BT21EEE074
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Experiment – 5

Aim- Calculation of Jacobian and bus voltage using NR method.

Software- Matlab2023a

Code -
```
clc
clear all
% The Y_bus matrix is
ybus = [20-50j -10+20j -10+30j;
-10+20j 26-52j -16+32j;
-10+30j -16+32j 26-62j];
g=real(ybus);b=imag(ybus);
p=[0; -2.556; -1.102];
q=[0; -1.386; -0.452];
mv_initial=[1.05;1;1];
mv=mv_initial;
th=[0;0;0];
nbus=length(p);
del=1;indx=0;
% The Newton-Raphson iterations starts here
while del>1e-6
% Power Calculation
for i=1:nbus
temp=0;
for k=1:nbus
temp=temp+mv(i)*mv(k)*(g(i,k)-j*b(i,k))*exp(j*(th(i)-th(k)));
end
pcal(i)=real(temp);qcal(i)=imag(temp);
end
% The mismatches
delp=p-pcal';
delq=q-qcal';
% The Jacobian matrix
%J11 calculation
for i=1:(nbus-1)
ii=i+1;
```

```matlab
for k=1:(nbus-1)

kk=k+1;

j11(i,k)=mv(ii)*mv(kk)*(g(ii,kk)*sin(th(ii)-th(kk))-b(ii,kk)*cos(th(ii)-th(kk)));

end

j11(i,i)=-qcal(ii)-b(ii,ii)*mv(ii)^2;

end

%J21 calculation

for i=1:(nbus-1)

ii=i+1;

for k=1:(nbus-1)

kk=k+1;

j21(i,k)=-mv(ii)*mv(kk)*(g(ii,kk)*cos(th(ii)-th(kk))-b(ii,kk)*sin(th(ii)-th(kk)));

end

j21(i,i)=pcal(ii)-g(ii,ii)*mv(ii)^2;

end

%J12 Calculation

for i=1:(nbus-1)

ii=i+1;

for k=1:(nbus-1)

kk=k+1;

j12(i,k)=mv(ii)*(g(ii,kk)*cos(th(ii)-th(kk))+b(ii,kk)*sin(th(ii)-th(kk)));

end

j12(i,i)=pcal(i+1)/mv(i+1)+g(i+1,i+1)*mv(i+1);

end

% J22 Calculation

for i=1:(nbus-1)

ii=i+1;

for k=1:(nbus-1)

kk=k+1;

j22(i,k)=mv(ii)*(g(ii,kk)*sin(th(ii)-th(kk))-b(ii,kk)*cos(th(ii)-th(kk)));

end

j22(i,i)=qcal(i+1)/mv(i+1)-b(i+1,i+1)*mv(i+1);

end

jacob=[j11 j12;j21 j22];

delpq=[delp(2:nbus);delq(2:nbus)];

% correction vector

corr=inv(jacob)*delpq;
```

```
% update theta
th=th+[0;corr(1:(nbus-1))];
% update voltage magnitude
mv=mv+[0;corr(nbus:end)];
del=max(abs(delpq));
indx=indx+1; %iteration counter
end
mv
th
indx
```

Result :

indx = 0

jacob =53.0000   -32.0000   25.5000   -16.0000

-32.0000   63.5000   -16.0000   25.5000

-26.5000   16.0000   51.0000   -32.0000

16.0000   -26.5000   -32.0000   60.5000

mv =1.0500

0.9766

1.0000

th = 0

-0.0548

-0.0430

indx =5