

# DEMO CODE OF

## TOPOLOGY IDENTIFICATION AND LINE PARAMETER ESTIMATION FOR NON-PMU DISTRIBUTION NETWORK: A NUMERICAL METHOD

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```
clear;  
fprintf('[Identification] Programme starts .....\\n')
```

[Identification] Programme starts .....

### DATA PROCESSING

#### IMPORT DATA

```
fprintf('[Identification] Data processing .....\\n')
```

[Identification] Data processing .....

```
pf = loadcase('case33bw');           % test case  
load = readLD;                       % power load origin file  
freq = 1/10;                         % times per hour  
err = 0.001;                        % additional error  
tol = 10^-8;                        % tol for ac flow calculation  
qlist = data_processing(pf,load,freq,err,tol); % build datasets
```

[data processing] Build No. 50 dataset

[data processing] Build No. 100 dataset

[data processing] Build No. 150 dataset

[data processing] Build No. 200 dataset

[data processing] Build No. 240 dataset

### BASIC IDENTIFICATION

```
fprintf('[Identification] Basic identification .....\\n')
```

[Identification] Basic identification .....

```
pect = 0.02;                        % gammar: remove branch thro
```

```
thro = 10^-8; % decide stop basic identification
[mpfn,flag] = basicidentify(qlist,pect,thro); % basic identification
```

```
[Basic Identification] No.1 ends with error 199.136773
Wrong branch +/-: 192,0

[Basic Identification] No.2 ends with error 85.058044
Wrong branch +/-: 43,0

[Basic Identification] No.3 ends with error 19.823915
Wrong branch +/-: 14,0

[Basic Identification] No.4 ends with error 8.336062
Wrong branch +/-: 10,0

[Basic Identification] No.5 ends with error 2.329934
Wrong branch +/-: 8,0

[Basic Identification] No.6 ends with error 2.361255
Wrong branch +/-: 6,0

[Basic Identification] No.7 ends with error 2.233993
Wrong branch +/-: 6,0

[Basic Identification] Converged after 8 iterations with error 0.000000e+00
Wrong branch +/-: 6,0

Time passed 0.064540 s.
```

```
% flag == 0: wrong topo
% detected
if flag == 0
    fprintf('[Basic identification] Wrong topology detected. REDUCE PECT!\n We terminate the
programme to save time\n')
    quit();
end
tic;
```

## FINE IDENTIFICATION

```
fprintf('[Identification] Fine identification ..... \n')
```

```
[Identification] Fine identification .....
```

## SELECT LAST 30 DATA

```
mpfn.q = mpfn.q(:,end-29:end);  
mpfn.smat = mpfn.smat(:,end-29:end);  
mpfn.dsmat = zeros(size(mpfn.smat));  
mpfn.vmat = mpfn.vmat(:,end-29:end);  
mpfn.thetamat = mpfn.thetamat(:,end-29:end);
```

## FINE IDENTIFICATION SETTINGS

```
MAXITER = 25;      % maximum iteration time  
varsigma = 0.01;   % decide whether to remove branches  
xi = 0.05;         % threshold to remove branches  
varphi = 1*10^-10; % decide whether to end iterations
```

## CONSTANTS

```
[n,~] = size(mpfn.bus);  
[m,~] = size(mpfn.branch);  
[~,M] = size(mpfn.smat);
```

## INITIALIZATION

```
deltapqlist = deltaPQ(mpfn);  
dftp = norm(deltapqlist,2); % threshold
```

## ERROR EVALUATION WHEN STARTS

```
[gberror,wrong_add,wrong_miss] = errorevaluate(mpfn,qlist(1));  
gberror = gberror*100; % display in 100%  
fprintf('[fine identification] Starts with error %e\n',dftp);
```

[fine identification] Starts with error 8.482319e-02

```
fprintf('MAPE: g: %f%%, b: %f%%; Wrong branch +/-  
: %d,%d\n',gberror(1),gberror(2),length(wrong_add),length(wrong_miss));
```

MAPE: g: 35.028203%, b: 41.714352%; Wrong branch +/-: 6,0

## START ITERATION

```
for T = 1:MAXITER
```

---

## PSEUDO-POWER FLOW CALCULATION

```
mpfn = pseudopf(mpfn);
```

---

#### JACOBIAN MATRIX

```
| A B C |
```

```
| D E F |
```

```
Jmat = Jacobianmat(mpfn);
```

---

#### GENERALIZED REVERSE

```
invJmat = pinv(Jmat);  
% Delta S = Delta P,Q  
deltapqlist = deltaPQ(mpfn);  
% delta g,b,theta  
deltagbt = invJmat*deltapqlist;  
% renew g,b and theta  
mpfn = renewgbt(mpfn,deltagbt);
```

---

#### CALCULATE THROSHOLD

```
deltapqlist = deltaPQ(mpfn);  
df = norm(deltapqlist,2); % threshold
```

---

#### REMOVE WRONG BRANCHES

```
if abs(df - dftp)<varsigma  
    mpfn = removebran(mpfn,xi);  
end
```

---

#### CALCULATE THROSHOLD

```
deltapqlist = deltaPQ(mpfn);  
df = norm(deltapqlist,2); % threshold
```

---

#### ERROR EVALUATION

```
[gberror,wrong_add,wrong_miss] = errevaluate(mpfn,qlist(1));  
gberror = gberror*100; % display in 100%
```

---

#### DECIDE WHETHER TO END ITERATION

```

if abs(df - dftp)<varphi && T~=1
    fprintf('[fine identification] Ends with %d iterations, with error %e\n',T,df);
    fprintf('MAPE: g: %f%%, b: %f%%; Wrong branch +/-
: %d,%d\n',gberror(1),gberror(2),length(wrong_add),length(wrong_miss));
    break;
else
    fprintf('[fine identification] No.%d ends with error %e\n',T,df);
    fprintf('MAPE: g: %f%%, b: %f%%; Wrong branch +/-
: %d,%d\n',gberror(1),gberror(2),length(wrong_add),length(wrong_miss));
end

```

[fine identification] No.1 ends with error 1.846560e-01

MAPE: g: 20.058325%, b: 16.032614%; Wrong branch +/-: 6,0

[fine identification] No.2 ends with error 3.951914e-02

MAPE: g: 0.776318%, b: 2.068346%; Wrong branch +/-: 6,0

[fine identification] No.3 ends with error 8.341512e-03

MAPE: g: 0.220732%, b: 0.418977%; Wrong branch +/-: 6,0

[fine identification] No.4 ends with error 2.228952e-03

MAPE: g: 0.305660%, b: 0.240022%; Wrong branch +/-: 0,0

[fine identification] No.5 ends with error 4.800817e-05

MAPE: g: 0.113633%, b: 0.156629%; Wrong branch +/-: 0,0

[fine identification] No.6 ends with error 4.347213e-05

MAPE: g: 0.113615%, b: 0.156165%; Wrong branch +/-: 0,0

[fine identification] Ends with 7 iterations, with error 4.347213e-05

MAPE: g: 0.113614%, b: 0.156166%; Wrong branch +/-: 0,0

```

dftp = df;
end
toc;
fprintf('[Identification] Programme successfully ends ..... \n')

```

Time passed 41.840540 s.

[Identification] Programme successfully ends .....