PŘÍLOHA 5

1 Zdrojový kód programu napsaného v programovacím prostředí MATLAB

1.1 NR_zadani

```
clc
clear all
close all

% Zde zadejte vstupni parametry:

 [V, Zk, Sm1, Sm2, Sm3] = Import_dat;
 Uod_1 = (238.3+0j);
 Uod_2 = (238.3+0j);
 Uod_3 = (237.7+0j);
 Eps = 0.000001;
 itM = 1000;

[dS1f,Uz,Uk] = NRfce_1f(V,Sm1,Zk,Uod_1,Eps,itM);
disp('_____________________________________')
disp('_____________________________________')
[dS2f] = NRfce_2f(V,Sm2,Zk,Uod_2,Eps,itM);
disp('_____________________________________')
disp('_____________________________________')
[dS3f] = NRfce_3f(V,Sm3,Zk,Uod_3,Eps,itM);
disp('_____________________________________')
disp('_____________________________________')
disp('-------------------------------------')
NR_sum_ztraty(Uz,Uk,dS1f, dS2f, dS3f);

% --Ukladani zadanych dat--
Ukladani_zadanych_dat
disp(' KONEC PROGRAMU')
```

1.2 Import_dat

```
function [V, Zk, Sm1, Sm2, Sm3] = Import_dat
% % Import the data
% % MŘÍŽOVÁ SÍŤ
% % Matice vedeni (site) - V -
% [~, ~, index1] = xlsread('D:\Škola\Magisterské studium\4. semestr\Diplomová
práce\matlab\NR\Save.xlsx','Zadavane_hodnoty','A8:A34');
% [~, ~, index2] = xlsread('D:\Škola\Magisterské studium\4. semestr\Diplomová
práce\matlab\NR\Save.xlsx','Zadavane_hodnoty','B8:B34');
% [~, ~, l] = xlsread('D:\Škola\Magisterské studium\4. semestr\Diplomová
práce\matlab\NR\Save.xlsx','Zadavane_hodnoty','C8:C34');
% % Impedanční matice na km - Zk -
% [~, ~, zk] = xlsread('D:\Škola\Magisterské studium\4. semestr\Diplomová
práce\matlab\NR\Save.xlsx','Zadavane_hodnoty','G8:G34');
% [~, ~, zks] = xlsread('D:\Škola\Magisterské studium\4. semestr\Diplomová
práce\matlab\NR\Save.xlsx','Zadavane_hodnoty','H8:H34');
%
%  % Matice vykonu - Sm1 az Sm3 -
% [~, ~, index0] = xlsread('D:\Škola\Magisterské studium\4. semestr\Diplomová
práce\matlab\NR\Save.xlsx','Zadavane_hodnoty','K8:K32');
% [~, ~, sm1] = xlsread('D:\Škola\Magisterské studium\4. semestr\Diplomová
práce\matlab\NR\Save.xlsx','Zadavane_hodnoty','L8:L32');
% [~, ~, sm1s] = xlsread('D:\Škola\Magisterské studium\4. semestr\Diplomová
práce\matlab\NR\Save.xlsx','Zadavane_hodnoty','M8:M32');
% [~, ~, sm2] = xlsread('D:\Škola\Magisterské studium\4. semestr\Diplomová
práce\matlab\NR\Save.xlsx','Zadavane_hodnoty','P8:P32');
% [~, ~, sm2s] = xlsread('D:\Škola\Magisterské studium\4. semestr\Diplomová
práce\matlab\NR\Save.xlsx','Zadavane_hodnoty','Q8:Q32');
% [~, ~, sm3] = xlsread('D:\Škola\Magisterské studium\4. semestr\Diplomová
práce\matlab\NR\Save.xlsx','Zadavane_hodnoty','T8:T32');
% [~, ~, sm3s] = xlsread('D:\Škola\Magisterské studium\4. semestr\Diplomová
práce\matlab\NR\Save.xlsx','Zadavane_hodnoty','U8:U32');


%% Import the data
% RADIÁLNÍ SÍŤ
% Matice vedeni (site) - V -
[~, ~, index1] = xlsread('D:\Škola\Magisterské studium\4. semestr\Diplomová
práce\matlab\NR\Save.xlsx','Zadavane_hodnoty','A8:A34');
[~, ~, index2] = xlsread('D:\Škola\Magisterské studium\4. semestr\Diplomová
práce\matlab\NR\Save.xlsx','Zadavane_hodnoty','B8:B34');
[~, ~, l] = xlsread('D:\Škola\Magisterské studium\4. semestr\Diplomová
práce\matlab\NR\Save.xlsx','Zadavane_hodnoty','C8:C34');
% Impedanční matice na km - Zk -
[~, ~, zk] = xlsread('D:\Škola\Magisterské studium\4. semestr\Diplomová
práce\matlab\NR\Save.xlsx','Zadavane_hodnoty','G8:G34');
[~, ~, zks] = xlsread('D:\Škola\Magisterské studium\4. semestr\Diplomová
práce\matlab\NR\Save.xlsx','Zadavane_hodnoty','H8:H34');


 % Matice vykonu - Sm1 az Sm3 -
[~, ~, index0] = xlsread('D:\Škola\Magisterské studium\4. semestr\Diplomová
práce\matlab\NR\Save.xlsx','Zadavane_hodnoty','K8:K35');
[~, ~, sm1] = xlsread('D:\Škola\Magisterské studium\4. semestr\Diplomová
práce\matlab\NR\Save.xlsx','Zadavane_hodnoty','L8:L35');
[~, ~, sm1s] = xlsread('D:\Škola\Magisterské studium\4. semestr\Diplomová
práce\matlab\NR\Save.xlsx','Zadavane_hodnoty','M8:M35');
[~, ~, sm2] = xlsread('D:\Škola\Magisterské studium\4. semestr\Diplomová
práce\matlab\NR\Save.xlsx','Zadavane_hodnoty','P8:P35');
[~, ~, sm2s] = xlsread('D:\Škola\Magisterské studium\4. semestr\Diplomová
práce\matlab\NR\Save.xlsx','Zadavane_hodnoty','Q8:Q35');
[~, ~, sm3] = xlsread('D:\Škola\Magisterské studium\4. semestr\Diplomová
práce\matlab\NR\Save.xlsx','Zadavane_hodnoty','T8:T35');
[~, ~, sm3s] = xlsread('D:\Škola\Magisterské studium\4. semestr\Diplomová
práce\matlab\NR\Save.xlsx','Zadavane_hodnoty','U8:U35');


 %% Create output variable
index1 = reshape([index1{:}],size(index1));
index2 = reshape([index2{:}],size(index2));
l = reshape([l{:}],size(l));


zk = reshape([zk{:}],size(zk));
zks = reshape([zks{:}],size(zks));


for n = 1:size(index1,1)


    V(n,1) = index1(n);
    V(n,2) = index2(n);
    V(n,3) = l(n);


    Zk(n,1) = index1(n);
    Zk(n,2) = index2(n);
    Zk(n,3) = zk(n)*(cos(zks(n)*(pi/180))+sin(zks(n)*(pi/180))*j);
```

```
end


index0 = reshape([index0{:}],size(index0));
sm1 = reshape([sm1{:}],size(sm1));
sm1s = reshape([sm1s{:}],size(sm1s));
sm2 = reshape([sm2{:}],size(sm2));
sm2s = reshape([sm2s{:}],size(sm2s));
sm3 = reshape([sm3{:}],size(sm3));
sm3s = reshape([sm3s{:}],size(sm3s));


for n = 1:size(sm1)


    Sm1(n,1) = index0(n);
    Sm1(n,2) = sm1(n)*(cos(sm1s(n)*(pi/180))+sin(sm1s(n)*(pi/180))*j);


    Sm2(n,1) = index0(n);
    Sm2(n,2) = sm2(n)*(cos(sm2s(n)*(pi/180))+sin(sm2s(n)*(pi/180))*j);


    Sm3(n,1) = index0(n);
    Sm3(n,2) = sm3(n)*(cos(sm3s(n)*(pi/180))+sin(sm3s(n)*(pi/180))*j);
end


%% Clear temporary variables
clearvars raw;


end
```

1.3 NR_fce1f

```
function [dS1f,Uz,Uk] = NRfce_1( V, Sm1, Zk, Uod_1, Eps, itM )
% - Matice vedeni (site) V -
Uz = V(:,1);
Uk = V(:,2);
l = V(:,3);


pocet_uzlu = max([Uz; Uk]);
lmat = zeros(pocet_uzlu);


% - Matice vykonu Sm -
P = real(Sm1(:,2));
Q = imag(Sm1(:,2));


% - Impedanční matice na km Zk -
Zk;
Z = l.*Zk(:,3);
%Z = l.*Zk1;
Re = real(Z);
Im = imag(Z);


ymat = zeros(pocet_uzlu);
for  o = 1:size(l,1)
    ymat(Uz(o),Uk(o)) = ymat(Uz(o),Uk(o))-1/(Z(o));
    ymat(Uk(o),Uz(o)) = ymat(Uk(o),Uz(o))-1/(Z(o));
    ymat(Uz(o),Uz(o)) = ymat(Uz(o),Uz(o))+1/(Z(o));
    ymat(Uk(o),Uk(o)) = ymat(Uk(o),Uk(o))+1/(Z(o));
end
ymat;


% - Odhadovane pocatecni napeti Uod -
U1f = zeros((size(Sm1,1)),1)+Uod_1 ;
%-----------------------------------------------------------------
EPS = zeros((size(U1f,1)-1),1)+Eps;
W = zeros(size(U1f));
w = 0;
CD = 1;


while CD >= Eps
    if w == itM % ukoncovaci podminka
        disp(' - CHYBA -                                POZOR Napětí se neustaluje !!!')
        break
    end
```

```
% ---- matice dP(k)_0 -
for o = 2:size(ymat,1)
   for p = 1:size(ymat,1)


        dp(p) = abs(U1f(p))*abs(ymat(o,p))*cos(angle(U1f(o))-angle(U1f(p))-angle(ymat(o,p)));
        dP(o-1,:) = P(o)-abs(U1f(o))*sum(dp);


        dq(p) = abs(U1f(p))*abs(ymat(o,p))*sin(angle(U1f(o))-angle(U1f(p))-angle(ymat(o,p)));
        dQ(o-1,:) = Q(o)-abs(U1f(o))*sum(dq);


    end
end
disp('------------------------------ ')


% ---- Vypocet prvku Jakobiho matice


jm1 = zeros(size(dP,1));
dp_du = zeros(1,size(ymat,1));
   for o = 2:size(ymat,1)
       for p = 1:size(ymat,1)
          if (o<p|o>p)
              dp_du(:,p,o-1) = abs(U1f(p))*abs(ymat(o,p))*cos(angle(U1f(o))-angle(U1f(p))-
angle(ymat(o,p)));
          end
       end
       q = sum(dp_du);
       dP_dU(o-1,:) = 2*abs(U1f(o))*abs(ymat(o,o))*cos(angle(ymat(o,o)))+q(o-1);
       jm1(o-1,o-1) = dP_dU(o-1);
   end


m = 0;
for o = 2:size(ymat,1)
    for p = 2:size(ymat,1)
        if (o<p|o>p)
           m = m+1;
           dP_dUm(m,:) =( abs(U1f(o))*abs(ymat(o,p))*cos(angle(U1f(o))-angle(U1f(p))-angle(ymat(o,p))));
           jm1(o-1,p-1) = dP_dUm(m);
        end
    end
end


jm2 = zeros(size(dP,1));
dp_dd = zeros(1,size(ymat,1));
   for o = 2:size(ymat,1)
       for p = 1:size(ymat,1)
          if (o<p|o>p)
              dp_dd(:,p,o-1) = abs(U1f(o))*abs(U1f(p))*abs(ymat(o,p))*sin(angle(U1f(o))-angle(U1f(p))-
angle(ymat(o,p)));
          end
       end
       q = sum(dp_dd);
       dP_dD(o-1,:) = -q(o-1);
       jm2(o-1,o-1) = dP_dD(o-1);
   end


mmm = 0;
for o = 2:size(ymat,1)
    for p = 2:size(ymat,1)
        if (o<p|o>p)
            mmm = mmm+1;
            dP_dDm(mmm,:) = abs(U1f(o))*abs(U1f(p))*abs(ymat(o,p))*sin(angle(U1f(o))-angle(U1f(p))-
angle(ymat(o,p)));
            jm2(o-1,p-1) = dP_dDm(mmm);
        end
    end
 end


jm3 = zeros(size(dP,1));
dq_du = zeros(1,size(ymat,1));
   for o = 2:size(ymat,1)
       for p = 1:size(ymat,1)
          if (o<p|o>p)
              dq_du(:,p,o-1) = abs(U1f(p))*abs(ymat(o,p))*sin(angle(U1f(o))-angle(U1f(p))-
angle(ymat(o,p)));
          end
       end
       q = sum(dq_du);
       dQ_dU(o-1,:) = -2*abs(U1f(o))*abs(ymat(o,o))*sin(angle(ymat(o,o)))+q(o-1);
       jm3(o-1,o-1) = dQ_dU(o-1);
   end
```

```
mm = 0;
for o = 2:size(ymat,1)
    for p = 2:size(ymat,1)
        if (o<p|o>p)
            mm = mm+1;
            dQ_dUm(mm,:) = abs(U1f(o))*abs(ymat(o,p))*sin(angle(U1f(o))-angle(U1f(p))-angle(ymat(o,p)));
            jm3(o-1,p-1) = dQ_dUm(mm);
        end
    end
end


jm4 = zeros(size(dP,1));
dq_dd = zeros(1,size(ymat,1));
   for o = 2:size(ymat,1)
       for p = 1:size(ymat,1)
          if (o<p|o>p)
              dq_dd(:,p,o-1) = abs(U1f(o))*abs(U1f(p))*abs(ymat(o,p))*cos(angle(U1f(o))-angle(U1f(p))-
angle(ymat(o,p)));
          end
       end
       q = sum(dq_dd);
       dQ_dD(o-1,:) = q(o-1);
       jm4(o-1,o-1) = dQ_dD(o-1);
   end


mmmm = 0;
for o = 2:size(ymat,1)
    for p = 2:size(ymat,1)
        if (o<p|o>p)
            mmmm = mmmm+1;
            dQ_dDm(mmmm,:) = -abs(U1f(o))*abs(U1f(p))*abs(ymat(o,p))*cos(angle(U1f(o))-angle(U1f(p))-
angle(ymat(o,p)));
            jm4(o-1,p-1) = dQ_dDm(mmmm);
        end
    end
end
% -- Jakobiho matice --


  jm1;
  jm2;
  jm3;
  jm4;


  J = [jm1 jm2; jm3 jm4];
  dPdQ0 = [dP; dQ];


 A = zeros(size(J,1),1);
 for n = 1:size(J)
     A(:,:,n) = J(:,n);
 end


B = A;
for m = 1:size(J)
     A = B;
     A(:,:,m) =  dPdQ0;
     for n = 1:size(J)
         Jj(:,n,m) = A(:,:,n);
     end
end


% -- Vypocet delt z matice --
for n = 1:size(J)
    dUdD(n,:) = det(Jj(:,:,n))/det(J);
end


dU = dUdD(1:(size(J)/2),:);
dD = dUdD((size(J)/2+1):end,:);


% -- Vypocet napeti v uzlech --


fprintf('%d. iterace 1.fáze \n', w)
format long


for n = 1:size(U1f)
    fprintf('U%d = %d úhel: %.4f \n', n, abs(U1f(n)), angle(U1f(n))*(180/pi));
    index0(n,:) = n;
end


for n = 2:size(U1f)
```

```
    U1f(n,:) = (abs(U1f(n))+dU(n-1))*(cos(angle(U1f(n))+dD(n-1))+sin(angle(U1f(n))+dD(n-1))*j);
end


% -- Citlivost --
 W = U1f;
 if w == 0
     UU = [U1f];
     ww = 0;
     C = UU(2:end,end-ww)+1;
 else
     UU = [UU U1f];
     ww = 1;
     C = UU(2:end,end-ww);
 end
     D = UU(2:end,end);
     CD = abs(C-D) ;
     w = w+1;
end


% - Ztraty v siti -
disp('-----------------------------------')
disp('Úbytky napětí na 1. fázi sítě')
for n = 1:size(Z,1)
    DU1f(n,:) = U1f(Uz(n))-U1f(Uk(n));
    fprintf('dU%d_%d = %.4d úhel: %.4f \n',Uz(n), Uk(n), abs(DU1f(n)), angle(DU1f(n))*(180/pi));
end


disp('-----------------------------------')
disp('Proudy v 1. fázích sítě:' )
I1f = DU1f./Z;
for n = 1:size(Z,1)
        fprintf('I%d_%d = %.4d úhel: %.4f \n',Uz(n), Uk(n), abs(I1f(n)), angle(I1f(n))*(180/pi));
end
disp('-----------------------------------')


% - Ztráty v jednotlivých vedeních sítě


for n = 1:size(I1f)


    DP(n,:) = Re(n)*abs(I1f(n))^2;
    DQ(n,:) = Im(n)*abs(I1f(n))^2*j;


end


dS1f = DP+DQ;


disp('Ztráty v jednotlivých 1.fázích sítě:')
for n = 1:size(Z,1)
        fprintf('dS%d_%d = %.4d úhel: %.4f \n',Uz(n), Uk(n), abs(dS1f(n)), angle(dS1f(n))*(180/pi));
end
disp('-----------------------------------')


disp('Celkové ztráty v 1.fázi sítě:')
dPc = sum(DP);
dQc = sum(DQ);
dSc1f = dPc+dQc;
fprintf('\ndSc_1f = %.4d úhel: %.4f \n', abs(dSc1f), angle(dSc1f)*(180/pi))


 % - Ukladani dat -


    save(' Data1f.mat', 'U1f','DU1f','I1f','dS1f','dSc1f')


 % Ukládání hodnot napětí
    filename = 'Save.xlsx';
    uloz = {'Ustálené napětí 1. fáze'};
    sheet = 1;
    xlRange = 'A1';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = {'index'};
    sheet = 1;
    xlRange = 'A2';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = {'U [V]'};
```

```
    sheet = 1;
    xlRange = 'B2';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = {'[stupeň]'};
    sheet = 1;
    xlRange = 'C2';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = index0;
    sheet = 1;
    xlRange = 'A3';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = abs(U1f);
    sheet = 1;
    xlRange = 'B3';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = angle(U1f)*(180/pi);
    sheet = 1;
    xlRange = 'C3';
    xlswrite(filename,uloz,sheet,xlRange)



% Ukládání hodnot úbytků napětí
    filename = 'Save.xlsx';
    uloz = {'Úbytky napětí v 1. fázi'};
    sheet = 1;
    xlRange = 'E1';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = {'index1'};
    sheet = 1;
    xlRange = 'E2';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = {'index2'};
    sheet = 1;
    xlRange = 'F2';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = {'dU [V]'};
    sheet = 1;
    xlRange = 'G2';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = {'[stupeň]'};
    sheet = 1;
    xlRange = 'H2';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = Uz;
    sheet = 1;
    xlRange = 'E3';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = Uk;
    sheet = 1;
    xlRange = 'F3';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = abs(DU1f);
    sheet = 1;
    xlRange = 'G3';
    xlswrite(filename,uloz,sheet,xlRange)
```

```
    filename = 'Save.xlsx';
    uloz = angle(DU1f)*(180/pi);
    sheet = 1;
    xlRange = 'H3';
    xlswrite(filename,uloz,sheet,xlRange)

% Ukládání hodnot proudu
    filename = 'Save.xlsx';
    uloz = {'Proudy v 1. fázi'};
    sheet = 1;
    xlRange = 'J1';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = {'index1'};
    sheet = 1;
    xlRange = 'J2';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = {'index2'};
    sheet = 1;
    xlRange = 'K2';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = Uz;
    sheet = 1;
    xlRange = 'J3';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = Uk;
    sheet = 1;
    xlRange = 'K3';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = {'I [A]'};
    sheet = 1;
    xlRange = 'L2';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = {'[stupeň]'};
    sheet = 1;
    xlRange = 'M2';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = abs(I1f);
    sheet = 1;
    xlRange = 'L3';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = angle(I1f)*(180/pi);
    sheet = 1;
    xlRange = 'M3';
    xlswrite(filename,uloz,sheet,xlRange)

% Ukládání hodnot ztrat

    filename = 'Save.xlsx';
    uloz = {'Ztráty v 1. fázi'};
    sheet = 1;
    xlRange = 'O1';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = {'index1'};
    sheet = 1;
    xlRange = 'O2';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = {'index2'};
    sheet = 1;
    xlRange = 'P2';
```

```
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = Uz;
    sheet = 1;
    xlRange = 'O3';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = Uk;
    sheet = 1;
    xlRange = 'P3';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = {'dS [VA]'};
    sheet = 1;
    xlRange = 'Q2';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = {'[stupeň]'};
    sheet = 1;
    xlRange = 'R2';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = abs(dS1f);
    sheet = 1;
    xlRange = 'Q3';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = angle(dS1f)*(180/pi);
    sheet = 1;
    xlRange = 'R3';
    xlswrite(filename,uloz,sheet,xlRange)

% Celkove ztraty site
    filename = 'Save.xlsx';
    uloz = {'Celkové ztráty v 1. fázi'};
    sheet = 1;
    xlRange = 'T1';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = {'dSc [VA]'};
    sheet = 1;
    xlRange = 'T2';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = {'[stupeň]'};
    sheet = 1;
    xlRange = 'U2';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = abs(dSc1f);
    sheet = 1;
    xlRange = 'T3';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = angle(dSc1f)*(180/pi);
    sheet = 1;
    xlRange = 'U3';
    xlswrite(filename,uloz,sheet,xlRange)


    % - Graf -
    figure
    ax1 = subplot(2,1,1);
    ax2 = subplot(2,1,2);


    plot(ax1,1:size(UU,2),abs(UU));
    title(ax1,' Průběh ustalování U v 1. fázi ')
    xlabel(ax1,' iterace ')
    ylabel(ax1,' U ')
```

```
    plot(ax2,1:size(UU,2),angle(UU)*180/pi);
    title(ax2,' Průběh ustalování úhlu napětí v \delta 1. fázi ')
    xlabel(ax2,' iterace ')
    ylabel(ax2,' stupeň ')

end
```

1.4 NRfce_2f

```
function [dS2f] = NRfce_2( V, Sm2, Zk, Uod_2, Eps, itM )
% - Matice vedeni (site) V -


Uz = V(:,1);
Uk = V(:,2);
l = V(:,3);


pocet_uzlu = max([Uz; Uk]);
lmat = zeros(pocet_uzlu);


% - Matice vykonu Sm -


P = real(Sm2(:,2));
Q = imag(Sm2(:,2));


% - Impedanční matice na km Zk -
Zk;
Z = l.*Zk(:,3);
%Z = l.*Zk1;
Re = real(Z);
Im = imag(Z);


ymat = zeros(pocet_uzlu);
for  o = 1:size(l,1)
    ymat(Uz(o),Uk(o)) = ymat(Uz(o),Uk(o))-1/(Z(o));
    ymat(Uk(o),Uz(o)) = ymat(Uk(o),Uz(o))-1/(Z(o));
    ymat(Uz(o),Uz(o)) = ymat(Uz(o),Uz(o))+1/(Z(o));
    ymat(Uk(o),Uk(o)) = ymat(Uk(o),Uk(o))+1/(Z(o));
end
ymat;


% - Odhadovane pocatecni napeti Uod -
U2f = zeros((size(Sm2,1)),1)+Uod_2 ;
%-----------------------------------------------------------------
EPS = zeros((size(U2f,1)-1),1)+Eps;
W = zeros(size(U2f));
w = 0;
CD = 1;


while CD >= Eps
    if w == itM % ukoncovaci podminka
        disp(' - CHYBA -                                POZOR Napětí se neustaluje !!!')
        break
    end


% ---- matice dP(k)_0 -
for o = 2:size(ymat,1)
   for p = 1:size(ymat,1)


        dp(p) = abs(U2f(p))*abs(ymat(o,p))*cos(angle(U2f(o))-angle(U2f(p))-angle(ymat(o,p)));
        dP(o-1,:) = P(o)-abs(U2f(o))*sum(dp);


        dq(p) = abs(U2f(p))*abs(ymat(o,p))*sin(angle(U2f(o))-angle(U2f(p))-angle(ymat(o,p)));
        dQ(o-1,:) = Q(o)-abs(U2f(o))*sum(dq);


   end
end
dP;
disp('------------------------------ ')
dQ;


% ---- Vypocet prvku Jakobiho matice


jm1 = zeros(size(dP,1));
%disp('Diagonalni prvky (dP/dU)')
% -- diagonalni prvky (dP/dU)
```

```
dp_du = zeros(1,size(ymat,1));
   for o = 2:size(ymat,1)
       for p = 1:size(ymat,1)
          if (o<p|o>p)
              dp_du(:,p,o-1) = abs(U2f(p))*abs(ymat(o,p))*cos(angle(U2f(o))-angle(U2f(p))-
angle(ymat(o,p)));
          end
       end
       q = sum(dp_du);
       dP_dU(o-1,:) = 2*abs(U2f(o))*abs(ymat(o,o))*cos(angle(ymat(o,o)))+q(o-1);
       jm1(o-1,o-1) = dP_dU(o-1);
   end
% -- mimodiagonalni prvky (dP/dU)
 m = 0;
for o = 2:size(ymat,1)
    for p = 2:size(ymat,1)
        if (o<p|o>p)
           m = m+1;
           dP_dUm(m,:) =( abs(U2f(o))*abs(ymat(o,p))*cos(angle(U2f(o))-angle(U2f(p))-angle(ymat(o,p))));
           jm1(o-1,p-1) = dP_dUm(m);
        end
    end
end
dP_dUm;


jm2 = zeros(size(dP,1));
% -- diagonalni prvkz (dP/dD)
dp_dd = zeros(1,size(ymat,1));
   for o = 2:size(ymat,1)
       for p = 1:size(ymat,1)
          if (o<p|o>p)
              dp_dd(:,p,o-1) = abs(U2f(o))*abs(U2f(p))*abs(ymat(o,p))*sin(angle(U2f(o))-angle(U2f(p))-
angle(ymat(o,p)));
          end
       end
       q = sum(dp_dd);
       dP_dD(o-1,:) = -q(o-1);
       jm2(o-1,o-1) = dP_dD(o-1);
   end
dP_dD;
 % -- mimodiagonalni prvky (dP/dD)
 mmm = 0;
for o = 2:size(ymat,1)
    for p = 2:size(ymat,1)
        if (o<p|o>p)
            mmm = mmm+1;
            dP_dDm(mmm,:) = abs(U2f(o))*abs(U2f(p))*abs(ymat(o,p))*sin(angle(U2f(o))-angle(U2f(p))-
angle(ymat(o,p)));
            jm2(o-1,p-1) = dP_dDm(mmm);
        end
     end
 end


% -- diagonalni prvky (dQ/dU)
jm3 = zeros(size(dP,1));
dq_du = zeros(1,size(ymat,1));
   for o = 2:size(ymat,1)
       for p = 1:size(ymat,1)
          if (o<p|o>p)
              dq_du(:,p,o-1) = abs(U2f(p))*abs(ymat(o,p))*sin(angle(U2f(o))-angle(U2f(p))-
angle(ymat(o,p)));
          end
       end
       q = sum(dq_du);
       dQ_dU(o-1,:) = -2*abs(U2f(o))*abs(ymat(o,o))*sin(angle(ymat(o,o)))+q(o-1);
       jm3(o-1,o-1) = dQ_dU(o-1);
   end
dQ_dU;


% -- mimodiagonalni prvky (dQ/dU)
 mm = 0;
for o = 2:size(ymat,1)
    for p = 2:size(ymat,1)
        if (o<p|o>p)
            mm = mm+1;
            dQ_dUm(mm,:) = abs(U2f(o))*abs(ymat(o,p))*sin(angle(U2f(o))-angle(U2f(p))-angle(ymat(o,p)));
            jm3(o-1,p-1) = dQ_dUm(mm);
        end
    end
end
% -- diagonalni prvky (dQ/dD)
jm4 = zeros(size(dP,1));
dq_dd = zeros(1,size(ymat,1));
   for o = 2:size(ymat,1)
       for p = 1:size(ymat,1)
          if (o<p|o>p)
```

```
              dq_dd(:,p,o-1) = abs(U2f(o))*abs(U2f(p))*abs(ymat(o,p))*cos(angle(U2f(o))-angle(U2f(p))-
angle(ymat(o,p)));
          end
       end
       q = sum(dq_dd);
       dQ_dD(o-1,:) = q(o-1);
       jm4(o-1,o-1) = dQ_dD(o-1);
   end
dQ_dD;


% -- mimodiagonalni prvky (dQ/dD)
mmmm = 0;
for o = 2:size(ymat,1)
    for p = 2:size(ymat,1)
        if (o<p|o>p)
            mmmm = mmmm+1;
            dQ_dDm(mmmm,:) = -abs(U2f(o))*abs(U2f(p))*abs(ymat(o,p))*cos(angle(U2f(o))-angle(U2f(p))-
angle(ymat(o,p)));
            jm4(o-1,p-1) = dQ_dDm(mmmm);
        end
    end
end
dQ_dDm;


% -- Jakobiho matice --
  jm1;
  jm2;
  jm3;
  jm4;


  J = [jm1 jm2; jm3 jm4];
  dPdQ0 = [dP; dQ];


 A = zeros(size(J,1),1);
 for n = 1:size(J)
     A(:,:,n) = J(:,n);
 end


B = A;
for m = 1:size(J)
     A = B;
     A(:,:,m) =  dPdQ0;
     for n = 1:size(J)
         Jj(:,n,m) = A(:,:,n);
     end
end
Jj;


% -- Vypocet delt z matice --
for n = 1:size(J)
    dUdD(n,:) = det(Jj(:,:,n))/det(J);
end


dU = dUdD(1:(size(J)/2),:);
dD = dUdD((size(J)/2+1):end,:);


% -- Vypocet napeti v uzlech --
fprintf('%d. iterace 2.fáze \n', w)
format long


for n = 1:size(U2f)
    fprintf('U%d = %d úhel: %.4f \n', n, abs(U2f(n)), angle(U2f(n))*(180/pi));
    index0(n,:) = n;
end


for n = 2:size(U2f)
    U2f(n,:) = (abs(U2f(n))+dU(n-1))*(cos(angle(U2f(n))+dD(n-1))+sin(angle(U2f(n))+dD(n-1))*j);
end


% -- Citlivost --
 W = U2f;
 if w == 0
     UU = [U2f];
     ww = 0;
     C = UU(2:end,end-ww)+1;
 else
     UU = [UU U2f];
     ww = 1;
     C = UU(2:end,end-ww);
 end
```

```
  D = UU(2:end,end);
  CD = abs(C-D) ;


  w = w+1;
end


% - Ztraty v siti -
disp('-----------------------------------')
disp('Úbytky napětí na 2. fázi sítě')
for n = 1:size(Z,1)
    DU2f(n,:) = U2f(Uz(n))-U2f(Uk(n));
    fprintf('dU%d_%d = %.4d úhel: %.4f \n',Uz(n), Uk(n), abs(DU2f(n)), angle(DU2f(n))*(180/pi));
end
DU2f;
disp('-----------------------------------')
disp('Proudy v 2. fázích sítě:' )
I2f = DU2f./Z;
for n = 1:size(Z,1)
        fprintf('I%d_%d = %.4d úhel: %.4f \n',Uz(n), Uk(n), abs(I2f(n)), angle(I2f(n))*(180/pi));
end
disp('-----------------------------------')


% - Ztráty v jednotlivých vedeních sítě
for n = 1:size(I2f)


    DP(n,:) = Re(n)*abs(I2f(n))^2;
    DQ(n,:) = Im(n)*abs(I2f(n))^2*j;


end
    dS2f = DP+DQ;


disp('Ztráty v jednotlivých 2.fázích sítě:')
for n = 1:size(Z,1)
        fprintf('dS%d_%d = %.4d úhel: %.4f \n',Uz(n), Uk(n), abs(dS2f(n)), angle(dS2f(n))*(180/pi));
end
disp('-----------------------------------')


disp('Celkové ztráty v 2.fázi sítě:')
dPc = sum(DP);
dQc = sum(DQ);
dSc2f = dPc+dQc;
fprintf('\ndSc_2f = %.4d úhel: %.4f \n', abs(dSc2f), angle(dSc2f)*(180/pi))


 % - Ukladani dat -


    Uabs = abs(U2f);
    dScabs = abs(dSc2f);
    Iabs = abs(I2f);
    DUabs = abs(DU2f);
    dSabs = abs(dS2f);


     save(' Data2f.mat', 'U2f','DU2f','I2f','dS2f','dSc2f')


 % Ukládání hodnot napětí
    filename = 'Save.xlsx';
    uloz = {'Ustálené napětí 2. fáze'};
    sheet = 2;
    xlRange = 'A1';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = {'index'};
    sheet = 2;
    xlRange = 'A2';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = {'U [V]'};
    sheet = 2;
    xlRange = 'B2';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = {'[stupeň]'};
    sheet = 2;
    xlRange = 'C2';
```

```
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = index0;
    sheet = 2;
    xlRange = 'A3';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = abs(U2f);
    sheet = 2;
    xlRange = 'B3';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = angle(U2f)*(180/pi);
    sheet = 2;
    xlRange = 'C3';
    xlswrite(filename,uloz,sheet,xlRange)



% Ukládání hodnot úbytků napětí


    filename = 'Save.xlsx';
    uloz = {'Úbytky napětí v 2. fázi'};
    sheet = 2;
    xlRange = 'E1';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = {'index1'};
    sheet = 2;
    xlRange = 'E2';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = {'index2'};
    sheet = 2;
    xlRange = 'F2';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = {'dU [V]'};
    sheet = 2;
    xlRange = 'G2';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = {'[stupeň]'};
    sheet = 2;
    xlRange = 'H2';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = Uz;
    sheet = 2;
    xlRange = 'E3';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = Uk;
    sheet = 2;
    xlRange = 'F3';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = abs(DU2f);
    sheet = 2;
    xlRange = 'G3';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = angle(DU2f)*(180/pi);
    sheet = 2;
    xlRange = 'H3';
    xlswrite(filename,uloz,sheet,xlRange)
```

```
% Ukládání hodnot proudu
    filename = 'Save.xlsx';
    uloz = {'Proudy ve 2. fázi'};
    sheet = 2;
    xlRange = 'J1';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = {'index1'};
    sheet = 2;
    xlRange = 'J2';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = {'index2'};
    sheet = 2;
    xlRange = 'K2';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = Uz;
    sheet = 2;
    xlRange = 'J3';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = Uk;
    sheet = 2;
    xlRange = 'K3';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = {'I [A]'};
    sheet = 2;
    xlRange = 'L2';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = {'[stupeň]'};
    sheet = 2;
    xlRange = 'M2';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = abs(I2f);
    sheet = 2;
    xlRange = 'L3';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = angle(I2f)*(180/pi);
    sheet = 2;
    xlRange = 'M3';
    xlswrite(filename,uloz,sheet,xlRange)

% Ukládání hodnot ztrat


    filename = 'Save.xlsx';
    uloz = {'Ztráty ve 2. fázi'};
    sheet = 2;
    xlRange = 'O1';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = {'index1'};
    sheet = 2;
    xlRange = 'O2';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = {'index2'};
    sheet = 2;
    xlRange = 'P2';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = Uz;
    sheet = 2;
    xlRange = 'O3';
```

```
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = Uk;
    sheet = 2;
    xlRange = 'P3';
    xlswrite(filename,uloz,sheet,xlRange)



    filename = 'Save.xlsx';
    uloz = {'dS [VA]'};
    sheet = 2;
    xlRange = 'Q2';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = {'[stupeň]'};
    sheet = 2;
    xlRange = 'R2';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = abs(dS2f);
    sheet = 2;
    xlRange = 'Q3';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = angle(dS2f)*(180/pi);
    sheet = 2;
    xlRange = 'R3';
    xlswrite(filename,uloz,sheet,xlRange)

% Celkove ztraty site
    filename = 'Save.xlsx';
    uloz = {'Celkové ztráty ve 2. fázi'};
    sheet = 2;
    xlRange = 'T1';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = {'dSc [VA]'};
    sheet = 2;
    xlRange = 'T2';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = {'[stupeň]'};
    sheet = 2;
    xlRange = 'U2';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = abs(dSc2f);
    sheet = 2;
    xlRange = 'T3';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = angle(dSc2f)*(180/pi);
    sheet = 2;
    xlRange = 'U3';
    xlswrite(filename,uloz,sheet,xlRange)
% - Graf -


    figure
    ax1 = subplot(2,1,1);
    ax2 = subplot(2,1,2);


    plot(ax1,1:size(UU,2),abs(UU));
    title(ax1,' Průběh ustalování U ve 2. fázi ')
    xlabel(ax1,' iterace ')
    ylabel(ax1,' U ')


    plot(ax2,1:size(UU,2),angle(UU)*180/pi);
    title(ax2,' Průběh ustalování úhlu napětí \delta ve 2. fázi ')
    xlabel(ax2,' iterace ')
    ylabel(ax2,' stupeň ')
```

```
end
```

1.5 NRfce_3f

```
function [dS3f] = NRfce_3( V, Sm3, Zk, Uod_3, Eps, itM )
% - Matice vedeni (site) V -


Uz = V(:,1);
Uk = V(:,2);
l = V(:,3);


pocet_uzlu = max([Uz; Uk]);
lmat = zeros(pocet_uzlu);


% - Matice vykonu Sm -


P = real(Sm3(:,2));
Q = imag(Sm3(:,2));


% - Impedanční matice na km Zk -
Zk;
Z = l.*Zk(:,3);
%Z = l.*Zk1;
Re = real(Z);
Im = imag(Z);


ymat = zeros(pocet_uzlu);
for  o = 1:size(l,1)
    ymat(Uz(o),Uk(o)) = ymat(Uz(o),Uk(o))-1/(Z(o));
    ymat(Uk(o),Uz(o)) = ymat(Uk(o),Uz(o))-1/(Z(o));
    ymat(Uz(o),Uz(o)) = ymat(Uz(o),Uz(o))+1/(Z(o));
    ymat(Uk(o),Uk(o)) = ymat(Uk(o),Uk(o))+1/(Z(o));
end
ymat;


% - Odhadovane pocatecni napeti Uod -
U3f = zeros((size(Sm3,1)),1)+Uod_3 ;
%-----------------------------------------------------------------
EPS = zeros((size(U3f,1)-1),1)+Eps;
W = zeros(size(U3f));
w = 0;
CD = 1;


while CD >= Eps
    if w == itM % ukoncovaci podminka
        disp(' - CHYBA -                                POZOR Napětí se neustaluje !!!')
        break
    end


% ---- matice dP(k)_0 -
for o = 2:size(ymat,1)
   for p = 1:size(ymat,1)


        dp(p) = abs(U3f(p))*abs(ymat(o,p))*cos(angle(U3f(o))-angle(U3f(p))-angle(ymat(o,p)));
        dP(o-1,:) = P(o)-abs(U3f(o))*sum(dp);


        dq(p) = abs(U3f(p))*abs(ymat(o,p))*sin(angle(U3f(o))-angle(U3f(p))-angle(ymat(o,p)));
        dQ(o-1,:) = Q(o)-abs(U3f(o))*sum(dq);


   end
end
dP;
disp('------------------------------- ')
dQ;


% ---- Vypocet prvku Jakobiho matice


jm1 = zeros(size(dP,1));
% -- diagonalni prvky (dP/dU)
dp_du = zeros(1,size(ymat,1));
   for o = 2:size(ymat,1)
       for p = 1:size(ymat,1)
          if (o<p|o>p)
```

```
            dp_du(:,p,o-1) = abs(U3f(p))*abs(ymat(o,p))*cos(angle(U3f(o))-angle(U3f(p))-
angle(ymat(o,p)));
          end
       end
       q = sum(dp_du);
       dP_dU(o-1,:) = 2*abs(U3f(o))*abs(ymat(o,o))*cos(angle(ymat(o,o)))+q(o-1);
       jm1(o-1,o-1) = dP_dU(o-1);
   end
% -- mimodiagonalni prvky (dP/dU)
m = 0;
for o = 2:size(ymat,1)
    for p = 2:size(ymat,1)
        if (o<p|o>p)
           m = m+1;
           dP_dUm(m,:) =( abs(U3f(o))*abs(ymat(o,p))*cos(angle(U3f(o))-angle(U3f(p))-angle(ymat(o,p))));
           jm1(o-1,p-1) = dP_dUm(m);
        end
    end
end
jm2 = zeros(size(dP,1));
% -- diagonalni prvkz (dP/dD)
dp_dd = zeros(1,size(ymat,1));
   for o = 2:size(ymat,1)
       for p = 1:size(ymat,1)
          if (o<p|o>p)
              dp_dd(:,p,o-1) = abs(U3f(o))*abs(U3f(p))*abs(ymat(o,p))*sin(angle(U3f(o))-angle(U3f(p))-
angle(ymat(o,p)));
          end
       end
       q = sum(dp_dd);
       dP_dD(o-1,:) = -q(o-1);
       jm2(o-1,o-1) = dP_dD(o-1);
   end
% -- mimodiagonalni prvky (dP/dD)
mmm = 0;
for o = 2:size(ymat,1)
    for p = 2:size(ymat,1)
        if (o<p|o>p)
            mmm = mmm+1;
            dP_dDm(mmm,:) = abs(U3f(o))*abs(U3f(p))*abs(ymat(o,p))*sin(angle(U3f(o))-angle(U3f(p))-
angle(ymat(o,p)));
            jm2(o-1,p-1) = dP_dDm(mmm);
        end
     end
 end
% -- diagonalni prvky (dQ/dU)
jm3 = zeros(size(dP,1));
dq_du = zeros(1,size(ymat,1));
   for o = 2:size(ymat,1)
       for p = 1:size(ymat,1)
          if (o<p|o>p)
              dq_du(:,p,o-1) = abs(U3f(p))*abs(ymat(o,p))*sin(angle(U3f(o))-angle(U3f(p))-
angle(ymat(o,p)));
          end
       end
       q = sum(dq_du);
       dQ_dU(o-1,:) = -2*abs(U3f(o))*abs(ymat(o,o))*sin(angle(ymat(o,o)))+q(o-1);
       jm3(o-1,o-1) = dQ_dU(o-1);
   end
% -- mimodiagonalni prvky (dQ/dU)
mm = 0;
for o = 2:size(ymat,1)
    for p = 2:size(ymat,1)
        if (o<p|o>p)
            mm = mm+1;
            dQ_dUm(mm,:) = abs(U3f(o))*abs(ymat(o,p))*sin(angle(U3f(o))-angle(U3f(p))-angle(ymat(o,p)));
            jm3(o-1,p-1) = dQ_dUm(mm);
        end
    end
end
% -- diagonalni prvky (dQ/dD)
jm4 = zeros(size(dP,1));
dq_dd = zeros(1,size(ymat,1));
   for o = 2:size(ymat,1)
       for p = 1:size(ymat,1)
          if (o<p|o>p)
              dq_dd(:,p,o-1) = abs(U3f(o))*abs(U3f(p))*abs(ymat(o,p))*cos(angle(U3f(o))-angle(U3f(p))-
angle(ymat(o,p)));
          end
       end
       q = sum(dq_dd);
       dQ_dD(o-1,:) = q(o-1);
       jm4(o-1,o-1) = dQ_dD(o-1);
   end
% -- mimodiagonalni prvky (dQ/dD)
mmmm = 0;
for o = 2:size(ymat,1)
    for p = 2:size(ymat,1)
```

```
        if (o<p|o>p)
            mmmm = mmmm+1;
            dQ_dDm(mmmm,:) = -abs(U3f(o))*abs(U3f(p))*abs(ymat(o,p))*cos(angle(U3f(o))-angle(U3f(p))-
angle(ymat(o,p)));
            jm4(o-1,p-1) = dQ_dDm(mmmm);
        end
    end
end
% -- Jakobiho matice --
  jm1;
  jm2;
  jm3;
  jm4;


  J = [jm1 jm2; jm3 jm4];
  dPdQ0 = [dP; dQ];


 A = zeros(size(J,1),1);
 for n = 1:size(J)
     A(:,:,n) = J(:,n);
 end


B = A;
for m = 1:size(J)
     A = B;
     A(:,:,m) =  dPdQ0;
     for n = 1:size(J)
         Jj(:,n,m) = A(:,:,n);
     end
end
Jj;


% -- Vypocet delt z matice --
for n = 1:size(J)
    dUdD(n,:) = det(Jj(:,:,n))/det(J);
end


dU = dUdD(1:(size(J)/2),:);
dD = dUdD((size(J)/2+1):end,:);


% -- Vypocet napeti v uzlech --
fprintf('%d. iterace 3.fáze \n', w)
format long


for n = 1:size(U3f)
    fprintf('U%d = %d úhel: %.4f \n', n, abs(U3f(n)), angle(U3f(n))*(180/pi));
    index0(n,:) = n;
end


for n = 2:size(U3f)
    U3f(n,:) = (abs(U3f(n))+dU(n-1))*(cos(angle(U3f(n))+dD(n-1))+sin(angle(U3f(n))+dD(n-1))*j);
end


% -- Citlivost --
 W = U3f;
 if w == 0
     UU = [U3f];
     ww = 0;
     C = UU(2:end,end-ww)+1;
 else
     UU = [UU U3f];
     ww = 1;
     C = UU(2:end,end-ww);
 end


  D = UU(2:end,end);
  CD = abs(C-D) ;


  w = w+1;
end


% - Ztraty v siti -
disp('-----------------------------------')
disp('Úbytky napětí na 3. fázi sítě')
for n = 1:size(Z,1)
    DU3f(n,:) = U3f(Uz(n))-U3f(Uk(n));
    fprintf('dU%d_%d = %.4d úhel: %.4f \n',Uz(n), Uk(n), abs(DU3f(n)), angle(DU3f(n))*(180/pi));
end
DU3f;
```

```
disp('-----------------------------------')
disp('Proudy v 3. fázích sítě:' )
I3f = DU3f./Z;
for n = 1:size(Z,1)
        fprintf('I%d_%d = %.4d úhel: %.4f \n',Uz(n), Uk(n), abs(I3f(n)), angle(I3f(n))*(180/pi));
end
disp('-----------------------------------')


% - Ztráty v jednotlivých vedeních sítě
for n = 1:size(I3f)


    DP(n,:) = Re(n)*abs(I3f(n))^2;
    DQ(n,:) = Im(n)*abs(I3f(n))^2*j;


end
    dS3f = DP+DQ;


disp('Ztráty v jednotlivých 3.fázích sítě:')
for n = 1:size(Z,1)
        fprintf('dS%d_%d = %.4d úhel: %.4f \n',Uz(n), Uk(n), abs(dS3f(n)), angle(dS3f(n))*(180/pi));
end
disp('-----------------------------------')


disp('Celkové ztráty v 3.fázi sítě:')
dPc = sum(DP);
dQc = sum(DQ);
dSc3f = dPc+dQc;
fprintf('\ndSc_3f = %.4d úhel: %.4f \n', abs(dSc3f), angle(dSc3f)*(180/pi))


% Ukládání hodnot napětí
    filename = 'Save.xlsx';
    uloz = {'Ustálené napětí 3. fáze'};
    sheet = 3;
    xlRange = 'A1';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = {'index'};
    sheet = 3;
    xlRange = 'A2';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = {'U [V]'};
    sheet = 3;
    xlRange = 'B2';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = {'[stupeň]'};
    sheet = 3;
    xlRange = 'C2';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = index0;
    sheet = 3;
    xlRange = 'A3';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = abs(U3f);
    sheet = 3;
    xlRange = 'B3';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = angle(U3f)*(180/pi);
    sheet = 3;
    xlRange = 'C3';
    xlswrite(filename,uloz,sheet,xlRange)



 % Ukládání hodnot úbytků napětí


    filename = 'Save.xlsx';
    uloz = {'Úbytky napětí v 3. fázi'};
```

```
    sheet = 3;
    xlRange = 'E1';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = {'index1'};
    sheet = 3;
    xlRange = 'E2';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = {'index2'};
    sheet = 3;
    xlRange = 'F2';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = {'dU [V]'};
    sheet = 3;
    xlRange = 'G2';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = {'[stupeň]'};
    sheet = 3;
    xlRange = 'H2';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = Uz;
    sheet = 3;
    xlRange = 'E3';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = Uk;
    sheet = 3;
    xlRange = 'F3';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = abs(DU3f);
    sheet = 3;
    xlRange = 'G3';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = angle(DU3f)*(180/pi);
    sheet = 3;
    xlRange = 'H3';
    xlswrite(filename,uloz,sheet,xlRange)

% Ukládání hodnot proudu
    filename = 'Save.xlsx';
    uloz = {'Proudy ve 3. fázi'};
    sheet = 3;
    xlRange = 'J1';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = {'index1'};
    sheet = 3;
    xlRange = 'J2';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = {'index2'};
    sheet = 3;
    xlRange = 'K2';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = Uz;
    sheet = 3;
    xlRange = 'J3';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = Uk;
```

```
    sheet = 3;
    xlRange = 'K3';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = {'I [A]'};
    sheet = 3;
    xlRange = 'L2';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = {'[stupeň]'};
    sheet = 3;
    xlRange = 'M2';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = abs(I3f);
    sheet = 3;
    xlRange = 'L3';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = angle(I3f)*(180/pi);
    sheet = 3;
    xlRange = 'M3';
    xlswrite(filename,uloz,sheet,xlRange)

% Ukládání hodnot ztrat
    filename = 'Save.xlsx';
    uloz = {'Ztráty ve 3. fázi'};
    sheet = 3;
    xlRange = 'O1';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = {'index1'};
    sheet = 3;
    xlRange = 'O2';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = {'index2'};
    sheet = 3;
    xlRange = 'P2';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = Uz;
    sheet = 3;
    xlRange = 'O3';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = Uk;
    sheet = 3;
    xlRange = 'P3';
    xlswrite(filename,uloz,sheet,xlRange)



    filename = 'Save.xlsx';
    uloz = {'dS [VA]'};
    sheet = 3;
    xlRange = 'Q2';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = {'[stupeň]'};
    sheet = 3;
    xlRange = 'R2';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = abs(dS3f);
    sheet = 3;
    xlRange = 'Q3';
    xlswrite(filename,uloz,sheet,xlRange)
```

```
    filename = 'Save.xlsx';
    uloz = angle(dS3f)*(180/pi);
    sheet = 3;
    xlRange = 'R3';
    xlswrite(filename,uloz,sheet,xlRange)

 % Celkove ztraty site
    filename = 'Save.xlsx';
    uloz = {'Celkové ztráty ve 3. fázi'};
    sheet = 3;
    xlRange = 'T1';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = {'dSc [VA]'};
    sheet = 3;
    xlRange = 'T2';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = {'[stupeň]'};
    sheet = 3;
    xlRange = 'U2';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = abs(dSc3f);
    sheet = 3;
    xlRange = 'T3';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = angle(dSc3f)*(180/pi);
    sheet = 3;
    xlRange = 'U3';
    xlswrite(filename,uloz,sheet,xlRange)



% - Graf -


    figure
    ax1 = subplot(2,1,1);
    ax2 = subplot(2,1,2);


    plot(ax1,1:size(UU,2),abs(UU));
    title(ax1,' Průběh ustalování U ve 3. fázi ')
    xlabel(ax1,' iterace ')
    ylabel(ax1,' U ')


    plot(ax2,1:size(UU,2),angle(UU)*180/pi);
    title(ax2,' Průběh ustalování úhlu napětí \delta ve 3. fázi ')
    xlabel(ax2,' iterace ')
    ylabel(ax2,' stupeň ')


end
```

1.6 NR_sum_ztraty

```
function [ dScf ] = NR_sum_ztraty(Uz,Uk,dS1f, dS2f, dS3f)
dScf = dS1f+dS2f+dS3f;


disp('Třífázové ztráty:')
for n = 1:size(Uz)
        fprintf('dS%d_%d = %.4d úhel: %.4f \n',Uz(n), Uk(n), abs(dScf(n)), angle(dScf(n))*(180/pi));
end
disp('-----------------------------------')
disp('Celkové třífázové ztráty:')
fprintf('\ndSc = %.4d úhel: %.4f \n', abs(sum(dScf)), angle(sum(dScf))*(180/pi))
```

```
% Ukládání hodnot ztrat
    filename = 'Save.xlsx';
    uloz = {'Třífázové ztráty'};
    sheet = 4;
    xlRange = 'A1';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = {'index1'};
    sheet = 4;
    xlRange = 'A2';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = {'index2'};
    sheet = 4;
    xlRange = 'B2';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = Uz;
    sheet = 4;
    xlRange = 'A3';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = Uk;
    sheet = 4;
    xlRange = 'B3';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = {'dS [VA]'};
    sheet = 4;
    xlRange = 'C2';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = {'[stupeň]'};
    sheet = 4;
    xlRange = 'D2';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = abs(dScf);
    sheet = 4;
    xlRange = 'C3';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = angle(dScf)*(180/pi);
    sheet = 4;
    xlRange = 'D3';
    xlswrite(filename,uloz,sheet,xlRange)

 % Celkove ztraty site
    filename = 'Save.xlsx';
    uloz = {'Celkové ztráty všech fází'};
    sheet = 4;
    xlRange = 'F1';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = {'dSc [VA]'};
    sheet = 4;
    xlRange = 'F2';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = {'[stupeň]'};
    sheet = 4;
    xlRange = 'G2';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = abs(sum(dScf));
    sheet = 4;
    xlRange = 'F3';
```

```
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = angle(sum(dScf))*(180/pi);
    sheet = 4;
    xlRange = 'G3';
    xlswrite(filename,uloz,sheet,xlRange)

end
```

1.7 Ukladani_zadanych_dat

```
% Ukladani zadanych dat


    filename = 'Save.xlsx';
    uloz = {'index'};
    sheet = 5;
    xlRange = 'A2';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = Sm1(:,1);
    sheet = 5;
    xlRange = 'A3';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = {'Sm1 [VA]'};
    sheet = 5;
    xlRange = 'B2';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = {'[stupeň]'};
    sheet = 5;
    xlRange = 'C2';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = abs(Sm1(:,2));
    sheet = 5;
    xlRange = 'B3';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = angle(Sm1(:,2))*(180/pi);
    sheet = 5;
    xlRange = 'C3';
    xlswrite(filename,uloz,sheet,xlRange)
    %Sm2
    filename = 'Save.xlsx';
    uloz = {'Sm2 [VA]'};
    sheet = 5;
    xlRange = 'D2';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = {'[stupeň]'};
    sheet = 5;
    xlRange = 'E2';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = abs(Sm2(:,2));
    sheet = 5;
    xlRange = 'D3';
    xlswrite(filename,uloz,sheet,xlRange)


    filename = 'Save.xlsx';
    uloz = angle(Sm2(:,2))*(180/pi);
    sheet = 5;
    xlRange = 'E3';
    xlswrite(filename,uloz,sheet,xlRange)
    %Sm3
    filename = 'Save.xlsx';
    uloz = {'Sm3 [VA]'};
    sheet = 5;
```

```
xlRange = 'F2';
xlswrite(filename,uloz,sheet,xlRange)


filename = 'Save.xlsx';
uloz = {'[stupeň]'};
sheet = 5;
xlRange = 'G2';
xlswrite(filename,uloz,sheet,xlRange)


filename = 'Save.xlsx';
uloz = abs(Sm3(:,2));
sheet = 5;
xlRange = 'F3';
xlswrite(filename,uloz,sheet,xlRange)


filename = 'Save.xlsx';
uloz = angle(Sm3(:,2))*(180/pi);
sheet = 5;
xlRange = 'G3';
xlswrite(filename,uloz,sheet,xlRange)


% Zk
filename = 'Save.xlsx';
uloz = {'Uložené zadané hodnoty'};
sheet = 5;
xlRange = 'A1';
xlswrite(filename,uloz,sheet,xlRange)


filename = 'Save.xlsx';
uloz = {'index1'};
sheet = 5;
xlRange = 'I2';
xlswrite(filename,uloz,sheet,xlRange)


filename = 'Save.xlsx';
uloz = {'index2'};
sheet = 5;
xlRange = 'J2';
xlswrite(filename,uloz,sheet,xlRange)


filename = 'Save.xlsx';
uloz = Uz;
sheet = 5;
xlRange = 'I3';
xlswrite(filename,uloz,sheet,xlRange)


filename = 'Save.xlsx';
uloz = Uk;
sheet = 5;
xlRange = 'J3';
xlswrite(filename,uloz,sheet,xlRange)


filename = 'Save.xlsx';
uloz = {'Zk [ohm/km]'};
sheet = 5;
xlRange = 'K2';
xlswrite(filename,uloz,sheet,xlRange)


filename = 'Save.xlsx';
uloz = {'[stupeň]'};
sheet = 5;
xlRange = 'L2';
xlswrite(filename,uloz,sheet,xlRange)


filename = 'Save.xlsx';
uloz = abs(Zk(:,3));
sheet = 5;
xlRange = 'K3';
xlswrite(filename,uloz,sheet,xlRange)


filename = 'Save.xlsx';
uloz = angle(Zk(:,3))*(180/pi);
sheet = 5;
xlRange = 'L3';
xlswrite(filename,uloz,sheet,xlRange)
% l
filename = 'Save.xlsx';
uloz = {'l [km]'};
sheet = 5;
```

```
xlRange = 'M2';
xlswrite(filename,uloz,sheet,xlRange)


filename = 'Save.xlsx';
uloz = V(:,3);
sheet = 5;
xlRange = 'M3';
xlswrite(filename,uloz,sheet,xlRange)
```