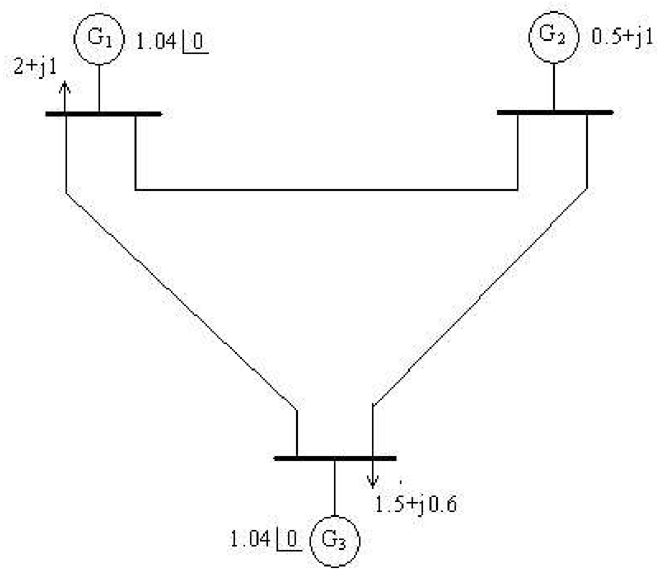
$$|V_p|^2 = e_p^2 + f_p^2$$

where, e_p = Real part of V_p

f_p = Imaginary part of V_p

G_{pq}, B_{pq} = Conductance and Susceptance of admittance Y_{pq} respectively

PROBLEM



Consider the 3 bus system each of the 3 line bus a series impedance of 0.02 + j0.08 p.u and a total shunt admittance of j0.02 pu.The specified quantities at the buses are given below :

Bus	Real load demand, PD	Reactive Load demand, QD	Real power generation,PG	Reactive Power Generation, QG	Voltage Specified
1	2	1	-	-	V_1 =1.04
2	0	0	0.5	1	Unspecified
3	1.5	0.6	0	QG3 = □	V_3 = 1.04

2. Verify the result using MATLAB (OR) MIpower

PROCEDURE :

1. Enter the command window of the MATLAB.
2. Create a new M – file by selecting File - New – M – File
3. Type and save the program.
4. Execute the program by either pressing Tools – Run.

5. View the results.

MATLAB PROGRAM :1

```
%Load Flow Solution by Newton Raphson method
clear all;
clc
nb=input('the number of buses\n');
nl=input('the number of lines\n');
sb=input('the number of starting buses\n');
eb=input('the number of ending buses\n');
sli=input('enter the details of series line impedance\n');
lca=input('enter the detail of line impedance\n');
for m=1:nb
    for n=1:nb
        if m==n||m~=n
            if sli(m,n)==0
                n=n+1;
                else
            y(m,n)=+sli(m,n)^-1+lca(m,n);
            y(n,n)=+sli(m,n)^-1+lca(m,n);
            y(m,n)=-sli(m,n)^-1;
            y(n,m)=y(m,n);
           end
        end
   end
end

for j=1:nb
mag(j)=input(['enyer the voltage magnitude of
bus',num2str(j),':']);
```

```
    th(j)=input(['enter the angle of the bus',num2str(j),':']) ;
    acp(j)=input(['enter the real power of bus',num2str(j),':']);
    acq(j)=input(['enter the reactive power of bus',num2str(j),':']);
end
my=abs(ybus); an=angle(ybus);
g=real(ybus);b=imag(ybus);
for i=1:nb;
    pe(i)=0; qu(i)=0;
    for j=1:nb;
        pe(i)=mag(i)*my(i,j)*mag(j)*cos(th(i)-th(j)-an(i,j))+pe(i);
        qu(i)=mag(i)*my(i,j)*mag(j)*sin(th(i)-th(j)-an(i,j))+qu(i);
    end
end
 for i=2:nb
     for j=2:nb
         if i~=j
             j1(i,j)=mag(i)*mag(j)*(g(i,j)*sin(th(i)-th(j))-b(i,j)*cos(th(i)-th(j)));
             j3(i,j)=-mag(i)*mag(j)*(g(i,j)*cos(th(i)-th(j))-b(i,j)*sin(th(i)-th(j)));
             j2(i,j)=-j3(i,j);
             j4(i,j)=-j1(i,j);
         else
             j1(i,j)=-qu(i)-b(i,j)*(mag(i)^2);
             j2(i,j)=pe(i)+g(i,j)*(mag(i)^2);
             j3(i,j)=pe(i)-g(i,j)*(mag(i)^2);
             j1(i,j)=qu(i)-b(i,j)*(mag(i)^2);
         end
     end
 end
 ja1(1:nb-1,1:nb-1)=j1(2:nb,2:nb);
 ja2(1:nb-1,1:nb-1)=j2(2:nb,2:nb);
```

```
ja3(1:nb-1,1:nb-1)=j3(2:nb,2:nb);
ja4(1:nb-1,1:nb-1)=j4(2:nb,2:nb);
  jacob=[ja1 ja2; ja3 ja4];
  disp(['the jacobian matrix is :']);
  jacob=[ja1 ja2; ja3 ja4];
  disp(['the jacobian matrix is :']);
  disp(jacob);
  delp(1:nb-1)=acp(2:nb)-pe(2:nb);
  delq(1:nb-1)=acp(2:nb)-qu(2:nb);
  chan=(inv(jacob))*[delp delp]';
  chth(2:nb)=chan(1:2);
  chma(2:nb)=chan(n:2*2);
  for i=2:nb
     chmag(i)=chma(i)*mag(i);
  end
  mag=mag+chmag;
  th=th + chth;
  disp(['the voltage magnitudes are:',num2str(mag),]);
  disp(['the phase value are:'    ,num2str(th),]);
```

(OR)

MIPOWER PROCEDURE:

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15.Procedure to enter load data

16.Click load icon enter element id and number

17.Solve –Load flow analysis

18.Select Gauss-seidal method and enter acceleration factor

19.Execute load flow analysis

20.Click report

RESULT :

Thus the power flow analysis using Newton Raphson method was determined.