

### Listing Program Aliran Daya Tiga Fasa Dengan Sistem Tiga Busbar Pada Matlab 7.0.1

```

clear all      %clear command window
clc
%              Mengambil contoh dari perhitungan manual          %
%              Menghitung Matriks Y Bus                          %
%              kode data jaringan                                %
%
%      Bus  Bus  R0      X0      R1      X1      R2      X2      1/2 B      tr. tap
%      nl   nr   p.u.    p.u.    p.u.    p.u.    p.u.    p.u.    p.u. at bus nl
D_J=[1   2   0.02   0.04   0.02   0.04   0.02   0.04   0.00001  1
      1   3   0.01   0.03   0.01   0.03   0.01   0.03   0.00001  1
      2   3   0.0125 0.025 0.0125 0.025 0.0125 0.025 0.00001 1];
% D_J = Data_jaringan

% Data untuk beban yang seimbang
% Data magnitude tegangan dan sudut tiap bus dari fasa a,b,c

Va1 = 1.05; Va2 = 1.00; Va3 = 1.04;
Vb1 = 1.05; Vb2 = 1.00; Vb3 = 1.04;
Vc1 = 1.05; Vc2 = 1.00; Vc3 = 1.04;

da1 = 0;          da2 = -0.01308333333; da3 = 0.000174444;
db1 = -2.093333333; db2 = -2.106416667; db3 = -2.093158889;
dc1 = 2.093333333; dc2 = 2.08025;      dc3 = 2.093507778;

% data daya aktif dan reaktif pada fasa a,b,c
Paa2 = -1.3333; Qaa2 = -0.8333; Paa3 = 0.6667; % data aliran daya pada fasa a
Pbb2 = -1.3333; Qbb2 = -0.8333; Pbb3 = 0.6667; %data aliran daya pada fasa b
Pcc2 = -1.3333; Qcc2 = -0.8333; Pcc3 = 0.6667; %data aliran daya pada fasa c

```

% Data untuk beban yang tidak seimbang

% Data magnitude tegangan dan sudut tiap bus dari fasa a,b,c

Va1 = 1.05; da1 = 0.000174444; %data yang diinput dr output digsilent

Vb1 = 1.05; db1 = -2.095077778; %data yang diinput dr output digsilent

Vc1 = 1.05; dc1 = 2.094903333; %data yang diinput dr output digsilent

Va2 = 1.00; da2 = -0.006628889; %data yang diinput dr output digsilent

Vb2 = 1.00; db2 = -2.101881111; %data yang diinput dr output digsilent

Vc2 = 1.00; dc2 = 2.088797778; %data yang diinput dr output digsilent

Va3 = 1.04; da3 = 0.004361111; %data yang diinput dr output digsilent

Vb3 = 1.04; db3 = -2.090891111; %data yang diinput dr output digsilent

Vc3 = 1.04; dc3 = 2.099264444; %data yang diinput dr output digsilent

% Data daya aktif dan reaktif pada fasa a,b,c

Paa2 = -1.0346; %data yang diinput dari output digsilent

Pbb2 = -1.0526; %data yang diinput dari output digsilent

Pcc2 = -1.0128; %data yang diinput dari output digsilent

Qaa2 = -0.8466; %data yang diinput dari output digsilent

Qbb2 = -0.8719; %data yang diinput dari output digsilent

Qcc2 = -0.8782; %data yang diinput dari output digsilent

Paa3 = 0.6676; %data yang diinput dari output digsilent

Pbb3 = 0.6758; %data yang diinput dari output digsilent

Pcc3 = 0.6567; %data yang diinput dari output digsilent

Ps = [Paa2; Pbb2; Pcc2; Paa3; Pbb3; Pcc3];

Qs = [Qaa2; Qbb2; Qcc2];

j = sqrt(-1); i = sqrt(-1); B = j\*sqrt(3); a = (-1+B)/2; a2 = (-1-B)/2;

nl = Data\_Jaringan(:,1); nr = Data\_Jaringan(:,2); R0 = Data\_Jaringan(:,3);

X0 = Data\_Jaringan(:,4); R1 = Data\_Jaringan(:,5); X1 = Data\_Jaringan(:, 6);

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R2 = Data_Jaringan(:,7); X2 = Data_Jaringan(:,8); W = j*Data_Jaringan(:, 9);
U = j*Data_Jaringan(:, 10);
nbr = length(Data_Jaringan(:,1)); nbus = max(max(nl), max(nr));
Z0 = R0 + j*X0; y0= ones(nbr,1)./Z0;      %admitansi y0
Z1 = R1 + j*X1; y1= ones(nbr,1)./Z1;      %admitansi y1
Z2 = R2 + j*X2; y2= ones(nbr,1)./Z2;      %admitansi y2
    for n = 1:nbr
        if U(n) <= 0 U(n) = 1; else end
        Ybus_nol=zeros(nbus,nbus);      % Penentuan awal matriks Ybus urutan
                                         % Nol dari pembentukan rangkaian diagonal
        Ybus_Positif=zeros(nbus,nbus); % Penentuan awal matriks Ybus urutan
                                         % Positif dari pembentukan rangkaian diagonal
        Ybus_negatif=zeros(nbus,nbus); % Penentuan awal matriks Ybus urutan dari
                                         % Negatif pembentukan rangkaian diagonal

        for k=1:nbr;
            Ybus_nol(nl(k),nr(k)) = Ybus_nol(nl(k),nr(k)) - y0(k)/U(k);
            Ybus_nol(nr(k),nl(k)) = Ybus_nol(nl(k),nr(k));
            Ybus_Positif(nl(k),nr(k)) = Ybus_Positif(nl(k),nr(k)) - y1(k)/U(k);
            Ybus_Positif(nr(k),nl(k)) = Ybus_Positif(nl(k),nr(k));
            Ybus_negatif(nl(k),nr(k)) = Ybus_negatif(nl(k),nr(k)) - y2(k)/U(k);
            Ybus_negatif(nr(k),nl(k)) = Ybus_negatif(nl(k),nr(k));
        end
    end

    % Membentuk Rangkaian Diagonal
    for n=1:nbus
        for k=1:nbr
            if nl(k)==n
                Ybus_nol(n,n) = Ybus_nol(n,n) + y0(k)/(U(k)^2) + W(k);
                Ybus_Positif(n,n) = Ybus_Positif(n,n) + y1(k)/(U(k)^2) + W(k);
                Ybus_negatif(n,n) = Ybus_negatif(n,n) + y2(k)/(U(k)^2) + W(k);
            end
        end
    end

```

```

elseif nr(k)==n
    Ybus_nol(n,n) = Ybus_nol(n,n) + y0(k) + W(k);
    Ybus_Positif(n,n) = Ybus_Positif(n,n) + y1(k) + W(k);
    Ybus_negatif(n,n) = Ybus_negatif(n,n) + y2(k) + W(k);
else,end
end
end

% data tegangan bus dan sudut bus pada fasa a,b,c
% untuk bus 1,1 fasa a,b,c
yaa11 = Ybus_nol(1,1) + Ybus_Positif(1,1)+ Ybus_negatif(1,1);
yab11 = Ybus_nol(1,1) + a.* Ybus_Positif(1,1)+ a2.* Ybus_negatif(1,1);
yac11 = Ybus_nol(1,1) + a2.* Ybus_Positif(1,1)+ a.* Ybus_negatif(1,1);
yba11 = Ybus_nol(1,1) + a2.* Ybus_Positif(1,1)+ a.* Ybus_negatif(1,1);
ybb11 = Ybus_nol(1,1) + Ybus_Positif(1,1)+ Ybus_negatif(1,1);
ybc11 = Ybus_nol(1,1) + a.* Ybus_Positif(1,1)+ a2.* Ybus_negatif(1,1);
yca11 = Ybus_nol(1,1) + a.* Ybus_Positif(1,1)+ a2.* Ybus_negatif(1,1);
ycb11 = Ybus_nol(1,1) + a2.* Ybus_Positif(1,1)+ a.* Ybus_negatif(1,1);
ycc11 = Ybus_nol(1,1) + Ybus_Positif(1,1)+ Ybus_negatif(1,1);

% untuk bus 1,2 fasa a,b,c
yaa12 = Ybus_nol(1,2) + Ybus_Positif(1,2)+ Ybus_negatif(1,2);
yab12 = Ybus_nol(1,2) + a.* Ybus_Positif(1,2)+ a2.* Ybus_negatif(1,2);
yac12 = Ybus_nol(1,2) + a2.* Ybus_Positif(1,2)+ a.* Ybus_negatif(1,2);
yba12 = Ybus_nol(1,2) + a2.* Ybus_Positif(1,2)+ a.* Ybus_negatif(1,2);
ybb12 = Ybus_nol(1,2) + Ybus_Positif(1,2)+ Ybus_negatif(1,2);
ybc12 = Ybus_nol(1,2) + a.* Ybus_Positif(1,2)+ a2.* Ybus_negatif(1,2);
yca12 = Ybus_nol(1,2) + a.* Ybus_Positif(1,2)+ a2.* Ybus_negatif(1,2);
ycb12 = Ybus_nol(1,2) + a2.* Ybus_Positif(1,2)+ a.* Ybus_negatif(1,2);
ycc12 = Ybus_nol(1,2) + Ybus_Positif(1,2)+ Ybus_negatif(1,2);

% untuk bus 1,3 fasa a,b,c

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yaa13 = Ybus_nol(1,3) + Ybus_Positif(1,3)+ Ybus_negatif(1,3);
yab13 = Ybus_nol(1,3) + a.* Ybus_Positif(1,3)+ a2.* Ybus_negatif(1,3);
yac13 = Ybus_nol(1,3) + a2.* Ybus_Positif(1,3)+ a.* Ybus_negatif(1,3);
yba13 = Ybus_nol(1,3) + a2.* Ybus_Positif(1,3)+ a.* Ybus_negatif(1,3);
ybb13 = Ybus_nol(1,3) + Ybus_Positif(1,3)+ Ybus_negatif(1,3);
ybc13 = Ybus_nol(1,3) + a.* Ybus_Positif(1,3)+ a2.* Ybus_negatif(1,3);
yca13 = Ybus_nol(1,3) + a.* Ybus_Positif(1,3)+ a2.* Ybus_negatif(1,3);
ycb13 = Ybus_nol(1,3) + a2.* Ybus_Positif(1,3)+ a.* Ybus_negatif(1,3);
ycc13 = Ybus_nol(1,3) + Ybus_Positif(1,3)+ Ybus_negatif(1,3);

```

%untuk bus 2,1 fasa a,b,c

```

yaa21 = Ybus_nol(2,1) + Ybus_Positif(2,1)+ Ybus_negatif(2,1);
yab21 = Ybus_nol(2,1) + a.* Ybus_Positif(2,1)+ a2.* Ybus_negatif(2,1);
yac21 = Ybus_nol(2,1) + a2.* Ybus_Positif(2,1)+ a.* Ybus_negatif(2,1);
yba21 = Ybus_nol(2,1) + a2.* Ybus_Positif(2,1)+ a.* Ybus_negatif(2,1);
ybb21 = Ybus_nol(2,1) + Ybus_Positif(2,1)+ Ybus_negatif(2,1);
ybc21 = Ybus_nol(2,1) + a.* Ybus_Positif(2,1)+ a2.* Ybus_negatif(2,1);
yca21 = Ybus_nol(2,1) + a.* Ybus_Positif(2,1)+ a2.* Ybus_negatif(2,1);
ycb21 = Ybus_nol(2,1) + a2.* Ybus_Positif(2,1)+ a.* Ybus_negatif(2,1);
ycc21 = Ybus_nol(2,1) + Ybus_Positif(2,1)+ Ybus_negatif(2,1);

```

%untuk bus 2,2 fasa a,b,c

```

yaa22 = Ybus_nol(2,2) + Ybus_Positif(2,2)+ Ybus_negatif(2,2);
yab22 = Ybus_nol(2,2) + a.* Ybus_Positif(2,2)+ a2.* Ybus_negatif(2,2);
yac22 = Ybus_nol(2,2) + a2.* Ybus_Positif(2,2)+ a.* Ybus_negatif(2,2);
yba22 = Ybus_nol(2,2) + a2.* Ybus_Positif(2,2)+ a.* Ybus_negatif(2,2);
ybb22 = Ybus_nol(2,2) + Ybus_Positif(2,2)+ Ybus_negatif(2,2);
ybc22 = Ybus_nol(2,2) + a.* Ybus_Positif(2,2)+ a2.* Ybus_negatif(2,2);
yca22 = Ybus_nol(2,2) + a.* Ybus_Positif(2,2)+ a2.* Ybus_negatif(2,2);
ycb22 = Ybus_nol(2,2) + a2.* Ybus_Positif(2,2)+ a.* Ybus_negatif(2,2);
ycc22 = Ybus_nol(2,2) + Ybus_Positif(2,2)+ Ybus_negatif(2,2);

```

%untuk bus 2,3 fasa a,b,c

```

yaa23 = Ybus_nol(2,3) + Ybus_Positif(2,3)+ Ybus_negatif(2,3);
yab23 = Ybus_nol(2,3) + a.* Ybus_Positif(2,3)+ a2.* Ybus_negatif(2,3);
yac23 = Ybus_nol(2,3) + a2.* Ybus_Positif(2,3)+ a.* Ybus_negatif(2,3);
yba23 = Ybus_nol(2,3) + a2.* Ybus_Positif(2,3)+ a.* Ybus_negatif(2,3);
ybb23 = Ybus_nol(2,3) + Ybus_Positif(2,3)+ Ybus_negatif(2,3);
ybc23 = Ybus_nol(2,3) + a.* Ybus_Positif(2,3)+ a2.* Ybus_negatif(2,3);
yca23 = Ybus_nol(2,3) + a.* Ybus_Positif(2,3)+ a2.* Ybus_negatif(2,3);
ycb23 = Ybus_nol(2,3) + a2.* Ybus_Positif(2,3)+ a.* Ybus_negatif(2,3);
ycc23 = Ybus_nol(2,3) + Ybus_Positif(2,3)+ Ybus_negatif(2,3);

```

%untuk bus 3,1 fasa a,b,c

```

yaa31 = Ybus_nol(3,1) + Ybus_Positif(3,1)+ Ybus_negatif(3,1);
yab31 = Ybus_nol(3,1) + a.* Ybus_Positif(3,1)+ a2.* Ybus_negatif(3,1);
yac31 = Ybus_nol(3,1) + a2.* Ybus_Positif(3,1)+ a.* Ybus_negatif(3,1);
yba31 = Ybus_nol(3,1) + a2.* Ybus_Positif(3,1)+ a.* Ybus_negatif(3,1);
ybb31 = Ybus_nol(3,1) + Ybus_Positif(3,1)+ Ybus_negatif(3,1);
ybc31 = Ybus_nol(3,1) + a.* Ybus_Positif(3,1)+ a2.* Ybus_negatif(3,1);
yca31 = Ybus_nol(3,1) + a.* Ybus_Positif(3,1)+ a2.* Ybus_negatif(3,1);
ycb31 = Ybus_nol(3,1) + a2.* Ybus_Positif(3,1)+ a.* Ybus_negatif(3,1);
ycc31 = Ybus_nol(3,1) + Ybus_Positif(3,1)+ Ybus_negatif(3,1);

```

%untuk bus 3,2 fasa a,b,c

```

yaa32 = Ybus_nol(3,2) + Ybus_Positif(3,2)+ Ybus_negatif(3,2);
yab32 = Ybus_nol(3,2) + a.* Ybus_Positif(3,2)+ a2.* Ybus_negatif(3,2);
yac32 = Ybus_nol(3,2) + a2.* Ybus_Positif(3,2)+ a.* Ybus_negatif(3,2);
yba32 = Ybus_nol(3,2) + a2.* Ybus_Positif(3,2)+ a.* Ybus_negatif(3,2);
ybb32 = Ybus_nol(3,2) + Ybus_Positif(3,2)+ Ybus_negatif(3,2);
ybc32 = Ybus_nol(3,2) + a.* Ybus_Positif(3,2)+ a2.* Ybus_negatif(3,2);
yca32 = Ybus_nol(3,2) + a.* Ybus_Positif(3,2)+ a2.* Ybus_negatif(3,2);
ycb32 = Ybus_nol(3,2) + a2.* Ybus_Positif(3,2)+ a.* Ybus_negatif(3,2);
ycc32 = Ybus_nol(3,2) + Ybus_Positif(3,2)+ Ybus_negatif(3,2);

```

```
%untuk bus 3,3 fasa a,b,c
yaa33 = Ybus_nol(3,3) + Ybus_Positif(3,3)+ Ybus_negatif(3,3);
yab33 = Ybus_nol(3,3) + a.* Ybus_Positif(3,3)+ a2.* Ybus_negatif(3,3);
yac33 = Ybus_nol(3,3) + a2.* Ybus_Positif(3,3)+ a.* Ybus_negatif(3,3);
yba33 = Ybus_nol(3,3) + a2.* Ybus_Positif(3,3)+ a.* Ybus_negatif(3,3);
ybb33 = Ybus_nol(3,3) + Ybus_Positif(3,3)+ Ybus_negatif(3,3);
ybc33 = Ybus_nol(3,3) + a.* Ybus_Positif(3,3)+ a2.* Ybus_negatif(3,3);
yca33 = Ybus_nol(3,3) + a.* Ybus_Positif(3,3)+ a2.* Ybus_negatif(3,3);
ycb33 = Ybus_nol(3,3) + a2.* Ybus_Positif(3,3)+ a.* Ybus_negatif(3,3);
ycc33 = Ybus_nol(3,3) + Ybus_Positif(3,3)+ Ybus_negatif(3,3);
```

```
% matrik Ybus a,b,c
```

```
% bus 1
```

```
Yaa11 = abs(yaa11); Yab11 = abs(yab11); Yac11 = abs(yac11);
Yaa12 = abs(yaa12); Yab12 = abs(yab12); Yac12 = abs(yac12);
Yaa13 = abs(yaa13); Yab13 = abs(yab13); Yac13 = abs(yac13);
Yba11 = abs(yba11); Ybb11 = abs(ybb11); Ybc11 = abs(ybc11);
Yba12 = abs(yba12); Ybb12 = abs(ybb12); Ybc12 = abs(ybc12);
Yba13 = abs(yba13); Ybb13 = abs(ybb13); Ybc13 = abs(ybc13);
Yca11 = abs(yca11); Ycb11 = abs(ycb11); Ycc11 = abs(ycc11);
Yca12 = abs(yca12); Ycb12 = abs(ycb12); Ycc12 = abs(ycc12);
Yca13 = abs(yca13); Ycb13 = abs(ycb13); Ycc13 = abs(ycc13);
```

```
% bus 2
```

```
Yaa21 = abs(yaa21); Yab21 = abs(yab21); Yac21 = abs(yac21);
Yaa22 = abs(yaa22); Yab22 = abs(yab22); Yac22 = abs(yac22);
Yaa23 = abs(yaa23); Yab23 = abs(yab23); Yac23 = abs(yac23);
Yba21 = abs(yba21); Ybb21 = abs(ybb21); Ybc21 = abs(ybc21);
Yba22 = abs(yba22); Ybb22 = abs(ybb22); Ybc22 = abs(ybc22);
Yba23 = abs(yba23); Ybb23 = abs(ybb23); Ybc23 = abs(ybc23);
Yca21 = abs(yca21); Ycb21 = abs(ycb21); Ycc21 = abs(ycc21);
```

```
Yca22 = abs(yca22); Ycb22 = abs(ycb22); Ycc22 = abs(ycc22);
Yca23 = abs(yca23); Ycb23 = abs(ycb23); Ycc23 = abs(ycc23);
```

```
% bus 3
```

```
Yaa31 = abs(yaa31); Yab31 = abs(yab31); Yac31 = abs(yac31);
Yaa32 = abs(yaa32); Yab32 = abs(yab32); Yac32 = abs(yac32);
Yaa33 = abs(yaa33); Yab33 = abs(yab33); Yac33 = abs(yac33);
Yba31 = abs(yba31); Ybb31 = abs(ybb31); Ybc31 = abs(ybc31);
Yba32 = abs(yba32); Ybb32 = abs(ybb32); Ybc32 = abs(ybc32);
Yba33 = abs(yba33); Ybb33 = abs(ybb33); Ybc33 = abs(ybc33);
Yca31 = abs(yca31); Ycb31 = abs(ycb31); Ycc31 = abs(ycc31);
Yca32 = abs(yca32); Ycb32 = abs(ycb32); Ycc32 = abs(ycc32);
Yca33 = abs(yca33); Ycb33 = abs(ycb33); Ycc33 = abs(ycc33);
```

```
Ybus=[Yaa11 Yab11 Yac11 Yaa12 Yab12 Yac12 Yaa13 Yab13 Yac13
      Yba11 Ybb11 Ybc11 Yba12 Ybb12 Ybc12 Yba13 Ybb13 Ybc13
      Yca11 Ycb11 Ycc11 Yca12 Ycb12 Ycc12 Yca13 Ycb13 Ycc13
      Yaa21 Yab21 Yac21 Yaa22 Yab22 Yac22 Yaa23 Yab23 Yac23
      Yba21 Ybb21 Ybc21 Yba22 Ybb22 Ybc22 Yba23 Ybb23 Ybc23
      Yca21 Ycb21 Ycc21 Yca22 Ycb22 Ycc22 Yca23 Ycb23 Ycc23
      Yaa31 Yab31 Yac31 Yaa32 Yab32 Yac32 Yaa33 Yab33 Yac33
      Yba31 Ybb31 Ybc31 Yba32 Ybb32 Ybc32 Yba33 Ybb33 Ybc33
      Yca31 Ycb31 Ycc31 Yca32 Ycb32 Ycc32 Yca33 Ycb33 Ycc33];
```

```
% bus 1
```

```
taa11 = angle(yaa11); tab11 = angle(yab11); tac11 = angle(yac11);
taa12 = angle(yaa12); tab12 = angle(yab12); tac12 = angle(yac12);
taa13 = angle(yaa13); tab13 = angle(yab13); tac13 = angle(yac13);
tba11 = angle(yba11); tbb11 = angle(ybb11); tbc11 = angle(ybc11);
tba12 = angle(yba12); tbb12 = angle(ybb12); tbc12 = angle(ybc12);
tba13 = angle(yba13); tbb13 = angle(ybb13); tbc13 = angle(ybc13);
tca11 = angle(yca11); tcb11 = angle(ycb11); tcc11 = angle(ycc11);
```



```

tca12 = angle(yca12); tcb12 = angle(ycb12); tcc12 = angle(ycc12);
tca13 = angle(yca13); tcb13 = angle(ycb13); tcc13 = angle(ycc13);
% bus 2
taa21 = angle(yaa21); tab21 = angle(yab21); tac21 = angle(yac21);
taa22 = angle(yaa22); tab22 = angle(yab22); tac22 = angle(yac22);
taa23 = angle(yaa23); tab23 = angle(yab23); tac23 = angle(yac23);
tba21 = angle(yba21); tbb21 = angle(ybb21); tbc21 = angle(ybc21);
tba22 = angle(yba22); tbb22 = angle(ybb22); tbc22 = angle(ybc22);
tba23 = angle(yba23); tbb23 = angle(ybb23); tbc23 = angle(ybc23);
tca21 = angle(yca21); tcb21 = angle(ycb21); tcc21 = angle(ycc21);
tca22 = angle(yca22); tcb22 = angle(ycb22); tcc22 = angle(ycc22);
tca23 = angle(yca23); tcb23 = angle(ycb23); tcc23 = angle(ycc23);
% bus 3
taa31 = angle(yaa31); tab31 = angle(yab31); tac31 = angle(yac31);
taa32 = angle(yaa32); tab32 = angle(yab32); tac32 = angle(yac32);
taa33 = angle(yaa33); tab33 = angle(yab33); tac33 = angle(yac33);
tba31 = angle(yba31); tbb31 = angle(ybb31); tbc31 = angle(ybc31);
tba32 = angle(yba32); tbb32 = angle(ybb32); tbc32 = angle(ybc32);
tba33 = angle(yba33); tbb33 = angle(ybb33); tbc33 = angle(ybc33);
tca31 = angle(yca31); tcb31 = angle(ycb31); tcc31 = angle(ycc31);
tca32 = angle(yca32); tcb32 = angle(ycb32); tcc32 = angle(ycc32);
tca33 = angle(yca33); tcb33 = angle(ycb33); tcc33 = angle(ycc33);

Tbus = [taa11 tab11 tac11 taa12 tab12 tac12 taa13 tab13 tac13
        tba11 tbb11 tbc11 tba12 tbb12 tbc12 tba13 tbb13 tbc13
        tca11 tcb11 tcc11 tca12 tcb12 tcc12 tca13 tcb13 tcc13
        taa21 tab21 tac21 taa22 tab22 tac22 taa23 tab23 tac23
        tba21 tbb21 tbc21 tba22 tbb22 tbc22 tba23 tbb23 tbc23
        tca21 tcb21 tcc21 tca22 tcb22 tcc22 tca23 tcb23 tcc23
        taa31 tab31 tac31 taa32 tab32 tac32 taa33 tab33 tac33
        tba31 tbb31 tbc31 tba32 tbb32 tbc32 tba33 tbb33 tbc33
        tca31 tcb31 tcc31 tca32 tcb32 tcc32 tca33 tcb33 tcc33];

```

```

iter=0;

pwracur = 0.00025; % Power accuracy
DC = 10;          % Set the maximum power residual to a high value
while max(abs(DC)) > pwracur
    iter = iter + 1;

% iter=0;
% maxerror = 1; converge=1;
% accuracy = 0.00025;
% maxiter = 12;
% while maxerror >= accuracy & iter <= maxiter % Test for max. power
% mismatch

% iter = iter + 1;

Pa1 = (1/3)*((Va1)*(Va1)*(Yaa11)*cos(taa11)+...
(Va1)*(Vb1)*(Yab11)*cos(tab11-da1+db1)+ ...
(Va1)*(Vc1)*(Yac11)*cos(tac11-da1+dc1)+...
(Va1)*(Va2)*(Yaa12)*cos(taa12-da1+da2)+ ...
(Va1)*(Vb2)*(Yab12)*cos(tab12-da1+db2)+ ...
(Va1)*(Vc2)*(Yac12)*cos(tac12-da1+dc2)+...
(Va1)*(Va3)*(Yaa13)*cos(taa13-da1+da3)+ ...
(Va1)*(Vb3)*(Yab13)*cos(tab13-da1+db3)+ ...
(Va1)*(Vc3)*(Yac13)*cos(tac13-da1+dc3));

Pb1 = (1/3)*((Vb1)*(Va1)*(Yba11)*cos(tba11-db1+da1)+v
(Vb1)*(Vb1)*(Ybb11)*cos(tbb11)+ ...
(Vb1)*(Vc1)*(Ybc11)*cos(tbc11-db1+dc1)+...
(Vb1)*(Va2)*(Yba12)*cos(tba12-db1+da2)+ ...
(Vb1)*(Vb2)*(Ybb12)*cos(tbb12-db1+db2)+ ...
(Vb1)*(Vc2)*(Ybc12)*cos(tbc12-da1+dc2)+...
(Vb1)*(Va3)*(Yba13)*cos(tba13-da1+da3)+ ...

```

$$(Vb1)*(Vb3)*(Ybb13)*\cos(tbb13-db1+db3)+ \dots$$

$$(Vb1)*(Vc3)*(Ybc13)*\cos(tbc13-da1+dc3));$$

$$Pc1 = (1/3)*((Vc1)*(Va1)*(Yca11)*\cos(tca11-dc1+da1)+ \dots$$

$$(Vc1)*(Vb1)*(Ycb11)*\cos(tcb11-dc1+db1)+ \dots$$

$$(Vc1)*(Vc1)*(Ycc11)*\cos(tcc11)+\dots$$

$$(Vc1)*(Va2)*(Yca12)*\cos(tca12-dc1+da2)+ \dots$$

$$(Vc1)*(Vb2)*(Ycb12)*\cos(tcb12-dc1+db2)+ \dots$$

$$(Vc1)*(Vc2)*(Ycc12)*\cos(tcc12-dc1+dc2)+\dots$$

$$(Vc1)*(Va3)*(Yca13)*\cos(tca13-dc1+da3)+ \dots$$

$$(Vc1)*(Vb3)*(Ycb13)*\cos(tcb13-dc1+db3)+ \dots$$

$$(Vc1)*(Vc3)*(Ycc13)*\cos(tcc13-dc1+dc3));$$

$$Pa2 = (1/3)*((Va2)*(Va1)*(Yaa21)*\cos(taa21-da2+da1)+ \dots$$

$$(Va2)*(Vb1)*(Yab21)*\cos(tab21-da2+db1)+ \dots$$

$$(Va2)*(Vc1)*(Yac21)*\cos(tac21-da2+dc1)+\dots$$

$$(Va2)*(Va2)*(Yaa22)*\cos(taa22)+ \dots$$

$$(Va2)*(Vb2)*(Yab22)*\cos(tab22-da2+db2)+ \dots$$

$$(Va2)*(Vc2)*(Yac22)*\cos(tac22-da2+dc2)+\dots$$

$$(Va2)*(Va3)*(Yaa23)*\cos(taa23-da2+da3)+ \dots$$

$$(Va2)*(Vb3)*(Yab23)*\cos(tab23-da2+db3)+ \dots$$

$$(Va2)*(Vc3)*(Yac23)*\cos(tac23-da2+dc3));$$

$$Pb2 = (1/3)*((Vb2)*(Va1)*(Yba21)*\cos(tba21-db2+da1)+ \dots$$

$$(Vb2)*(Vb1)*(Ybb21)*\cos(tbb21-db2+db1)+ \dots$$

$$(Vb2)*(Vc1)*(Ybc21)*\cos(tbc21-db2+dc1)+\dots$$

$$(Vb2)*(Va2)*(Yba22)*\cos(tba22-db2+da2)+ \dots$$

$$(Vb2)*(Vb2)*(Ybb22)*\cos(tbb22)+ \dots$$

$$(Vb2)*(Vc2)*(Ybc22)*\cos(tbc22-db2+dc2)+\dots$$

$$(Vb2)*(Va3)*(Yba23)*\cos(tba23-db2+da3)+ \dots$$

$$(Vb2)*(Vb3)*(Ybb23)*\cos(tbb23-db2+db3)+ \dots$$

$$(Vb2)*(Vc3)*(Ybc23)*\cos(tbc23-db2+dc3));$$

$$\begin{aligned}
P_{c2} = & (1/3)*((V_{c2})*(V_{a1})*(Y_{ca21})*\cos(t_{ca21}-d_{c2}+d_{a1})+ \dots \\
& (V_{c2})*(V_{b1})*(Y_{cb21})*\cos(t_{cb21}-d_{c2}+d_{b1})+ \dots \\
& (V_{c2})*(V_{c1})*(Y_{cc21})*\cos(t_{cc21}-d_{c2}+d_{c1})+ \dots \\
& (V_{c2})*(V_{a2})*(Y_{ca22})*\cos(t_{ca22}-d_{c2}+d_{a2})+ \dots \\
& (V_{c2})*(V_{b2})*(Y_{cb22})*\cos(t_{cb22}-d_{c2}+d_{b2})+ \dots \\
& (V_{c2})*(V_{c2})*(Y_{cc22})*\cos(t_{cc22})+ \dots \\
& (V_{c2})*(V_{a3})*(Y_{ca23})*\cos(t_{ca23}-d_{c2}+d_{a3})+ \dots \\
& (V_{c2})*(V_{b3})*(Y_{cb23})*\cos(t_{cb23}-d_{c2}+d_{b3})+ \dots \\
& (V_{c2})*(V_{c3})*(Y_{cc23})*\cos(t_{cc23}-d_{c2}+d_{c3}));
\end{aligned}$$

$$\begin{aligned}
P_{a3} = & (1/3)*((V_{a3})*(V_{a1})*(Y_{aa31})*\cos(t_{aa31}-d_{a3}+d_{a1})+ \dots \\
& (V_{a3})*(V_{b1})*(Y_{ba31})*\cos(t_{ba31}-d_{b3}+d_{a1})+ \dots \\
& (V_{a3})*(V_{c1})*(Y_{bc31})*\cos(t_{bc31}-d_{b3}+d_{c1})+ \dots \\
& (V_{a3})*(V_{a2})*(Y_{aa32})*\cos(t_{aa32}-d_{a3}+d_{a2})+ \dots \\
& (V_{a3})*(V_{b2})*(Y_{ab32})*\cos(t_{ab32}-d_{a3}+d_{b2})+ \dots \\
& (V_{a3})*(V_{c2})*(Y_{ac32})*\cos(t_{ac32}-d_{a3}+d_{c2})+ \dots \\
& (V_{a3})*(V_{a3})*(Y_{aa33})*\cos(t_{aa33})+ \dots \\
& (V_{a3})*(V_{b3})*(Y_{ab33})*\cos(t_{ab33}-d_{a3}+d_{b3})+ \dots \\
& (V_{a3})*(V_{c3})*(Y_{ac33})*\cos(t_{ac33}-d_{a3}+d_{c3}));
\end{aligned}$$

$$\begin{aligned}
P_{b3} = & (1/3)*((V_{b3})*(V_{a1})*(Y_{ba31})*\cos(t_{ba31}-d_{b3}+d_{a1})+ \dots \\
& (V_{b3})*(V_{b1})*(Y_{bb31})*\cos(t_{bb31}-d_{b3}+d_{b1})+ \dots \\
& (V_{b3})*(V_{c1})*(Y_{bc31})*\cos(t_{bc31}-d_{b3}+d_{c1})+ \dots \\
& (V_{b3})*(V_{a2})*(Y_{ba32})*\cos(t_{ba32}-d_{b3}+d_{a2})+ \dots \\
& (V_{b3})*(V_{b2})*(Y_{bb32})*\cos(t_{bb32}-d_{b3}+d_{b2})+ \dots \\
& (V_{b3})*(V_{c2})*(Y_{bc32})*\cos(t_{bc32}-d_{b3}+d_{c2})+ \dots \\
& (V_{b3})*(V_{a3})*(Y_{ba33})*\cos(t_{ba33}-d_{b3}+d_{a3})+ \dots \\
& (V_{b3})*(V_{b3})*(Y_{bb33})*\cos(t_{bb33})+ \dots \\
& (V_{b3})*(V_{c3})*(Y_{bc33})*\cos(t_{bc33}-d_{b3}+d_{c3}));
\end{aligned}$$

$$\begin{aligned}
P_{c3} = & (1/3)*((V_{c3})*(V_{a1})*(Y_{ca31})*\cos(t_{ca31}-d_{c3}+d_{a1})+ \dots \\
& (V_{c3})*(V_{b1})*(Y_{cb31})*\cos(t_{cb31}-d_{c3}+d_{b1})+ \dots
\end{aligned}$$

$$\begin{aligned}
& (Vc3)*(Vc1)*(Ycc31)*\cos(tcc31-dc3+dc1)+... \\
& (Vc3)*(Va2)*(Yca32)*\cos(tca32-dc3+da2)+... \\
& (Vc3)*(Vb2)*(Ycb32)*\cos(tcb32-dc3+db2)+... \\
& (Vc3)*(Vc2)*(Ycc32)*\cos(tcc32-dc3+dc2)+... \\
& (Vc3)*(Va3)*(Yca33)*\cos(tca33-dc3+da3)+... \\
& (Vc3)*(Vb3)*(Ycb33)*\cos(tcb33-dc3+db3)+... \\
& (Vc3)*(Vc3)*(Ycc33)*\cos(tcc33));
\end{aligned}$$

$$\begin{aligned}
Qa1 = & -(1/3)*((Va1)*(Va1)*(Yaa11)*\sin(taa11)+... \\
& (Va1)*(Vb1)*(Yab11)*\sin(tab11-da1+db1)+... \\
& (Va1)*(Vc1)*(Yac11)*\sin(tac11-da1+dc1)+... \\
& (Va1)*(Va2)*(Yaa12)*\sin(taa12-da1+da2)+... \\
& (Va1)*(Vb2)*(Yab12)*\sin(tab12-da1+db2)+... \\
& (Va1)*(Vc2)*(Yac12)*\sin(tac12-da1+dc2)+... \\
& (Va1)*(Va3)*(Yaa13)*\sin(taa13-da1+da3)+... \\
& (Va1)*(Vb3)*(Yab13)*\sin(tab13-da1+db3)+... \\
& (Va1)*(Vc3)*(Yac13)*\sin(tac13-da1+dc3));
\end{aligned}$$

$$\begin{aligned}
Qb1 = & -(1/3)*((Vb1)*(Va1)*(Yba11)*\sin(tba11-db1+da1)+... \\
& (Vb1)*(Vb1)*(Ybb11)*\sin(tbb11)+... \\
& (Vb1)*(Vc1)*(Ybc11)*\sin(tbc11-db1+dc1)+... \\
& (Vb1)*(Va2)*(Yba12)*\sin(tba12-db1+da2)+... \\
& (Vb1)*(Vb2)*(Ybb12)*\sin(tbb12-db1+db2)+... \\
& (Vb1)*(Vc2)*(Ybc12)*\sin(tbc12-db1+dc2)+... \\
& (Vb1)*(Va3)*(Yba13)*\sin(tba13-db1+da3)+... \\
& (Vb1)*(Vb3)*(Ybb13)*\sin(tbb13-db1+db3)+... \\
& (Vb1)*(Vc3)*(Ybc13)*\sin(tbc13-db1+dc3));
\end{aligned}$$

$$\begin{aligned}
Qc1 = & -(1/3)*((Vc1)*(Va1)*(Yca11)*\sin(tca11-dc1+da1)+... \\
& (Vc1)*(Vb1)*(Ycb11)*\sin(tcb11-dc1+db1)+... \\
& (Vc1)*(Vc1)*(Ycc11)*\sin(tcc11)+... \\
& (Vc1)*(Va2)*(Yca12)*\sin(tca12-dc1+da2)+...
\end{aligned}$$

$$\begin{aligned}
& (Vc1)*(Vb2)*(Ycb12)*\sin(tcb12-dc1+db2)+ \dots \\
& (Vc1)*(Vc2)*(Ycc12)*\sin(tcc12-dc1+dc2)+\dots \\
& (Vc1)*(Va3)*(Yca13)*\sin(tca13-dc1+da3)+ \dots \\
& (Vc1)*(Vb3)*(Ycb13)*\sin(tcb13-dc1+db3)+ \dots \\
& (Vc1)*(Vc3)*(Ycc13)*\sin(tcc13-dc1+dc3));
\end{aligned}$$

$$\begin{aligned}
Qa2 = & -(1/3)*((Va2)*(Va1)*(Yaa21)*\sin(taa21-da2+da1)+ \dots \\
& (Va2)*(Vb1)*(Yab21)*\sin(tab21-da2+db1)+ \dots \\
& (Va2)*(Vc1)*(Yac21)*\sin(tac21-da2+dc1)+\dots \\
& (Va2)*(Va2)*(Yaa22)*\sin(taa22)+ \dots \\
& (Va2)*(Vb2)*(Yab22)*\sin(tab22-da2+db2)+ \dots \\
& (Va2)*(Vc2)*(Yac22)*\sin(tac22-da2+dc2)+\dots \\
& (Va2)*(Va3)*(Yaa23)*\sin(taa23-da2+da3)+ \dots \\
& (Va2)*(Vb3)*(Yab23)*\sin(tab23-da2+db3)+ \dots \\
& (Va2)*(Vc3)*(Yac23)*\sin(tac23-da2+dc3));
\end{aligned}$$

$$\begin{aligned}
Qb2 = & -(1/3)*((Vb2)*(Va1)*(Yba21)*\sin(tba21-db2+da1)+ \dots \\
& (Vb2)*(Vb1)*(Ybb21)*\sin(tbb21-db2+db1)+ \dots \\
& (Vb2)*(Vc1)*(Ybc21)*\sin(tbc21-db2+dc1)+\dots \\
& (Vb2)*(Va2)*(Yba22)*\sin(tba22-db2+da2)+ \dots \\
& (Vb2)*(Vb2)*(Ybb22)*\sin(tbb22)+ \dots \\
& (Vb2)*(Vc2)*(Ybc22)*\sin(tbc22-db2+dc2)+\dots \\
& (Vb2)*(Va3)*(Yba23)*\sin(tba23-db2+da3)+ \dots \\
& (Vb2)*(Vb3)*(Ybb23)*\sin(tbb23-db2+db3)+ \dots \\
& (Vb2)*(Vc3)*(Ybc23)*\sin(tbc23-db2+dc3));
\end{aligned}$$

$$\begin{aligned}
Qc2 = & -(1/3)*((Vc2)*(Va1)*(Yca21)*\sin(tca21-dc2+da1)+ \dots \\
& (Vc2)*(Vb1)*(Ycb21)*\sin(tcb21-dc2+db1)+ \dots \\
& (Vc2)*(Vc1)*(Ycc21)*\sin(tcc21-dc2+dc1)+\dots \\
& (Vc2)*(Va2)*(Yca22)*\sin(tca22-dc2+da2)+ \dots \\
& (Vc2)*(Vb2)*(Ycb22)*\sin(tcb22-dc2+db2)+ \dots \\
& (Vc2)*(Vc2)*(Ycc22)*\sin(tcc22)+\dots
\end{aligned}$$

$$\begin{aligned}
& (Vc2)*(Va3)*(Yca23)*\sin(tca23-dc2+da3)+ \dots \\
& (Vc2)*(Vb3)*(Ycb23)*\sin(tcb23-dc2+db3)+ \dots \\
& (Vc2)*(Vc3)*(Ycc23)*\sin(tcc23-dc2+dc3));
\end{aligned}$$

$$\begin{aligned}
Qa3 = & -(1/3)*((Va3)*(Va1)*(Yaa31)*\sin(taa31-da3+da1)+ \dots \\
& (Va3)*(Vb1)*(Yab31)*\sin(tab31-da3+db1)+ \dots \\
& (Va3)*(Vc1)*(Yac31)*\sin(tac31-da3+dc1)+\dots \\
& (Va3)*(Va2)*(Yaa32)*\sin(taa32-da3+da2)+ \dots \\
& (Va3)*(Vb2)*(Yab32)*\sin(tab32-da3+db2)+ \dots \\
& (Va3)*(Vc2)*(Yac32)*\sin(tac32-da3+dc2)+\dots \\
& (Va3)*(Va3)*(Yaa33)*\sin(taa33)+ \dots \\
& (Va3)*(Vb3)*(Yab33)*\sin(tab33-da3+db3)+ \dots \\
& (Va3)*(Vc3)*(Yac33)*\sin(tac33-da3+dc3));
\end{aligned}$$

$$\begin{aligned}
Qb3 = & -(1/3)*((Vb3)*(Va1)*(Yba31)*\sin(tba31-db3+da1)+ \dots \\
& (Vb3)*(Vb1)*(Ybb31)*\sin(tbb31-db3+db1)+ \dots \\
& (Vb3)*(Vc1)*(Ybc31)*\sin(tbc31-db3+dc1)+\dots \\
& (Vb3)*(Va2)*(Yba32)*\sin(tba32-db3+da2)+ \dots \\
& (Vb3)*(Vb2)*(Ybb32)*\sin(tbb32-db3+db2)+ \dots \\
& (Vb3)*(Vc2)*(Ybc32)*\sin(tbc32-db3+dc2)+\dots \\
& (Vb3)*(Va3)*(Yba33)*\sin(tba33-db3+da3)+ \dots \\
& (Vb3)*(Vb3)*(Ybb33)*\sin(tbb33)+ \dots \\
& (Vb3)*(Vc3)*(Ybc33)*\sin(tbc33-db3+dc3));
\end{aligned}$$

$$\begin{aligned}
Qc3 = & -(1/3)*((Vc3)*(Va1)*(Yca31)*\sin(tca31-dc3+da1)+ \dots \\
& (Vc3)*(Vb1)*(Ycb31)*\sin(tcb31-dc3+db1)+ \dots \\
& (Vc3)*(Vc1)*(Ycc31)*\sin(tcc31-dc3+dc1)+\dots \\
& (Vc3)*(Va2)*(Yca32)*\sin(tca32-dc3+da2)+ \dots \\
& (Vc3)*(Vb2)*(Ycb32)*\sin(tcb32-dc3+db2)+ \dots \\
& (Vc3)*(Vc2)*(Ycc32)*\sin(tcc32-dc3+dc2)+\dots \\
& (Vc3)*(Va3)*(Yca33)*\sin(tca33-dc3+da3)+ \dots \\
& (Vc3)*(Vb3)*(Ycb33)*\sin(tcb33-dc3+db3)+ \dots \\
& (Vc3)*(Vc3)*(Ycc33)*\sin(tcc33));
\end{aligned}$$

Pt = [Pa2; Pb2; Pc2; Pa3; Pb3; Pc3]; % data perhitungan

Qt = [Qa2; Qb2; Qc2]; % data perhitungan

% matriks jacobiyen di bus 2

% matriks bus 2 untuk fasa A

PA2Va2 = (1/3)\*((Va1)\*(Yaa21)\*cos(taa21-da2+da1)+ ...  
 (Vb1)\*(Yab21)\*cos(tab21-da2+db1)+ ...  
 (Vc1)\*(Yac21)\*cos(tac21-da2+dc1)+...  
 (2)\*(Va2)\*(Yaa22)\*cos(taa22)+ ...  
 (Vb2)\*(Yab22)\*cos(tab22-da2+db2) ...  
 +(Vc2)\*(Yac22)\*cos(tac22-da2+dc2)+...  
 (Va3)\*(Yaa23)\*cos(taa23-da2+da3)+ ...  
 (Vb3)\*(Yab23)\*cos(tab23-da2+db3)+ ...  
 (Vc3)\*(Yac23)\*cos(tac23-da2+dc3));

PA2Vb2 = (1/3)\*(Va2)\*(Yab22)\*cos(tab22-da2+db2);

PA2Vc2 = (1/3)\*(Va2)\*(Yac22)\*cos(tac22-da2+dc2);

PA2da2 = (1/3)\*((Va2)\*(Va1)\*(Yaa21)\*sin(taa21-da2+da1)+ ...  
 (Va2)\*(Vb1)\*(Yab21)\*sin(tab21-da2+db1)+ ...  
 (Va2)\*(Vc1)\*(Yac21)\*sin(tac21-da2+dc1)+...  
 (Va2)\*(Vb2)\*(Yab22)\*sin(tab22-da2+db2)+ ...  
 (Va2)\*(Vc2)\*(Yac22)\*sin(tac22-da2+dc2)+...  
 (Va2)\*(Va3)\*(Yaa23)\*sin(taa23-da2+da3)+ ...  
 (Va2)\*(Vb3)\*(Yab23)\*sin(tab23-da2+db3)+ ...  
 (Va2)\*(Vc3)\*(Yac23)\*sin(tac23-da2+dc3));

PA2db2 = -(1/3)\*(Va2)\*(Vb2)\*(Yab22)\*sin(tab22-da2+db2);

PA2dc2 = -(1/3)\*(Va2)\*(Vc2)\*(Yac22)\*sin(tac22-da2+dc2);

PA2da3 = -(1/3)\*(Va2)\*(Va3)\*(Yaa23)\*sin(taa23-da2+da3);

PA2db3 = -(1/3)\*(Va2)\*(Vb3)\*(Yab23)\*sin(tab23-da2+db3);

PA2dc3 = -(1/3)\*(Va2)\*(Vc3)\*(Yac23)\*sin(tac23-da2+dc3);



% matriks bus 2 untuk fasa B

$$\begin{aligned}
 PB2Va2 &= (1/3)*(Vb2)*(Yba22)*\cos(tba22-db2+da2); \\
 PB2Vb2 &= (1/3)*((Va1)*(Yba21)*\cos(tba21-db2+da1)+ \dots \\
 &\quad (Vb1)*(Ybb21)*\cos(tbb21-db2+db1)+ \dots \\
 &\quad (Vc1)*(Ybc21)*\cos(tbc21-db2+dc1)+\dots \\
 &\quad (Va2)*(Yba22)*\cos(tba22-db2+da2)+ \dots \\
 &\quad (2)*(Vb2)*(Ybb22)*\cos(tbb22)+ \dots \\
 &\quad (Vc2)*(Ybc22)*\cos(tbc22-db2+dc2)+\dots \\
 &\quad (Va3)*(Yba23)*\cos(tba23-db2+da3)+ \dots \\
 &\quad (Vb3)*(Ybb23)*\cos(tbb23-db2+db3)+ \dots \\
 &\quad (Vc3)*(Ybc23)*\cos(tbc23-db2+dc3)); \\
 PB2Vc2 &= (1/3)*(Vb2)*(Ybc22)*\cos(tbc22-db2+dc2); \\
 \\ 
 PB2da2 &= -(1/3)*(Vb2)*(Va2)*(Yba22)*\sin(tba22-db2+da2); \\
 PB2db2 &= (1/3)*((Vb2)*(Va1)*(Yba21)*\sin(tba21-db2+da1)+ \dots \\
 &\quad (Vb2)*(Vb1)*(Ybb21)*\sin(tbb21-db2+db1)+ \dots \\
 &\quad (Vb2)*(Vc1)*(Ybc21)*\sin(tbc21-db2+dc1)+\dots \\
 &\quad (Vb2)*(Va2)*(Yba22)*\sin(tba22-db2+da2)+ \dots \\
 &\quad (Vb2)*(Vc2)*(Ybc22)*\sin(tbc22-db2+dc2)+\dots \\
 &\quad (Vb2)*(Va3)*(Yba23)*\sin(tba23-db2+da3)+ \dots \\
 &\quad (Vb2)*(Vb3)*(Ybb23)*\sin(tbb23-db2+db3)+ \dots \\
 &\quad (Vb2)*(Vc3)*(Ybc23)*\sin(tbc23-db2+dc3)); \\
 PB2dc2 &= -(1/3)*(Vb2)*(Vc2)*(Ybc22)*\sin(tbc22-db2+dc2); \\
 \\ 
 PB2da3 &= -(1/3)*(Vb2)*(Va3)*(Yba23)*\sin(tba23-db2+da3); \\
 PB2db3 &= -(1/3)*(Vb2)*(Vb3)*(Ybb23)*\sin(tbb23-db2+db3); \\
 PB2dc3 &= -(1/3)*(Vb2)*(Vc3)*(Ybc23)*\sin(tbc23-db2+dc3);
 \end{aligned}$$

% matriks bus 2 untuk fasa C

$$\begin{aligned}
 PC2Va2 &= (1/3)*(Vc2)*(Yca22)*\cos(tca22-dc2+da2); \\
 PC2Vb2 &= (1/3)*(Vc2)*(Ycb22)*\cos(tcb22-dc2+db2); \\
 PC2Vc2 &= (1/3)*((Va1)*(Yca21)*\cos(tca21-dc2+da1)+
 \end{aligned}$$

```

(Vb1)*(Ycb21)*cos(tcb21-dc2+db1)+ ...
(Vc1)*(Ycc21)*cos(tcc21-dc2+dc1)+...
(Va2)*(Yca22)*cos(tca22-dc2+da2)+ ...
(Vb2)*(Ycb22)*cos(tcb22-dc2+db2)+ ...
(2)*(Vc2)*(Ycc22)*cos(tcc22)+...
(Va3)*(Yca23)*cos(tca23-dc2+da3)+ ...
(Vb3)*(Ycb23)*cos(tcb23-dc2+db3)+ ...
(Vc3)*(Ycc23)*cos(tcc23-dc2+dc3));

PC2da2 = -(1/3)*(Vc2)*(Va2)*(Yca22)*sin(tca22-dc2+da2);
PC2db2 = -(1/3)*(Vc2)*(Vb2)*(Ycb22)*sin(tcb22-dc2+db2);
PC2dc2 = (1/3)*((Vc2)*(Va1)*(Yca21)*sin(tca21-dc2+da1)+ ...
(Vc2)*(Vb1)*(Ycb21)*sin(tcb21-dc2+db1)+ ...
(Vc2)*(Vc1)*(Ycc21)*sin(tcc21-dc2+dc1)+...
(Vc2)*(Va2)*(Yca22)*sin(tca22-dc2+da2)+ ...
(Vc2)*(Vb2)*(Ycb22)*sin(tcb22-dc2+db2)+...
(Vc2)*(Va3)*(Yca23)*sin(tca23-dc2+da3)+ ...
(Vc2)*(Vb3)*(Ycb23)*sin(tcb23-dc2+db3)+ ...
(Vc2)*(Vc3)*(Ycc23)*sin(tcc23-dc2+dc3));

PC2da3 = -(1/3)*(Vc2)*(Va3)*(Yca23)*sin(tca23-dc2+da3);
PC2db3 = -(1/3)*(Vc2)*(Vb3)*(Ycb23)*sin(tcb23-dc2+db3);
PC2dc3 = -(1/3)*(Vc2)*(Vc3)*(Ycc23)*sin(tcc23-dc2+dc3);

% matriks jacobiyen di bus 3
% matriks bus 3 untuk fasa A
PA3Va2 = (1/3)*(Va3)*(Yaa32)*cos(taa32-da3+da2);
PA3Vb2 = (1/3)*(Va3)*(Yab32)*cos(tab32-da3+db2);
PA3Vc2 = (1/3)*(Va3)*(Yac32)*cos(tac32-da3+dc2);

PA3da2 = -(1/3)*(Va3)*(Va2)*(Yaa32)*sin(taa32-da3+da2);
PA3db2 = -(1/3)*(Va3)*(Vb2)*(Yab32)*sin(tab32-da3+db2);

```

$$PA3dc2 = -(1/3)*(Va3)*(Vc2)*(Yac32)*\sin(tac32-da3+dc2);$$

$$\begin{aligned} PA3da3 = & (1/3)*((Va3)*(Va1)*(Yaa31)*\sin(taa31-da3+da1)+ \dots \\ & (Va3)*(Vb1)*(Yab31)*\sin(tab31-da3+db1)+ \dots \\ & (Va3)*(Vc1)*(Yac31)*\sin(tac31-da3+dc1)+\dots \\ & (Va3)*(Va2)*(Yaa32)*\sin(taa32-da3+da2)+ \dots \\ & (Va3)*(Vb2)*(Yab32)*\sin(tab32-da3+db2)+ \dots \\ & (Va3)*(Vc2)*(Yac32)*\sin(tac32-da3+dc2)+\dots \\ & (Va3)*(Vb3)*(Yab33)*\sin(tab33-da3+db3)+ \dots \\ & (Va3)*(Vc3)*(Yac33)*\sin(tac33-da3+dc3)); \end{aligned}$$

$$PA3db3 = -(1/3)*(Va3)*(Vb3)*(Yab33)*\sin(tab33-da3+db3);$$

$$PA3dc3 = -(1/3)*(Va3)*(Vc3)*(Yac33)*\sin(tac33-da3+dc3);$$

% matriks bus 3 untuk fasa B

$$PB3Va2 = (1/3)*(Vb3)*(Yba32)*\cos(tba32-db3+da2);$$

$$PB3Vb2 = (1/3)*(Vb3)*(Ybb32)*\cos(tbb32-db3+db2);$$

$$PB3Vc2 = (1/3)*(Vb3)*(Ybc32)*\cos(tbc32-db3+dc2);$$

$$PB3da2 = -(1/3)*(Vb3)*(Va2)*(Yba32)*\sin(tba32-db3+da2);$$

$$PB3db2 = -(1/3)*(Vb3)*(Vb2)*(Ybb32)*\sin(tbb32-db3+db2);$$

$$PB3dc2 = -(1/3)*(Vb3)*(Vc2)*(Ybc32)*\sin(tbc32-db3+dc2);$$

$$PB3da3 = -(1/3)*(Vb3)*(Va3)*(Yba33)*\sin(tba33-db3+da3);$$

$$\begin{aligned} PB3db3 = & (1/3)*((Vb3)*(Va1)*(Yba31)*\sin(tba31-db3+da1)+ \dots \\ & (Vb3)*(Vb1)*(Ybb31)*\sin(tbb31-db3+db1)+ \dots \\ & (Vb3)*(Vc1)*(Ybc31)*\sin(tbc31-db3+dc1)+\dots \\ & (Vb3)*(Va2)*(Yba32)*\sin(tba32-db3+da2)+ \dots \\ & (Vb3)*(Vb2)*(Ybb32)*\sin(tbb32-db3+db2)+ \dots \\ & (Vb3)*(Vc2)*(Ybc32)*\sin(tbc32-db3+dc2)+\dots \\ & (Vb3)*(Va3)*(Yba33)*\sin(tba33-db3+da3)+ \dots \\ & (Vb3)*(Vc3)*(Ybc33)*\sin(tbc33-db3+dc3)); \end{aligned}$$

$$PB3dc3 = -(1/3)*(Vb3)*(Vc3)*(Ybc33)*\sin(tbc33-db3+dc3);$$

% matriks bus 3 untuk fasa C

$$\begin{aligned}
 PC3Va2 &= (1/3)*(Vc3)*(Yca32)*\cos(tca32-dc3+da2); \\
 PC3Vb2 &= (1/3)*(Vc3)*(Ycb32)*\cos(tcb32-dc3+db2); \\
 PC3Vc2 &= (1/3)*(Vc3)*(Ycc32)*\cos(tcc32-dc3+dc2); \\
 PC3da2 &= -(1/3)*(Vc3)*(Va2)*(Yca32)*\sin(tca32-dc3+da2); \\
 PC3db2 &= -(1/3)*(Vc3)*(Vb2)*(Ycb32)*\sin(tcb32-dc3+db2); \\
 PC3dc2 &= -(1/3)*(Vc3)*(Vc2)*(Ycc32)*\sin(tcc32-dc3+dc2); \\
 \\ 
 PC3da3 &= -(1/3)*(Vc3)*(Va3)*(Yca33)*\sin(tca33-dc3+da3); \\
 PC3db3 &= -(1/3)*(Vc3)*(Vb3)*(Ycb33)*\sin(tcb33-dc3+db3); \\
 PC3dc3 &= (1/3)*((Vc3)*(Va1)*(Yca31)*\sin(tca31-dc3+da1)+ \dots \\
 &\quad (Vc3)*(Vb1)*(Ycb31)*\sin(tcb31-dc3+db1)+ \dots \\
 &\quad (Vc3)*(Vc1)*(Ycc31)*\sin(tcc31-dc3+dc1)+\dots \\
 &\quad (Vc3)*(Va2)*(Yca32)*\sin(tca32-dc3+da2)+ \dots \\
 &\quad (Vc3)*(Vb2)*(Ycb32)*\sin(tcb32-dc3+db2)+ \dots \\
 &\quad (Vc3)*(Vc2)*(Ycc32)*\sin(tcc32-dc3+dc2)+\dots \\
 &\quad (Vc3)*(Va3)*(Yca33)*\sin(tca33-dc3+da3)+ \dots \\
 &\quad (Vc3)*(Vb3)*(Ycb33)*\sin(tcb33-dc3+db3));
 \end{aligned}$$

% untuk matrik jacobiyen terhadap tegangan di bus 2 fasa a,b,c

$$\begin{aligned}
 QA2Va2 &= -(1/3)*((Va1)*(Yaa21)*\sin(taa21-da2+da1)+ \dots \\
 &\quad (Vb1)*(Yab21)*\sin(tab21-da2+db1)+ \dots \\
 &\quad (Vc1)*(Yac21)*\sin(tac21-da2+dc1)+\dots \\
 &\quad (2)*(Va2)*(Yaa22)*\sin(taa22)+ \dots \\
 &\quad (Vb2)*(Yab22)*\sin(tab22-da2+db2)+ \dots \\
 &\quad (Vc2)*(Yac22)*\sin(tac22-da2+dc2)+\dots \\
 &\quad (Va3)*(Yaa23)*\sin(taa23-da2+da3)+ \dots \\
 &\quad (Vb3)*(Yab23)*\sin(tab23-da2+db3)+ \dots \\
 &\quad (Vc3)*(Yac23)*\sin(tac23-da2+dc3)); \\
 QA2Vb2 &= -(1/3)*(Va2)*(Yab22)*\sin(tab22-da2+db2); \\
 QA2Vc2 &= -(1/3)*(Va2)*(Yac22)*\sin(tac22-da2+dc2);
 \end{aligned}$$

$$\begin{aligned}
QA2da2 &= (1/3)*((Va2)*(Va1)*(Yaa21)*\cos(taa21-da2+da1)+ \dots \\
&\quad (Va2)*(Vb1)*(Yab21)*\cos(tab21-da2+db1)+ \dots \\
&\quad (Va2)*(Vc1)*(Yac21)*\cos(tac21-da2+dc1)+\dots \\
&\quad (Va2)*(Vb2)*(Yab22)*\cos(tab22-da2+db2)+ \dots \\
&\quad (Va2)*(Vc2)*(Yac22)*\cos(tac22-da2+dc2)+\dots \\
&\quad (Va2)*(Va3)*(Yaa23)*\cos(taa23-da2+da3)+ \dots \\
&\quad (Va2)*(Vb3)*(Yab23)*\cos(tab23-da2+db3)+ \dots \\
&\quad (Va2)*(Vc3)*(Yac23)*\cos(tac23-da2+dc3)); \\
QA2db2 &= -(1/3)*(Va2)*(Vb2)*(Yab22)*\cos(tab22-da2+db2); \\
QA2dc2 &= -(1/3)*(Va2)*(Vc2)*(Yac22)*\cos(tac22-da2+dc2); \\
QA2da3 &= -(1/3)*(Va2)*(Va3)*(Yaa23)*\cos(taa23-da2+da3); \\
QA2db3 &= -(1/3)*(Va2)*(Vb3)*(Yab23)*\cos(tab23-da2+db3); \\
QA2dc3 &= -(1/3)*(Va2)*(Vc3)*(Yac23)*\cos(tac23-da2+dc3);
\end{aligned}$$

% aliran daya untuk matrik jacobiyen di fasa b bus 2

$$\begin{aligned}
QB2Va2 &= -(1/3)*(Vb2)*(Yba22)*\sin(tba22-db2+da2); \\
QB2Vb2 &= -(1/3)*((Va1)*(Yba21)*\sin(tba21-db2+da1)+ \dots \\
&\quad (Vb1)*(Ybb21)*\sin(tbb21-db2+db1)+ \dots \\
&\quad (Vc1)*(Ybc21)*\sin(tbc21-db2+dc1)+\dots \\
&\quad (Va2)*(Yba22)*\sin(tba22-db2+da2)+ \dots \\
&\quad (2)*(Vb2)*(Ybb22)*\sin(tbb22)+ \dots \\
&\quad (Vc2)*(Ybc22)*\sin(tbc22-db2+dc2)+\dots \\
&\quad (Va3)*(Yba23)*\sin(tba23-db2+da3)+ \dots \\
&\quad (Vb3)*(Ybb23)*\sin(tbb23-db2+db3)+ \dots \\
&\quad (Vc3)*(Ybc23)*\sin(tbc23-db2+dc3)); \\
QB2Vc2 &= -(1/3)*(Vb2)*(Ybc22)*\sin(tbc22-db2+dc2); \\
QB2da2 &= -(1/3)*(Vb2)*(Va2)*(Yba22)*\cos(tba22-db2+da2); \\
QB2db2 &= (1/3)*((Vb2)*(Va1)*(Yba21)*\cos(tba21-db2+da1)+ \dots \\
&\quad (Vb2)*(Vb1)*(Ybb21)*\cos(tbb21-db2+db1)+ \dots \\
&\quad (Vb2)*(Vc1)*(Ybc21)*\cos(tbc21-db2+dc1)+\dots
\end{aligned}$$

$$\begin{aligned}
& (Vb2)*(Va2)*(Yba22)*\cos(tba22-db2+da2)+ \dots \\
& (Vb2)*(Vc2)*(Ybc22)*\cos(tbc22-db2+dc2)+\dots \\
& (Vb2)*(Va3)*(Yba23)*\cos(tba23-db2+da3)+ \dots \\
& (Vb2)*(Vb3)*(Ybb23)*\cos(tbb23-db2+db3)+ \dots \\
& (Vb2)*(Vc3)*(Ybc23)*\cos(tbc23-db2+dc3)); \\
QB2dc2 = & -(1/3)*(Vb2)*(Vc2)*(Ybc22)*\cos(tca22-db2+dc2); \\
\\
QB2da3 = & -(1/3)*(Vb2)*(Va3)*(Yba23)*\cos(tba23-db2+da3); \\
QB2db3 = & -(1/3)*(Vb2)*(Vb3)*(Ybb23)*\cos(tbb23-db2+db3); \\
QB2dc3 = & -(1/3)*(Vb2)*(Vc3)*(Ybc23)*\cos(tbc23-db2+dc3);
\end{aligned}$$

% aliran daya untuk matrik jacobiyen di fasa c bus 2

$$\begin{aligned}
QC2Va2 = & -(1/3)*(Vc2)*(Yca22)*\sin(tca22-dc2+da2); \\
QC2Vb2 = & -(1/3)*(Vc2)*(Ycb22)*\sin(tcb22-dc2+db2); \\
QC2Vc2 = & -(1/3)*((Va1)*(Yca21)*\sin(tca21-dc2+da1)+ \dots \\
& (Vb1)*(Ycb21)*\sin(tcb21-dc2+db1)+ \dots \\
& (Vc1)*(Ycc21)*\sin(tcc21-dc2+dc1)+\dots \\
& (Va2)*(Yca22)*\sin(tca22-dc2+da2)+ \dots \\
& (Vb2)*(Ycb22)*\sin(tcb22-dc2+db2)+ \dots \\
& (2)*(Vc2)*(Ycc22)*\sin(tcc22)+\dots \\
& (Va3)*(Yca23)*\sin(tca23-dc2+da3)+ \dots \\
& (Vb3)*(Ycb23)*\sin(tcb23-dc2+db3)+ \dots \\
& (Vc3)*(Ycc23)*\sin(tcc23-dc2+dc3)); \\
\\
QC2da2 = & -(1/3)*(Vc2)*(Va2)*(Yca22)*\cos(tca22-dc2+da2); \\
QC2db2 = & -(1/3)*(Vc2)*(Vb2)*(Ycb22)*\cos(tcb22-dc2+db2); \\
QC2dc2 = & (1/3)*((Vc2)*(Va1)*(Yca21)*\cos(tca21-dc2+da1)+ \dots \\
& (Vc2)*(Vb1)*(Ycb21)*\cos(tcb21-dc2+db1)+ \dots \\
& (Vc2)*(Vc1)*(Ycc21)*\cos(tcc21-dc2+dc1)+\dots \\
& (Vc2)*(Va2)*(Yca22)*\cos(tca22-dc2+da2)+ \dots \\
& (Vc2)*(Vb2)*(Ycb22)*\cos(tcb22-dc2+db2)+\dots \\
& (Vc2)*(Va3)*(Yca23)*\cos(tca23-dc2+da3)+ \dots
\end{aligned}$$

$$(Vc2)*(Vb3)*(Ycb23)*\cos(tcb23-dc2+db3)+ \dots \\ (Vc2)*(Vc3)*(Ycc23)*\cos(tcc23-dc2+dc3));$$

$$QC2da3 = -(1/3)*(Vc2)*(Va3)*(Yca23)*\cos(tca23-dc2+da3);$$

$$QC2db3 = -(1/3)*(Vc2)*(Vb3)*(Ycb23)*\cos(tcb23-dc2+db3);$$

$$QC2dc3 = -(1/3)*(Vc2)*(Vc3)*(Ycc23)*\cos(tcc23-dc2+dc3);$$

$$JT = [PA2da2 \ PA2db2 \ PA2dc2 \ PA2da3 \ PA2db3 \ PA2dc3 \ PA2Va2 \ PA2Vb2 \ PA2Vc2 \\ PB2da2 \ PB2db2 \ PB2dc2 \ PB2da3 \ PB2db3 \ PB2dc3 \ PB2Va2 \ PB2Vb2 \ PB2Vc2 \\ PC2da2 \ PC2db2 \ PC2dc2 \ PC2da3 \ PC2db3 \ PC2dc3 \ PC2Va2 \ PC2Vb2 \ PC2Vc2 \\ PA3da2 \ PA3db2 \ PA3dc2 \ PA3da3 \ PA3db3 \ PA3dc3 \ PA3Va2 \ PA3Vb2 \ PA3Vc2 \\ PB3da2 \ PB3db2 \ PB3dc2 \ PB3da3 \ PB3db3 \ PB3dc3 \ PB3Va2 \ PB3Vb2 \ PB3Vc2 \\ PC3da2 \ PC3db2 \ PC3dc2 \ PC3da3 \ PC3db3 \ PC3dc3 \ PC3Va2 \ PC3Vb2 \ PC3Vc2 \\ QA2da2 \ QA2db2 \ QA2dc2 \ QA2da3 \ QA2db3 \ QA2dc3 \ QA2Va2 \ QA2Vb2 \ QA2Vc2 \\ QB2da2 \ QB2db2 \ QB2dc2 \ QB2da3 \ QB2db3 \ QB2dc3 \ QB2Va2 \ QB2Vb2 \ QB2Vc2 \\ QC2da2 \ QC2db2 \ QC2dc2 \ QC2da3 \ QC2db3 \ QC2dc3 \ QC2Va2 \ QC2Vb2 \ QC2Vc2];$$

$$DP = Ps - Pt;$$

$$DQ = Qs - Qt;$$

$$DC = [DP; DQ];$$

$$JT;$$

$$DX = JT \backslash DC;$$

$$da2 = da2 + DX(1); \ db2 = db2 + DX(2); \ dc2 = dc2 + DX(3);$$

$$da3 = da3 + DX(4); \ db3 = db3 + DX(5); \ dc3 = dc3 + DX(6);$$

$$Va2 = Va2 + DX(7); \ Vb2 = Vb2 + DX(8); \ Vc2 = Vc2 + DX(9);$$

$$V = [Va1; Vb1; Vc1; Va2; Vb2; Vc2; Va3; Vb3; Vc3];$$

$$d = [da1; db1; dc1; da2; db2; dc2; da3; db3; dc3];$$

$$V;d; \text{delta} = 180/\pi*d;$$

End

$$PA1 = (1/3)*((Va1)*(Va1)*(Yaa11)*\cos(taa11)+ \dots$$

$$(Va1)*(Vb1)*(Yab11)*\cos(tab11-da1+db1)+ \dots$$

$$\begin{aligned}
& (Va1)*(Vc1)*(Yac11)*\cos(tac11-da1+dc1)+... \\
& (Va1)*(Va2)*(Yaa12)*\cos(taa12-da1+da2)+ ... \\
& (Va1)*(Vb2)*(Yab12)*\cos(tab12-da1+db2)+ ... \\
& (Va1)*(Vc2)*(Yac12)*\cos(tac12-da1+dc2)+... \\
& (Va1)*(Va3)*(Yaa13)*\cos(taa13-da1+da3)+ ... \\
& (Va1)*(Vb3)*(Yab13)*\cos(tab13-da1+db3)+ ... \\
& (Va1)*(Vc3)*(Yac13)*\cos(tac13-da1+dc3));
\end{aligned}$$

$$\begin{aligned}
PB1 = & (1/3)*((Vb1)*(Va1)*(Yba11)*\cos(tba11-db1+da1)+ ... \\
& (Vb1)*(Vb1)*(Ybb11)*\cos(tbb11)+ ... \\
& (Vb1)*(Vc1)*(Ybc11)*\cos(tbc11-db1+dc1)+... \\
& (Vb1)*(Va2)*(Yba12)*\cos(tba12-db1+da2)+ ... \\
& (Vb1)*(Vb2)*(Ybb12)*\cos(tbb12-db1+db2)+ ... \\
& (Vb1)*(Vc2)*(Ybc12)*\cos(tbc12-db1+dc2)+... \\
& (Vb1)*(Va3)*(Yba13)*\cos(tba13-db1+da3)+ ... \\
& (Vb1)*(Vb3)*(Ybb13)*\cos(tbb13-db1+db3)+ ... \\
& (Vb1)*(Vc3)*(Ybc13)*\cos(tbc13-db1+dc3));
\end{aligned}$$

$$\begin{aligned}
PC1 = & (1/3)*((Vc1)*(Va1)*(Yca11)*\cos(tca11-dc1+da1)+ ... \\
& (Vc1)*(Vb1)*(Ycb11)*\cos(tcb11-dc1+db1)+ ... \\
& (Vc1)*(Vc1)*(Ycc11)*\cos(tcc11)+... \\
& (Vc1)*(Va2)*(Yca12)*\cos(tca12-dc1+da2)+ ... \\
& (Vc1)*(Vb2)*(Ycb12)*\cos(tcb12-dc1+db2)+ ... \\
& (Vc1)*(Vc2)*(Ycc12)*\cos(tcc12-dc1+dc2)+... \\
& (Vc1)*(Va3)*(Yca13)*\cos(tca13-dc1+da3)+ ... \\
& (Vc1)*(Vb3)*(Ycb13)*\cos(tcb13-dc1+db3)+ ... \\
& (Vc1)*(Vc3)*(Ycc13)*\cos(tcc13-dc1+dc3));
\end{aligned}$$

$$\begin{aligned}
PA2 = & (1/3)*((Va2)*(Va1)*(Yaa21)*\cos(taa21-da2+da1)+ ... \\
& (Va2)*(Vb1)*(Yab21)*\cos(tab21-da2+db1)+ ... \\
& (Va2)*(Vc1)*(Yac21)*\cos(tac21-da2+dc1)+... \\
& (Va2)*(Va2)*(Yaa22)*\cos(taa22)+ ...
\end{aligned}$$



$$\begin{aligned}
& (Va2)*(Vb2)*(Yab22)*\cos(tab22-da2+db2)+ \dots \\
& (Va2)*(Vc2)*(Yac22)*\cos(tac22-da2+dc2)+\dots \\
& (Va2)*(Va3)*(Yaa23)*\cos(taa23-da2+da3)+ \dots \\
& (Va2)*(Vb3)*(Yab23)*\cos(tab23-da2+db3)+ \dots \\
& (Va2)*(Vc3)*(Yac23)*\cos(tac23-da2+dc3));
\end{aligned}$$

$$\begin{aligned}
PB2 = & (1/3)*((Vb2)*(Va1)*(Yba21)*\cos(tba21-db2+da1)+ \dots \\
& (Vb2)*(Vb1)*(Ybb21)*\cos(tbb21-db2+db1)+ \dots \\
& (Vb2)*(Vc1)*(Ybc21)*\cos(tbc21-db2+dc1)+\dots \\
& (Vb2)*(Va2)*(Yba22)*\cos(tba22-db2+da2)+ \dots \\
& (Vb2)*(Vb2)*(Ybb22)*\cos(tbb22)+ \dots \\
& (Vb2)*(Vc2)*(Ybc22)*\cos(tbc22-db2+dc2)+\dots \\
& (Vb2)*(Va3)*(Yba23)*\cos(tba23-db2+da3)+ \dots \\
& (Vb2)*(Vb3)*(Ybb23)*\cos(tbb23-db2+db3)+ \dots \\
& (Vb2)*(Vc3)*(Ybc23)*\cos(tbc23-db2+dc3));
\end{aligned}$$

$$\begin{aligned}
PC2 = & (1/3)*((Vc2)*(Va1)*(Yca21)*\cos(tca21-dc2+da1)+ \dots \\
& (Vc2)*(Vb1)*(Ycb21)*\cos(tcb21-dc2+db1)+ \dots \\
& (Vc2)*(Vc1)*(Ycc21)*\cos(tcc21-dc2+dc1)+\dots \\
& (Vc2)*(Va2)*(Yca22)*\cos(tca22-dc2+da2)+ \dots \\
& (Vc2)*(Vb2)*(Ycb22)*\cos(tcb22-dc2+db2)+ \dots \\
& (Vc2)*(Vc2)*(Ycc22)*\cos(tcc22)+\dots \\
& (Vc2)*(Va3)*(Yca23)*\cos(tca23-dc2+da3)+ \dots \\
& (Vc2)*(Vb3)*(Ycb23)*\cos(tcb23-dc2+db3)+ \dots \\
& (Vc2)*(Vc3)*(Ycc23)*\cos(tcc23-dc2+dc3));
\end{aligned}$$

$$\begin{aligned}
PA3 = & (1/3)*((Va3)*(Va1)*(Yaa31)*\cos(taa31-da3+da1)+ \dots \\
& (Va3)*(Vb1)*(Yba31)*\cos(tba31-db3+da1)+ \dots \\
& (Va3)*(Vc1)*(Ybc31)*\cos(tbc31-db3+dc1)+\dots \\
& (Va3)*(Va2)*(Yaa32)*\cos(taa32-da3+da2)+ \dots \\
& (Va3)*(Vb2)*(Yab32)*\cos(tab32-da3+db2)+ \dots \\
& (Va3)*(Vc2)*(Yac32)*\cos(tac32-da3+dc2)+\dots
\end{aligned}$$

$$\begin{aligned}
& (Va3)*(Va3)*(Yaa33)*\cos(taa33)+ \dots \\
& (Va3)*(Vb3)*(Yab33)*\cos(tab33-da3+db3)+ \dots \\
& (Va3)*(Vc3)*(Yac33)*\cos(tac33-da3+dc3));
\end{aligned}$$

$$\begin{aligned}
PB3 = & (1/3)*((Vb3)*(Va1)*(Yba31)*\cos(tba31-db3+da1)+ \dots \\
& (Vb3)*(Vb1)*(Ybb31)*\cos(tbb31-db3+db1)+ \dots \\
& (Vb3)*(Vc1)*(Ybc31)*\cos(tbc31-db3+dc1)+\dots \\
& (Vb3)*(Va2)*(Yba32)*\cos(tba32-db3+da2)+ \dots \\
& (Vb3)*(Vb2)*(Ybb32)*\cos(tbb32-db3+db2)+ \dots \\
& (Vb3)*(Vc2)*(Ybc32)*\cos(tbc32-db3+dc2)+\dots \\
& (Vb3)*(Va3)*(Yba33)*\cos(tba33-db3+da3)+ \dots \\
& (Vb3)*(Vb3)*(Ybb33)*\cos(tbb33)+ \dots \\
& (Vb3)*(Vc3)*(Ybc33)*\cos(tbc33-db3+dc3));
\end{aligned}$$

$$\begin{aligned}
PC3 = & (1/3)*((Vc3)*(Va1)*(Yca31)*\cos(tca31-dc3+da1)+ \dots \\
& (Vc3)*(Vb1)*(Ycb31)*\cos(tcb31-dc3+db1)+ \dots \\
& (Vc3)*(Vc1)*(Ycc31)*\cos(tcc31-dc3+dc1)+\dots \\
& (Vc3)*(Va2)*(Yca32)*\cos(tca32-dc3+da2)+ \dots \\
& (Vc3)*(Vb2)*(Ycb32)*\cos(tcb32-dc3+db2)+ \dots \\
& (Vc3)*(Vc2)*(Ycc32)*\cos(tcc32-dc3+dc2)+\dots \\
& (Vc3)*(Va3)*(Yca33)*\cos(tca33-dc3+da3)+ \dots \\
& (Vc3)*(Vb3)*(Ycb33)*\cos(tcb33-dc3+db3)+ \dots \\
& (Vc3)*(Vc3)*(Ycc33)*\cos(tcc33));
\end{aligned}$$

$$\begin{aligned}
QA1 = & -(1/3)*((Va1)*(Va1)*(Yaa11)*\sin(taa11)+ \dots \\
& (Va1)*(Vb1)*(Yab11)*\sin(tab11-da1+db1)+ \dots \\
& (Va1)*(Vc1)*(Yac11)*\sin(tac11-da1+dc1)+\dots \\
& (Va1)*(Va2)*(Yaa12)*\sin(taa12-da1+da2)+ \dots \\
& (Va1)*(Vb2)*(Yab12)*\sin(tab12-da1+db2)+ \dots \\
& (Va1)*(Vc2)*(Yac12)*\sin(tac12-da1+dc2)+\dots \\
& (Va1)*(Va3)*(Yaa13)*\sin(taa13-da1+da3)+ \dots \\
& (Va1)*(Vb3)*(Yab13)*\sin(tab13-da1+db3)+ \dots
\end{aligned}$$

$$(Va1)*(Vc3)*(Yac13)*\sin(tac13-da1+dc3));$$

$$\begin{aligned} QB1 = & -(1/3)*((Vb1)*(Va1)*(Yba11)*\sin(tba11-db1+da1)+ \dots \\ & (Vb1)*(Vb1)*(Ybb11)*\sin(tbb11)+ \dots \\ & (Vb1)*(Vc1)*(Ybc11)*\sin(tbc11-db1+dc1)+\dots \\ & (Vb1)*(Va2)*(Yba12)*\sin(tba12-db1+da2)+ \dots \\ & (Vb1)*(Vb2)*(Ybb12)*\sin(tbb12-db1+db2)+ \dots \\ & (Vb1)*(Vc2)*(Ybc12)*\sin(tbc12-db1+dc2)+\dots \\ & (Vb1)*(Va3)*(Yba13)*\sin(tba13-db1+da3)+ \dots \\ & (Vb1)*(Vb3)*(Ybb13)*\sin(tbb13-db1+db3)+ \dots \\ & (Vb1)*(Vc3)*(Ybc13)*\sin(tbc13-db1+dc3)); \end{aligned}$$

$$\begin{aligned} QC1 = & -(1/3)*((Vc1)*(Va1)*(Yca11)*\sin(tca11-dc1+da1)+ \dots \\ & (Vc1)*(Vb1)*(Ycb11)*\sin(tcb11-dc1+db1)+ \dots \\ & (Vc1)*(Vc1)*(Ycc11)*\sin(tcc11)+\dots \\ & (Vc1)*(Va2)*(Yca12)*\sin(tca12-dc1+da2)+ \dots \\ & (Vc1)*(Vb2)*(Ycb12)*\sin(tcb12-dc1+db2)+ \dots \\ & (Vc1)*(Vc2)*(Ycc12)*\sin(tcc12-dc1+dc2)+\dots \\ & (Vc1)*(Va3)*(Yca13)*\sin(tca13-dc1+da3)+ \dots \\ & (Vc1)*(Vb3)*(Ycb13)*\sin(tcb13-dc1+db3)+ \dots \\ & (Vc1)*(Vc3)*(Ycc13)*\sin(tcc13-dc1+dc3)); \end{aligned}$$

$$\begin{aligned} QA2 = & -(1/3)*((Va2)*(Va1)*(Yaa21)*\sin(taa21-da2+da1)+ \dots \\ & (Va2)*(Vb1)*(Yab21)*\sin(tab21-da2+db1)+ \dots \\ & (Va2)*(Vc1)*(Yac21)*\sin(tac21-da2+dc1)+\dots \\ & (Va2)*(Va2)*(Yaa22)*\sin(taa22)+ \dots \\ & (Va2)*(Vb2)*(Yab22)*\sin(tab22-da2+db2)+ \dots \\ & (Va2)*(Vc2)*(Yac22)*\sin(tac22-da2+dc2)+\dots \\ & (Va2)*(Va3)*(Yaa23)*\sin(taa23-da2+da3)+ \dots \\ & (Va2)*(Vb3)*(Yab23)*\sin(tab23-da2+db3)+ \dots \\ & (Va2)*(Vc3)*(Yac23)*\sin(tac23-da2+dc3)); \end{aligned}$$

$$\begin{aligned}
 QB2 = & -(1/3)*((Vb2)*(Va1)*(Yba21)*\sin(tba21-db2+da1)+ \dots \\
 & (Vb2)*(Vb1)*(Ybb21)*\sin(tbb21-db2+db1)+ \dots \\
 & (Vb2)*(Vc1)*(Ybc21)*\sin(tbc21-db2+dc1)+\dots \\
 & (Vb2)*(Va2)*(Yba22)*\sin(tba22-db2+da2)+ \dots \\
 & (Vb2)*(Vb2)*(Ybb22)*\sin(tbb22)+ \dots \\
 & (Vb2)*(Vc2)*(Ybc22)*\sin(tbc22-db2+dc2)+\dots \\
 & (Vb2)*(Va3)*(Yba23)*\sin(tba23-db2+da3)+ \dots \\
 & (Vb2)*(Vb3)*(Ybb23)*\sin(tbb23-db2+db3)+ \dots \\
 & (Vb2)*(Vc3)*(Ybc23)*\sin(tbc23-db2+dc3));
 \end{aligned}$$

$$\begin{aligned}
 QC2 = & -(1/3)*((Vc2)*(Va1)*(Yca21)*\sin(tca21-dc2+da1)+ \dots \\
 & (Vc2)*(Vb1)*(Ycb21)*\sin(tcb21-dc2+db1)+ \dots \\
 & (Vc2)*(Vc1)*(Ycc21)*\sin(tcc21-dc2+dc1)+\dots \\
 & (Vc2)*(Va2)*(Yca22)*\sin(tca22-dc2+da2)+ \dots \\
 & (Vc2)*(Vb2)*(Ycb22)*\sin(tcb22-dc2+db2)+ \dots \\
 & (Vc2)*(Vc2)*(Ycc22)*\sin(tcc22)+\dots \\
 & (Vc2)*(Va3)*(Yca23)*\sin(tca23-dc2+da3)+ \dots \\
 & (Vc2)*(Vb3)*(Ycb23)*\sin(tcb23-dc2+db3)+ \dots \\
 & (Vc2)*(Vc3)*(Ycc23)*\sin(tcc23-dc2+dc3));
 \end{aligned}$$

$$\begin{aligned}
 QA3 = & -(1/3)*((Va3)*(Va1)*(Yaa31)*\sin(taa31-da3+da1)+ \dots \\
 & (Va3)*(Vb1)*(Yab31)*\sin(tab31-da3+db1)+ \dots \\
 & (Va3)*(Vc1)*(Yac31)*\sin(tac31-da3+dc1)+\dots \\
 & (Va3)*(Va2)*(Yaa32)*\sin(taa32-da3+da2)+ \dots \\
 & (Va3)*(Vb2)*(Yab32)*\sin(tab32-da3+db2)+ \dots \\
 & (Va3)*(Vc2)*(Yac32)*\sin(tac32-da3+dc2)+\dots \\
 & (Va3)*(Va3)*(Yaa33)*\sin(taa33)+ \dots \\
 & (Va3)*(Vb3)*(Yab33)*\sin(tab33-da3+db3)+ \dots \\
 & (Va3)*(Vc3)*(Yac33)*\sin(tac33-da3+dc3));
 \end{aligned}$$

$$\begin{aligned}
 QB3 = & -(1/3)*((Vb3)*(Va1)*(Yba31)*\sin(tba31-db3+da1)+ \dots \\
 & (Vb3)*(Vb1)*(Ybb31)*\sin(tbb31-db3+db1)+ \dots
 \end{aligned}$$

```

(Vb3)*(Vc1)*(Ybc31)*sin(tbc31-db3+dc1)+...
(Vb3)*(Va2)*(Yba32)*sin(tba32-db3+da2)+ ...
(Vb3)*(Vb2)*(Ybb32)*sin(tbb32-db3+db2)+ ...
(Vb3)*(Vc2)*(Ybc32)*sin(tbc32-db3+dc2)+...
(Vb3)*(Va3)*(Yba33)*sin(tba33-db3+da3)+ ...
(Vb3)*(Vb3)*(Ybb33)*sin(tbb33)+ ...
(Vb3)*(Vc3)*(Ybc33)*sin(tbc33-db3+dc3));

```

```

QC3 = -(1/3)*((Vc3)*(Va1)*(Yca31)*sin(tca31-dc3+da1)+ ...
(Vc3)*(Vb1)*(Ycb31)*sin(tcb31-dc3+db1)+ ...
(Vc3)*(Vc1)*(Ycc31)*sin(tcc31-dc3+dc1)+...
(Vc3)*(Va2)*(Yca32)*sin(tca32-dc3+da2)+ ...
(Vc3)*(Vb2)*(Ycb32)*sin(tcb32-dc3+db2)+ ...
(Vc3)*(Vc2)*(Ycc32)*sin(tcc32-dc3+dc2)+...
(Vc3)*(Va3)*(Yca33)*sin(tca33-dc3+da3)+ ...
(Vc3)*(Vb3)*(Ycb33)*sin(tcb33-dc3+db3)+ ...
(Vc3)*(Vc3)*(Ycc33)*sin(tcc33));

```

```

fprintf('                No. of Iterations = %g \n\n', iter);
% fprintf('PA1 = %g \n\n', PA1 );
% fprintf('PB1 = %g \n\n', PB1 );
% fprintf('PC1 = %g \n\n', PC1 );
% fprintf('PA2 = %g \n\n', PA2 );
% fprintf('PB2 = %g \n\n', PB2 );
% fprintf('PC2 = %g \n\n', PC2 );
% fprintf('PA3 = %g \n\n', PA3 );
% fprintf('PB3 = %g \n\n', PB3 );
% fprintf('PC3 = %g \n\n', PC3 );
%
% fprintf('QA1 = %g \n\n', QA1 );
% fprintf('QB1 = %g \n\n', QB1 );
% fprintf('QC1 = %g \n\n', QC1 );

```

```
% fprintf('QA2 = %g \n\n', QA2 );  
% fprintf('QB2 = %g \n\n', QB2 );  
% fprintf('QC2 = %g \n\n', QC2 );  
% fprintf('QA3 = %g \n\n', QA3 );  
% fprintf('QB3 = %g \n\n', QB3 );  
% fprintf('QC3 = %g \n\n', QC3 );
```

```
P_output =[PA1; PB1; PC1; PA2; PB2; PC2; PA3; PB3; PC3]
```

```
Q_output =[QA1; QB1; QC1; QA2; QB2; QC2; QA3; QB3; QC3]
```

```
V,delta
```