电力系统分析专题研究二 潮流计算

技术报告

电 61 王铮澄
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一、程序设计

- 实验要求：

  根据 N-R 算法框图，使用给定的子程序编制主程序，对给定的模型系统进行潮流计算，对结果进行分析。

- 已有材料：

  1、 潮流计算子程序 ybus()，dpqc()，jmcc()，sevc()，plsc()

  2、 算例参数文件 FLOW.D1

- 程序分析：

  所给的程序为 C 语言程序，考虑到其封装性和复用性不佳，可以将其使用 C++语言进行改写和封装，将潮流计算封装为一个单独的类，使其模块化程度更高，代码规范性更强。此外，原函数的名称可读性较差，将 5 个子函数重新命名如下：

原名称	现名称	函数功能
ybus()	GenNodeYMatrix()	根据输入参数形成节点导纳阵
dpqc()	CalError()	计算功率误差
jmcc()	CalJacobian()	形成 jacobian 矩阵
sevc()	SolveBias()	解修正方程得到状态变量的修正值
plsc()	CalPower()	计算线路潮流，PV 节点无功功率及平衡节点功率

一共编写 5 个子文件如下：

FlowSolve.h	FlowSolve 类及其成员变量、函数的声明和初始化
FlowSolve.cpp	FlowSolve 类成员函数的实现
FlowSolveApp.h	FlowSolve 应用类的声明
FlowSolveApp.cpp	整合 FlowSolve 类的成员函数，形成完整的潮流计算主程序
FlowSolveAppMain.cpp	主程序实例化及其运算

FlowSolve 类以及和 FlowSolveApp 类分析如下：

----------FlowSolve 类 start----------

```
class FlowSolve {
public:
    int iter_count;              //iteration counter
    int n, m, l, n0, n1;
    int pq_num, pv_num;
    int k, k1;
    float dd;
    float epsilon;                    //converge standard
    float* g;float* b;float* g1;float* b1;float* c1;
    float* c;float* co;int* s1;int* e1;float* p;
```

```
    float* q;float* p0;float* q0;float* p1;float* q1;
    float* v;float* v0;float* e;float* f;float* jm;
    float* a;float* p2;float* q2;float* p3;float* q3;
    float* angle;


public:
    FlowSolve() :iter_count(0), epsilon(0.0001), k(1), k1(0) {
        g = NULL;b = NULL;g1 = NULL;b1 = NULL;c1 = NULL;
        c = NULL;co = NULL;s1 = NULL;e1 = NULL;p = NULL;
        q = NULL;p0 = NULL;q0 = NULL;p1 = NULL;q1 = NULL;
        v = NULL;v0 = NULL;e = NULL;f = NULL;jm = NULL;
        a = NULL;p2 = NULL;q2 = NULL;p3 = NULL;q3 = NULL;
        angle = NULL;
    };
    ~FlowSolve() {
        delete s1, g1, b1, c1, c, co, e1, p, q, e, f, angle;
        delete g, b, p0, q0, p1, q1, p2, q2, p3, q3, v, v0, jm, a;
    };
    void SetEpsilon();
    void GetParameters();
    void GenNodeYMatrix();
    void CalError();
    void CalJacobian();
    void SolveBias();
    void CalSPower();
    void UpdateEF();
    void MakeA();
    void ShowA();
};
```

----------FlowSolve类end----------

FlowSolve类的成员变量基本上都是指示书中所给出的变量，新添加了iter_count用于记录迭代次数，epsilon用于存储收敛指标，pv_num为PV节点个数，可以根据总节点数和PQ节点个数计算得到。

成员函数中，除了所给的5个子程序之外，新添加的函数作用如下：

函数	作用
SetEpsilon()	接受键盘输入，设置收敛指标epsilon
GetParameters()	从算例文件FLOW.D1读入网络参数，并对状态变量进行初始化
UpdateEF()	在一轮迭代之后更新状态变量e[]，f[]的值
MakeA()	根据jacobian矩阵和误差向量形成矩阵A[]
ShowA()	打印矩阵A[]，调试用

子程序具体代码这里不再给出，可以参见附件中的程序。

----------FlowSolveApp 类 start----------

```
class FlowSolveApp {
public:
FlowSolveApp() {};
~FlowSolveApp() {};
void Run();
};
```

----------FlowSolveApp类end----------

FlowSolveApp类的作用就是将FlowSolve类的各个子函数进行整合，也就是完成任务中“给出主程序”的功能。主程序为Run()函数，具体代码如下：

----------FlowSolveApp.Run()----------

```
void FlowSolveApp::Run() {
	FlowSolve m_fs;
	m_fs.GetParameters();
	m_fs.iter_count = 0;
	m_fs.SetEpsilon();
	m_fs.GenNodeYMatrix();

	m_fs.CalError();
	m_fs.CalJacobian();
	m_fs.MakeA();
	m_fs.SolveBias();
	m_fs.UpdateEF();
	m_fs.iter_count++;
	while (m_fs.dd > m_fs.epsilon) {
		//cout << "\n" << endl;
		//cout << "The max error: " << m_fs.dd << endl;
		m_fs.CalError();
		m_fs.CalJacobian();
		m_fs.MakeA();
		m_fs.SolveBias();
		m_fs.UpdateEF();
		m_fs.iter_count++;
	}

	m_fs.CalSPower();
	cout << "The total iterations is: " << m_fs.iter_count << endl;
}
```

----------FlowSolveApp.Run()----------

该主程序的流程可以用图 1说明，图中黄色部分表示所给子程序：

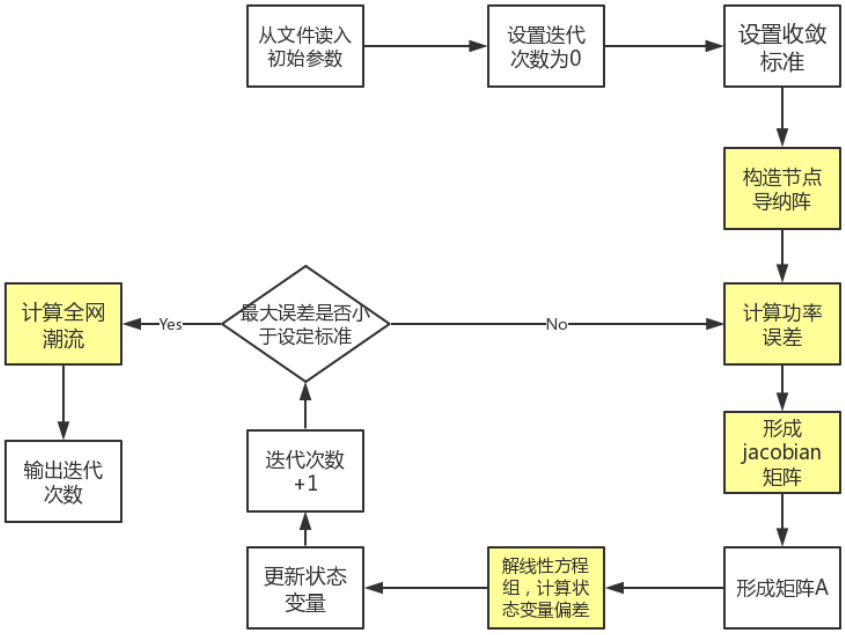

图 1 潮流计算流程图

二、算例探究 1

为了验证程序的正确性，使用指示书中的模型系统 1 进行验证。

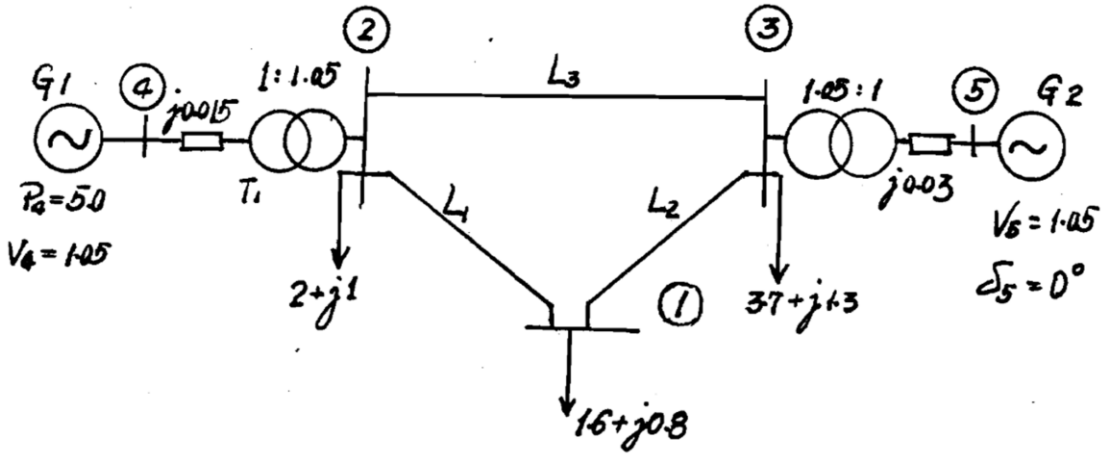

图 2 模型系统 1 示意图

设置收敛指标 epsilon=1e-03：

迭代次数：3

每轮状态变量的误差变化如下表：

迭代次数	ΔE1	ΔE2	ΔE3	ΔE4
1	−0.033569	0.105382	0.058813	0.000000

	ΔF1	ΔF2	ΔF3	ΔF4
	0.033482	0.360705	−0.069000	0.457490
2	ΔE1	ΔE2	ΔE3	ΔE4
	−0.095285	−0.074975	−0.023675	−0.071321
	ΔF1	ΔF2	ΔF3	ΔF4
	−0.036405	−0.030737	−0.007981	−0.065055
3	ΔE1	ΔE2	ΔE3	ΔE4
	−0.011776	−0.004372	−0.001600	−0.004051
	ΔF1	ΔF2	ΔF3	ΔF4
	−0.001895	0.000493	−0.000395	−0.001770

每轮误差向量的最大功率误差变化如下表：

迭代轮数	最大功率误差
1	3.06103
2	0.170494
3	6.89879e-04

从迭代过程可以看出，每一轮的迭代都使得状态变量的偏差和最大功率误差越来越小，并且作为收敛指标的最大功率误差下降得非常快，说明算法趋向于收敛，并且收敛速度很快。当收敛指标设置为 0.001 时，经过 4 轮迭代即可收敛。下面尝试其它收敛指标。

epsilon=1e-04：
迭代次数：4
epsilon=1e-05：
迭代次数：4
这里不再详细列出迭代过程，只将 epsilon=1e-5 时的计算结果列举如下：

节点复电压及节点平衡功率

节点	电压	角度/°	注入有功 P	注入无功 Q
1	0.86215	−4.77855	−1.60000	−0.80000
2	1.07792	17.85348	−2.00000	−1.00000
3	1.03641	−4.28194	−3.70000	−1.30000
4	1.05000	21.84327	5.00000	1.81309
5	1.05000	0.00000	2.57943	2.29940

表中标为黄色的数据是原系统已知的部分，与原系统图对比，可以发现这部分数据与原系统完全吻合。（这里将输入文件中的 0 0 0 1.05 1.05 行改为全 0，因为这一行应该代表节点接地电纳，但是接地电纳取值为正应该是不对的，因此将其置零，得到结果刚好和文件参数吻合。）

线路功率

线路编号	方向	有功	无功	方向	有功	无功
1	1-2	-1.46618	-0.40908	2-1	1.58455	0.67256
2	1-2	-0.13382	-0.39092	3-1	0.15679	0.47131
3	2-3	1.41545	-0.24433	3-2	-1.27736	0.20317

4	2-4	-5.00000	-1.42823	4-2	5.00000	1.81308
5	3-5	-2.57943	-1.97449	5-3	2.57943	2.29940

对比节点复电压及节点平衡功率，可以发现，计算得到的结果完全符合“有功从角度超前流向角度滞后，无功从电压高流向电压低”这一结论，并且节点有功无功计算值与所给文件中的参数数据吻合，结合两张表格，可以认为潮流计算结果正确。

三、节点转化

模型系统 1 中没有节点电压和无功的限制，但是在实际电力系统潮流计算中，PQ 节点有电压限制，PV 节点也有无功功率限制，因此对节点转化进行考虑十分必要。

节点转化的主要思路是：

如果在迭代过程中，某 PQ 节点电压超限，则需要将其转换为 PV 节点，其 Q 方程转化为 V 方程。若超上限，则将该节点的已知电压设为电压上界；若超下限，则将该节点的已知电压设为电压下界。

如果在迭代过程中，某 PV 节点无功超限，则需要将其转换为 PQ 节点，其 V 方程转化为 Q 方程。若超上限，则将该节点的无功设为无功上界；若超下限，则将该节点的无功设为无功下界。

考虑此功能，需要对主程序、jacobian 矩阵计算函数以及矩阵 A 形成函数 MakeA()进行修改，并且加入判断电压和无功超限与否的函数。以上几个方面分别说明如下：

主程序流程图转变如图 3：

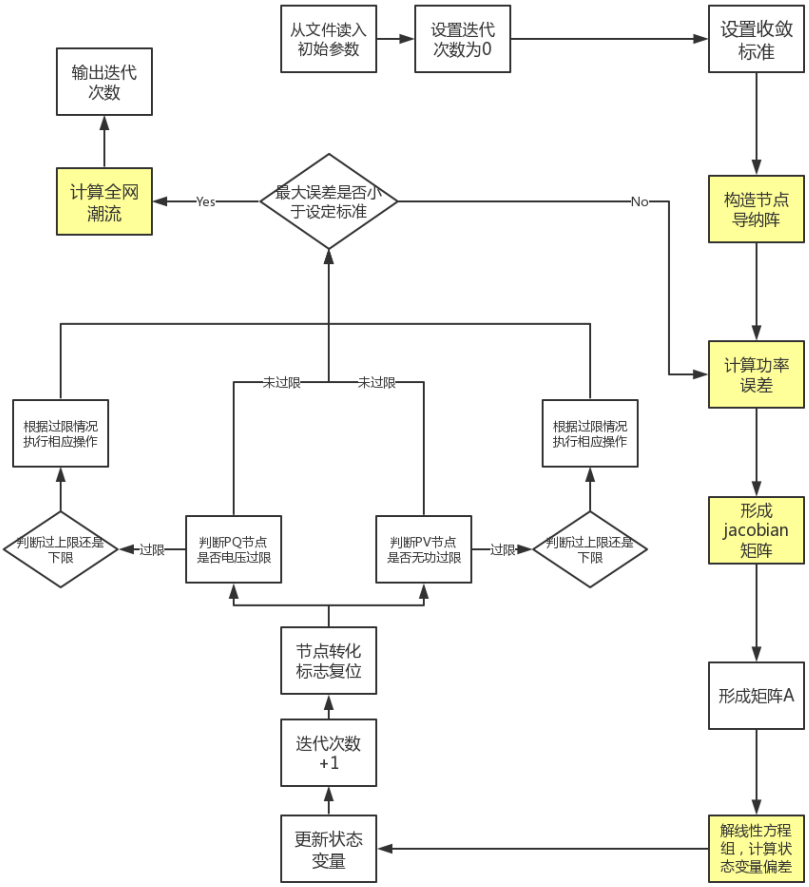

图 3 考虑节点转化的主程序流程图

对 jacobian 矩阵构造函数 CalJacobian()进行修改：在代码中加入判断，如果 PQ 转 PV 的标志为 1，则在计算 PV 节点相应参数的时候，多计算待转化节点对应的行。如果 PV 转 PQ 的标志为 1，则在计算 PQ 节点相应参数的时候，多计算待转化节点对应的行。事实上，节点转化在程序中的体现为两个方面：

1、 相应节点对应 jacobian 矩阵行参数类型的变化；

2、 误差计算的时候相应节点计算的误差类型不同（无功误差还是电压平方误差）

其中第一点通过修改函数 CalJacobian()内容得到实现，第二点则在主程序以及 CalError()函数中进行修改。对应流程图中“根据过限情况执行相应操作”的模块。具体操作如下：

如果 PQ 节点电压超过上限，则将对应节点的变量 V 改为电压上界；

如果 PQ 节点电压超过下限，则将对应节点的变量 V 改为电压下界；

如果 PV 节点无功超过上限，则将对应节点的变量 Q 改为无功上界；

如果 PV 节点无功超过下限，则将对应节点的变量 Q 改为无功下界；

由于 CalError()函数在计算误差时，基础就是变量 V 和 Q，因此在外部对这两个变量直接修改。并且在 CalError()函数中，对误差类型计算的语句进行修改，例如将判断 PQ 类型节点误差的判断语句中加入对 PV 转 PQ 节点的判断，将这种节点的误差也按照 PQ 节点误差进行计算，就可以达到对误差计算方式进行修改的目的。

MakeA()函数的修改思路与 CalError()的修改思路对应，此处不再赘述。

最后需要解决的就是电压/无功超限与否，以及超限类型的判断，并且需要将这两种信息以及超限节点编号进行反馈。电压与无功的计算参考 CalPower()函数。将电压和无功的上下限写在初始输入文件末尾，作为系统基本信息读入，使用判断函数 CheckQBound()和 CheckVBound()进行判断。由于 C++的函数只能返回一个值，为了减少函数数量，将这两个判断函数的返回值类型设置为 vector<int>，将判断信息存在向量中，便可以一次性返回是否超限，超限类型（上/下）以及超限节点编号等信息，供后续使用。

值得一提的是，根据课件上的说法，应该在算法收敛之后再进行限制判断和节点转化，而我选择的方法是从算法开始，每次迭代就进行限制因素判断和节点转化。对于这两种办法的对比，我将在后续算例探究中进行。

四、算例探究 2

以模型系统 2 为例进行探究，系统 2 示意图如图 4：

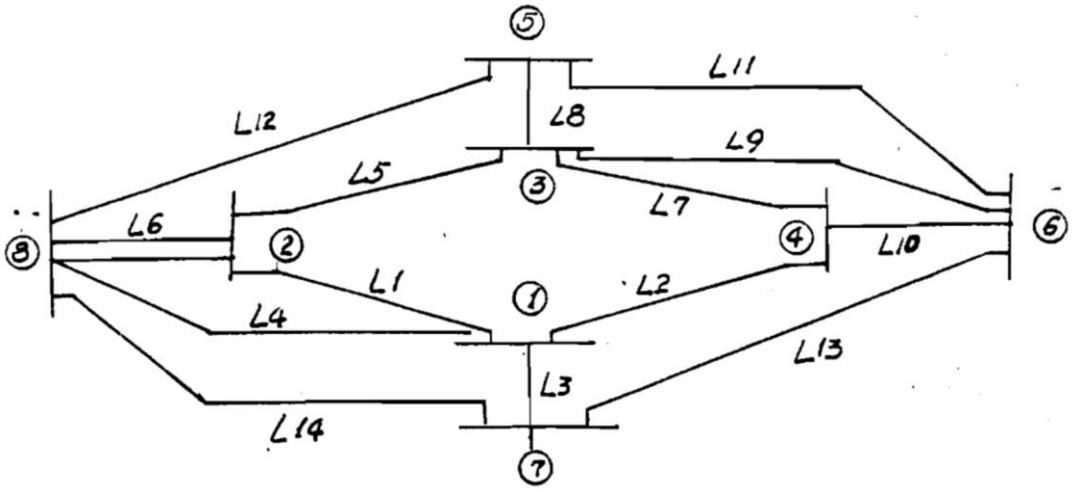

图 4 模型系统 2 示意图

在未考虑节点转化时，设置收敛指标为 epsilon=1e-04，经过 4 次迭代收敛，计算结果

如下：

节点复电压及节点平衡功率

节点	电压	角度/°	注入有功 P	注入无功 Q
1	0.94594	2.88676	0.25000	0.20000
2	0.89152	−1.74215	−0.22000	−1.30000
3	0.90523	3.53031	0.25000	0
4	0.73805	3.80368	0	−1.00000
5	1.00000	0.56220	−2.33000	0.19186
6	1.00000	1.92144	−1.50000	0.45701
7	1.00000	1.90007	−0.20000	0.00144
8	1.00000	0	−0.36117	0.24381

表中标黄的部分为已知数据。

可以看出，在不进行节点转化的情况下，PV 节点 5，6 的无功均超过了上界，不满足要求。

加入节点转化功能之后，发现迭代次数明显增加，但是最终结果能够符合限制要求，结果如下：

节点复电压及节点平衡功率

节点	电压	角度/°	注入有功 P	注入无功 Q
1	0.92457	3.10681	0.25000	0.20000
2	0.86766	−1.73334	−0.22000	−1.30000
3	0.86033	4.08829	0.25000	0
4	0.68259	4.34427	0	−1.00000
5	0.96415	0.81668	−2.33000	0.10000
6	0.94802	2.38533	−1.50000	0.10000
7	0.98155	2.08757	−0.20000	0.10000
8	1.00000	0	−0.35187	0.71104

一共经过了 22 次迭代算法收敛，发现三个 PV 节点最终计算得到的无功都变成了无功上限值，原先不超限的 7 号节点在这里也进行了转化，原因是在迭代过程中，收到 5、6 号节点转化的影响，7 号节点也出现超限。此外，5、6、7 号节点最终的电压都不再是给定值 1，由此可见这三个节点确实由 PV 节点转化为了 PQ 节点。

作为对比，我尝试了课件上提到的在算法收敛后再进行电压无功限制判断，并进行节点转化的方法，发现这种方法虽然也能得到合理的结果，但是迭代次数大大增加，在同样的算例和收敛指标（epsilon=1e-04）下，一共迭代了 61 次才收敛，因此我最终选择了从算法开始，每次迭代中就进行判断和转化。其中的原因，我分析是因为如果等到算法先收敛再进行判断和转化，并重新迭代，可能会造成节点电压或无功偏离限定值太远，导致算法“往回”迭代较为困难，而若每一轮都进行“监视”，则可以在计算值与限制值偏离不多的时候就及时进行“纠正”，使得迭代次数大大下降。

五、难点分析

1、数据和指示书本身有错误：

在算例 1 的计算中，我第一次得到的结果 4 号和 5 号节点的无功非常小，看似不太合理，而所给的算例文件含义又不甚清晰，其中 0 0 0 1.05 1.05 这一行的含义尤其不明确，在我确定了其它行的参数含义之后，我认为这一行代表的应该是节点接地电纳，但是其数值又十分不合理，节点接地电纳应该为负值。因此我直接将这一行置零，才得到了合理的潮流解。

在算例 2 的指示书中，支路串联导纳 Y 被写成了阻抗 Z，并且虚部符号也出现错误，导致我一开始的计算结果一直在震荡不收敛，后来我仔细分析了指示书数据，将其按照导纳处理并改变了符号，迭代过程才最终收敛。

2、节点转化逻辑修改：

在我加入节点转化功能后，我的算法趋于发散。经过仔细分析，是由于我在改变节点方程形式的时候，只将转化后的方程写入矩阵，却忘记将转化前的方程去除，导致 jacobian 矩阵参数和方程类型不匹配。将这一错误去除后，得到正确结果。

六、疑问

1、 在算例 2 的计算中，我起初按照指示书上的数据，将所给的阻抗 Z 转化为了导纳 Y 之后进行计算，但是出现震荡，当我修改数据之后才收敛。但是事实上经过阻抗 Z 转化得到的 Y 和实际的 Y 数据之间并没有数量级上的差距，在我看来最多导致计算结果收敛到一个错误的值，但是实际中却出现了震荡和收敛两种天差地别的结果，为什么这种数据的改变会带来这么大的差异呢？

2、 在加入节点转化功能后，迭代次数变多是可以理解的，但是按理说 N-R 法是一种能够快速收敛的算法，为何会在加入节点转化之后，迭代次数增加程度如此大呢？（由 4 次到 22 次）

附录一：

程序代码：

【FlowSolveAppMain.cpp】

```
#include"FlowSolveApp.h"
#include<iostream>
using namespace std;

int main() {
    FlowSolveApp m_flow_app;
    m_flow_app.Run();
    system("pause");
    return 0;
}
```

【FlowSolveApp.h】

```
#pragma once
#ifndef FLOWSOLVEAPP
#define FLOWSOLVEAPP
#include "FlowSolve.h"
class FlowSolveApp {
public:
    FlowSolveApp() {};
    ~FlowSolveApp() {};
    void Run();
};
#endif // !FLOWSOLVEAPP
```

【FlowSolveApp.cpp】

```
#include <iostream>
#include "FlowSolveApp.h"
using namespace std;

void FlowSolveApp::Run() {
    FlowSolve m_fs;
    m_fs.pq_to_pv.clear();
    m_fs.pv_to_pq.clear();
    m_fs.pq_conv = 0;
    m_fs.pv_conv = 0;
    m_fs.GetParameters();
    m_fs.iter_count = 0;
    m_fs.SetEpsilon();
    m_fs.GenNodeYMatrix();

    m_fs.CalError();
    while (1) {
```

```
            m_fs.CalJacobian();
            m_fs.MakeA();
            m_fs.SolveBias();
            m_fs.UpdateEF();

            m_fs.pq_conv_info = m_fs.CheckVBound();
            m_fs.pv_conv_info = m_fs.CheckQBound();
            if (m_fs.pq_conv_info[0] != 0) {
                m_fs.pq_conv = 1;
                if (find(m_fs.pq_to_pv.begin(), m_fs.pq_to_pv.end(),
                    m_fs.pq_conv_info[1]) == m_fs.pq_to_pv.end()) {
                    m_fs.pq_to_pv.push_back(m_fs.pq_conv_info[1]);
                    if (m_fs.pq_conv_info[0] == 1) {            //PQ节点V超上界
                        m_fs.v[f1(m_fs.pq_conv_info[1])] =
m_fs.pq_v_up[f1(m_fs.pq_conv_info[1])];
                        cout << endl;
                        cout << "PQ节点" << m_fs.pq_conv_info[1] << "电压V超过上界，转化
为PV节点" << endl;
                    }
                    if (m_fs.pq_conv_info[0] == 2) {            //PQ节点V超下界
                        m_fs.v[f1(m_fs.pq_conv_info[1])] =
m_fs.pq_v_down[f1(m_fs.pq_conv_info[1])];
                        cout << endl;
                        cout << "PQ节点" << m_fs.pq_conv_info[1] << "电压V超过下界，转化
为PV节点" << endl;
                    }
                }
            }

            if (m_fs.pv_conv_info[0] != 0) {
                m_fs.pv_conv = 1;
                if (find(m_fs.pv_to_pq.begin(), m_fs.pv_to_pq.end(),
                    m_fs.pv_conv_info[1]) == m_fs.pv_to_pq.end()) {
                    m_fs.pv_to_pq.push_back(m_fs.pv_conv_info[1]);
                    if (m_fs.pv_conv_info[0] == 1) {            //PV节点Q超上界
                        m_fs.q[f1(m_fs.pv_conv_info[1])] =
m_fs.pv_q_up[f1(m_fs.pv_conv_info[1])];
                        cout << endl;
                        cout << "PV节点" << m_fs.pv_conv_info[1] << "无功Q超过上界，转化
为PQ节点" << endl;
                    }
                    if (m_fs.pv_conv_info[0] == 2) {            //PV节点Q超下界
                        m_fs.q[f1(m_fs.pv_conv_info[1])] =
m_fs.pv_q_down[f1(m_fs.pv_conv_info[1])];
```

```
                    cout << endl;
                    cout << "PV节点" << m_fs.pv_conv_info[1] << "无功Q超过下界，转化
为PQ节点" << endl;
                }
            }
        }
        m_fs.CalError();
        cout << "\n" << "max error is: " << m_fs.dd << endl;
        m_fs.iter_count++;

        if ((m_fs.dd <= m_fs.epsilon) && (m_fs.pq_conv_info[0] == 0) &&
(m_fs.pv_conv_info[0] == 0)) {
            break;
        }
    }

    m_fs.CalSPower(1);
    cout << "\n" << "The total iterations is: " << m_fs.iter_count << endl;
}
```

【FlowSolve.h】

```
#pragma once
#ifndef FLOWSOLVE
#define FLOWSOLVE
#include<cstdio>
#include<cmath>
#include<vector>

#define Pi 3.1415927/180
#define f1(i) (i-1)
/* 把习惯的一阶矩阵的下标转化为C语言数组下标*/

#define f2(i,j,n) ((i-1)*(n)+j-1)
/* 把习惯的二阶矩阵的下标转化为C语言数组下标*/

class FlowSolve {
public:
    int choose;
    int iter_count;           //iteration counter
    int n, m, l, n0, n1;
    int pq_num, pv_num;
    int k, k1;
    float dd;
    float epsilon;                //converge standard
    float* g;float* b;float* g1;float* b1;float* c1;
```

```
    float* c;float* co;int* s1;int* e1;float* p;
    float* q;float* p0;float* q0;float* p1;float* q1;
    float* v;float* v0;float* e;float* f;float* jm;
    float* a;float* p2;float* q2;float* p3;float* q3;
    float* angle;
    float* pq_v_up; float* pq_v_down;
    float* pv_q_up; float* pv_q_down;
    int pq_conv;
    int pv_conv;
    std::vector<int> pq_conv_info;
    std::vector<int> pv_conv_info;
    std::vector<int> pq_to_pv;
    std::vector<int> pv_to_pq;


public:
    FlowSolve() :choose(0), iter_count(0), epsilon(0.0001), k(1), k1(0){
        g = NULL;b = NULL;g1 = NULL;b1 = NULL;c1 = NULL;
        c = NULL;co = NULL;s1 = NULL;e1 = NULL;p = NULL;
        q = NULL;p0 = NULL;q0 = NULL;p1 = NULL;q1 = NULL;
        v = NULL;v0 = NULL;e = NULL;f = NULL;jm = NULL;
        a = NULL;p2 = NULL;q2 = NULL;p3 = NULL;q3 = NULL;
        angle = NULL;
        pv_q_up = NULL; pv_q_down = NULL; pq_v_up = NULL; pq_v_down = NULL;
    };
    ~FlowSolve() {
        delete s1, g1, b1, c1, c, co, e1, p, q, e, f, angle;
        delete g, b, p0, q0, p1, q1, p2, q2, p3, q3, v, v0, jm, a;
        delete pv_q_up, pv_q_down, pq_v_up, pq_v_down;
    };
    void ChooseTest();
    void SetEpsilon();
    void GetParameters();
    void GenNodeYMatrix();
    void CalError();
    void CalJacobian();
    void SolveBias();
    void CalSPower(int print_result);
    void UpdateEF();
    void MakeA();
    void ShowA();
    std::vector<int> CheckVBound();
    std::vector<int> CheckQBound();
};
```

```
#endif // !FLOWSOLVE
```

【FlowSolve.cpp】

```
#include "FlowSolve.h"
#include <iostream>
#include <fstream>
#include <string>
using namespace std;
FILE *file2 = NULL, *file4 = NULL, *file6 = NULL;
void FlowSolve::SetEpsilon() {
    float eps;
    cout << "请设置收敛指标epsilon:" << endl;
    cin >> eps;
    epsilon = eps;
}
/*****************************************************
 *    本子程序根据所给的支路导纳及有关信息,形成节点 *
 * 导纳矩阵,如打印参数K=1,则输出电导矩阵G和电纳矩阵B  *
 *****************************************************/
void FlowSolve::GenNodeYMatrix() {
    extern FILE *file4;
    FILE *fp;
    int i, j, io, i0;
    int pos1, pos2;
    int st, en;
    if (file4 == NULL)
    {
        fp = stdout;
    }
    else
    {
        fp = file4; /* 输出到文件 */
    }

    /* 初始化矩阵G,B */
    for (i = 1; i <= n; i++)
    {
        for (j = 1; j <= n; j++)
        {
            pos2 = f2(i, j, n);
            g[pos2] = 0; b[pos2] = 0;
        }
    }
```

```
/* 计算支路导纳 */
for (i = 1; i <= l; i++)
{
    /* 计算对角元 */
    pos1 = f1(i);
    st = s1[pos1]; en = e1[pos1];
    pos2 = f2(st, st, n);
    g[pos2] += g1[pos1];
    b[pos2] += b1[pos1] + c1[pos1];
    pos2 = f2(en, en, n);
    g[pos2] += g1[pos1];
    b[pos2] += b1[pos1] + c1[pos1];

    /* 计算非对角元 */
    pos2 = f2(st, en, n);
    g[pos2] -= g1[pos1];
    b[pos2] -= b1[pos1];
    g[f2(en, st, n)] = g[f2(st, en, n)];
    b[f2(en, st, n)] = b[f2(st, en, n)];
}
//cout << endl;
//for (int kk = 1; kk <= n; kk++) {
//  for (int t = 1; t <= n; t++) {
//      cout << b[f2(kk, t, n)] << "\t";
//  }
//  cout << endl;
//}

/* 计算接地支路导纳 */
for (i = 1; i <= n; i++)
{
    /*  对称部分  */
    b[f2(i, i, n)] += co[f1(i)];
    /* 非对称部分  */
    for (j = 1; j <= l; j++)
    {
        b[f2(i, i, n)] += c[f2(i, j, l)];
    }
    //cout << endl;
    //for (int kk = 1; kk <= n; kk++) {
    //  for (int t = 1; t <= n; t++) {
    //      cout << b[f2(kk, t, n)] << "\t";
    //  }
    //  cout << endl;
```

```
    //}
}

if (k != 1)
{
    return; /* 如果K不为 1,则返回;否则,打印导纳矩阵 */
}
fprintf(fp, "\n          BUS ADMITTANCE MATRIX Y(BUS):");
fprintf(fp, "\n ****************** ARRAY G ********************");
for (io = 1; io <= n; io += 5)
{
    i0 = (io + 4) > n ? n : (io + 4);
    fprintf(fp, "\n");
    for (j = io; j <= i0; j++)
    {
        fprintf(fp, "%13d", j);
    }
    for (i = 1; i <= n; i++)
    {
        fprintf(fp, "\n%2d", i);
        for (j = io; j <= i0; j++)
        {
            fprintf(fp, "%13.6f", g[f2(i, j, n)]);
        }
    }
    fprintf(fp, "\n");
}

fprintf(fp, "\n ****************** ARRAY B ********************");
for (io = 1; io <= n; io += 5)
{
    i0 = (io + 4) > n ? n : (io + 4);
    fprintf(fp, "\n");
    for (j = io; j <= i0; j++)
    {
        fprintf(fp, "%13d", j);
    }
    for (i = 1; i <= n; i++)
    {
        fprintf(fp, "\n%2d", i);
        for (j = io; j <= i0; j++)
        {
            fprintf(fp, "%13.6f", b[f2(i, j, n)]);
        }
```

```
        }
        fprintf(fp, "\n");
    }
    fprintf(fp, "\n*********************************************");
}

/*****************************************
 *     本子程序根据所给的功率及电压等数据  *
 * 求出功率及电压误差量,并返回最大有功功率 *
 * 以用于与给定误差比较.如打印参数K=1,则输 *
 * 出P0,Q0(对PQ结点),V0(对PV结点).         *
 * 对应附录一P177式(4-86)(4-87)               *
 *****************************************/
void FlowSolve::CalError() {
    extern FILE *file4;
    FILE *fp;
    int i, j, l;
    int pos1, pos2;
    float a1, a2, d1, d;
    if (file4 == NULL)
    {
        fp = stdout; /* 输出到屏幕 */
    }
    else
    {
        fp = file4;  /* 输出到文件  */
    }
    l = n - 1;
    if (k == 1)
    {
        fprintf(fp, "\n        CHANGE OF P0,V**2,P0(I),Q0(I),V0(I) ");
        fprintf(fp, "\n  I       P0(I)           Q0(I)");
    }
    for (i = 1; i <= n; i++)//l->n?
    {
        a1 = 0; a2 = 0;
        pos1 = f1(i);
        for (j = 1; j <= n; j++)
        {
            /* a1,a2对应附录一P177式(4-86)中括号内的式子 */
            pos2 = f2(i, j, n);
            a1 += g[pos2] * e[f1(j)] - b[pos2] * f[f1(j)];
            a2 += g[pos2] * f[f1(j)] + b[pos2] * e[f1(j)];
        }
```

```
        /* 计算式(4-86)(4-87)中的deltaPi  */
        p0[pos1] = p[pos1] - e[pos1] * a1 - f[pos1] * a2;
        if (pv_conv == 0) {
            if (i <= m)                //没有PV节点转化为PQ
            {   /* 计算PQ结点中的deltaQi  */
                q0[pos1] = q[pos1] - f[pos1] * a1 + e[pos1] * a2;
            }
        }
        if (pv_conv != 0) {            //有PV节点转化为PQ
            if (((i <= m) && (find(pq_to_pv.begin(), pq_to_pv.end(), i) ==
pq_to_pv.end()))
                || (find(pv_to_pq.begin(), pv_to_pq.end(), i) != pv_to_pq.end()))
            {   /* 计算PQ结点中的deltaQi  */
                q0[pos1] = q[pos1] - f[pos1] * a1 + e[pos1] * a2;
            }
        }
        if (pq_conv == 0) {            //没有PQ节点转化为PV
            if (i > m)
            {   /* 计算PV结点中的deltaVi平方  */
                v0[pos1] = v[pos1] * v[pos1] - e[pos1] * e[pos1] - f[pos1] * f[pos1];
            }
        }
        if (pq_conv == 1) {            //有PQ节点转化为PV
            if (((i > m) && (find(pv_to_pq.begin(), pv_to_pq.end(), i) ==
pv_to_pq.end()))
                || (find(pq_to_pv.begin(), pq_to_pv.end(), i) != pq_to_pv.end()))
            {   /* 计算PV结点中的deltaVi平方  */
                v0[pos1] = v[pos1] * v[pos1] - e[pos1] * e[pos1] - f[pos1] * f[pos1];
            }
        }


        /* 输出结果 */
        if (k == 1)
        {
            if (i < m)
            {
                fprintf(fp, "\n %2d %15.6e %15.6e", i, p0[pos1], q0[pos1]);
            }
            else if (i == m)
            {
                fprintf(fp, "\n %2d %15.6e %15.6e", i, p0[pos1], q0[pos1]);
                fprintf(fp, "\n  I       P0(I)           V0(I)");
            }
```

```
            else
            {
                fprintf(fp, "\n %2d %15.6e %15.6e", i, p0[pos1], v0[pos1]);
            }
        }
    }

    /* 找到deltaP和deltaQ中的最大者，作为收敛指标，存在dd中 */
    d = 0;
    for (i = 1; i <= l; i++)
    {
        pos1 = f1(i);
        d1 = p0[pos1] > 0 ? p0[pos1] : -p0[pos1];
        if (d < d1)
        {
            d = d1;
        }
        if (i <= m)
        {
            d1 = q0[pos1] > 0 ? q0[pos1] : -q0[pos1];
            if (d < d1)
            {
                d = d1;
            }
        }
    }
    dd = d;
}

/***************************************************
 *    本子程序根据节点导纳及电压求Jacoby矩阵,用于求*
 *  电压修正量,如打印参数K=1,则输出Jacoby矩阵.     *
 *  对应于附录一P178式(4-89)(4-90)                  *
 *    值得注意的是，程序中Jacobi阵中H N J L的排列顺*
 *  序与式（4－88）略有不同，程序中H N在偶数行     *
 *  （2*i），J L在奇数行（2*i-1）                   *
 ***************************************************/
void FlowSolve::CalJacobian() {
    extern FILE *file4;
    FILE *fp;
    int i, j, i1, io, i0, ns;
    int pos1, pos2;
    if (file4 == NULL)
    {
```

```
        fp = stdout;
    }
    else
    {
        fp = file4;
    }

    /* 初始化矩阵jm */
    for (i = 1; i <= n0; i++)
    {
        for (j = 1; j <= n0; j++)
        {
            jm[f2(i, j, n0)] = 0;
        }
    }

    ns = n - 1; /* 去掉一个平衡结点 */

    /* 计算式(4-89)(4-90) */
    for (i = 1; i <= ns; i++)
    {
        /* 计算式(4-90) */
        for (i1 = 1; i1 <= n; i1++)
        {
            /* pos1是式(4-90)中的j */
            pos1 = f1(i1);

            /* pos2是式(4-90)中的ij */
            pos2 = f2(i, i1, n);

            if (pv_conv == 0) {             //没有PV节点需要转换为PQ
                if (i <= m) /* i是PQ结点 */
                {
                    /* 计算式(4-90)中的Jii等式右侧第一部分 */
                    jm[f2(2 * i - 1, 2 * i - 1, n0)] += g[pos2] * f[pos1] + b[pos2] *
e[pos1];

                    /* 计算式(4-90)中的Lii等式右侧第一部分 */
                    jm[f2(2 * i - 1, 2 * i, n0)] += -g[pos2] * e[pos1] + b[pos2] *
f[pos1];
                }
            }
            if (pv_conv != 0) {                 //有PV节点需要转换为PQ
                if (((i <= m) && (find(pq_to_pv.begin(), pq_to_pv.end(), i) ==
```

```
pq_to_pv.end()))
                    || (find(pv_to_pq.begin(), pv_to_pq.end(), i) != pv_to_pq.end()))
/* i是PQ结点 */
                {
                    /* 计算式(4-90)中的Jii等式右侧第一部分 */
                    jm[f2(2 * i - 1, 2 * i - 1, n0)] += g[pos2] * f[pos1] + b[pos2] *
e[pos1];

                    /* 计算式(4-90)中的Lii等式右侧第一部分 */
                    jm[f2(2 * i - 1, 2 * i, n0)] += -g[pos2] * e[pos1] + b[pos2] *
f[pos1];
                }
            }

            /* 计算式(4-90)中的Hii等式右侧第一部分 */
            jm[f2(2 * i, 2 * i - 1, n0)] += -g[pos2] * e[pos1] + b[pos2] * f[pos1];

            /* 计算式(4-90)中的Nii等式右侧第一部分 */
            jm[f2(2 * i, 2 * i, n0)] += -g[pos2] * f[pos1] - b[pos2] * e[pos1];

        }



        /* pos2是式(4-90)中的ii */
        pos2 = f2(i, i, n);

        /* pos1是式(4-90)中的i */
        pos1 = f1(i);

        if (pv_conv == 0) {                 //没有PV节点需要转换为PQ
            if (i <= m) /* i是PQ结点 */
            {
                /* 计算式(4-90)中的Jii */
                jm[f2(2 * i - 1, 2 * i - 1, n0)] += -g[pos2] * f[pos1] + b[pos2] *
e[pos1];

                /* 计算式(4-90)中的Lii */
                jm[f2(2 * i - 1, 2 * i, n0)] += g[pos2] * e[pos1] + b[pos2] *
f[pos1];
            }
        }
        if (pv_conv != 0) {                 //有PV节点需要转换为PQ
            if (((i <= m) && (find(pq_to_pv.begin(), pq_to_pv.end(), i) ==
```

```
pq_to_pv.end()))
                || (find(pv_to_pq.begin(), pv_to_pq.end(), i) != pv_to_pq.end())) /*
i是PQ结点 */
            {
                /* 计算式(4-90)中的Jii */
                jm[f2(2 * i - 1, 2 * i - 1, n0)] += -g[pos2] * f[pos1] + b[pos2] *
e[pos1];

                /* 计算式(4-90)中的Lii */
                jm[f2(2 * i - 1, 2 * i, n0)] += g[pos2] * e[pos1] + b[pos2] *
f[pos1];
            }
        }

        /* 计算式(4-90)中的Hii */
        jm[f2(2 * i, 2 * i - 1, n0)] += -g[pos2] * e[pos1] - b[pos2] * f[pos1];

        /* 计算式(4-90)中的Nii */
        jm[f2(2 * i, 2 * i, n0)] += -g[pos2] * f[pos1] + b[pos2] * e[pos1];

        if (pq_conv == 0) {             //没有PQ节点需要转换为PV
            if ((i > m) && (find(pv_to_pq.begin(), pv_to_pq.end(), i) ==
pv_to_pq.end()))/* PV结点 */
            {
                /* 计算式(4-90)中的Rii */
                jm[f2(2 * i - 1, 2 * i - 1, n0)] = -2 * e[pos1];

                /* 计算式(4-90)中的Sii */
                jm[f2(2 * i - 1, 2 * i, n0)] = -2 * f[pos1];
            }
        }
        if (pq_conv != 0) {             //有PQ节点需要转换为PV
            if (((i > m) && (find(pv_to_pq.begin(), pv_to_pq.end(), i) ==
pv_to_pq.end()))
                || (find(pq_to_pv.begin(), pq_to_pv.end(), i) != pq_to_pv.end())) /*
PV结点 */
            {
                /* 计算式(4-90)中的Rii */
                jm[f2(2 * i - 1, 2 * i - 1, n0)] = -2 * e[pos1];

                /* 计算式(4-90)中的Sii */
                jm[f2(2 * i - 1, 2 * i, n0)] = -2 * f[pos1];
            }
        }
```

```
        /* 计算式(4-89) */
        for (j = 1; j <= ns; j++)
        {
            if (j != i)
            {
                /* pos1是式(4-89)中的i */
                pos1 = f1(i);

                /* pos2是式(4-89)中的ij */
                pos2 = f2(i, j, n);

                /* 计算式(4-89)中的Nij */
                jm[f2(2 * i, 2 * j, n0)] = b[pos2] * e[pos1] - g[pos2] * f[pos1];

                /* 计算式(4-89)中的Hij */
                jm[f2(2 * i, 2 * j - 1, n0)] = -g[pos2] * e[pos1] - b[pos2] *
f[pos1];

                if (pv_conv == 0) {             //没有PV节点需要转换为PQ
                    if (i <= m) /* i是PQ结点 */
                    {
                        /* 计算式(4-89)中的Lij (=-Hij) */
                        jm[f2(2 * i - 1, 2 * j, n0)] = -jm[f2(2 * i, 2 * j - 1,
n0)];

                        /* 计算式(4-89)中的Jij (=Nij) */
                        jm[f2(2 * i - 1, 2 * j - 1, n0)] = jm[f2(2 * i, 2 * j, n0)];
                    }
                }
                if (pv_conv != 0) {             //有PV节点需要转换为PQ
                    if (((i <= m) && (find(pq_to_pv.begin(), pq_to_pv.end(), i) ==
pq_to_pv.end()))
                        || (find(pv_to_pq.begin(), pv_to_pq.end(), i) !=
pv_to_pq.end())) /* i是PQ结点 */
                    {
                        /* 计算式(4-89)中的Lij (=-Hij) */
                        jm[f2(2 * i - 1, 2 * j, n0)] = -jm[f2(2 * i, 2 * j - 1,
n0)];

                        /* 计算式(4-89)中的Jij (=Nij) */
                        jm[f2(2 * i - 1, 2 * j - 1, n0)] = jm[f2(2 * i, 2 * j, n0)];
                    }
                }
```

```
                if (pq_conv == 0) {             //没有PQ节点需要转换为PV
                    if ((i > m) && (find(pv_to_pq.begin(), pv_to_pq.end(), i) ==
pv_to_pq.end())) {    /* i是PV结点 */
                        /* 计算式(4-89)中的Rij (=0) */
                        jm[f2(2 * i - 1, 2 * j - 1, n0)] = 0;

                        /* 计算式(4-89)中的Sij (=0) */
                        jm[f2(2 * i - 1, 2 * j, n0)] = 0;
                    }
                }
                if (pq_conv != 0) {             //有PQ节点需要转换为PV
                    if (((i > m) && (find(pv_to_pq.begin(), pv_to_pq.end(), i) ==
pv_to_pq.end()))
                        || (find(pq_to_pv.begin(), pq_to_pv.end(), i) !=
pq_to_pv.end())) {    /* i是PV结点 */
                        /* 计算式(4-89)中的Rij (=0) */
                        jm[f2(2 * i - 1, 2 * j - 1, n0)] = 0;

                        /* 计算式(4-89)中的Sij (=0) */
                        jm[f2(2 * i - 1, 2 * j, n0)] = 0;
                    }
                }

            }
        }
    }
    if (k != 1)
    {
        return;
    }

    /* 输出Jacoby矩阵 */
    fprintf(fp, "\n J                  MATRIX(Jacobian)");
    for (io = 1; io <= n0; io += 5)
    {
        i1 = (io + 4) > n0 ? n0 : (io + 4);
        fprintf(fp, "\n");
        for (j = io; j <= i1; j++)
        {
            fprintf(fp, "%10d", j);
        }
        for (i = 1; i <= n0; i++)
        {
            fprintf(fp, "\n%2d", i);
```

```
            for (j = io; j <= i1; j++)
            {
                fprintf(fp, "%12.6f", jm[f2(i, j, n0)]);
            }
        }
    }
    fprintf(fp, "\n");
}

void FlowSolve::ShowA() {
    cout << "\n" << endl;
    for (int ii = 1; ii <= n0; ii++) {
        for (int jj = 1; jj <= n1; jj++) {
            cout << a[f2(ii, jj, n1)] << " ";
        }
        cout << "\n" << endl;
    }
}

//void FlowSolve::MakeA() {
//  for (int ii = 1; ii <= n0; ii++) {
//      for (int jj = 1; jj <= n0; jj++) {
//          a[f2(ii, jj, n1)] = -1*jm[f2(ii, jj, n0)];
//      }
//  }
//
//  for (int ii = 1; ii <= pq_num; ii++) {
//      a[f2(2 * ii - 1, n1, n1)] = q0[f1(ii)];
//      a[f2(2 * ii, n1, n1)] = p0[f1(ii)];
//  }
//
//  for (int jj = 1; jj <= pv_num; jj++) {
//      a[f2(2 * pq_num + 2 * jj - 1, n1, n1)] = v0[f1(pq_num + jj)];
//      a[f2(2 * pq_num + 2 * jj, n1, n1)] = p0[f1(pq_num + jj)];
//  }
//}
void FlowSolve::MakeA() {
    for (int ii = 1; ii <= n0; ii++) {
        for (int jj = 1; jj <= n0; jj++) {
            a[f2(ii, jj, n1)] = -1 * jm[f2(ii, jj, n0)];
        }
    }
    int ii = 1;
    while (1) {
```

```
        if (((ii <= pq_num) && (find(pq_to_pv.begin(), pq_to_pv.end(), ii) ==
pq_to_pv.end()))
            || (find(pv_to_pq.begin(), pv_to_pq.end(), ii) != pv_to_pq.end())) {
            a[f2(2 * ii - 1, n1, n1)] = q0[f1(ii)];
            a[f2(2 * ii, n1, n1)] = p0[f1(ii)];
        }
        ii++;
        if (ii >= n) break;
    }
    int jj = 1;
    while (1) {
        if ((((jj + pq_num) > pq_num) && (find(pv_to_pq.begin(), pv_to_pq.end(), (jj +
pq_num)) == pv_to_pq.end()))
            || (find(pq_to_pv.begin(), pq_to_pv.end(), (jj + pq_num)) !=
pq_to_pv.end())) {
            a[f2(2 * pq_num + 2 * jj - 1, n1, n1)] = v0[f1(pq_num + jj)];
            a[f2(2 * pq_num + 2 * jj, n1, n1)] = p0[f1(pq_num + jj)];
        }
        jj++;
        if ((jj + pq_num) >= n) break;
    }
}
/*********************************************
 *     本子程序用选列主元素的高斯消元法求解组 *
 * 性方程组求各结点电压修正量,如打印参数K=1,则*
 * 输出增广矩阵变换中的上三角及电压修正量.如果*
 * 无唯一解,则给出信息,并停止程序运行.        *
 *********************************************/
void FlowSolve::SolveBias() {
    //ShowA();
    extern FILE *file4;
    FILE *fp;
    int i, j, l, n2, n3, n4, i0, io, j1, i1;
    float t0, t, c;
    if (file4 == NULL) fp = stdout;
    else fp = file4;
    for (i = 1; i <= n0; i++)
    {
        l = i;
        for (j = i; j <= n0; j++)
        {
            if (fabs(a[f2(j, i, n1)]) > fabs(a[f2(l, i, n1)]))
            {
                l = j; /* 找到这列中的最大元 */
```

```
        }
    }
    if (l != i)
    {   /* 行交换 */
        for (j = i; j <= n1; j++)
        {
            t = a[f2(i, j, n1)];
            a[f2(i, j, n1)] = a[f2(l, j, n1)];
            a[f2(l, j, n1)] = t;
        }
    }

    //ShowA(n0, n1, a);
    if (fabs(a[f2(i, i, n1)] - 0) < 1e-10)
    {   /* 对角元近似于0, 无解 */
        printf("\nNo Solution\n");

        system("pause");
        exit(1);
    }

    t0 = a[f2(i, i, n1)];
    for (j = i; j <= n1; j++)
    {
        /* 除对角元 */
        a[f2(i, j, n1)] /= t0;
    }
    if (i == n0)
    {   /* 最后一行，不用消元 */
        continue;
    }

    /* 消元 */
    j1 = i + 1;
    for (i1 = j1; i1 <= n0; i1++)
    {
        c = a[f2(i1, i, n1)];
        for (j = i; j <= n1; j++)
        {
            a[f2(i1, j, n1)] -= a[f2(i, j, n1)] * c;
        }
    }
}
```

```
if (k == 1)
{   /* 输出上三角矩阵 */
    fprintf(fp, "\nTrianglar Angmentex Matrix ");
    for (io = 1; io <= n1; io += 5)
    {
        i0 = (io + 4) > n1 ? n1 : (io + 4);
        fprintf(fp, "\n");
        fprintf(fp, "       ");
        for (i = io; i <= i0; i++)
        {
            fprintf(fp, "%12d", i);
        }
        for (i = 1; i <= n0; i++)
        {
            fprintf(fp, "\n");
            fprintf(fp, "%2d", i);
            for (j = io; j <= i0; j++)
            {
                fprintf(fp, "%15.6f", a[f2(i, j, n1)]);
            }
        }
    }
}

/* 回代求方程解 */
n2 = n1 - 2;
for (i = 1; i <= n2; i++)
{
    n3 = n1 - i;
    for (i1 = n3; i1 <= n0; i1++)
    {
        n4 = n0 - i;
        a[f2(n4, n1, n1)] -= a[f2(i1, n1, n1)] * a[f2(n4, i1, n1)];
    }
}

if (k != 1)
{
    return;
}

/* 输出电压修正值 */
fprintf(fp, "\nVoltage correction E(i), F(i) :");
for (io = 1; io <= n0; io += 4)
```

```
    {
        i1 = (io + 1) / 2;
        i0 = ((io + 3) / 2) > (n0 / 2) ? (n0 / 2) : ((io + 3) / 2);
        fprintf(fp, "\n");
        for (j = i1; j <= i0; j++)
        {
            fprintf(fp, "%16d%16d", j, j);
        }
        i1 = 2 * i0;
        fprintf(fp, "\n");
        for (i = io; i <= i1; i++)
        {
            fprintf(fp, "%15.6f", a[f2(i, n1, n1)]);
        }
    }
}

/*************************************************
 *   本子程序计算线路功率,平衡节点功率,PV节点无功功 *
 * 率及线路的功率损耗并输出.如选择参数K1=1,则表示输 *
 * 入为极座标.                                     *
 *************************************************/
void FlowSolve::CalSPower(int print_result) {
    extern FILE *file4;/**file6;*/
    FILE *fp;
    float t1, t2, cm, x, y, z, x1, x2, y1, y2;
    int i, i1, j, m1, ns, pos1, pos2, km, st, en;
    ns = n - 1;
    if (file4 == NULL)
    {
        fp = stdout;
    }
    else
    {
        fp = file4;
    }
    if (print_result) {
        fprintf(fp, "\nTHE RESULT ARE:");
    }

    if (k1 == 1)
    {
        for (i = 0; i < n; i++)
        {
```

```
            angle[i] *= Pi;
            e[i] = v[i] * cos(angle[i]);
            f[i] = v[i] * sin(angle[i]);
        }
    }
    t1 = 0.0; t2 = 0.0;
    for (i = 1; i <= n; i++)
    {
        pos1 = f1(i); pos2 = f2(n, i, n);
        t1 += g[pos2] * e[pos1] - b[pos2] * f[pos1];
        t2 += g[pos2] * f[pos1] + b[pos2] * e[pos1];
    }
    pos1 = f1(n);
    p[pos1] = t1 * e[pos1];
    q[pos1] = -t2 * e[pos1];
    m1 = m + 1;
    for (i1 = m1; i1 <= ns; i1++)
    {
        t1 = 0; t2 = 0;
        for (i = 1; i <= n; i++)
        {
            pos1 = f1(i); pos2 = f2(i1, i, n);
            t1 += g[pos2] * e[pos1] - b[pos2] * f[pos1];
            t2 += g[pos2] * f[pos1] + b[pos2] * e[pos1];
        }
        pos1 = f1(i1);
        q[pos1] = f[pos1] * t1 - e[pos1] * t2;
    }
    for (i = 0; i < n; i++)
    {
        cm = co[i];
        if (cm != 0)
        {
            q[i] -= (e[i] * e[i] + f[i] * f[i])*cm;
        }
    }
    if (print_result) {
        fprintf(fp, "\nBUS DATA");
        fprintf(fp, "\nBUS     VOLTAGE      ANGLE(DEGS.)      BUS P          BUS Q");
    }

    for (i = 0; i < n; i++)
    {
        v[i] = sqrt(e[i] * e[i] + f[i] * f[i]);
```

```
        x = e[i];
        y = f[i];
        z = y / x;
        angle[i] = atan(z);
        angle[i] /= Pi;
        if (print_result) {
            fprintf(fp, "\n%3d%13.5e%15.5f%15.5e%15.5e", i + 1, v[i], angle[i], p[i],
q[i]);
        }

    }
    if (print_result) {
        fprintf(fp, "\n LINE FLOW ");
    }

    for (i = 1; i <= l; i++)
    {
        pos1 = f1(i);
        st = s1[pos1];
        en = e1[pos1];
        x1 = e[f1(st)] * e[f1(st)] + f[f1(st)] * f[f1(st)];
        x2 = e[f1(en)] * e[f1(en)] + f[f1(en)] * f[f1(en)];
        y1 = e[f1(st)] * e[f1(en)] + f[f1(st)] * f[f1(en)];
        y2 = f[f1(st)] * e[f1(en)] - e[f1(st)] * f[f1(en)];
        p1[pos1] = (x1 - y1)*g1[pos1] - y2 * b1[pos1];
        q1[pos1] = -x1 * (c1[pos1] + b1[pos1]) + y1 * b1[pos1] - y2 * g1[pos1];
        p2[pos1] = (x2 - y1)*g1[pos1] + y2 * b1[pos1];
        q2[pos1] = -x2 * (c1[pos1] + b1[pos1]) + y1 * b1[pos1] + y2 * g1[pos1];
        for (j = 1; j <= n; j++)
        {
            cm = c[f2(j, i, 1)];
            if (cm != 0.0)
            {
                km = 1;
                if (en == j)
                {
                    km = 2;
                }
                if (km == 1)
                {
                    q1[pos1] -= (e[f1(j)] * e[f1(j)] + f[f1(j)] * f[f1(j)])*cm;
                }
                else
                {
```

```
                    q2[pos1] -= (e[f1(j)] * e[f1(j)] + f[f1(j)] * f[f1(j)])*cm;
                }
            }
        }
        p3[pos1] = p1[pos1] + p2[pos1];
        q3[pos1] = q1[pos1] + q2[pos1];
        if (print_result) {
            fprintf(fp, "\n%2d%8d%11d%13.6e%13.6e%13.6e%13.6e%17d%11d%13.6e%13.6e", \
                i, s1[pos1], e1[pos1], p1[pos1], q1[pos1], p3[pos1], q3[pos1], \
                e1[pos1], s1[pos1], p2[pos1], q2[pos1]);
        }
    }
}

void FlowSolve::ChooseTest() {
    cout << "Please input the test system. 1 to choose the Model_1, 2 to choose
Model_2:" << endl;
    cin >> choose;
}
//从文件中读取网络的输入参数：节点数n，PQ节点数m，支路总数l，各支路导纳参数g1[]，b1[]，
c1[]，c[]，co[]，
//节点注入有功p[]，无功q[]
//网络拓扑参数s1[]，e1[]
//设置初始的电压参数e[]，f[]
//并计算其它初始参数：雅可比矩阵行数n0，n1
void FlowSolve::GetParameters() {
    string temp;

    ifstream input_file("FLOW3.D1");
    if (!input_file.is_open()) {
        cout << "Failed while open the file!" << endl;
    }
    input_file >> n >> m >> l;
    pq_num = m;
    pv_num = n - pq_num - 1;
    //cout << n << " " << m << " " << l << endl;
    n0 = 2 * n - 2;
    n1 = n0 + 1;
    //input parameters
    s1 = new int[l];
    e1 = new int[l];
    g1 = new float[l];
    b1 = new float[l];
    c1 = new float[l];
```

```
c = new float[n*l];
co = new float[n];
p = new float[n];
q = new float[n];
e = new float[n];
f = new float[n];
angle = new float[n];

//other float*
g = new float[n*l];
b = new float[n*l];
p0 = new float[n];
q0 = new float[n];
p1 = new float[l];
q1 = new float[l];
p2 = new float[l];
q2 = new float[l];
p3 = new float[l];
q3 = new float[l];
v = new float[n];
v0 = new float[n];
jm = new float[n0*n0];
a = new float[n0*n1];

pq_v_up = new float[n];
pq_v_down = new float[n];
pv_q_up = new float[n];
pv_q_down = new float[n];

for (int i = 1; i <= l; i++) {
    input_file >> s1[f1(i)];
}
for (int i = 1; i <= l; i++) {
    input_file >> e1[f1(i)];
}
for (int i = 1; i <= l; i++) {
    input_file >> g1[f1(i)];
}
for (int i = 1; i <= l; i++) {
    input_file >> b1[f1(i)];
}
for (int i = 1; i <= l; i++) {
    input_file >> c1[f1(i)];
}
```

```
    for (int i = 1; i <= n; i++) {
        for (int j = 1; j <= l; j++) {
            input_file >> c[f2(i, j, l)];
        }
    }
    for (int i = 1; i <= n; i++) {
        input_file >> p[f1(i)];
    }
    for (int i = 1; i <= n; i++) {
        input_file >> q[f1(i)];
    }
    for (int i = 1; i <= n; i++) {
        input_file >> co[f1(i)];
    }
    for (int i = 1; i <= n; i++) {
        input_file >> e[f1(i)];
        v[f1(i)] = e[f1(i)];
    }
    for (int i = 1; i <= n; i++) {
        input_file >> f[f1(i)];
    }
    for (int i = 1; i <= n; i++) {
        input_file >> angle[f1(i)];
    }

    for (int i = 1; i <= n; i++) {
        input_file >> pq_v_up[f1(i)];
    }
    for (int i = 1; i <= n; i++) {
        input_file >> pq_v_down[f1(i)];
    }
    for (int i = 1; i <= n; i++) {
        input_file >> pv_q_up[f1(i)];
    }
    for (int i = 1; i <= n; i++) {
        input_file >> pv_q_down[f1(i)];
    }
    input_file.close();
}
//当sevc()解出电压修正量后，更新状态变量的e[]和f[]的值
void FlowSolve::UpdateEF() {
    for (int i = 1; i <= (n - 1); i++) {
        e[f1(i)] += a[f2(2 * i - 1, n1, n1)];
        f[f1(i)] += a[f2(2 * i, n1, n1)];
```

```
    }
}

//check V of PQ nodes
vector<int> FlowSolve::CheckVBound() {
    vector<int> a;
    for (int i = 1; i <= pq_num; i++) {
        float vi = sqrt(e[f1(i)] * e[i] + f[i] * f[i]);
        if (pq_v_up[f1(i)] != 0) {
            if (vi > pq_v_up[f1(i)]) {
                a.clear();
                a.push_back(1);
                a.push_back(i);
                return a;
            }
        }
        if (pq_v_down[f1(i)] != 0) {
            if (vi < pq_v_down[f1(i)]) {
                a.clear();
                a.push_back(2);
                a.push_back(i);
                return a;
            }
        }
    }
    a.clear();
    a.push_back(0);
    return a;
}

//check Q of PV nodes
vector<int> FlowSolve::CheckQBound() {
    vector<int> a;
    float* qq = new float[n];
    for (int i = 0; i < n; i++) {
        qq[i] = q[i];
    }
    float t1, t2, cm;
    int i, i1, j, m1, ns, pos1, pos2;
    ns = n - 1;

    t1 = 0.0; t2 = 0.0;
    for (i = 1; i <= n; i++)
    {
```

```
    pos1 = f1(i); pos2 = f2(n, i, n);
    t1 += g[pos2] * e[pos1] - b[pos2] * f[pos1];
    t2 += g[pos2] * f[pos1] + b[pos2] * e[pos1];
}
pos1 = f1(n);
qq[pos1] = -t2 * e[pos1];
m1 = m + 1;
for (i1 = m1; i1 <= ns; i1++)
{
    t1 = 0; t2 = 0;
    for (i = 1; i <= n; i++)
    {
        pos1 = f1(i); pos2 = f2(i1, i, n);
        t1 += g[pos2] * e[pos1] - b[pos2] * f[pos1];
        t2 += g[pos2] * f[pos1] + b[pos2] * e[pos1];
    }
    pos1 = f1(i1);
    qq[pos1] = f[pos1] * t1 - e[pos1] * t2;
}
for (i = 0; i < n; i++)
{
    cm = co[i];
    if (cm != 0)
    {
        qq[i] -= (e[i] * e[i] + f[i] * f[i])*cm;
    }
}
for (int i = pq_num + 1; i <= pq_num + pv_num; i++) {
    if (pv_q_up[f1(i)] != 0) {
        if (qq[f1(i)] > pv_q_up[f1(i)]) {
            a.clear();
            a.push_back(1);
            a.push_back(i);
            return a;
        }
    }
    if (pv_q_down[f1(i)] != 0) {
        if (qq[f1(i)] < pv_q_down[f1(i)]) {
            a.clear();
            a.push_back(2);
            a.push_back(i);
            return a;
        }
    }
```

```
    }
    a.clear();
    a.push_back(0);
    delete qq;
    return a;
}
```

附录二：

模型1求解过程：

请设置收敛指标epsilon:

0.00001

BUS ADMITTANCE MATRIX Y(BUS):

********** ARRAY G **********

	1	2	3	4	5
1	1.378741	-0.624024	-0.754717	0.000000	0.000000
2	-0.624024	1.453900	-0.829876	0.000000	0.000000
3	-0.754717	-0.829876	1.584593	0.000000	0.000000
4	0.000000	0.000000	0.000000	0.000000	0.000000
5	0.000000	0.000000	0.000000	0.000000	0.000000

********** ARRAY B **********

	1	2	3	4	5
1	-6.291665	3.900156	2.641509	0.000000	0.000000
2	3.900156	-66.980820	3.112033	63.492062	0.000000
3	2.641509	3.112033	-35.737858	0.000000	31.746033
4	0.000000	63.492062	0.000000	-66.666664	0.000000
5	0.000000	0.000000	31.746033	0.000000	-33.333332

****

CHANGE OF P0,V**2,P0(I),Q0(I),V0(I)

I	P0(I)	Q0(I)
1	-1.600000e+00	-5.500000e-01
2	-2.000000e+00	5.698032e+00
3	-3.700000e+00	2.049016e+00
I	P0(I)	V0(I)
4	5.000000e+00	0.000000e+00
5	2.580000e+00	0.000000e+00

J MATRIX(Jacobian)

	1	2	3	4	5
1	-6.041665	1.378741	3.900156	-0.624024	2.641509
2	-1.378741	-6.541665	0.624024	3.900156	0.754717
3	3.900156	-0.624024	-60.282787	1.453900	3.112033
4	0.624024	3.900156	-1.453900	-73.678848	0.829876

5	2.641509	-0.754717	3.112033	-0.829876	-32.388840
6	0.754717	2.641509	0.829876	3.112033	-1.584593
7	0.000000	0.000000	0.000000	0.000000	0.000000
8	-0.000000	0.000000	-0.000000	66.666664	-0.000000

	6	7	8
1	-0.754717	0.000000	0.000000
2	2.641509	-0.000000	0.000000
3	-0.829876	63.492062	0.000000
4	3.112033	-0.000000	63.492062
5	1.584593	0.000000	0.000000
6	-39.086876	-0.000000	0.000000
7	0.000000	-2.100000	-0.000000
8	0.000000	0.000000	-63.492062

Trianglar Angmentex Matrix

	1	2	3	4	5
1	1.000000	-0.228205	-0.645543	0.103287	-0.437215
2	0.000000	1.000000	0.038798	-0.589613	-0.022156
3	0.000000	0.000000	1.000000	-0.020907	-0.083481
4	0.000000	0.000000	0.000000	1.000000	-0.015289
5	0.000000	0.000000	0.000000	0.000000	1.000000
6	0.000000	0.000000	0.000000	0.000000	0.000000
7	0.000000	0.000000	0.000000	0.000000	0.000000
8	0.000000	0.000000	0.000000	0.000000	0.000000

	6	7	8	9
1	0.124919	-0.000000	-0.000000	-0.091035
2	-0.410387	0.000000	0.000000	-0.215056
3	0.020907	-1.098946	0.000000	0.091488
4	-0.066097	0.018595	-0.889431	-0.042540
5	-0.033039	-0.172461	0.031466	0.075488
6	1.000000	-0.028165	-0.111949	-0.120216
7	0.000000	1.000000	0.000000	0.000000
8	0.000000	0.000000	1.000000	0.457490

Voltage correction E(i), F(i) :

1	1	2	2
-0.033569	-0.033482	0.105382	0.360705
3	3	4	4
0.058813	-0.069000	0.000000	0.457490

CHANGE OF P0,V**2,P0(I),Q0(I),V0(I)

I	P0(I)	Q0(I)
1	-3.473388e-02	-7.203585e-02
2	2.775280e+00	9.180284e-01
3	4.904552e-02	-3.714473e-01

I	P0(I)	V0(I)

4	-3.061033e+00	-2.092974e-01
5	2.800016e-01	0.000000e+00

max error is: 3.06103

J MATRIX(Jacobian)

	1	2	3	4	5
1	-5.225904	3.134743	3.748337	-0.733660	2.527566
2	0.048516	-6.842688	0.733660	3.748337	0.817824
3	4.536251	0.717022	-74.269669	-18.137197	3.739326
4	-0.717022	4.536251	26.969225	-74.857971	-0.205196
5	2.744789	-0.981368	3.237800	-1.093414	-36.627338
6	0.981368	2.744789	1.093414	3.237800	-0.674780
7	0.000000	0.000000	0.000000	0.000000	0.000000
8	-0.000000	0.000000	-29.047009	66.666664	-0.000000

	6	7	8
1	-0.817824	0.000000	-0.000000
2	2.527566	0.000000	0.000000
3	0.205196	70.182983	22.901913
4	3.739326	-22.901913	70.182983
5	7.612617	0.000000	-0.000000
6	-38.833408	0.000000	0.000000
7	0.000000	-2.100000	-0.914981
8	0.000000	22.901913	-70.182983

Trianglar Angmentex Matrix

	1	2	3	4	5
1	1.000000	-0.599847	-0.717261	0.140389	-0.483661
2	0.000000	1.000000	-0.112783	-0.549127	-0.123472
3	0.000000	0.000000	1.000000	0.239084	-0.090018
4	0.000000	0.000000	0.000000	1.000000	-0.030126
5	0.000000	0.000000	0.000000	0.000000	1.000000
6	0.000000	0.000000	0.000000	0.000000	0.000000
7	0.000000	0.000000	0.000000	0.000000	0.000000
8	0.000000	0.000000	0.000000	0.000000	0.000000

	6	7	8	9
1	0.156494	-0.000000	0.000000	-0.013784
2	-0.369845	-0.000000	0.000000	-0.005196
3	-0.010858	-0.993696	-0.324260	0.011860
4	-0.071733	-0.048727	-0.999661	0.039057
5	-0.210145	-0.147426	0.019040	-0.012722
6	1.000000	-0.065793	-0.136830	0.005613
7	0.000000	1.000000	2.527767	-0.235764
8	0.000000	0.000000	1.000000	-0.065055

Voltage correction E(i), F(i) :

1	1	2	2
-0.095285	-0.036405	-0.074975	-0.030737
3	3	4	4
-0.023675	-0.007981	-0.071321	-0.065055

CHANGE OF P0,V**2,P0(I),Q0(I),V0(I)

I	P0(I)	Q0(I)
1	-6.757893e-03	-2.655661e-02
2	1.666033e-01	6.541318e-02
3	3.279969e-03	-9.477377e-03
I	P0(I)	V0(I)
4	-1.704954e-01	-9.318873e-03
5	1.398325e-02	0.000000e+00

max error is: 0.170495

J MATRIX(Jacobian)

	1	2	3	4	5
1	-4.356647	3.387227	3.353992	-0.816185	2.248394
2	0.105650	-6.412552	0.816185	3.353992	0.842075
3	4.224656	0.643929	-69.170151	-18.396025	3.480493
4	-0.643929	4.224656	22.810850	-69.824326	-0.171762
5	2.676228	-0.984581	3.157499	-1.098602	-35.367180
6	0.984581	2.676228	1.098602	3.157499	-0.925701
7	0.000000	0.000000	0.000000	0.000000	0.000000
8	-0.000000	0.000000	-24.916550	62.138359	-0.000000

	6	7	8
1	-0.842075	0.000000	-0.000000
2	2.248394	0.000000	0.000000
3	0.171762	65.422653	20.950365
4	3.480493	-20.950365	65.422653
5	7.857080	0.000000	-0.000000
6	-38.376076	0.000000	0.000000
7	0.000000	-1.957358	-0.784871
8	0.000000	20.950365	-65.422653

Trianglar Angmentex Matrix

	1	2	3	4	5
1	1.000000	-0.777485	-0.769856	0.187343	-0.516084
2	0.000000	1.000000	-0.141779	-0.526696	-0.141634
3	0.000000	0.000000	1.000000	0.261905	-0.095121
4	0.000000	0.000000	0.000000	1.000000	-0.029789
5	0.000000	0.000000	0.000000	0.000000	1.000000
6	0.000000	0.000000	0.000000	0.000000	0.000000
7	0.000000	0.000000	0.000000	0.000000	0.000000
8	0.000000	0.000000	0.000000	0.000000	0.000000

	6	7	8	9
1	0.193285	-0.000000	0.000000	-0.006096
2	-0.351948	-0.000000	0.000000	-0.001169
3	-0.011289	-1.000947	-0.320534	0.000537
4	-0.070173	-0.025966	-0.986703	0.002420
5	-0.228070	-0.159176	0.020223	-0.000901
6	1.000000	-0.068258	-0.131544	0.000115
7	0.000000	1.000000	0.400985	-0.004761
8	0.000000	0.000000	1.000000	-0.001770

Voltage correction E(i), F(i) :

1	1	2	2
-0.011776	-0.001895	-0.004372	0.000493
3	3	4	4
-0.001600	-0.000395	-0.004051	-0.001770

CHANGE OF P0,V**2,P0(I),Q0(I),V0(I)

I	P0(I)	Q0(I)
1	-2.003983e-04	-6.384850e-04
2	6.898940e-04	-2.181530e-05
3	3.650784e-06	-2.217293e-05
I	P0(I)	V0(I)
4	-6.177872e-04	-1.950562e-05
5	8.249283e-04	0.000000e+00

max error is: 0.000689894

J MATRIX(Jacobian)

	1	2	3	4	5
1	-4.229751	3.408015	3.306881	-0.816226	2.215857
2	0.135069	-6.386042	0.816226	3.306881	0.838192
3	4.207913	0.648582	-68.891129	-18.591789	3.467297
4	-0.648582	4.207913	22.693905	-69.519135	-0.176926
5	2.671704	-0.984416	3.152193	-1.098503	-35.296535
6	0.984416	2.671704	1.098503	3.152193	-0.936616
7	0.000000	0.000000	0.000000	0.000000	0.000000
8	-0.000000	0.000000	-24.804188	61.881130	-0.000000

	6	7	8
1	-0.838192	0.000000	-0.000000
2	2.215857	0.000000	0.000000
3	0.176926	65.145081	20.981699
4	3.467297	-20.981699	65.145081
5	7.869310	0.000000	-0.000000
6	-38.331135	0.000000	0.000000
7	0.000000	-1.949256	-0.781332
8	0.000000	20.981699	-65.145081

Trianglar Angmentex Matrix

	1	2	3	4	5
1	1.000000	-0.805725	-0.781815	0.192973	-0.523874
2	0.000000	1.000000	-0.146853	-0.522655	-0.144802
3	0.000000	0.000000	1.000000	0.266010	-0.096243
4	0.000000	0.000000	0.000000	1.000000	-0.029986
5	0.000000	0.000000	0.000000	0.000000	1.000000
6	0.000000	0.000000	0.000000	0.000000	0.000000
7	0.000000	0.000000	0.000000	0.000000	0.000000
8	0.000000	0.000000	0.000000	0.000000	0.000000

	6	7	8	9
1	0.198166	-0.000000	0.000000	-0.000151
2	-0.348736	-0.000000	0.000000	-0.000035
3	-0.011562	-1.002106	-0.322755	-0.000012
4	-0.069971	-0.024406	-0.985948	0.000005
5	-0.229534	-0.161186	0.019892	-0.000016
6	1.000000	-0.069183	-0.131195	-0.000008
7	0.000000	1.000000	2.586649	0.000006
8	0.000000	0.000000	1.000000	0.000007

Voltage correction E(i), F(i) :

1	1	2	2
-0.000216	-0.000039	-0.000028	0.000011
3	3	4	4
-0.000020	-0.000008	-0.000013	0.000007

CHANGE OF P0,V**2,P0(I),Q0(I),V0(I)

I	P0(I)	Q0(I)
1	-2.607703e-07	-6.556511e-07
2	-1.221895e-06	4.708767e-06
3	2.756715e-07	1.549721e-06
I	P0(I)	V0(I)
4	2.212822e-06	1.490116e-08
5	5.724430e-04	0.000000e+00

max error is: 4.70877e-06

THE RESULT ARE:

BUS DATA

BUS	VOLTAGE	ANGLE(DEGS.)	BUS P	BUS Q
1	8.62150e-01	-4.77851	-1.60000e+00	-8.00000e-01
2	1.07792e+00	17.85353	-2.00000e+00	-1.00000e+00
3	1.03641e+00	-4.28193	-3.70000e+00	-1.30000e+00
4	1.05000e+00	21.84332	5.00000e+00	1.81309e+00
5	1.05000e+00	0.00000	2.57943e+00	2.29940e+00

LINE FLOW

1	1	2	-1.466181e+00	-4.090762e-01	1.183648e-01 2.634799e-01

```
2           1 1.584546e+00 6.725561e-01
 2        1           3-1.338185e-01-3.909231e-01 2.296895e-02 8.039129e-02
3           1 1.567875e-01 4.713144e-01
 3        2           3 1.415454e+00-2.443331e-01 1.380935e-01-4.116201e-02
3           2-1.277360e+00 2.031711e-01
 4        2           4-4.999999e+00-1.428230e+00 0.000000e+00 3.848538e-01
4           2 4.999999e+00 1.813084e+00
 5        3           5-2.579427e+00-1.974487e+00 0.000000e+00 3.249145e-01
5           3 2.579427e+00 2.299402e+00
The total iterations is: 4
```

附录三：

模型2求解过程（含节点转化）

请设置收敛指标epsilon:

0.0001

BUS ADMITTANCE MATRIX Y(BUS):

********** ARRAY G **********

	1	2	3	4	5
1	1.010000	-0.200000	0.000000	-0.160000	0.000000
2	-0.200000	0.610000	-0.210000	0.000000	0.000000
3	0.000000	-0.210000	0.990000	-0.210000	-0.320000
4	-0.160000	0.000000	-0.210000	0.470000	0.000000
5	0.000000	0.000000	-0.320000	0.000000	2.420000
6	0.000000	0.000000	-0.250000	-0.100000	-1.100000
7	-0.350000	0.000000	0.000000	0.000000	0.000000
8	-0.300000	-0.200000	0.000000	0.000000	-1.000000

	6	7	8
1	0.000000	-0.350000	-0.300000
2	0.000000	0.000000	-0.200000
3	-0.250000	0.000000	0.000000
4	-0.100000	0.000000	0.000000
5	-1.100000	0.000000	-1.000000
6	2.200000	-0.750000	0.000000
7	-0.750000	1.900000	-0.800000
8	0.000000	-0.800000	2.300000

********** ARRAY B **********

	1	2	3	4	5
1	-8.400000	1.300000	0.000000	2.100000	0.000000
2	1.300000	-3.300000	1.000000	0.000000	0.000000
3	0.000000	1.000000	-9.410000	3.110000	3.000000
4	2.100000	0.000000	3.110000	-6.710000	0.000000

5	0.000000	0.000000	3.000000	0.000000	-17.970001
6	0.000000	0.000000	2.300000	1.500000	8.100000
7	2.000000	0.000000	0.000000	0.000000	0.000000
8	3.000000	1.000000	0.000000	0.000000	7.000000

	6	7	8
1	0.000000	2.000000	3.000000
2	0.000000	0.000000	1.000000
3	2.300000	0.000000	0.000000
4	1.500000	0.000000	0.000000
5	8.100000	0.000000	7.000000
6	-18.060001	6.300000	0.000000
7	6.300000	-14.709999	6.500000
8	0.000000	6.500000	-17.420000

****

CHANGE OF P0,V**2,P0(I),Q0(I),V0(I)

I	P0(I)	Q0(I)
1	2.500000e-01	2.000005e-01
2	-2.200000e-01	-1.300000e-01
3	2.499999e-01	-2.384186e-07
4	7.450581e-09	-1.000000e+00

I	P0(I)	V0(I)
5	-2.330001e-01	0.000000e+00
6	1.500000e-01	0.000000e+00
7	1.999999e-01	0.000000e+00
8	0.000000e+00	0.000000e+00

J MATRIX(Jacobian)

	1	2	3	4	5
1	-8.400000	1.010000	1.300000	-0.200000	0.000000
2	-1.010000	-8.400000	0.200000	1.300000	-0.000000
3	1.300000	-0.200000	-3.300000	0.610000	1.000000
4	0.200000	1.300000	-0.610000	-3.300000	0.210000
5	0.000000	0.000000	1.000000	-0.210000	-9.410000
6	-0.000000	0.000000	0.210000	1.000000	-0.990000
7	2.100000	-0.160000	0.000000	0.000000	3.110000
8	0.160000	2.100000	-0.000000	0.000000	0.210000
9	0.000000	0.000000	0.000000	0.000000	0.000000
10	-0.000000	0.000000	-0.000000	0.000000	0.320000
11	0.000000	0.000000	0.000000	0.000000	0.000000
12	-0.000000	0.000000	-0.000000	0.000000	0.250000
13	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.350000	2.000000	-0.000000	0.000000	-0.000000

	6	7	8	9	10

1	0.000000	2.100000	-0.160000	0.000000	0.000000
2	0.000000	0.160000	2.100000	-0.000000	0.000000
3	-0.210000	0.000000	0.000000	0.000000	0.000000
4	1.000000	-0.000000	0.000000	-0.000000	0.000000
5	0.990000	3.110000	-0.210000	3.000000	-0.320000
6	-9.410000	0.210000	3.110000	0.320000	3.000000
7	-0.210000	-6.710000	0.470000	0.000000	0.000000
8	3.110000	-0.470000	-6.710000	-0.000000	0.000000
9	0.000000	0.000000	0.000000	-2.000000	-0.000000
10	3.000000	-0.000000	0.000000	-2.420000	-18.100000
11	0.000000	0.000000	0.000000	0.000000	0.000000
12	2.300000	0.100000	1.500000	1.100000	8.100000
13	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.000000	-0.000000	0.000000	-0.000000	0.000000

	11	12	13	14
1	0.000000	0.000000	2.000000	-0.350000
2	-0.000000	0.000000	0.350000	2.000000
3	0.000000	0.000000	0.000000	0.000000
4	-0.000000	0.000000	-0.000000	0.000000
5	2.300000	-0.250000	0.000000	0.000000
6	0.250000	2.300000	-0.000000	0.000000
7	1.500000	-0.100000	0.000000	0.000000
8	0.100000	1.500000	-0.000000	0.000000
9	0.000000	0.000000	0.000000	0.000000
10	1.100000	8.100000	-0.000000	0.000000
11	-2.000000	-0.000000	0.000000	0.000000
12	-2.200000	-18.200001	0.750000	6.300000
13	0.000000	0.000000	-2.000000	-0.000000
14	0.750000	6.300000	-1.900000	-14.800000

Trianglar Angmentex Matrix

	1	2	3	4	5
1	1.000000	-0.120238	-0.154762	0.023810	-0.000000
2	0.000000	1.000000	-0.005127	-0.155378	0.000000
3	0.000000	0.000000	1.000000	-0.184657	-0.322681
4	0.000000	0.000000	0.000000	1.000000	-0.007908
5	0.000000	0.000000	0.000000	0.000000	1.000000
6	0.000000	0.000000	0.000000	0.000000	0.000000
7	0.000000	0.000000	0.000000	0.000000	0.000000
8	0.000000	0.000000	0.000000	0.000000	0.000000
9	0.000000	0.000000	0.000000	0.000000	0.000000
10	0.000000	0.000000	0.000000	0.000000	0.000000
11	0.000000	0.000000	0.000000	0.000000	0.000000
12	0.000000	0.000000	0.000000	0.000000	0.000000

13	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.000000	0.000000	0.000000	0.000000	0.000000

	6	7	8	9	10
1	-0.000000	-0.250000	0.019048	-0.000000	-0.000000
2	0.000000	0.010855	-0.248695	0.000000	0.000000
3	0.067763	-0.105024	0.011496	-0.000000	-0.000000
4	-0.324142	0.007637	-0.103614	0.000000	0.000000
5	-0.100580	-0.353806	0.024663	-0.330123	0.035213
6	1.000000	0.010814	-0.352718	-0.001989	-0.330323
7	0.000000	1.000000	-0.081251	-0.211666	0.016036
8	0.000000	0.000000	1.000000	0.001154	-0.211572
9	0.000000	0.000000	0.000000	1.000000	7.365186
10	0.000000	0.000000	0.000000	0.000000	1.000000
11	0.000000	0.000000	0.000000	0.000000	0.000000
12	0.000000	0.000000	0.000000	0.000000	0.000000
13	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.000000	0.000000	0.000000	0.000000	0.000000

	11	12	13	14	15
1	-0.000000	-0.000000	-0.238095	0.041667	0.023810
2	0.000000	0.000000	-0.012853	-0.239641	0.026516
3	-0.000000	-0.000000	-0.099696	0.020857	-0.032335
4	0.000000	0.000000	-0.002367	-0.100133	-0.050434
5	-0.253094	0.027510	-0.010964	0.002574	-0.003418
6	-0.002033	-0.253299	-0.001457	-0.011111	0.021128
7	-0.461359	0.032561	-0.113466	0.015322	-0.193040
8	0.004893	-0.460962	-0.006062	-0.113959	0.037319
9	-0.531741	-4.078015	-0.010263	-0.066895	-0.063551
10	-0.072197	-0.553688	-0.001393	-0.009083	-0.008629
11	1.000000	0.000000	0.000000	0.000000	0.000000
12	0.000000	1.000000	-0.070493	-0.586670	0.015204
13	0.000000	0.000000	1.000000	0.000000	0.000000
14	0.000000	0.000000	0.000000	1.000000	0.034234

Voltage correction E(i), F(i) :

1	1	2	2
-0.032901	0.047931	-0.083397	-0.021308
3	3	4	4
-0.067816	0.057322	-0.190030	0.059861
5	5	6	6
-0.000000	0.011221	0.000000	0.035288
7	7		
0.000000	0.034234		

PV节点5无功Q超过上界，转化为PQ节点

CHANGE OF P0,V**2,P0(I),Q0(I),V0(I)

I	P0(I)	Q0(I)
1	1.781143e-02	-5.402893e-03
2	-1.557718e-02	-1.552953e-02
3	1.695392e-02	-1.432988e-02
4	-5.986094e-02	-1.900303e-01

I	P0(I)	V0(I)
5	2.619636e-03	-1.259051e-04
6	1.488159e-02	-1.245221e-03
7	1.506265e-03	-1.171948e-03
8	3.969996e-01	0.000000e+00

max error is: 0.19003

J MATRIX(Jacobian)

	1	2	3	4	5
1	-8.372046	0.324150	1.266815	-0.131110	0.000000
2	-0.824150	-7.972044	0.131110	1.266815	-0.000000
3	1.187323	-0.211021	-2.881793	0.849445	0.912129
4	0.211021	1.187323	-0.409445	-3.141793	0.213795
5	0.000000	0.000000	0.944222	-0.138436	-8.828599
6	-0.000000	0.000000	0.138436	0.944222	-0.633461
7	1.710515	-0.003887	0.000000	0.000000	2.531578
8	0.003887	1.710515	-0.000000	0.000000	-0.016074
9	0.000000	0.000000	0.000000	0.000000	3.003591
10	-0.000000	0.000000	-0.000000	0.000000	0.286338
11	0.000000	0.000000	0.000000	0.000000	0.000000
12	-0.000000	0.000000	-0.000000	0.000000	0.168838
13	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.281533	2.011982	-0.000000	0.000000	-0.000000

	6	7	8	9	10
1	0.000000	2.038578	-0.054081	0.000000	0.000000
2	0.000000	0.054081	2.038578	-0.000000	0.000000
3	-0.213795	0.000000	-0.000000	0.000000	-0.000000
4	0.912129	0.000000	0.000000	0.000000	0.000000
5	0.133460	2.911130	-0.017487	2.814895	-0.126332
6	-8.828601	0.017487	2.911130	0.126332	2.814895
7	0.016074	-4.463036	-0.020981	0.000000	0.000000
8	2.531578	0.020981	-6.463035	-0.000000	0.000000
9	-0.286338	0.000000	0.000000	-18.100609	2.452822
10	3.003591	-0.000000	0.000000	-1.983904	-17.893703
11	0.000000	0.000000	0.000000	0.000000	0.000000
12	2.308822	0.047068	1.503529	0.814170	8.138817
13	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.000000	-0.000000	0.000000	-0.000000	0.000000

	11	12	13	14

1	0.000000	0.000000	1.950975	-0.242623
2	-0.000000	0.000000	0.242623	1.950975
3	0.000000	-0.000000	0.000000	-0.000000
4	0.000000	0.000000	0.000000	0.000000
5	2.158354	-0.101205	0.000000	0.000000
6	0.101205	2.158354	-0.000000	0.000000
7	1.220941	0.008794	0.000000	0.000000
8	-0.008794	1.220941	-0.000000	0.000000
9	8.112343	-1.009112	0.000000	0.000000
10	1.009112	8.112343	-0.000000	0.000000
11	-2.000000	-0.070575	0.000000	0.000000
12	-1.707764	-17.855909	0.527688	6.326466
13	0.000000	0.000000	-2.000000	-0.068467
14	0.534328	6.325675	-1.593341	-14.821046

Trianglar Angmentex Matrix

	1	2	3	4	5
1	1.000000	-0.038718	-0.151315	0.015660	-0.000000
2	0.000000	1.000000	-0.000800	-0.159886	0.000000
3	0.000000	0.000000	1.000000	-0.297699	-0.337542
4	0.000000	0.000000	0.000000	1.000000	-0.028274
5	0.000000	0.000000	0.000000	0.000000	1.000000
6	0.000000	0.000000	0.000000	0.000000	0.000000
7	0.000000	0.000000	0.000000	0.000000	0.000000
8	0.000000	0.000000	0.000000	0.000000	0.000000
9	0.000000	0.000000	0.000000	0.000000	0.000000
10	0.000000	0.000000	0.000000	0.000000	0.000000
11	0.000000	0.000000	0.000000	0.000000	0.000000
12	0.000000	0.000000	0.000000	0.000000	0.000000
13	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.000000	0.000000	0.000000	0.000000	0.000000

	6	7	8	9	10
1	-0.000000	-0.243498	0.006460	-0.000000	-0.000000
2	0.000000	0.018316	-0.255361	0.000000	0.000000
3	0.079117	-0.108107	0.018435	-0.000000	0.000000
4	-0.307209	0.003660	-0.101388	0.000000	0.000000
5	-0.012060	-0.354190	0.002402	-0.330936	0.014852
6	1.000000	0.019793	-0.352292	0.006861	-0.330447
7	0.000000	1.000000	0.001606	-0.280334	0.007702
8	0.000000	0.000000	1.000000	0.007606	-0.170359
9	0.000000	0.000000	0.000000	1.000000	-0.136915
10	0.000000	0.000000	0.000000	0.000000	1.000000
11	0.000000	0.000000	0.000000	0.000000	0.000000
12	0.000000	0.000000	0.000000	0.000000	0.000000

13	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.000000	0.000000	0.000000	0.000000	0.000000

	11	12	13	14	15
1	-0.000000	-0.000000	-0.233034	0.028980	-0.000645
2	0.000000	0.000000	-0.006318	-0.246735	0.002292
3	-0.000000	0.000000	-0.102005	0.027804	-0.006170
4	0.000000	0.000000	-0.005974	-0.097625	-0.003474
5	-0.253749	0.011898	-0.011424	0.001449	-0.002428
6	0.004753	-0.253408	-0.001595	-0.010905	0.001643
7	-0.609752	0.003494	-0.147378	0.012548	-0.064375
8	0.012332	-0.371101	-0.001596	-0.094154	-0.009539
9	-0.567025	0.068314	-0.011382	0.001763	-0.004547
10	0.000049	-0.553060	0.000339	-0.007941	0.000161
11	1.000000	0.035288	0.000000	0.000000	-0.000623
12	0.000000	1.000000	-0.049226	-0.591755	-0.000837
13	0.000000	0.000000	1.000000	0.034234	-0.000586
14	0.000000	0.000000	0.000000	1.000000	-0.000861

Voltage correction E(i), F(i) :

1	1	2	2
-0.020344	-0.000212	-0.024016	-0.005488
3	3	4	4
-0.027577	-0.001161	-0.066134	-0.010190
5	5	6	6
-0.004866	-0.000606	-0.000574	-0.001374
7	7		
-0.000556	-0.000861		

CHANGE OF P0,V**2,P0(I),Q0(I),V0(I)

I	P0(I)	Q0(I)
1	4.788823e-04	-4.597008e-05
2	-3.938773e-04	-6.500185e-04
3	6.967866e-04	-4.285220e-04
4	-2.411723e-03	-2.136236e-02

I	P0(I)	V0(I)
5	7.060124e-06	9.595666e-03
6	-2.564285e-04	-2.247165e-06
7	-3.005829e-05	-1.097680e-06
8	3.648221e-01	0.000000e+00

max error is: 0.0213624

J MATRIX(Jacobian)

	1	2	3	4	5
1	-8.198452	0.281872	1.240326	-0.127316	0.000000
2	-0.828890	-7.803431	0.127316	1.240326	-0.000000
3	1.155005	-0.213353	-2.777029	0.874372	0.886961

4	0.213353	1.155005	-0.391443	-3.081359	0.214240
5	0.000000	0.000000	0.916400	-0.133806	-8.551374
6	-0.000000	0.000000	0.133806	0.916400	-0.641647
7	1.570002	-0.014705	0.000000	0.000000	2.323760
8	0.014705	1.570002	-0.000000	0.000000	0.001729
9	0.000000	0.000000	0.000000	0.000000	2.988799
10	-0.000000	0.000000	-0.000000	0.000000	0.286598
11	0.000000	0.000000	0.000000	0.000000	0.000000
12	-0.000000	0.000000	-0.000000	0.000000	0.171856
13	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.283060	2.010567	-0.000000	0.000000	-0.000000

	6	7	8	9	10
1	0.000000	1.995821	-0.051270	0.000000	0.000000
2	0.000000	0.051270	1.995821	-0.000000	0.000000
3	-0.214240	0.000000	-0.000000	0.000000	-0.000000
4	0.886961	0.000000	0.000000	0.000000	0.000000
5	0.092519	2.825120	-0.015306	2.731791	-0.120990
6	-8.584518	0.015306	2.825120	0.120990	2.731791
7	-0.001729	-3.704445	0.100549	0.000000	0.000000
8	2.323760	0.067927	-6.324522	-0.000000	0.000000
9	-0.286598	0.000000	0.000000	-18.011223	2.450520
10	2.988799	-0.000000	0.000000	-1.984424	-17.805271
11	0.000000	0.000000	0.000000	0.000000	0.000000
12	2.307158	0.049073	1.502530	0.824671	8.132655
13	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.000000	-0.000000	0.000000	-0.000000	0.000000

	11	12	13	14
1	0.000000	0.000000	1.910212	-0.235926
2	-0.000000	0.000000	0.235926	1.910212
3	0.000000	-0.000000	0.000000	-0.000000
4	0.000000	0.000000	0.000000	0.000000
5	2.094635	-0.096981	0.000000	0.000000
6	0.096981	2.094635	-0.000000	0.000000
7	1.120721	0.000123	0.000000	0.000000
8	-0.000123	1.120721	-0.000000	0.000000
9	8.072263	-1.008666	0.000000	0.000000
10	1.008666	8.072263	-0.000000	0.000000
11	-1.998852	-0.067827	0.000000	0.000000
12	-1.752801	-17.646935	0.535915	6.321818
13	0.000000	0.000000	-1.998887	-0.066745
14	0.539335	6.321524	-1.607859	-14.774573

Trianglar Angmentex Matrix

	1	2	3	4	5

1	1.000000	-0.034381	-0.151288	0.015529	-0.000000
2	0.000000	1.000000	-0.000245	-0.160011	0.000000
3	0.000000	0.000000	1.000000	-0.318426	-0.340833
4	0.000000	0.000000	0.000000	1.000000	-0.030509
5	0.000000	0.000000	0.000000	0.000000	1.000000
6	0.000000	0.000000	0.000000	0.000000	0.000000
7	0.000000	0.000000	0.000000	0.000000	0.000000
8	0.000000	0.000000	0.000000	0.000000	0.000000
9	0.000000	0.000000	0.000000	0.000000	0.000000
10	0.000000	0.000000	0.000000	0.000000	0.000000
11	0.000000	0.000000	0.000000	0.000000	0.000000
12	0.000000	0.000000	0.000000	0.000000	0.000000
13	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.000000	0.000000	0.000000	0.000000	0.000000

	6	7	8	9	10
1	-0.000000	-0.243439	0.006254	-0.000000	-0.000000
2	0.000000	0.019218	-0.255493	0.000000	0.000000
3	0.082326	-0.109329	0.019824	-0.000000	0.000000
4	-0.304188	0.003198	-0.100483	0.000000	0.000000
5	-0.007910	-0.355201	0.002137	-0.331761	0.014694
6	1.000000	0.020998	-0.351461	0.008070	-0.329805
7	0.000000	1.000000	-0.041779	-0.326783	0.012416
8	0.000000	0.000000	1.000000	0.003539	-0.156592
9	0.000000	0.000000	0.000000	1.000000	-0.137872
10	0.000000	0.000000	0.000000	0.000000	1.000000
11	0.000000	0.000000	0.000000	0.000000	0.000000
12	0.000000	0.000000	0.000000	0.000000	0.000000
13	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.000000	0.000000	0.000000	0.000000	0.000000

	11	12	13	14	15
1	-0.000000	-0.000000	-0.232997	0.028777	-0.000006
2	0.000000	0.000000	-0.005464	-0.246946	0.000062
3	-0.000000	0.000000	-0.103047	0.029250	-0.000256
4	0.000000	0.000000	-0.006333	-0.096713	-0.000077
5	-0.254382	0.011778	-0.011590	0.001400	-0.000082
6	0.005681	-0.252917	-0.001600	-0.010788	0.000076
7	-0.709363	0.009973	-0.171436	0.016403	-0.008855
8	0.003036	-0.341800	-0.003326	-0.086585	-0.000415
9	-0.575406	0.068365	-0.013018	0.001753	-0.000582
10	0.000401	-0.550481	0.000384	-0.007427	0.000032
11	1.000000	0.033933	0.000000	0.000000	-0.000001
12	0.000000	1.000000	-0.050987	-0.594076	-0.000163
13	0.000000	0.000000	1.000000	0.033391	-0.000001
14	0.000000	0.000000	0.000000	1.000000	-0.000158

Voltage correction E(i), F(i) :

1	1	2	2
-0.002572	0.000024	-0.002488	-0.000228
3	3	4	4
-0.003480	-0.000019	-0.009052	-0.000532
5	5	6	6
-0.000575	-0.000111	0.000008	-0.000256
7	7		
0.000005	-0.000158		

CHANGE OF P0,V**2,P0(I),Q0(I),V0(I)

I	P0(I)	Q0(I)
1	3.215857e-06	1.251698e-06
2	-2.235640e-06	-3.054738e-06
3	6.236252e-06	-2.567656e-06
4	-3.338605e-05	-4.047155e-04
I	P0(I)	V0(I)
5	-2.214219e-07	1.074122e-02
6	-6.776303e-06	-4.889444e-09
7	-8.423958e-07	7.101335e-09
8	3.610237e-01	0.000000e+00

max error is: 0.000404716

J MATRIX(Jacobian)

	1	2	3	4	5
1	-8.177284	0.277801	1.236987	-0.126771	0.000000
2	-0.827369	-7.781430	0.126771	1.236987	-0.000000
3	1.151725	-0.213153	-2.767435	0.874647	0.884425
4	0.213153	1.151725	-0.389641	-3.074255	0.213946
5	0.000000	0.000000	0.912916	-0.133094	-8.517965
6	-0.000000	0.000000	0.133094	0.912916	-0.640165
7	1.550908	-0.014373	0.000000	0.000000	2.295496
8	0.014373	1.550908	-0.000000	0.000000	0.001482
9	0.000000	0.000000	0.000000	0.000000	2.987040
10	-0.000000	0.000000	-0.000000	0.000000	0.286746
11	0.000000	0.000000	0.000000	0.000000	0.000000
12	-0.000000	0.000000	-0.000000	0.000000	0.172447
13	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.283377	2.010522	-0.000000	0.000000	-0.000000

	6	7	8	9	10
1	0.000000	1.990423	-0.050809	0.000000	0.000000
2	0.000000	0.050809	1.990423	-0.000000	0.000000
3	-0.213946	0.000000	-0.000000	0.000000	-0.000000
4	0.884425	0.000000	0.000000	0.000000	0.000000
5	0.087463	2.814293	-0.014633	2.721344	-0.119933

6	-8.552395	0.014633	2.814293	0.119933	2.721344
7	-0.001482	-3.599153	0.106152	0.000000	0.000000
8	2.295496	0.074901	-6.307833	-0.000000	0.000000
9	-0.286746	0.000000	0.000000	-18.000668	2.451254
10	2.987040	-0.000000	0.000000	-1.984882	-17.794643
11	0.000000	0.000000	0.000000	0.000000	0.000000
12	2.307111	0.049458	1.502516	0.826755	8.132434
13	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.000000	-0.000000	0.000000	-0.000000	0.000000

	11	12	13	14
1	0.000000	0.000000	1.905076	-0.234978
2	-0.000000	0.000000	0.234978	1.905076
3	0.000000	-0.000000	0.000000	-0.000000
4	0.000000	0.000000	0.000000	0.000000
5	2.086626	-0.096154	0.000000	0.000000
6	0.096154	2.086626	-0.000000	0.000000
7	1.107089	0.000230	0.000000	0.000000
8	-0.000230	1.107089	-0.000000	0.000000
9	8.067487	-1.008929	0.000000	0.000000
10	1.008929	8.067487	-0.000000	0.000000
11	-1.998867	-0.067314	0.000000	0.000000
12	-1.757971	-17.619896	0.537536	6.321674
13	0.000000	0.000000	-1.998896	-0.066429
14	0.540334	6.321435	-1.610340	-14.769059

Trianglar Angmentex Matrix

	1	2	3	4	5
1	1.000000	-0.033972	-0.151271	0.015503	-0.000000
2	0.000000	1.000000	-0.000207	-0.160037	0.000000
3	0.000000	0.000000	1.000000	-0.319654	-0.341049
4	0.000000	0.000000	0.000000	1.000000	-0.030649
5	0.000000	0.000000	0.000000	0.000000	1.000000
6	0.000000	0.000000	0.000000	0.000000	0.000000
7	0.000000	0.000000	0.000000	0.000000	0.000000
8	0.000000	0.000000	0.000000	0.000000	0.000000
9	0.000000	0.000000	0.000000	0.000000	0.000000
10	0.000000	0.000000	0.000000	0.000000	0.000000
11	0.000000	0.000000	0.000000	0.000000	0.000000
12	0.000000	0.000000	0.000000	0.000000	0.000000
13	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.000000	0.000000	0.000000	0.000000	0.000000

	6	7	8	9	10
1	-0.000000	-0.243409	0.006213	-0.000000	-0.000000
2	0.000000	0.019282	-0.255529	0.000000	0.000000

3	0.082501	-0.109398	0.019907	-0.000000	0.000000
4	-0.303997	0.003172	-0.100436	0.000000	0.000000
5	-0.007364	-0.355249	0.002056	-0.331800	0.014623
6	1.000000	0.021110	-0.351424	0.008179	-0.329780
7	0.000000	1.000000	-0.045653	-0.335218	0.012810
8	0.000000	0.000000	1.000000	0.003087	-0.154701
9	0.000000	0.000000	0.000000	1.000000	-0.138068
10	0.000000	0.000000	0.000000	0.000000	1.000000
11	0.000000	0.000000	0.000000	0.000000	0.000000
12	0.000000	0.000000	0.000000	0.000000	0.000000
13	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.000000	0.000000	0.000000	0.000000	0.000000

	11	12	13	14	15
1	-0.000000	-0.000000	-0.232972	0.028735	0.000000
2	0.000000	0.000000	-0.005407	-0.246987	0.000000
3	-0.000000	0.000000	-0.103106	0.029337	-0.000001
4	0.000000	0.000000	-0.006353	-0.096666	-0.000000
5	-0.254412	0.011724	-0.011599	0.001395	-0.000000
6	0.005765	-0.252898	-0.001599	-0.010782	0.000001
7	-0.727602	0.010241	-0.175831	0.016846	-0.000172
8	0.002039	-0.337718	-0.003510	-0.085543	-0.000006
9	-0.576901	0.068402	-0.013310	0.001760	-0.000011
10	0.000471	-0.550148	0.000398	-0.007360	0.000001
11	1.000000	0.033676	0.000000	0.000000	-0.000000
12	0.000000	1.000000	-0.051270	-0.594400	-0.000003
13	0.000000	0.000000	1.000000	0.033233	0.000000
14	0.000000	0.000000	0.000000	1.000000	-0.000003

Voltage correction E(i), F(i) :

1	1	2	2
-0.000049	0.000000	-0.000044	-0.000003
3	3	4	4
-0.000067	-0.000000	-0.000176	-0.000008
5	5	6	6
-0.000011	-0.000002	0.000000	-0.000005
7	7		
0.000000	-0.000003		

PV节点6无功Q超过上界，转化为PQ节点

CHANGE OF P0,V**2,P0(I),Q0(I),V0(I)

I	P0(I)	Q0(I)
1	3.911555e-08	5.662441e-07
2	3.026798e-08	-1.043081e-07
3	3.655441e-08	5.029142e-08
4	2.980232e-08	0.000000e+00

I	P0(I)	V0(I)
5	-6.600749e-08	1.076320e-02
6	-1.452863e-07	-3.026798e-08
7	-5.748007e-09	-2.735760e-08
8	3.609517e-01	0.000000e+00

max error is: 5.66244e-07

J MATRIX(Jacobian)

	1	2	3	4	5
1	-8.176882	0.277730	1.236923	-0.126761	0.000000
2	-0.827334	-7.781007	0.126761	1.236923	-0.000000
3	1.151667	-0.213148	-2.767276	0.874644	0.884380
4	0.213148	1.151667	-0.389611	-3.074121	0.213940
5	0.000000	0.000000	0.912850	-0.133080	-8.517333
6	-0.000000	0.000000	0.133080	0.912850	-0.640131
7	1.550536	-0.014363	0.000000	0.000000	2.294946
8	0.014363	1.550536	-0.000000	0.000000	0.001471
9	0.000000	0.000000	0.000000	0.000000	2.987006
10	-0.000000	0.000000	-0.000000	0.000000	0.286748
11	0.000000	0.000000	0.000000	0.000000	2.307110
12	-0.000000	0.000000	-0.000000	0.000000	0.172459
13	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.283384	2.010521	-0.000000	0.000000	-0.000000

	6	7	8	9	10
1	0.000000	1.990320	-0.050801	0.000000	0.000000
2	0.000000	0.050801	1.990320	-0.000000	0.000000
3	-0.213940	0.000000	-0.000000	0.000000	-0.000000
4	0.884380	0.000000	0.000000	0.000000	0.000000
5	0.087374	2.814085	-0.014621	2.721145	-0.119913
6	-8.551774	0.014621	2.814085	0.119913	2.721145
7	-0.001471	-3.597096	0.106236	0.000000	0.000000
8	2.294946	0.075037	-6.307516	-0.000000	0.000000
9	-0.286748	0.000000	0.000000	-18.000462	2.451269
10	2.987006	-0.000000	0.000000	-1.984891	-17.794441
11	-0.172459	1.502516	-0.049465	8.132430	-0.826796
12	2.307110	0.049465	1.502516	0.826796	8.132430
13	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.000000	-0.000000	0.000000	-0.000000	0.000000

	11	12	13	14
1	0.000000	0.000000	1.904978	-0.234960
2	-0.000000	0.000000	0.234960	1.904978
3	0.000000	-0.000000	0.000000	-0.000000
4	0.000000	0.000000	0.000000	0.000000
5	2.086473	-0.096138	0.000000	0.000000

6	0.096138	2.086473	-0.000000	0.000000
7	1.106824	0.000235	0.000000	0.000000
8	-0.000235	1.106824	-0.000000	0.000000
9	8.067395	-1.008934	0.000000	0.000000
10	1.008934	8.067395	-0.000000	0.000000
11	-18.628239	1.423928	6.321671	-0.537567
12	-1.758068	-17.619373	0.537567	6.321671
13	0.000000	0.000000	-1.998897	-0.066423
14	0.540353	6.321434	-1.610388	-14.768954

Trianglar Angmentex Matrix

	1	2	3	4	5
1	1.000000	-0.033965	-0.151271	0.015502	-0.000000
2	0.000000	1.000000	-0.000206	-0.160037	0.000000
3	0.000000	0.000000	1.000000	-0.319671	-0.341052
4	0.000000	0.000000	0.000000	1.000000	-0.030651
5	0.000000	0.000000	0.000000	0.000000	1.000000
6	0.000000	0.000000	0.000000	0.000000	0.000000
7	0.000000	0.000000	0.000000	0.000000	0.000000
8	0.000000	0.000000	0.000000	0.000000	0.000000
9	0.000000	0.000000	0.000000	0.000000	0.000000
10	0.000000	0.000000	0.000000	0.000000	0.000000
11	0.000000	0.000000	0.000000	0.000000	0.000000
12	0.000000	0.000000	0.000000	0.000000	0.000000
13	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.000000	0.000000	0.000000	0.000000	0.000000

	6	7	8	9	10
1	-0.000000	-0.243408	0.006213	-0.000000	-0.000000
2	0.000000	0.019283	-0.255530	0.000000	0.000000
3	0.082504	-0.109399	0.019909	-0.000000	0.000000
4	-0.303995	0.003172	-0.100435	0.000000	0.000000
5	-0.007354	-0.355249	0.002055	-0.331801	0.014622
6	1.000000	0.021112	-0.351424	0.008181	-0.329779
7	0.000000	1.000000	-0.045723	-0.335389	0.012817
8	0.000000	0.000000	1.000000	0.003078	-0.154665
9	0.000000	0.000000	0.000000	1.000000	-0.138072
10	0.000000	0.000000	0.000000	0.000000	1.000000
11	0.000000	0.000000	0.000000	0.000000	0.000000
12	0.000000	0.000000	0.000000	0.000000	0.000000
13	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.000000	0.000000	0.000000	0.000000	0.000000

	11	12	13	14	15
1	-0.000000	-0.000000	-0.232971	0.028735	0.000000
2	0.000000	0.000000	-0.005406	-0.246987	-0.000000

3	-0.000000	0.000000	-0.103106	0.029338	-0.000000
4	0.000000	0.000000	-0.006354	-0.096665	0.000000
5	-0.254413	0.011723	-0.011599	0.001395	0.000000
6	0.005766	-0.252898	-0.001599	-0.010782	0.000000
7	-0.727972	0.010244	-0.175921	0.016854	0.000000
8	0.002020	-0.337638	-0.003514	-0.085522	0.000000
9	-0.576932	0.068403	-0.013316	0.001760	0.000000
10	0.000472	-0.550141	0.000399	-0.007359	-0.000000
11	1.000000	-0.082481	-0.639751	0.055373	-0.038070
12	0.000000	1.000000	0.016652	-0.592968	0.004005
13	0.000000	0.000000	1.000000	0.033230	-0.000000
14	0.000000	0.000000	0.000000	1.000000	0.000427

Voltage correction E(i), F(i) :

1	1	2	2
-0.010563	0.001372	-0.013947	0.000576
3	3	4	4
-0.029233	0.003688	-0.034768	0.001983
5	5	6	6
-0.021746	0.002364	-0.037752	0.004258
7	7		
-0.000014	0.000427		

CHANGE OF P0,V**2,P0(I),Q0(I),V0(I)

I	P0(I)	Q0(I)
1	3.862754e-05	1.247227e-05
2	-5.476829e-05	-3.077090e-05
3	2.476797e-04	-9.817258e-05
4	-5.481243e-04	-2.169251e-03
I	P0(I)	V0(I)
5	-9.797921e-05	5.348985e-02
6	-1.845302e-03	7.373051e-02
7	1.117848e-04	-2.076849e-07
8	3.572495e-01	0.000000e+00

max error is: 0.00216925

J MATRIX(Jacobian)

	1	2	3	4	5
1	-8.091181	0.252093	1.223465	-0.122865	0.000000
2	-0.808588	-7.692023	0.122865	1.223465	-0.000000
3	1.133651	-0.209610	-2.719237	0.868064	0.870554
4	0.209610	1.133651	-0.375376	-3.030809	0.210435
5	0.000000	0.000000	0.884391	-0.123254	-8.243662
6	-0.000000	0.000000	0.123254	0.884391	-0.585247
7	1.477840	-0.004636	0.000000	0.000000	2.187233
8	0.004636	1.477840	-0.000000	0.000000	-0.011997

9	0.000000	0.000000	0.000000	0.000000	2.922525
10	-0.000000	0.000000	-0.000000	0.000000	0.272699
11	0.000000	0.000000	0.000000	0.000000	2.221346
12	-0.000000	0.000000	-0.000000	0.000000	0.153226
13	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.282525	2.010642	-0.000000	0.000000	-0.000000

	6	7	8	9	10
1	0.000000	1.968357	-0.046230	0.000000	0.000000
2	0.000000	0.046230	1.968357	-0.000000	0.000000
3	-0.210435	0.000000	-0.000000	0.000000	-0.000000
4	0.870554	0.000000	0.000000	0.000000	0.000000
5	0.014977	2.723944	0.002986	2.634624	-0.099496
6	-8.282572	-0.002986	2.723944	0.099496	2.634624
7	0.011997	-3.301650	0.088755	0.000000	0.000000
8	2.187233	0.116852	-6.138235	-0.000000	0.000000
9	-0.272699	0.000000	0.000000	-17.618267	2.360992
10	2.922525	-0.000000	0.000000	-1.884966	-17.406528
11	-0.153226	1.446314	-0.039302	7.831326	-0.750775
12	2.221346	0.039302	1.446314	0.750775	7.831326
13	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.000000	-0.000000	0.000000	-0.000000	0.000000

	11	12	13	14
1	0.000000	0.000000	1.884332	-0.228520
2	-0.000000	0.000000	0.228520	1.884332
3	0.000000	-0.000000	0.000000	-0.000000
4	0.000000	0.000000	0.000000	0.000000
5	2.020158	-0.080349	0.000000	0.000000
6	0.080349	2.020158	-0.000000	0.000000
7	1.054870	0.006687	0.000000	0.000000
8	-0.006687	1.054870	-0.000000	0.000000
9	7.893853	-0.965868	0.000000	0.000000
10	0.965868	7.893853	-0.000000	0.000000
11	-17.564314	1.268690	6.087030	-0.482426
12	-1.593385	-17.338449	0.482426	6.087030
13	0.000000	0.000000	-1.998868	-0.067277
14	0.537652	6.321664	-1.612773	-14.507942

Trianglar Angmentex Matrix

	1	2	3	4	5
1	1.000000	-0.031156	-0.151210	0.015185	-0.000000
2	0.000000	1.000000	-0.000078	-0.160128	0.000000
3	0.000000	0.000000	1.000000	-0.322997	-0.341684
4	0.000000	0.000000	0.000000	1.000000	-0.031405
5	0.000000	0.000000	0.000000	0.000000	1.000000

6	0.000000	0.000000	0.000000	0.000000	0.000000
7	0.000000	0.000000	0.000000	0.000000	0.000000
8	0.000000	0.000000	0.000000	0.000000	0.000000
9	0.000000	0.000000	0.000000	0.000000	0.000000
10	0.000000	0.000000	0.000000	0.000000	0.000000
11	0.000000	0.000000	0.000000	0.000000	0.000000
12	0.000000	0.000000	0.000000	0.000000	0.000000
13	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.000000	0.000000	0.000000	0.000000	0.000000

	6	7	8	9	10
1	-0.000000	-0.243272	0.005714	-0.000000	-0.000000
2	0.000000	0.019499	-0.255659	0.000000	0.000000
3	0.082594	-0.109577	0.020031	-0.000000	0.000000
4	-0.303448	0.003001	-0.100318	0.000000	0.000000
5	0.001107	-0.355372	-0.000197	-0.331968	0.012537
6	1.000000	0.021837	-0.351246	0.008883	-0.329650
7	0.000000	1.000000	-0.041779	3.827456	-0.370657
8	0.000000	0.000000	1.000000	0.033539	-0.153537
9	0.000000	0.000000	0.000000	1.000000	-0.126562
10	0.000000	0.000000	0.000000	0.000000	1.000000
11	0.000000	0.000000	0.000000	0.000000	0.000000
12	0.000000	0.000000	0.000000	0.000000	0.000000
13	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.000000	0.000000	0.000000	0.000000	0.000000

	11	12	13	14	15
1	-0.000000	-0.000000	-0.232887	0.028243	0.000002
2	0.000000	0.000000	-0.005210	-0.247132	0.000005
3	-0.000000	0.000000	-0.103266	0.029472	-0.000012
4	0.000000	0.000000	-0.006507	-0.096537	-0.000015
5	-0.254544	0.010124	-0.011641	0.001309	-0.000014
6	0.006305	-0.252800	-0.001592	-0.010767	0.000030
7	-7.591339	0.538982	2.729932	-0.217500	0.006607
8	-0.053439	-0.324932	0.017996	-0.085092	-0.000046
9	-0.802568	0.079709	0.136478	-0.010460	0.000336
10	0.016173	-0.550840	-0.010251	-0.006355	-0.000031
11	1.000000	-0.081096	-0.677437	0.054649	-0.001804
12	0.000000	1.000000	0.019034	-0.571135	-0.000018
13	0.000000	0.000000	1.000000	0.033658	-0.000000
14	0.000000	0.000000	0.000000	1.000000	-0.000115

Voltage correction E(i), F(i) :

1	1	2	2
-0.000829	-0.000020	-0.000975	-0.000084
3	3	4	4
-0.001846	0.000022	-0.002831	-0.000149

```
                5                5                6                6
      -0.001112       -0.000048       -0.001802       -0.000083
                7                7
       0.000004       -0.000115
        CHANGE OF P0,V**2,P0(I),Q0(I),V0(I)
  I        P0(I)            Q0(I)
  1     3.250316e-07     5.960464e-08
  2    -2.849847e-07    -1.788139e-07
  3     1.590932e-06     4.451722e-07
  4    -3.077090e-06    -2.473593e-05
  I        P0(I)            V0(I)
  5    -5.265465e-07     5.565283e-02
  6    -2.746470e-06     7.719924e-02
  7    -1.355074e-06    -1.816079e-08
  8     3.544714e-01     0.000000e+00
max error is: 2.47359e-05

 J                MATRIX(Jacobian)
         1          2          3          4          5
 1    -8.084379   0.251130   1.222384  -0.122725   0.000000
 2    -0.808212  -7.684858   0.122725   1.222384  -0.000000
 3     1.132367  -0.209524  -2.715727   0.868061   0.869561
 4     0.209524   1.132367  -0.374744  -3.027782   0.210315
 5     0.000000   0.000000   0.882549  -0.122844  -8.226090
 6    -0.000000   0.000000   0.122844   0.882549  -0.584081
 7     1.471871  -0.004496   0.000000   0.000000   2.178398
 8     0.004496   1.471871  -0.000000   0.000000  -0.012127
 9     0.000000   0.000000   0.000000   0.000000   2.919174
10    -0.000000   0.000000  -0.000000   0.000000   0.272487
11     0.000000   0.000000   0.000000   0.000000   2.217181
12    -0.000000   0.000000  -0.000000   0.000000   0.152967
13     0.000000   0.000000   0.000000   0.000000   0.000000
14     0.282755   2.010609  -0.000000   0.000000  -0.000000
         6          7          8          9         10
 1     0.000000   1.966613  -0.046139   0.000000   0.000000
 2     0.000000   0.046139   1.966613  -0.000000   0.000000
 3    -0.210315   0.000000  -0.000000   0.000000  -0.000000
 4     0.869561   0.000000   0.000000   0.000000   0.000000
 5     0.012066   2.718207   0.003444   2.629093  -0.098838
 6    -8.265445  -0.003444   2.718207   0.098838   2.629093
 7     0.012127  -3.273839   0.089962   0.000000   0.000000
 8     2.178398   0.118715  -6.127917  -0.000000   0.000000
 9    -0.272487   0.000000   0.000000 -17.598358   2.359542
10     2.919174  -0.000000   0.000000  -1.882765 -17.386246
```

11	-0.152967	1.443603	-0.039247	7.816639	-0.749467
12	2.217181	0.039247	1.443603	0.749467	7.816639
13	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.000000	-0.000000	0.000000	-0.000000	0.000000

	11	12	13	14
1	0.000000	0.000000	1.882667	-0.228270
2	-0.000000	0.000000	0.228270	1.882667
3	0.000000	-0.000000	0.000000	-0.000000
4	0.000000	0.000000	0.000000	0.000000
5	2.015917	-0.079836	0.000000	0.000000
6	0.079836	2.015917	-0.000000	0.000000
7	1.050609	0.006746	0.000000	0.000000
8	-0.006746	1.050609	-0.000000	0.000000
9	7.884795	-0.965035	0.000000	0.000000
10	0.965035	7.884795	-0.000000	0.000000
11	-17.516554	1.268445	6.075615	-0.481598
12	-1.588706	-17.320757	0.481598	6.075615
13	0.000000	0.000000	-1.998876	-0.067048
14	0.538377	6.321602	-1.614992	-14.494568

Trianglar Angmentex Matrix

	1	2	3	4	5
1	1.000000	-0.031064	-0.151203	0.015180	-0.000000
2	0.000000	1.000000	-0.000068	-0.160137	0.000000
3	0.000000	0.000000	1.000000	-0.323421	-0.341739
4	0.000000	0.000000	0.000000	1.000000	-0.031459
5	0.000000	0.000000	0.000000	0.000000	1.000000
6	0.000000	0.000000	0.000000	0.000000	0.000000
7	0.000000	0.000000	0.000000	0.000000	0.000000
8	0.000000	0.000000	0.000000	0.000000	0.000000
9	0.000000	0.000000	0.000000	0.000000	0.000000
10	0.000000	0.000000	0.000000	0.000000	0.000000
11	0.000000	0.000000	0.000000	0.000000	0.000000
12	0.000000	0.000000	0.000000	0.000000	0.000000
13	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.000000	0.000000	0.000000	0.000000	0.000000

	6	7	8	9	10
1	-0.000000	-0.243261	0.005707	-0.000000	-0.000000
2	0.000000	0.019516	-0.255673	0.000000	0.000000
3	0.082654	-0.109594	0.020058	-0.000000	0.000000
4	-0.303398	0.002989	-0.100308	0.000000	0.000000
5	0.001458	-0.355387	-0.000259	-0.331982	0.012481
6	1.000000	0.021899	-0.351233	0.008943	-0.329642
7	0.000000	1.000000	-0.041851	3.827371	-0.370754

8	0.000000	0.000000	1.000000	0.035091	-0.153242
9	0.000000	0.000000	0.000000	1.000000	-0.126617
10	0.000000	0.000000	0.000000	0.000000	1.000000
11	0.000000	0.000000	0.000000	0.000000	0.000000
12	0.000000	0.000000	0.000000	0.000000	0.000000
13	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.000000	0.000000	0.000000	0.000000	0.000000

	11	12	13	14	15
1	-0.000000	-0.000000	-0.232877	0.028236	0.000000
2	0.000000	0.000000	-0.005195	-0.247146	0.000000
3	-0.000000	0.000000	-0.103279	0.029500	-0.000000
4	0.000000	0.000000	-0.006517	-0.096526	-0.000000
5	-0.254555	0.010081	-0.011643	0.001306	0.000000
6	0.006351	-0.252793	-0.001591	-0.010765	0.000000
7	-7.584479	0.539873	2.729859	-0.217530	0.000012
8	-0.056377	-0.323747	0.019104	-0.084940	-0.000000
9	-0.802233	0.079775	0.136480	-0.010462	0.000001
10	0.016073	-0.550768	-0.010214	-0.006343	-0.000000
11	1.000000	-0.081671	-0.680199	0.054859	-0.000006
12	0.000000	1.000000	0.019063	-0.570135	0.000000
13	0.000000	0.000000	1.000000	0.033543	-0.000000
14	0.000000	0.000000	0.000000	1.000000	-0.000000

Voltage correction E(i), F(i) :

1	1	2	2
-0.000005	0.000000	-0.000005	-0.000000
3	3	4	4
-0.000009	0.000000	-0.000018	-0.000001
5	5	6	6
-0.000004	-0.000000	-0.000006	-0.000000
7	7		
0.000000	-0.000000		

PV节点7无功Q超过上界，转化为PQ节点

CHANGE OF PO,V**2,PO(I),QO(I),VO(I)

I	PO(I)	QO(I)
1	-1.247972e-07	7.450581e-08
2	5.587935e-09	-4.470348e-08
3	1.967419e-08	7.078052e-08
4	2.235174e-08	-2.384186e-07
I	PO(I)	VO(I)
5	-1.769513e-08	5.566105e-02
6	1.443550e-07	7.721105e-02
7	-3.818423e-08	1.234002e-08
8	3.544610e-01	0.000000e+00

max error is: 2.38419e-07

J MATRIX(Jacobian)

	1	2	3	4	5
1	-8.084337	0.251122	1.222377	-0.122724	0.000000
2	-0.808208	-7.684814	0.122724	1.222377	-0.000000
3	1.132360	-0.209524	-2.715708	0.868060	0.869556
4	0.209524	1.132360	-0.374740	-3.027766	0.210314
5	0.000000	0.000000	0.882540	-0.122842	-8.226002
6	-0.000000	0.000000	0.122842	0.882540	-0.584073
7	1.471833	-0.004495	0.000000	0.000000	2.178341
8	0.004495	1.471833	-0.000000	0.000000	-0.012129
9	0.000000	0.000000	0.000000	0.000000	2.919161
10	-0.000000	0.000000	-0.000000	0.000000	0.272486
11	0.000000	0.000000	0.000000	0.000000	2.217167
12	-0.000000	0.000000	-0.000000	0.000000	0.152966
13	2.010609	-0.282756	0.000000	0.000000	0.000000
14	0.282756	2.010609	-0.000000	0.000000	-0.000000

	6	7	8	9	10
1	0.000000	1.966603	-0.046138	0.000000	0.000000
2	0.000000	0.046138	1.966603	-0.000000	0.000000
3	-0.210314	0.000000	-0.000000	0.000000	-0.000000
4	0.869556	0.000000	0.000000	0.000000	0.000000
5	0.012049	2.718178	0.003447	2.629065	-0.098834
6	-8.265356	-0.003447	2.718178	0.098834	2.629065
7	0.012129	-3.273646	0.089969	0.000000	0.000000
8	2.178341	0.118730	-6.127867	-0.000000	0.000000
9	-0.272486	0.000000	0.000000	-17.598282	2.359534
10	2.919161	-0.000000	0.000000	-1.882754	-17.386169
11	-0.152966	1.443594	-0.039247	7.816589	-0.749461
12	2.217167	0.039247	1.443594	0.749461	7.816589
13	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.000000	-0.000000	0.000000	-0.000000	0.000000

	11	12	13	14
1	0.000000	0.000000	1.882657	-0.228268
2	-0.000000	0.000000	0.228268	1.882657
3	0.000000	-0.000000	0.000000	-0.000000
4	0.000000	0.000000	0.000000	0.000000
5	2.015896	-0.079832	0.000000	0.000000
6	0.079832	2.015896	-0.000000	0.000000
7	1.050581	0.006746	0.000000	0.000000
8	-0.006746	1.050581	-0.000000	0.000000
9	7.884760	-0.965030	0.000000	0.000000
10	0.965030	7.884760	-0.000000	0.000000

11	-17.516415	1.268436	6.075577	-0.481594
12	-1.588691	-17.320675	0.481594	6.075577
13	6.321602	-0.538380	-15.036335	1.196600
14	0.538380	6.321602	-1.614999	-14.494516

Trianglar Angmentex Matrix

	1	2	3	4	5
1	1.000000	-0.031063	-0.151203	0.015180	-0.000000
2	0.000000	1.000000	-0.000067	-0.160137	0.000000
3	0.000000	0.000000	1.000000	-0.323423	-0.341739
4	0.000000	0.000000	0.000000	1.000000	-0.031459
5	0.000000	0.000000	0.000000	0.000000	1.000000
6	0.000000	0.000000	0.000000	0.000000	0.000000
7	0.000000	0.000000	0.000000	0.000000	0.000000
8	0.000000	0.000000	0.000000	0.000000	0.000000
9	0.000000	0.000000	0.000000	0.000000	0.000000
10	0.000000	0.000000	0.000000	0.000000	0.000000
11	0.000000	0.000000	0.000000	0.000000	0.000000
12	0.000000	0.000000	0.000000	0.000000	0.000000
13	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.000000	0.000000	0.000000	0.000000	0.000000

	6	7	8	9	10
1	-0.000000	-0.243261	0.005707	-0.000000	-0.000000
2	0.000000	0.019516	-0.255673	0.000000	0.000000
3	0.082654	-0.109594	0.020058	-0.000000	0.000000
4	-0.303397	0.002989	-0.100308	0.000000	0.000000
5	0.001461	-0.355387	-0.000259	-0.331982	0.012480
6	1.000000	0.021899	-0.351233	0.008943	-0.329642
7	0.000000	1.000000	-0.041851	3.827371	-0.370754
8	0.000000	0.000000	1.000000	0.035102	-0.153240
9	0.000000	0.000000	0.000000	1.000000	-0.126617
10	0.000000	0.000000	0.000000	0.000000	1.000000
11	0.000000	0.000000	0.000000	0.000000	0.000000
12	0.000000	0.000000	0.000000	0.000000	0.000000
13	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.000000	0.000000	0.000000	0.000000	0.000000

	11	12	13	14	15
1	-0.000000	-0.000000	-0.232877	0.028236	0.000000
2	0.000000	0.000000	-0.005195	-0.247146	-0.000000
3	-0.000000	0.000000	-0.103279	0.029500	-0.000000
4	0.000000	0.000000	-0.006517	-0.096526	-0.000000
5	-0.254555	0.010081	-0.011643	0.001306	0.000000
6	0.006351	-0.252793	-0.001591	-0.010765	0.000000
7	-7.584466	0.539873	2.729859	-0.217529	-0.000000

8	-0.056400	-0.323739	0.019112	-0.084939	-0.000000
9	-0.802232	0.079775	0.136480	-0.010462	0.000000
10	0.016072	-0.550767	-0.010214	-0.006343	-0.000000
11	1.000000	-0.082519	-1.769191	0.131664	0.019922
12	0.000000	1.000000	0.098126	-0.575673	-0.001446
13	0.000000	0.000000	1.000000	-0.070086	-0.018295
14	0.000000	0.000000	0.000000	1.000000	0.002227

Voltage correction E(i), F(i) :

1	1	2	2
-0.009223	0.001006	-0.007592	0.000305
3	3	4	4
-0.011407	0.001462	-0.015666	0.000764
5	5	6	6
-0.007404	0.000917	-0.012328	0.001616
7	7		
-0.018139	0.002227		

CHANGE OF P0,V**2,P0(I),Q0(I),V0(I)

I	P0(I)	Q0(I)
1	2.968684e-05	1.108646e-05
2	-1.674984e-05	-9.477139e-06
3	4.039495e-05	-1.710281e-05
4	-1.214147e-04	-4.887581e-04
I	P0(I)	V0(I)
5	-1.147122e-05	6.997085e-02
6	2.908939e-05	1.006015e-01
7	-4.117985e-04	3.577361e-02
8	3.524778e-01	0.000000e+00

max error is: 0.000488758

J MATRIX(Jacobian)

	1	2	3	4	5
1	-8.009390	0.230310	1.210588	-0.119572	0.000000
2	-0.793495	-7.606838	0.119572	1.210588	-0.000000
3	1.122551	-0.207609	-2.689507	0.864577	0.862028
4	0.207609	1.122551	-0.366949	-3.004232	0.208415
5	0.000000	0.000000	0.871439	-0.118984	-8.119116
6	-0.000000	0.000000	0.118984	0.871439	-0.562674
7	1.439057	-0.000384	0.000000	0.000000	2.129781
8	0.000384	1.439057	-0.000000	0.000000	-0.017795
9	0.000000	0.000000	0.000000	0.000000	2.897242
10	-0.000000	0.000000	-0.000000	0.000000	0.267366
11	0.000000	0.000000	0.000000	0.000000	2.189216
12	-0.000000	0.000000	-0.000000	0.000000	0.146168
13	1.975111	-0.271953	0.000000	0.000000	0.000000

14	0.271953	1.975111	-0.000000	0.000000	-0.000000

	6	7	8	9	10
1	0.000000	1.947394	-0.042551	0.000000	0.000000
2	0.000000	0.042551	1.947394	-0.000000	0.000000
3	-0.208415	0.000000	-0.000000	0.000000	-0.000000
4	0.862028	0.000000	0.000000	0.000000	0.000000
5	-0.016648	2.683008	0.010388	2.595311	-0.090798
6	-8.160448	-0.010388	2.683008	0.090798	2.595311
7	0.017795	-3.137380	0.083694	0.000000	0.000000
8	2.129781	0.137433	-6.054616	-0.000000	0.000000
9	-0.267366	0.000000	0.000000	-17.468508	2.326843
10	2.897242	-0.000000	0.000000	-1.846657	-17.254278
11	-0.146168	1.425263	-0.035590	7.718507	-0.722813
12	2.189216	0.035590	1.425263	0.722813	7.718507
13	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.000000	-0.000000	0.000000	-0.000000	0.000000

	11	12	13	14
1	0.000000	0.000000	1.864562	-0.223028
2	-0.000000	0.000000	0.223028	1.864562
3	0.000000	-0.000000	0.000000	-0.000000
4	0.000000	0.000000	0.000000	0.000000
5	1.990024	-0.073619	0.000000	0.000000
6	0.073619	1.990024	-0.000000	0.000000
7	1.027159	0.009459	0.000000	0.000000
8	-0.009459	1.027159	-0.000000	0.000000
9	7.825796	-0.949459	0.000000	0.000000
10	0.949459	7.825796	-0.000000	0.000000
11	-17.298220	1.209878	5.999120	-0.462169
12	-1.534647	-17.100683	0.462169	5.999120
13	6.208999	-0.510743	-14.600376	1.130788
14	0.510743	6.208999	-1.546357	-14.405300

Trianglar Angmentex Matrix

	1	2	3	4	5
1	1.000000	-0.028755	-0.151146	0.014929	-0.000000
2	0.000000	1.000000	0.000047	-0.160221	0.000000
3	0.000000	0.000000	1.000000	-0.325310	-0.342098
4	0.000000	0.000000	0.000000	1.000000	-0.031883
5	0.000000	0.000000	0.000000	0.000000	1.000000
6	0.000000	0.000000	0.000000	0.000000	0.000000
7	0.000000	0.000000	0.000000	0.000000	0.000000
8	0.000000	0.000000	0.000000	0.000000	0.000000
9	0.000000	0.000000	0.000000	0.000000	0.000000
10	0.000000	0.000000	0.000000	0.000000	0.000000

11	0.000000	0.000000	0.000000	0.000000	0.000000
12	0.000000	0.000000	0.000000	0.000000	0.000000
13	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.000000	0.000000	0.000000	0.000000	0.000000

	6	7	8	9	10
1	-0.000000	-0.243139	0.005313	-0.000000	-0.000000
2	0.000000	0.019710	-0.255793	0.000000	0.000000
3	0.082710	-0.109687	0.020165	-0.000000	0.000000
4	-0.303092	0.002922	-0.100260	0.000000	0.000000
5	0.004973	-0.355450	-0.001191	-0.332061	0.011617
6	1.000000	0.022202	-0.351151	0.009236	-0.329580
7	0.000000	1.000000	-0.039935	3.827489	-0.362502
8	0.000000	0.000000	1.000000	0.048659	-0.152469
9	0.000000	0.000000	0.000000	1.000000	-0.125454
10	0.000000	0.000000	0.000000	0.000000	1.000000
11	0.000000	0.000000	0.000000	0.000000	0.000000
12	0.000000	0.000000	0.000000	0.000000	0.000000
13	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.000000	0.000000	0.000000	0.000000	0.000000

	11	12	13	14	15
1	-0.000000	-0.000000	-0.232797	0.027846	0.000001
2	0.000000	0.000000	-0.005021	-0.247280	0.000004
3	-0.000000	0.000000	-0.103359	0.029611	-0.000003
4	0.000000	0.000000	-0.006577	-0.096473	-0.000004
5	-0.254617	0.009419	-0.011663	0.001271	-0.000003
6	0.006576	-0.252746	-0.001588	-0.010759	0.000005
7	-7.585175	0.520893	2.729795	-0.211446	-0.000001
8	-0.081350	-0.317891	0.028738	-0.084601	-0.000022
9	-0.802265	0.078413	0.136484	-0.010152	0.000000
10	0.015345	-0.550381	-0.009824	-0.006328	-0.000001
11	1.000000	-0.079663	-1.750071	0.126415	0.000358
12	0.000000	1.000000	0.093788	-0.574296	-0.000027
13	0.000000	0.000000	1.000000	-0.068404	-0.000406
14	0.000000	0.000000	0.000000	1.000000	0.000004

Voltage correction E(i), F(i) :

1	1	2	2
-0.000302	0.000009	-0.000271	-0.000013
3	3	4	4
-0.000419	0.000022	-0.000695	-0.000022
5	5	6	6
-0.000226	0.000008	-0.000351	0.000013
7	7		
-0.000406	0.000004		

CHANGE OF P0,V**2,P0(I),Q0(I),V0(I)

I	P0(I)	Q0(I)
1	5.587935e-09	-3.874302e-07
2	-1.629815e-08	-1.639128e-07
3	9.022187e-08	2.812594e-07
4	-2.384186e-07	-1.728535e-06

I	P0(I)	V0(I)
5	7.799827e-08	7.040725e-02
6	-5.844049e-08	1.012660e-01
7	-1.760200e-07	3.656965e-02
8	3.518724e-01	0.000000e+00

max error is: 1.72853e-06

J MATRIX(Jacobian)

	1	2	3	4	5
1	-8.006927	0.229802	1.210196	-0.119500	0.000000
2	-0.793246	-7.604238	0.119500	1.210196	-0.000000
3	1.122197	-0.207572	-2.688540	0.864547	0.861755
4	0.207572	1.122197	-0.366734	-3.003397	0.208371
5	0.000000	0.000000	0.871025	-0.118874	-8.115141
6	-0.000000	0.000000	0.118874	0.871025	-0.562235
7	1.437595	-0.000319	0.000000	0.000000	2.127617
8	0.000319	1.437595	-0.000000	0.000000	-0.017872
9	0.000000	0.000000	0.000000	0.000000	2.896565
10	-0.000000	0.000000	-0.000000	0.000000	0.267271
11	0.000000	0.000000	0.000000	0.000000	2.188411
12	-0.000000	0.000000	-0.000000	0.000000	0.146049
13	1.974301	-0.271803	0.000000	0.000000	0.000000
14	0.271803	1.974301	-0.000000	0.000000	-0.000000

	6	7	8	9	10
1	0.000000	1.946761	-0.042484	0.000000	0.000000
2	0.000000	0.042484	1.946761	-0.000000	0.000000
3	-0.208371	0.000000	-0.000000	0.000000	-0.000000
4	0.861755	0.000000	0.000000	0.000000	0.000000
5	-0.017456	2.681709	0.010545	2.594060	-0.090598
6	-8.156576	-0.010545	2.681709	0.090598	2.594060
7	0.017872	-3.130533	0.083924	0.000000	0.000000
8	2.127617	0.138021	-6.052122	-0.000000	0.000000
9	-0.267271	0.000000	0.000000	-17.464497	2.326226
10	2.896565	-0.000000	0.000000	-1.845906	-17.250191
11	-0.146049	1.424737	-0.035535	7.715677	-0.722318
12	2.188411	0.035535	1.424737	0.722318	7.715677
13	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.000000	-0.000000	0.000000	-0.000000	0.000000

	11	12	13	14

1	0.000000	0.000000	1.863960	-0.222905
2	-0.000000	0.000000	0.222905	1.863960
3	0.000000	-0.000000	0.000000	-0.000000
4	0.000000	0.000000	0.000000	0.000000
5	1.989066	-0.073463	0.000000	0.000000
6	0.073463	1.989066	-0.000000	0.000000
7	1.026115	0.009495	0.000000	0.000000
8	-0.009495	1.026115	-0.000000	0.000000
9	7.823970	-0.949149	0.000000	0.000000
10	0.949149	7.823970	-0.000000	0.000000
11	-17.291945	1.208769	5.996917	-0.461821
12	-1.533726	-17.094328	0.461821	5.996917
13	6.206445	-0.510415	-14.591267	1.130409
14	0.510415	6.206445	-1.545082	-14.402485

Trianglar Angmentex Matrix

	1	2	3	4	5
1	1.000000	-0.028700	-0.151144	0.014925	-0.000000
2	0.000000	1.000000	0.000052	-0.160225	0.000000
3	0.000000	0.000000	1.000000	-0.325418	-0.342113
4	0.000000	0.000000	0.000000	1.000000	-0.031899
5	0.000000	0.000000	0.000000	0.000000	1.000000
6	0.000000	0.000000	0.000000	0.000000	0.000000
7	0.000000	0.000000	0.000000	0.000000	0.000000
8	0.000000	0.000000	0.000000	0.000000	0.000000
9	0.000000	0.000000	0.000000	0.000000	0.000000
10	0.000000	0.000000	0.000000	0.000000	0.000000
11	0.000000	0.000000	0.000000	0.000000	0.000000
12	0.000000	0.000000	0.000000	0.000000	0.000000
13	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.000000	0.000000	0.000000	0.000000	0.000000

	6	7	8	9	10
1	-0.000000	-0.243135	0.005306	-0.000000	-0.000000
2	0.000000	0.019717	-0.255798	0.000000	0.000000
3	0.082722	-0.109691	0.020172	-0.000000	0.000000
4	-0.303078	0.002919	-0.100257	0.000000	0.000000
5	0.005073	-0.355454	-0.001213	-0.332065	0.011597
6	1.000000	0.022215	-0.351147	0.009249	-0.329577
7	0.000000	1.000000	-0.039918	3.827476	-0.362399
8	0.000000	0.000000	1.000000	0.049134	-0.152400
9	0.000000	0.000000	0.000000	1.000000	-0.125444
10	0.000000	0.000000	0.000000	0.000000	1.000000
11	0.000000	0.000000	0.000000	0.000000	0.000000
12	0.000000	0.000000	0.000000	0.000000	0.000000

13	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.000000	0.000000	0.000000	0.000000	0.000000

	11	12	13	14	15
1	-0.000000	-0.000000	-0.232793	0.027839	-0.000000
2	0.000000	0.000000	-0.005014	-0.247285	0.000000
3	-0.000000	0.000000	-0.103362	0.029618	-0.000000
4	0.000000	0.000000	-0.006579	-0.096471	0.000000
5	-0.254620	0.009404	-0.011663	0.001270	0.000000
6	0.006586	-0.252744	-0.001588	-0.010759	0.000000
7	-7.585167	0.520587	2.729781	-0.211364	0.000001
8	-0.082259	-0.317590	0.029077	-0.084566	-0.000000
9	-0.802267	0.078394	0.136484	-0.010148	0.000000
10	0.015320	-0.550360	-0.009811	-0.006325	0.000000
11	1.000000	-0.079636	-1.749722	0.126421	0.000000
12	0.000000	1.000000	0.093651	-0.574236	-0.000000
13	0.000000	0.000000	1.000000	-0.068477	-0.000001
14	0.000000	0.000000	0.000000	1.000000	0.000000

Voltage correction E(i), F(i) :

1	1	2	2
-0.000001	0.000000	-0.000001	-0.000000
3	3	4	4
-0.000001	0.000000	-0.000002	-0.000000
5	5	6	6
-0.000001	0.000000	-0.000001	0.000000
7	7		
-0.000001	0.000000		

CHANGE OF P0,V**2,P0(I),Q0(I),V0(I)

I	P0(I)	Q0(I)
1	-6.984919e-08	1.639128e-07
2	-1.955777e-08	5.960464e-08
3	-1.930166e-07	1.223758e-06
4	1.490116e-08	0.000000e+00
I	P0(I)	V0(I)
5	-1.558801e-07	7.040832e-02
6	-1.699664e-07	1.012675e-01
7	8.428469e-08	3.657072e-02
8	3.518717e-01	0.000000e+00

max error is: 1.22376e-06

J MATRIX(Jacobian)

	1	2	3	4	5
1	-8.006920	0.229800	1.210195	-0.119500	0.000000
2	-0.793246	-7.604232	0.119500	1.210195	-0.000000
3	1.122196	-0.207571	-2.688538	0.864547	0.861754

4	0.207571	1.122196	-0.366733	-3.003395	0.208371
5	0.000000	0.000000	0.871024	-0.118874	-8.115131
6	-0.000000	0.000000	0.118874	0.871024	-0.562234
7	1.437592	-0.000319	0.000000	0.000000	2.127611
8	0.000319	1.437592	-0.000000	0.000000	-0.017873
9	0.000000	0.000000	0.000000	0.000000	2.896564
10	-0.000000	0.000000	-0.000000	0.000000	0.267271
11	0.000000	0.000000	0.000000	0.000000	2.188409
12	-0.000000	0.000000	-0.000000	0.000000	0.146049
13	1.974300	-0.271803	0.000000	0.000000	0.000000
14	0.271803	1.974300	-0.000000	0.000000	-0.000000

	6	7	8	9	10
1	0.000000	1.946759	-0.042484	0.000000	0.000000
2	0.000000	0.042484	1.946759	-0.000000	0.000000
3	-0.208371	0.000000	-0.000000	0.000000	-0.000000
4	0.861754	0.000000	0.000000	0.000000	0.000000
5	-0.017458	2.681706	0.010546	2.594057	-0.090597
6	-8.156569	-0.010546	2.681706	0.090597	2.594057
7	0.017873	-3.130514	0.083924	0.000000	0.000000
8	2.127611	0.138023	-6.052116	-0.000000	0.000000
9	-0.267271	0.000000	0.000000	-17.464487	2.326224
10	2.896564	-0.000000	0.000000	-1.845905	-17.250181
11	-0.146049	1.424736	-0.035535	7.715671	-0.722317
12	2.188409	0.035535	1.424736	0.722317	7.715671
13	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.000000	-0.000000	0.000000	-0.000000	0.000000

	11	12	13	14
1	0.000000	0.000000	1.863959	-0.222905
2	-0.000000	0.000000	0.222905	1.863959
3	0.000000	-0.000000	0.000000	-0.000000
4	0.000000	0.000000	0.000000	0.000000
5	1.989063	-0.073462	0.000000	0.000000
6	0.073462	1.989063	-0.000000	0.000000
7	1.026113	0.009496	0.000000	0.000000
8	-0.009496	1.026113	-0.000000	0.000000
9	7.823966	-0.949148	0.000000	0.000000
10	0.949148	7.823966	-0.000000	0.000000
11	-17.291925	1.208766	5.996912	-0.461820
12	-1.533723	-17.094316	0.461820	5.996912
13	6.206441	-0.510415	-14.591256	1.130408
14	0.510415	6.206441	-1.545080	-14.402478

Trianglar Angmentex Matrix

	1	2	3	4	5

1	1.000000	-0.028700	-0.151144	0.014925	-0.000000
2	0.000000	1.000000	0.000052	-0.160225	0.000000
3	0.000000	0.000000	1.000000	-0.325418	-0.342113
4	0.000000	0.000000	0.000000	1.000000	-0.031899
5	0.000000	0.000000	0.000000	0.000000	1.000000
6	0.000000	0.000000	0.000000	0.000000	0.000000
7	0.000000	0.000000	0.000000	0.000000	0.000000
8	0.000000	0.000000	0.000000	0.000000	0.000000
9	0.000000	0.000000	0.000000	0.000000	0.000000
10	0.000000	0.000000	0.000000	0.000000	0.000000
11	0.000000	0.000000	0.000000	0.000000	0.000000
12	0.000000	0.000000	0.000000	0.000000	0.000000
13	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.000000	0.000000	0.000000	0.000000	0.000000

	6	7	8	9	10
1	-0.000000	-0.243135	0.005306	-0.000000	-0.000000
2	0.000000	0.019717	-0.255798	0.000000	0.000000
3	0.082722	-0.109691	0.020172	-0.000000	0.000000
4	-0.303078	0.002919	-0.100257	0.000000	0.000000
5	0.005073	-0.355454	-0.001213	-0.332065	0.011597
6	1.000000	0.022215	-0.351147	0.009249	-0.329577
7	0.000000	1.000000	-0.039918	3.827477	-0.362399
8	0.000000	0.000000	1.000000	0.049135	-0.152400
9	0.000000	0.000000	0.000000	1.000000	-0.125444
10	0.000000	0.000000	0.000000	0.000000	1.000000
11	0.000000	0.000000	0.000000	0.000000	0.000000
12	0.000000	0.000000	0.000000	0.000000	0.000000
13	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.000000	0.000000	0.000000	0.000000	0.000000

	11	12	13	14	15
1	-0.000000	-0.000000	-0.232793	0.027839	0.000000
2	0.000000	0.000000	-0.005014	-0.247285	-0.000000
3	-0.000000	0.000000	-0.103362	0.029618	0.000000
4	0.000000	0.000000	-0.006579	-0.096471	-0.000000
5	-0.254620	0.009404	-0.011663	0.001270	0.000000
6	0.006586	-0.252744	-0.001588	-0.010758	-0.000000
7	-7.585165	0.520586	2.729782	-0.211364	-0.000001
8	-0.082261	-0.317589	0.029078	-0.084566	-0.000000
9	-0.802266	0.078394	0.136484	-0.010148	-0.000000
10	0.015320	-0.550360	-0.009811	-0.006325	-0.000000
11	1.000000	-0.079636	-1.749722	0.126421	-0.000000
12	0.000000	1.000000	0.093651	-0.574236	-0.000000
13	0.000000	0.000000	1.000000	-0.068477	0.000000
14	0.000000	0.000000	0.000000	1.000000	-0.000000

Voltage correction E(i), F(i) :

1	1	2	2
0.000000	-0.000000	0.000000	-0.000000
3	3	4	4
0.000001	-0.000000	0.000001	-0.000000
5	5	6	6
0.000000	-0.000000	0.000001	-0.000000
7	7		
0.000000	-0.000000		

CHANGE OF P0,V**2,P0(I),Q0(I),V0(I)

I	P0(I)	Q0(I)
1	-7.078052e-08	-8.940697e-08
2	-1.303852e-08	1.341105e-07
3	1.332955e-07	-1.771376e-06
4	-4.470348e-08	5.960464e-08
I	P0(I)	V0(I)
5	-1.168810e-07	7.040773e-02
6	1.078006e-07	1.012664e-01
7	-1.511071e-07	3.657001e-02
8	3.518713e-01	0.000000e+00

max error is: 1.77138e-06

J MATRIX(Jacobian)

	1	2	3	4	5
1	-8.006924	0.229801	1.210196	-0.119500	0.000000
2	-0.793246	-7.604235	0.119500	1.210196	-0.000000
3	1.122196	-0.207572	-2.688539	0.864547	0.861754
4	0.207572	1.122196	-0.366734	-3.003397	0.208371
5	0.000000	0.000000	0.871024	-0.118874	-8.115141
6	-0.000000	0.000000	0.118874	0.871024	-0.562235
7	1.437593	-0.000319	0.000000	0.000000	2.127613
8	0.000319	1.437593	-0.000000	0.000000	-0.017872
9	0.000000	0.000000	0.000000	0.000000	2.896565
10	-0.000000	0.000000	-0.000000	0.000000	0.267271
11	0.000000	0.000000	0.000000	0.000000	2.188411
12	-0.000000	0.000000	-0.000000	0.000000	0.146049
13	1.974301	-0.271803	0.000000	0.000000	0.000000
14	0.271803	1.974301	-0.000000	0.000000	-0.000000

	6	7	8	9	10
1	0.000000	1.946760	-0.042484	0.000000	0.000000
2	0.000000	0.042484	1.946760	-0.000000	0.000000
3	-0.208371	0.000000	-0.000000	0.000000	-0.000000
4	0.861754	0.000000	0.000000	0.000000	0.000000
5	-0.017456	2.681708	0.010545	2.594059	-0.090598

6	-8.156570	-0.010545	2.681708	0.090598	2.594059
7	0.017872	-3.130520	0.083924	0.000000	0.000000
8	2.127613	0.138022	-6.052120	-0.000000	0.000000
9	-0.267271	0.000000	0.000000	-17.464491	2.326226
10	2.896565	-0.000000	0.000000	-1.845906	-17.250189
11	-0.146049	1.424737	-0.035535	7.715675	-0.722318
12	2.188411	0.035535	1.424737	0.722318	7.715675
13	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.000000	-0.000000	0.000000	-0.000000	0.000000

	11	12	13	14
1	0.000000	0.000000	1.863960	-0.222905
2	-0.000000	0.000000	0.222905	1.863960
3	0.000000	-0.000000	0.000000	-0.000000
4	0.000000	0.000000	0.000000	0.000000
5	1.989065	-0.073463	0.000000	0.000000
6	0.073463	1.989065	-0.000000	0.000000
7	1.026114	0.009495	0.000000	0.000000
8	-0.009495	1.026114	-0.000000	0.000000
9	7.823968	-0.949149	0.000000	0.000000
10	0.949149	7.823968	-0.000000	0.000000
11	-17.291939	1.208770	5.996915	-0.461821
12	-1.533726	-17.094322	0.461821	5.996915
13	6.206444	-0.510415	-14.591264	1.130409
14	0.510415	6.206444	-1.545082	-14.402482

Trianglar Angmentex Matrix

	1	2	3	4	5
1	1.000000	-0.028700	-0.151144	0.014925	-0.000000
2	0.000000	1.000000	0.000052	-0.160225	0.000000
3	0.000000	0.000000	1.000000	-0.325418	-0.342113
4	0.000000	0.000000	0.000000	1.000000	-0.031899
5	0.000000	0.000000	0.000000	0.000000	1.000000
6	0.000000	0.000000	0.000000	0.000000	0.000000
7	0.000000	0.000000	0.000000	0.000000	0.000000
8	0.000000	0.000000	0.000000	0.000000	0.000000
9	0.000000	0.000000	0.000000	0.000000	0.000000
10	0.000000	0.000000	0.000000	0.000000	0.000000
11	0.000000	0.000000	0.000000	0.000000	0.000000
12	0.000000	0.000000	0.000000	0.000000	0.000000
13	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.000000	0.000000	0.000000	0.000000	0.000000

	6	7	8	9	10
1	-0.000000	-0.243135	0.005306	-0.000000	-0.000000
2	0.000000	0.019717	-0.255798	0.000000	0.000000

3	0.082722	-0.109691	0.020172	-0.000000	0.000000
4	-0.303078	0.002920	-0.100257	0.000000	0.000000
5	0.005073	-0.355454	-0.001213	-0.332065	0.011597
6	1.000000	0.022215	-0.351147	0.009249	-0.329578
7	0.000000	1.000000	-0.039918	3.827477	-0.362399
8	0.000000	0.000000	1.000000	0.049134	-0.152400
9	0.000000	0.000000	0.000000	1.000000	-0.125444
10	0.000000	0.000000	0.000000	0.000000	1.000000
11	0.000000	0.000000	0.000000	0.000000	0.000000
12	0.000000	0.000000	0.000000	0.000000	0.000000
13	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.000000	0.000000	0.000000	0.000000	0.000000

	11	12	13	14	15
1	-0.000000	-0.000000	-0.232793	0.027839	-0.000000
2	0.000000	0.000000	-0.005014	-0.247285	-0.000000
3	-0.000000	0.000000	-0.103362	0.029618	0.000000
4	0.000000	0.000000	-0.006579	-0.096471	-0.000000
5	-0.254620	0.009404	-0.011663	0.001270	-0.000000
6	0.006586	-0.252744	-0.001588	-0.010759	0.000000
7	-7.585167	0.520587	2.729782	-0.211364	0.000000
8	-0.082260	-0.317589	0.029078	-0.084566	0.000000
9	-0.802266	0.078394	0.136484	-0.010148	0.000000
10	0.015320	-0.550360	-0.009811	-0.006325	-0.000000
11	1.000000	-0.079636	-1.749722	0.126421	0.000000
12	0.000000	1.000000	0.093651	-0.574236	0.000000
13	0.000000	0.000000	1.000000	-0.068477	-0.000000
14	0.000000	0.000000	0.000000	1.000000	0.000000

Voltage correction E(i), F(i) :

1	1	2	2
-0.000000	0.000000	-0.000000	-0.000000
3	3	4	4
-0.000001	0.000000	-0.000001	0.000000
5	5	6	6
-0.000000	0.000000	-0.000000	0.000000
7	7		
-0.000000	0.000000		

CHANGE OF P0,V**2,P0(I),Q0(I),V0(I)

I	P0(I)	Q0(I)
1	2.607703e-08	4.023314e-07
2	-9.313226e-10	-5.960464e-08
3	-4.307367e-08	1.050532e-06
4	6.705523e-08	1.192093e-07
I	P0(I)	V0(I)
5	5.075708e-08	7.040820e-02

6	2.754387e-07	1.012671e-01
7	9.918585e-08	3.657049e-02
8	3.518710e-01	0.000000e+00

max error is: 1.05053e-06

J MATRIX(Jacobian)

	1	2	3	4	5
1	-8.006921	0.229801	1.210195	-0.119500	0.000000
2	-0.793246	-7.604234	0.119500	1.210195	-0.000000
3	1.122196	-0.207572	-2.688538	0.864547	0.861754
4	0.207572	1.122196	-0.366733	-3.003396	0.208371
5	0.000000	0.000000	0.871024	-0.118874	-8.115133
6	-0.000000	0.000000	0.118874	0.871024	-0.562234
7	1.437592	-0.000319	0.000000	0.000000	2.127611
8	0.000319	1.437592	-0.000000	0.000000	-0.017872
9	0.000000	0.000000	0.000000	0.000000	2.896564
10	-0.000000	0.000000	-0.000000	0.000000	0.267271
11	0.000000	0.000000	0.000000	0.000000	2.188410
12	-0.000000	0.000000	-0.000000	0.000000	0.146049
13	1.974300	-0.271803	0.000000	0.000000	0.000000
14	0.271803	1.974300	-0.000000	0.000000	-0.000000

	6	7	8	9	10
1	0.000000	1.946759	-0.042484	0.000000	0.000000
2	0.000000	0.042484	1.946759	-0.000000	0.000000
3	-0.208371	0.000000	-0.000000	0.000000	-0.000000
4	0.861754	0.000000	0.000000	0.000000	0.000000
5	-0.017458	2.681706	0.010546	2.594057	-0.090597
6	-8.156569	-0.010546	2.681706	0.090597	2.594057
7	0.017872	-3.130515	0.083924	0.000000	0.000000
8	2.127611	0.138022	-6.052117	-0.000000	0.000000
9	-0.267271	0.000000	0.000000	-17.464485	2.326225
10	2.896564	-0.000000	0.000000	-1.845905	-17.250183
11	-0.146049	1.424736	-0.035535	7.715672	-0.722317
12	2.188410	0.035535	1.424736	0.722317	7.715672
13	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.000000	-0.000000	0.000000	-0.000000	0.000000

	11	12	13	14
1	0.000000	0.000000	1.863959	-0.222905
2	-0.000000	0.000000	0.222905	1.863959
3	0.000000	-0.000000	0.000000	-0.000000
4	0.000000	0.000000	0.000000	0.000000
5	1.989063	-0.073463	0.000000	0.000000
6	0.073463	1.989063	-0.000000	0.000000
7	1.026113	0.009496	0.000000	0.000000

8	-0.009496	1.026113	-0.000000	0.000000
9	7.823967	-0.949148	0.000000	0.000000
10	0.949148	7.823967	-0.000000	0.000000
11	-17.291931	1.208768	5.996913	-0.461821
12	-1.533724	-17.094318	0.461821	5.996913
13	6.206442	-0.510415	-14.591259	1.130409
14	0.510415	6.206442	-1.545081	-14.402479

Trianglar Angmentex Matrix

	1	2	3	4	5
1	1.000000	-0.028700	-0.151144	0.014925	-0.000000
2	0.000000	1.000000	0.000052	-0.160225	0.000000
3	0.000000	0.000000	1.000000	-0.325418	-0.342113
4	0.000000	0.000000	0.000000	1.000000	-0.031899
5	0.000000	0.000000	0.000000	0.000000	1.000000
6	0.000000	0.000000	0.000000	0.000000	0.000000
7	0.000000	0.000000	0.000000	0.000000	0.000000
8	0.000000	0.000000	0.000000	0.000000	0.000000
9	0.000000	0.000000	0.000000	0.000000	0.000000
10	0.000000	0.000000	0.000000	0.000000	0.000000
11	0.000000	0.000000	0.000000	0.000000	0.000000
12	0.000000	0.000000	0.000000	0.000000	0.000000
13	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.000000	0.000000	0.000000	0.000000	0.000000

	6	7	8	9	10
1	-0.000000	-0.243135	0.005306	-0.000000	-0.000000
2	0.000000	0.019717	-0.255798	0.000000	0.000000
3	0.082722	-0.109691	0.020172	-0.000000	0.000000
4	-0.303078	0.002919	-0.100257	0.000000	0.000000
5	0.005073	-0.355454	-0.001213	-0.332065	0.011597
6	1.000000	0.022215	-0.351147	0.009249	-0.329577
7	0.000000	1.000000	-0.039918	3.827476	-0.362399
8	0.000000	0.000000	1.000000	0.049135	-0.152400
9	0.000000	0.000000	0.000000	1.000000	-0.125444
10	0.000000	0.000000	0.000000	0.000000	1.000000
11	0.000000	0.000000	0.000000	0.000000	0.000000
12	0.000000	0.000000	0.000000	0.000000	0.000000
13	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.000000	0.000000	0.000000	0.000000	0.000000

	11	12	13	14	15
1	-0.000000	-0.000000	-0.232793	0.027839	0.000000
2	0.000000	0.000000	-0.005014	-0.247285	-0.000000
3	-0.000000	0.000000	-0.103362	0.029618	-0.000000
4	0.000000	0.000000	-0.006579	-0.096471	0.000000

5	-0.254620	0.009404	-0.011663	0.001270	0.000000
6	0.006586	-0.252744	-0.001588	-0.010758	-0.000000
7	-7.585166	0.520586	2.729781	-0.211364	0.000000
8	-0.082261	-0.317589	0.029078	-0.084566	0.000000
9	-0.802267	0.078394	0.136484	-0.010148	0.000000
10	0.015320	-0.550360	-0.009811	-0.006325	-0.000000
11	1.000000	-0.079636	-1.749722	0.126421	-0.000000
12	0.000000	1.000000	0.093651	-0.574236	0.000000
13	0.000000	0.000000	1.000000	-0.068477	0.000000
14	0.000000	0.000000	0.000000	1.000000	0.000000

Voltage correction E(i), F(i) :

1	1	2	2
0.000000	-0.000000	0.000000	0.000000
3	3	4	4
0.000001	-0.000000	0.000001	0.000000
5	5	6	6
0.000000	-0.000000	0.000000	0.000000
7	7		
0.000000	0.000000		

CHANGE OF P0,V**2,P0(I),Q0(I),V0(I)

I	P0(I)	Q0(I)
1	1.983717e-07	-1.206994e-06
2	6.100163e-08	1.341105e-07
3	-1.525041e-08	-7.711351e-07
4	-5.960464e-08	2.980232e-07
I	P0(I)	V0(I)
5	1.448207e-07	7.040761e-02
6	-9.173527e-08	1.012665e-01
7	-6.402843e-08	3.657013e-02
8	3.518717e-01	0.000000e+00

max error is: 1.20699e-06

J MATRIX(Jacobian)

	1	2	3	4	5
1	-8.006926	0.229802	1.210196	-0.119500	0.000000
2	-0.793246	-7.604235	0.119500	1.210196	-0.000000
3	1.122196	-0.207572	-2.688539	0.864547	0.861754
4	0.207572	1.122196	-0.366733	-3.003397	0.208371
5	0.000000	0.000000	0.871024	-0.118874	-8.115139
6	-0.000000	0.000000	0.118874	0.871024	-0.562235
7	1.437593	-0.000319	0.000000	0.000000	2.127613
8	0.000319	1.437593	-0.000000	0.000000	-0.017872
9	0.000000	0.000000	0.000000	0.000000	2.896565
10	-0.000000	0.000000	-0.000000	0.000000	0.267271

11	0.000000	0.000000	0.000000	0.000000	2.188411
12	-0.000000	0.000000	-0.000000	0.000000	0.146049
13	1.974301	-0.271803	0.000000	0.000000	0.000000
14	0.271803	1.974301	-0.000000	0.000000	-0.000000

	6	7	8	9	10
1	0.000000	1.946760	-0.042484	0.000000	0.000000
2	0.000000	0.042484	1.946760	-0.000000	0.000000
3	-0.208371	0.000000	-0.000000	0.000000	-0.000000
4	0.861754	0.000000	0.000000	0.000000	0.000000
5	-0.017457	2.681708	0.010545	2.594059	-0.090597
6	-8.156570	-0.010545	2.681708	0.090597	2.594059
7	0.017872	-3.130520	0.083924	0.000000	0.000000
8	2.127613	0.138022	-6.052120	-0.000000	0.000000
9	-0.267271	0.000000	0.000000	-17.464493	2.326226
10	2.896565	-0.000000	0.000000	-1.845906	-17.250187
11	-0.146049	1.424737	-0.035535	7.715674	-0.722318
12	2.188411	0.035535	1.424737	0.722318	7.715674
13	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.000000	-0.000000	0.000000	-0.000000	0.000000

	11	12	13	14
1	0.000000	0.000000	1.863960	-0.222905
2	-0.000000	0.000000	0.222905	1.863960
3	0.000000	-0.000000	0.000000	-0.000000
4	0.000000	0.000000	0.000000	0.000000
5	1.989065	-0.073463	0.000000	0.000000
6	0.073463	1.989065	-0.000000	0.000000
7	1.026114	0.009495	0.000000	0.000000
8	-0.009495	1.026114	-0.000000	0.000000
9	7.823969	-0.949149	0.000000	0.000000
10	0.949149	7.823969	-0.000000	0.000000
11	-17.291939	1.208768	5.996915	-0.461821
12	-1.533725	-17.094322	0.461821	5.996915
13	6.206443	-0.510415	-14.591262	1.130409
14	0.510415	6.206443	-1.545082	-14.402482

Trianglar Angmentex Matrix

	1	2	3	4	5
1	1.000000	-0.028700	-0.151144	0.014925	-0.000000
2	0.000000	1.000000	0.000052	-0.160225	0.000000
3	0.000000	0.000000	1.000000	-0.325418	-0.342113
4	0.000000	0.000000	0.000000	1.000000	-0.031899
5	0.000000	0.000000	0.000000	0.000000	1.000000
6	0.000000	0.000000	0.000000	0.000000	0.000000
7	0.000000	0.000000	0.000000	0.000000	0.000000

8	0.000000	0.000000	0.000000	0.000000	0.000000
9	0.000000	0.000000	0.000000	0.000000	0.000000
10	0.000000	0.000000	0.000000	0.000000	0.000000
11	0.000000	0.000000	0.000000	0.000000	0.000000
12	0.000000	0.000000	0.000000	0.000000	0.000000
13	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.000000	0.000000	0.000000	0.000000	0.000000

	6	7	8	9	10
1	-0.000000	-0.243135	0.005306	-0.000000	-0.000000
2	0.000000	0.019717	-0.255798	0.000000	0.000000
3	0.082722	-0.109691	0.020172	-0.000000	0.000000
4	-0.303078	0.002919	-0.100257	0.000000	0.000000
5	0.005073	-0.355454	-0.001213	-0.332065	0.011597
6	1.000000	0.022215	-0.351147	0.009249	-0.329578
7	0.000000	1.000000	-0.039918	3.827476	-0.362399
8	0.000000	0.000000	1.000000	0.049134	-0.152400
9	0.000000	0.000000	0.000000	1.000000	-0.125444
10	0.000000	0.000000	0.000000	0.000000	1.000000
11	0.000000	0.000000	0.000000	0.000000	0.000000
12	0.000000	0.000000	0.000000	0.000000	0.000000
13	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.000000	0.000000	0.000000	0.000000	0.000000

	11	12	13	14	15
1	-0.000000	-0.000000	-0.232793	0.027839	-0.000000
2	0.000000	0.000000	-0.005014	-0.247285	0.000000
3	-0.000000	0.000000	-0.103362	0.029618	-0.000000
4	0.000000	0.000000	-0.006579	-0.096471	0.000000
5	-0.254620	0.009404	-0.011663	0.001270	-0.000000
6	0.006586	-0.252744	-0.001588	-0.010759	0.000000
7	-7.585167	0.520586	2.729782	-0.211364	0.000001
8	-0.082260	-0.317589	0.029078	-0.084566	0.000000
9	-0.802267	0.078394	0.136484	-0.010148	0.000000
10	0.015320	-0.550360	-0.009811	-0.006325	0.000000
11	1.000000	-0.079636	-1.749722	0.126421	-0.000000
12	0.000000	1.000000	0.093651	-0.574236	0.000000
13	0.000000	0.000000	1.000000	-0.068477	-0.000000
14	0.000000	0.000000	0.000000	1.000000	0.000000

Voltage correction E(i), F(i) :

1	1	2	2
-0.000000	0.000000	-0.000000	0.000000
3	3	4	4
-0.000000	0.000000	-0.000000	0.000000
5	5	6	6
-0.000000	0.000000	-0.000000	0.000000

```
                7                7
      -0.000000        0.000000
        CHANGE OF P0,V**2,P0(I),Q0(I),V0(I)
  I        P0(I)            Q0(I)
  1   -1.471490e-07     1.028180e-06
  2   -1.024455e-08    -8.940697e-08
  3   -8.847564e-08     8.437783e-07
  4    7.450581e-09    -1.192093e-07
  I        P0(I)            V0(I)
  5   -1.335284e-07     7.040796e-02
  6   -1.415610e-07     1.012670e-01
  7   -3.282912e-08     3.657037e-02
  8    3.518717e-01     0.000000e+00
max error is: 1.02818e-06

 J                MATRIX(Jacobian)
         1          2          3          4          5
 1   -8.006920   0.229800   1.210195  -0.119500   0.000000
 2   -0.793246  -7.604234   0.119500   1.210195  -0.000000
 3    1.122196  -0.207571  -2.688539   0.864547   0.861754
 4    0.207571   1.122196  -0.366733  -3.003396   0.208371
 5    0.000000   0.000000   0.871024  -0.118874  -8.115135
 6   -0.000000   0.000000   0.118874   0.871024  -0.562234
 7    1.437592  -0.000319   0.000000   0.000000   2.127612
 8    0.000319   1.437592  -0.000000   0.000000  -0.017872
 9    0.000000   0.000000   0.000000   0.000000   2.896564
10   -0.000000   0.000000  -0.000000   0.000000   0.267271
11    0.000000   0.000000   0.000000   0.000000   2.188410
12   -0.000000   0.000000  -0.000000   0.000000   0.146049
13    1.974300  -0.271803   0.000000   0.000000   0.000000
14    0.271803   1.974300  -0.000000   0.000000  -0.000000
         6          7          8          9         10
 1    0.000000   1.946759  -0.042484   0.000000   0.000000
 2    0.000000   0.042484   1.946759  -0.000000   0.000000
 3   -0.208371   0.000000  -0.000000   0.000000  -0.000000
 4    0.861754   0.000000   0.000000   0.000000   0.000000
 5   -0.017458   2.681706   0.010546   2.594058  -0.090597
 6   -8.156570  -0.010546   2.681706   0.090597   2.594058
 7    0.017872  -3.130517   0.083924   0.000000   0.000000
 8    2.127612   0.138022  -6.052118  -0.000000   0.000000
 9   -0.267271   0.000000   0.000000 -17.464487   2.326225
10    2.896564  -0.000000   0.000000  -1.845906 -17.250185
11   -0.146049   1.424736  -0.035535   7.715672  -0.722317
12    2.188410   0.035535   1.424736   0.722317   7.715672
```

13	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.000000	-0.000000	0.000000	-0.000000	0.000000

	11	12	13	14
1	0.000000	0.000000	1.863959	-0.222905
2	-0.000000	0.000000	0.222905	1.863959
3	0.000000	-0.000000	0.000000	-0.000000
4	0.000000	0.000000	0.000000	0.000000
5	1.989064	-0.073463	0.000000	0.000000
6	0.073463	1.989064	-0.000000	0.000000
7	1.026113	0.009496	0.000000	0.000000
8	-0.009496	1.026113	-0.000000	0.000000
9	7.823967	-0.949148	0.000000	0.000000
10	0.949148	7.823967	-0.000000	0.000000
11	-17.291933	1.208767	5.996913	-0.461821
12	-1.533724	-17.094320	0.461821	5.996913
13	6.206442	-0.510415	-14.591260	1.130408
14	0.510415	6.206442	-1.545081	-14.402480

Trianglar Angmentex Matrix

	1	2	3	4	5
1	1.000000	-0.028700	-0.151144	0.014925	-0.000000
2	0.000000	1.000000	0.000052	-0.160225	0.000000
3	0.000000	0.000000	1.000000	-0.325418	-0.342113
4	0.000000	0.000000	0.000000	1.000000	-0.031899
5	0.000000	0.000000	0.000000	0.000000	1.000000
6	0.000000	0.000000	0.000000	0.000000	0.000000
7	0.000000	0.000000	0.000000	0.000000	0.000000
8	0.000000	0.000000	0.000000	0.000000	0.000000
9	0.000000	0.000000	0.000000	0.000000	0.000000
10	0.000000	0.000000	0.000000	0.000000	0.000000
11	0.000000	0.000000	0.000000	0.000000	0.000000
12	0.000000	0.000000	0.000000	0.000000	0.000000
13	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.000000	0.000000	0.000000	0.000000	0.000000

	6	7	8	9	10
1	-0.000000	-0.243135	0.005306	-0.000000	-0.000000
2	0.000000	0.019717	-0.255798	0.000000	0.000000
3	0.082722	-0.109691	0.020172	-0.000000	0.000000
4	-0.303078	0.002920	-0.100257	0.000000	0.000000
5	0.005073	-0.355454	-0.001213	-0.332065	0.011597
6	1.000000	0.022215	-0.351147	0.009249	-0.329577
7	0.000000	1.000000	-0.039918	3.827476	-0.362399
8	0.000000	0.000000	1.000000	0.049135	-0.152400
9	0.000000	0.000000	0.000000	1.000000	-0.125444

10	0.000000	0.000000	0.000000	0.000000	1.000000
11	0.000000	0.000000	0.000000	0.000000	0.000000
12	0.000000	0.000000	0.000000	0.000000	0.000000
13	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.000000	0.000000	0.000000	0.000000	0.000000

	11	12	13	14	15
1	-0.000000	-0.000000	-0.232794	0.027839	0.000000
2	0.000000	0.000000	-0.005014	-0.247285	-0.000000
3	-0.000000	0.000000	-0.103362	0.029618	0.000000
4	0.000000	0.000000	-0.006579	-0.096471	-0.000000
5	-0.254620	0.009404	-0.011663	0.001270	0.000000
6	0.006586	-0.252744	-0.001588	-0.010758	-0.000000
7	-7.585166	0.520586	2.729782	-0.211364	-0.000000
8	-0.082261	-0.317589	0.029078	-0.084566	-0.000000
9	-0.802267	0.078394	0.136484	-0.010148	0.000000
10	0.015320	-0.550360	-0.009811	-0.006325	-0.000000
11	1.000000	-0.079636	-1.749722	0.126421	-0.000000
12	0.000000	1.000000	0.093651	-0.574236	-0.000000
13	0.000000	0.000000	1.000000	-0.068477	0.000000
14	0.000000	0.000000	0.000000	1.000000	-0.000000

Voltage correction E(i), F(i) :

1	1	2	2
0.000000	-0.000000	0.000000	-0.000000
3	3	4	4
0.000000	-0.000000	0.000000	-0.000000
5	5	6	6
0.000000	-0.000000	0.000000	-0.000000
7	7		
0.000000	-0.000000		

CHANGE OF P0,V**2,P0(I),Q0(I),V0(I)

I	P0(I)	Q0(I)
1	-7.171184e-08	-1.043081e-07
2	-4.656613e-08	2.980232e-08
3	3.061723e-08	-5.457550e-07
4	1.490116e-08	-1.788139e-07
I	P0(I)	V0(I)
5	-5.564652e-08	7.040749e-02
6	2.654269e-08	1.012665e-01
7	-4.749745e-08	3.657002e-02
8	3.518715e-01	0.000000e+00

max error is: 5.45755e-07

J MATRIX(Jacobian)

1	2	3	4	5

1	-8.006925	0.229801	1.210196	-0.119500	0.000000
2	-0.793247	-7.604236	0.119500	1.210196	-0.000000
3	1.122197	-0.207572	-2.688539	0.864547	0.861754
4	0.207572	1.122197	-0.366734	-3.003397	0.208371
5	0.000000	0.000000	0.871024	-0.118874	-8.115139
6	-0.000000	0.000000	0.118874	0.871024	-0.562235
7	1.437593	-0.000319	0.000000	0.000000	2.127614
8	0.000319	1.437593	-0.000000	0.000000	-0.017872
9	0.000000	0.000000	0.000000	0.000000	2.896565
10	-0.000000	0.000000	-0.000000	0.000000	0.267271
11	0.000000	0.000000	0.000000	0.000000	2.188411
12	-0.000000	0.000000	-0.000000	0.000000	0.146049
13	1.974301	-0.271803	0.000000	0.000000	0.000000
14	0.271803	1.974301	-0.000000	0.000000	-0.000000

	6	7	8	9	10
1	0.000000	1.946760	-0.042484	0.000000	0.000000
2	0.000000	0.042484	1.946760	-0.000000	0.000000
3	-0.208371	0.000000	-0.000000	0.000000	-0.000000
4	0.861754	0.000000	0.000000	0.000000	0.000000
5	-0.017456	2.681708	0.010545	2.594059	-0.090598
6	-8.156572	-0.010545	2.681708	0.090598	2.594059
7	0.017872	-3.130522	0.083924	0.000000	0.000000
8	2.127614	0.138022	-6.052120	-0.000000	0.000000
9	-0.267271	0.000000	0.000000	-17.464497	2.326226
10	2.896565	-0.000000	0.000000	-1.845907	-17.250187
11	-0.146049	1.424737	-0.035535	7.715674	-0.722318
12	2.188411	0.035535	1.424737	0.722318	7.715674
13	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.000000	-0.000000	0.000000	-0.000000	0.000000

	11	12	13	14
1	0.000000	0.000000	1.863960	-0.222905
2	-0.000000	0.000000	0.222905	1.863960
3	0.000000	-0.000000	0.000000	-0.000000
4	0.000000	0.000000	0.000000	0.000000
5	1.989065	-0.073463	0.000000	0.000000
6	0.073463	1.989065	-0.000000	0.000000
7	1.026114	0.009495	0.000000	0.000000
8	-0.009495	1.026114	-0.000000	0.000000
9	7.823969	-0.949149	0.000000	0.000000
10	0.949149	7.823969	-0.000000	0.000000
11	-17.291937	1.208769	5.996915	-0.461821
12	-1.533726	-17.094324	0.461821	5.996915
13	6.206444	-0.510415	-14.591264	1.130409
14	0.510415	6.206444	-1.545082	-14.402482

Trianglar Angmentex Matrix

	1	2	3	4	5
1	1.000000	-0.028700	-0.151144	0.014925	-0.000000
2	0.000000	1.000000	0.000052	-0.160225	0.000000
3	0.000000	0.000000	1.000000	-0.325418	-0.342113
4	0.000000	0.000000	0.000000	1.000000	-0.031899
5	0.000000	0.000000	0.000000	0.000000	1.000000
6	0.000000	0.000000	0.000000	0.000000	0.000000
7	0.000000	0.000000	0.000000	0.000000	0.000000
8	0.000000	0.000000	0.000000	0.000000	0.000000
9	0.000000	0.000000	0.000000	0.000000	0.000000
10	0.000000	0.000000	0.000000	0.000000	0.000000
11	0.000000	0.000000	0.000000	0.000000	0.000000
12	0.000000	0.000000	0.000000	0.000000	0.000000
13	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.000000	0.000000	0.000000	0.000000	0.000000

	6	7	8	9	10
1	-0.000000	-0.243135	0.005306	-0.000000	-0.000000
2	0.000000	0.019717	-0.255798	0.000000	0.000000
3	0.082722	-0.109691	0.020172	-0.000000	0.000000
4	-0.303078	0.002920	-0.100257	0.000000	0.000000
5	0.005073	-0.355454	-0.001213	-0.332065	0.011597
6	1.000000	0.022215	-0.351147	0.009249	-0.329578
7	0.000000	1.000000	-0.039918	3.827477	-0.362399
8	0.000000	0.000000	1.000000	0.049134	-0.152400
9	0.000000	0.000000	0.000000	1.000000	-0.125444
10	0.000000	0.000000	0.000000	0.000000	1.000000
11	0.000000	0.000000	0.000000	0.000000	0.000000
12	0.000000	0.000000	0.000000	0.000000	0.000000
13	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.000000	0.000000	0.000000	0.000000	0.000000

	11	12	13	14	15
1	-0.000000	-0.000000	-0.232793	0.027839	-0.000000
2	0.000000	0.000000	-0.005014	-0.247285	-0.000000
3	-0.000000	0.000000	-0.103362	0.029618	0.000000
4	0.000000	0.000000	-0.006579	-0.096471	-0.000000
5	-0.254620	0.009404	-0.011663	0.001270	-0.000000
6	0.006586	-0.252744	-0.001588	-0.010759	0.000000
7	-7.585166	0.520587	2.729782	-0.211364	-0.000000
8	-0.082260	-0.317589	0.029078	-0.084566	0.000000
9	-0.802266	0.078394	0.136484	-0.010148	-0.000000
10	0.015320	-0.550360	-0.009811	-0.006325	0.000000
11	1.000000	-0.079636	-1.749722	0.126421	0.000000

12	0.000000	1.000000	0.093651	-0.574236	0.000000
13	0.000000	0.000000	1.000000	-0.068477	-0.000000
14	0.000000	0.000000	0.000000	1.000000	0.000000

Voltage correction E(i), F(i) :

1	1	2	2
-0.000000	0.000000	-0.000000	-0.000000
3	3	4	4
-0.000000	0.000000	-0.000001	0.000000
5	5	6	6
-0.000000	0.000000	-0.000000	0.000000
7	7		
-0.000000	0.000000		

CHANGE OF P0,V**2,P0(I),Q0(I),V0(I)

I	P0(I)	Q0(I)
1	9.685755e-08	1.639128e-07
2	4.097819e-08	-1.490116e-07
3	-4.342292e-08	4.451722e-07
4	2.235174e-08	0.000000e+00

I	P0(I)	V0(I)
5	-2.747402e-08	7.040808e-02
6	3.166497e-07	1.012671e-01
7	1.010485e-07	3.657037e-02
8	3.518713e-01	0.000000e+00

max error is: 4.45172e-07

J MATRIX(Jacobian)

	1	2	3	4	5
1	-8.006922	0.229801	1.210195	-0.119500	0.000000
2	-0.793246	-7.604234	0.119500	1.210195	-0.000000
3	1.122196	-0.207572	-2.688539	0.864547	0.861754
4	0.207572	1.122196	-0.366733	-3.003396	0.208371
5	0.000000	0.000000	0.871024	-0.118874	-8.115133
6	-0.000000	0.000000	0.118874	0.871024	-0.562234
7	1.437592	-0.000319	0.000000	0.000000	2.127612
8	0.000319	1.437592	-0.000000	0.000000	-0.017872
9	0.000000	0.000000	0.000000	0.000000	2.896564
10	-0.000000	0.000000	-0.000000	0.000000	0.267271
11	0.000000	0.000000	0.000000	0.000000	2.188410
12	-0.000000	0.000000	-0.000000	0.000000	0.146049
13	1.974300	-0.271803	0.000000	0.000000	0.000000
14	0.271803	1.974300	-0.000000	0.000000	-0.000000

	6	7	8	9	10
1	0.000000	1.946759	-0.042484	0.000000	0.000000
2	0.000000	0.042484	1.946759	-0.000000	0.000000

3	-0.208371	0.000000	-0.000000	0.000000	-0.000000
4	0.861754	0.000000	0.000000	0.000000	0.000000
5	-0.017457	2.681706	0.010545	2.594058	-0.090597
6	-8.156569	-0.010545	2.681706	0.090597	2.594058
7	0.017872	-3.130517	0.083924	0.000000	0.000000
8	2.127612	0.138022	-6.052117	-0.000000	0.000000
9	-0.267271	0.000000	0.000000	-17.464489	2.326225
10	2.896564	-0.000000	0.000000	-1.845906	-17.250183
11	-0.146049	1.424736	-0.035535	7.715672	-0.722317
12	2.188410	0.035535	1.424736	0.722317	7.715672
13	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.000000	-0.000000	0.000000	-0.000000	0.000000

	11	12	13	14
1	0.000000	0.000000	1.863959	-0.222905
2	-0.000000	0.000000	0.222905	1.863959
3	0.000000	-0.000000	0.000000	-0.000000
4	0.000000	0.000000	0.000000	0.000000
5	1.989064	-0.073463	0.000000	0.000000
6	0.073463	1.989064	-0.000000	0.000000
7	1.026113	0.009496	0.000000	0.000000
8	-0.009496	1.026113	-0.000000	0.000000
9	7.823967	-0.949149	0.000000	0.000000
10	0.949149	7.823967	-0.000000	0.000000
11	-17.291931	1.208768	5.996913	-0.461821
12	-1.533724	-17.094318	0.461821	5.996913
13	6.206442	-0.510415	-14.591261	1.130409
14	0.510415	6.206442	-1.545082	-14.402479

Trianglar Angmentex Matrix

	1	2	3	4	5
1	1.000000	-0.028700	-0.151144	0.014925	-0.000000
2	0.000000	1.000000	0.000052	-0.160225	0.000000
3	0.000000	0.000000	1.000000	-0.325418	-0.342113
4	0.000000	0.000000	0.000000	1.000000	-0.031899
5	0.000000	0.000000	0.000000	0.000000	1.000000
6	0.000000	0.000000	0.000000	0.000000	0.000000
7	0.000000	0.000000	0.000000	0.000000	0.000000
8	0.000000	0.000000	0.000000	0.000000	0.000000
9	0.000000	0.000000	0.000000	0.000000	0.000000
10	0.000000	0.000000	0.000000	0.000000	0.000000
11	0.000000	0.000000	0.000000	0.000000	0.000000
12	0.000000	0.000000	0.000000	0.000000	0.000000
13	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.000000	0.000000	0.000000	0.000000	0.000000

	6	7	8	9	10
1	-0.000000	-0.243135	0.005306	-0.000000	-0.000000
2	0.000000	0.019717	-0.255798	0.000000	0.000000
3	0.082722	-0.109691	0.020172	-0.000000	0.000000
4	-0.303078	0.002919	-0.100257	0.000000	0.000000
5	0.005073	-0.355454	-0.001213	-0.332065	0.011597
6	1.000000	0.022215	-0.351147	0.009249	-0.329577
7	0.000000	1.000000	-0.039918	3.827476	-0.362399
8	0.000000	0.000000	1.000000	0.049134	-0.152400
9	0.000000	0.000000	0.000000	1.000000	-0.125444
10	0.000000	0.000000	0.000000	0.000000	1.000000
11	0.000000	0.000000	0.000000	0.000000	0.000000
12	0.000000	0.000000	0.000000	0.000000	0.000000
13	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.000000	0.000000	0.000000	0.000000	0.000000

	11	12	13	14	15
1	-0.000000	-0.000000	-0.232793	0.027839	0.000000
2	0.000000	0.000000	-0.005014	-0.247285	0.000000
3	-0.000000	0.000000	-0.103362	0.029618	-0.000000
4	0.000000	0.000000	-0.006579	-0.096471	0.000000
5	-0.254620	0.009404	-0.011663	0.001270	0.000000
6	0.006586	-0.252744	-0.001588	-0.010758	-0.000000
7	-7.585166	0.520586	2.729781	-0.211364	-0.000000
8	-0.082260	-0.317589	0.029078	-0.084566	0.000000
9	-0.802266	0.078394	0.136484	-0.010148	-0.000000
10	0.015320	-0.550360	-0.009811	-0.006325	0.000000
11	1.000000	-0.079636	-1.749722	0.126421	0.000000
12	0.000000	1.000000	0.093651	-0.574236	0.000000
13	0.000000	0.000000	1.000000	-0.068477	-0.000000
14	0.000000	0.000000	0.000000	1.000000	0.000000

Voltage correction E(i), F(i) :

1	1	2	2
0.000000	0.000000	-0.000000	0.000000
3	3	4	4
0.000000	0.000000	0.000000	0.000000
5	5	6	6
-0.000000	0.000000	0.000000	0.000000
7	7		
-0.000000	0.000000		

CHANGE OF P0,V**2,P0(I),Q0(I),V0(I)

I	P0(I)	Q0(I)
1	-5.215406e-08	-2.980232e-07
2	-5.587935e-09	0.000000e+00
3	1.051230e-07	4.488975e-07

4	-3.725290e-08	5.960464e-08

I	P0(I)	V0(I)
5	8.149073e-08	7.040808e-02
6	-1.185108e-07	1.012671e-01
7	-1.490116e-08	3.657037e-02
8	3.518717e-01	0.000000e+00

max error is: 4.48897e-07

J MATRIX(Jacobian)

	1	2	3	4	5
1	-8.006923	0.229801	1.210196	-0.119500	0.000000
2	-0.793246	-7.604234	0.119500	1.210196	-0.000000
3	1.122196	-0.207571	-2.688538	0.864547	0.861754
4	0.207571	1.122196	-0.366733	-3.003396	0.208371
5	0.000000	0.000000	0.871024	-0.118874	-8.115135
6	-0.000000	0.000000	0.118874	0.871024	-0.562234
7	1.437592	-0.000319	0.000000	0.000000	2.127612
8	0.000319	1.437592	-0.000000	0.000000	-0.017872
9	0.000000	0.000000	0.000000	0.000000	2.896564
10	-0.000000	0.000000	-0.000000	0.000000	0.267271
11	0.000000	0.000000	0.000000	0.000000	2.188410
12	-0.000000	0.000000	-0.000000	0.000000	0.146049
13	1.974300	-0.271803	0.000000	0.000000	0.000000
14	0.271803	1.974300	-0.000000	0.000000	-0.000000

	6	7	8	9	10
1	0.000000	1.946759	-0.042484	0.000000	0.000000
2	0.000000	0.042484	1.946759	-0.000000	0.000000
3	-0.208371	0.000000	-0.000000	0.000000	-0.000000
4	0.861754	0.000000	0.000000	0.000000	0.000000
5	-0.017457	2.681706	0.010545	2.594058	-0.090597
6	-8.156570	-0.010545	2.681706	0.090597	2.594058
7	0.017872	-3.130517	0.083924	0.000000	0.000000
8	2.127612	0.138022	-6.052118	-0.000000	0.000000
9	-0.267271	0.000000	0.000000	-17.464487	2.326225
10	2.896564	-0.000000	0.000000	-1.845905	-17.250185
11	-0.146049	1.424736	-0.035535	7.715672	-0.722317
12	2.188410	0.035535	1.424736	0.722317	7.715672
13	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.000000	-0.000000	0.000000	-0.000000	0.000000

	11	12	13	14
1	0.000000	0.000000	1.863959	-0.222905
2	-0.000000	0.000000	0.222905	1.863959
3	0.000000	-0.000000	0.000000	-0.000000
4	0.000000	0.000000	0.000000	0.000000

5	1.989064	-0.073463	0.000000	0.000000
6	0.073463	1.989064	-0.000000	0.000000
7	1.026113	0.009496	0.000000	0.000000
8	-0.009496	1.026113	-0.000000	0.000000
9	7.823967	-0.949148	0.000000	0.000000
10	0.949148	7.823967	-0.000000	0.000000
11	-17.291931	1.208767	5.996913	-0.461821
12	-1.533724	-17.094318	0.461821	5.996913
13	6.206442	-0.510415	-14.591261	1.130408
14	0.510415	6.206442	-1.545081	-14.402479

Trianglar Angmentex Matrix

	1	2	3	4	5
1	1.000000	-0.028700	-0.151144	0.014925	-0.000000
2	0.000000	1.000000	0.000052	-0.160225	0.000000
3	0.000000	0.000000	1.000000	-0.325418	-0.342113
4	0.000000	0.000000	0.000000	1.000000	-0.031899
5	0.000000	0.000000	0.000000	0.000000	1.000000
6	0.000000	0.000000	0.000000	0.000000	0.000000
7	0.000000	0.000000	0.000000	0.000000	0.000000
8	0.000000	0.000000	0.000000	0.000000	0.000000
9	0.000000	0.000000	0.000000	0.000000	0.000000
10	0.000000	0.000000	0.000000	0.000000	0.000000
11	0.000000	0.000000	0.000000	0.000000	0.000000
12	0.000000	0.000000	0.000000	0.000000	0.000000
13	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.000000	0.000000	0.000000	0.000000	0.000000

	6	7	8	9	10
1	-0.000000	-0.243135	0.005306	-0.000000	-0.000000
2	0.000000	0.019717	-0.255798	0.000000	0.000000
3	0.082722	-0.109691	0.020172	-0.000000	0.000000
4	-0.303078	0.002919	-0.100257	0.000000	0.000000
5	0.005073	-0.355454	-0.001213	-0.332065	0.011597
6	1.000000	0.022215	-0.351147	0.009249	-0.329577
7	0.000000	1.000000	-0.039918	3.827476	-0.362399
8	0.000000	0.000000	1.000000	0.049135	-0.152400
9	0.000000	0.000000	0.000000	1.000000	-0.125444
10	0.000000	0.000000	0.000000	0.000000	1.000000
11	0.000000	0.000000	0.000000	0.000000	0.000000
12	0.000000	0.000000	0.000000	0.000000	0.000000
13	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.000000	0.000000	0.000000	0.000000	0.000000

	11	12	13	14	15
1	-0.000000	-0.000000	-0.232793	0.027839	-0.000000

2	0.000000	0.000000	-0.005014	-0.247285	-0.000000
3	-0.000000	0.000000	-0.103362	0.029618	-0.000000
4	0.000000	0.000000	-0.006579	-0.096471	-0.000000
5	-0.254620	0.009404	-0.011663	0.001270	0.000000
6	0.006586	-0.252744	-0.001588	-0.010758	0.000000
7	-7.585166	0.520586	2.729781	-0.211364	-0.000000
8	-0.082261	-0.317589	0.029078	-0.084566	-0.000000
9	-0.802267	0.078394	0.136484	-0.010148	0.000000
10	0.015320	-0.550360	-0.009811	-0.006325	0.000000
11	1.000000	-0.079636	-1.749722	0.126421	0.000000
12	0.000000	1.000000	0.093651	-0.574236	-0.000000
13	0.000000	0.000000	1.000000	-0.068477	0.000000
14	0.000000	0.000000	0.000000	1.000000	-0.000000

Voltage correction E(i), F(i) :

1	1	2	2
0.000000	-0.000000	0.000000	-0.000000
3	3	4	4
0.000000	-0.000000	0.000000	-0.000000
5	5	6	6
0.000000	-0.000000	0.000000	-0.000000
7	7		
0.000000	-0.000000		

CHANGE OF P0,V**2,P0(I),Q0(I),V0(I)

I	P0(I)	Q0(I)
1	3.911555e-08	1.341105e-07
2	-3.632158e-08	-2.980232e-08
3	7.345807e-08	-1.179054e-06
4	-1.490116e-08	0.000000e+00
I	P0(I)	V0(I)
5	1.885928e-08	7.040773e-02
6	-3.152527e-07	1.012666e-01
7	-4.610047e-08	3.657013e-02
8	3.518717e-01	0.000000e+00

max error is: 1.17905e-06

J MATRIX(Jacobian)

	1	2	3	4	5
1	-8.006923	0.229801	1.210196	-0.119500	0.000000
2	-0.793246	-7.604235	0.119500	1.210196	-0.000000
3	1.122196	-0.207571	-2.688539	0.864547	0.861754
4	0.207571	1.122196	-0.366733	-3.003396	0.208371
5	0.000000	0.000000	0.871024	-0.118874	-8.115139
6	-0.000000	0.000000	0.118874	0.871024	-0.562235
7	1.437593	-0.000319	0.000000	0.000000	2.127613

8	0.000319	1.437593	-0.000000	0.000000	-0.017872
9	0.000000	0.000000	0.000000	0.000000	2.896565
10	-0.000000	0.000000	-0.000000	0.000000	0.267271
11	0.000000	0.000000	0.000000	0.000000	2.188410
12	-0.000000	0.000000	-0.000000	0.000000	0.146049
13	1.974301	-0.271803	0.000000	0.000000	0.000000
14	0.271803	1.974301	-0.000000	0.000000	-0.000000

	6	7	8	9	10
1	0.000000	1.946760	-0.042484	0.000000	0.000000
2	0.000000	0.042484	1.946760	-0.000000	0.000000
3	-0.208371	0.000000	-0.000000	0.000000	-0.000000
4	0.861754	0.000000	0.000000	0.000000	0.000000
5	-0.017457	2.681707	0.010545	2.594059	-0.090597
6	-8.156570	-0.010545	2.681707	0.090597	2.594059
7	0.017872	-3.130520	0.083924	0.000000	0.000000
8	2.127613	0.138022	-6.052119	-0.000000	0.000000
9	-0.267271	0.000000	0.000000	-17.464493	2.326226
10	2.896565	-0.000000	0.000000	-1.845906	-17.250187
11	-0.146049	1.424737	-0.035535	7.715674	-0.722318
12	2.188410	0.035535	1.424737	0.722318	7.715674
13	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.000000	-0.000000	0.000000	-0.000000	0.000000

	11	12	13	14
1	0.000000	0.000000	1.863959	-0.222905
2	-0.000000	0.000000	0.222905	1.863959
3	0.000000	-0.000000	0.000000	-0.000000
4	0.000000	0.000000	0.000000	0.000000
5	1.989064	-0.073463	0.000000	0.000000
6	0.073463	1.989064	-0.000000	0.000000
7	1.026114	0.009495	0.000000	0.000000
8	-0.009495	1.026114	-0.000000	0.000000
9	7.823968	-0.949149	0.000000	0.000000
10	0.949149	7.823968	-0.000000	0.000000
11	-17.291935	1.208768	5.996915	-0.461821
12	-1.533725	-17.094322	0.461821	5.996915
13	6.206443	-0.510415	-14.591263	1.130409
14	0.510415	6.206443	-1.545082	-14.402481

Trianglar Angmentex Matrix

	1	2	3	4	5
1	1.000000	-0.028700	-0.151144	0.014925	-0.000000
2	0.000000	1.000000	0.000052	-0.160225	0.000000
3	0.000000	0.000000	1.000000	-0.325418	-0.342113
4	0.000000	0.000000	0.000000	1.000000	-0.031899

5	0.000000	0.000000	0.000000	0.000000	1.000000
6	0.000000	0.000000	0.000000	0.000000	0.000000
7	0.000000	0.000000	0.000000	0.000000	0.000000
8	0.000000	0.000000	0.000000	0.000000	0.000000
9	0.000000	0.000000	0.000000	0.000000	0.000000
10	0.000000	0.000000	0.000000	0.000000	0.000000
11	0.000000	0.000000	0.000000	0.000000	0.000000
12	0.000000	0.000000	0.000000	0.000000	0.000000
13	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.000000	0.000000	0.000000	0.000000	0.000000

	6	7	8	9	10
1	-0.000000	-0.243135	0.005306	-0.000000	-0.000000
2	0.000000	0.019717	-0.255798	0.000000	0.000000
3	0.082722	-0.109691	0.020172	-0.000000	0.000000
4	-0.303078	0.002919	-0.100257	0.000000	0.000000
5	0.005073	-0.355454	-0.001213	-0.332065	0.011597
6	1.000000	0.022215	-0.351147	0.009249	-0.329578
7	0.000000	1.000000	-0.039918	3.827477	-0.362399
8	0.000000	0.000000	1.000000	0.049134	-0.152400
9	0.000000	0.000000	0.000000	1.000000	-0.125444
10	0.000000	0.000000	0.000000	0.000000	1.000000
11	0.000000	0.000000	0.000000	0.000000	0.000000
12	0.000000	0.000000	0.000000	0.000000	0.000000
13	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.000000	0.000000	0.000000	0.000000	0.000000

	11	12	13	14	15
1	-0.000000	-0.000000	-0.232793	0.027839	0.000000
2	0.000000	0.000000	-0.005014	-0.247285	0.000000
3	-0.000000	0.000000	-0.103362	0.029618	-0.000000
4	0.000000	0.000000	-0.006579	-0.096471	-0.000000
5	-0.254620	0.009404	-0.011663	0.001270	-0.000000
6	0.006586	-0.252744	-0.001588	-0.010759	0.000000
7	-7.585166	0.520586	2.729782	-0.211364	-0.000000
8	-0.082260	-0.317589	0.029078	-0.084566	0.000000
9	-0.802266	0.078394	0.136484	-0.010148	-0.000000
10	0.015320	-0.550360	-0.009811	-0.006325	0.000000
11	1.000000	-0.079636	-1.749722	0.126421	0.000000
12	0.000000	1.000000	0.093651	-0.574236	-0.000000
13	0.000000	0.000000	1.000000	-0.068477	-0.000000
14	0.000000	0.000000	0.000000	1.000000	-0.000000

Voltage correction E(i), F(i) :

1	1	2	2
-0.000000	0.000000	-0.000000	-0.000000

3	3	4	4

```
      -0.000000        0.000000       -0.000000       -0.000000
               5               5               6               6
      -0.000000       -0.000000       -0.000000       -0.000000
               7               7
      -0.000000       -0.000000
        CHANGE OF P0,V**2,P0(I),Q0(I),V0(I)
  I        P0(I)            Q0(I)
  1    1.052395e-07     6.109476e-07
  2   -4.656613e-10     4.470348e-08
  3   -3.104797e-07     1.654029e-06
  4    3.725290e-08    -1.192093e-07
  I        P0(I)            V0(I)
  5   -1.287553e-07     7.040796e-02
  6    3.702007e-08     1.012669e-01
  7   -3.236346e-08     3.657025e-02
  8    3.518715e-01     0.000000e+00
max error is: 1.65403e-06

 J                MATRIX(Jacobian)
         1          2          3          4          5
 1   -8.006922   0.229801   1.210195  -0.119500   0.000000
 2   -0.793246  -7.604234   0.119500   1.210195  -0.000000
 3    1.122196  -0.207571  -2.688538   0.864547   0.861754
 4    0.207571   1.122196  -0.366733  -3.003396   0.208371
 5    0.000000   0.000000   0.871024  -0.118874  -8.115133
 6   -0.000000   0.000000   0.118874   0.871024  -0.562234
 7    1.437592  -0.000319   0.000000   0.000000   2.127612
 8    0.000319   1.437592  -0.000000   0.000000  -0.017872
 9    0.000000   0.000000   0.000000   0.000000   2.896564
10   -0.000000   0.000000  -0.000000   0.000000   0.267271
11    0.000000   0.000000   0.000000   0.000000   2.188410
12   -0.000000   0.000000  -0.000000   0.000000   0.146049
13    1.974300  -0.271803   0.000000   0.000000   0.000000
14    0.271803   1.974300  -0.000000   0.000000  -0.000000
         6          7          8          9         10
 1    0.000000   1.946759  -0.042484   0.000000   0.000000
 2    0.000000   0.042484   1.946759  -0.000000   0.000000
 3   -0.208371   0.000000  -0.000000   0.000000  -0.000000
 4    0.861754   0.000000   0.000000   0.000000   0.000000
 5   -0.017458   2.681706   0.010545   2.594058  -0.090597
 6   -8.156570  -0.010545   2.681706   0.090597   2.594058
 7    0.017872  -3.130517   0.083924   0.000000   0.000000
 8    2.127612   0.138022  -6.052118  -0.000000   0.000000
 9   -0.267271   0.000000   0.000000 -17.464487   2.326225
```

10	2.896564	-0.000000	0.000000	-1.845906	-17.250185
11	-0.146049	1.424736	-0.035535	7.715673	-0.722318
12	2.188410	0.035535	1.424736	0.722318	7.715673
13	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.000000	-0.000000	0.000000	-0.000000	0.000000

	11	12	13	14
1	0.000000	0.000000	1.863959	-0.222905
2	-0.000000	0.000000	0.222905	1.863959
3	0.000000	-0.000000	0.000000	-0.000000
4	0.000000	0.000000	0.000000	0.000000
5	1.989064	-0.073463	0.000000	0.000000
6	0.073463	1.989064	-0.000000	0.000000
7	1.026113	0.009496	0.000000	0.000000
8	-0.009496	1.026113	-0.000000	0.000000
9	7.823967	-0.949149	0.000000	0.000000
10	0.949149	7.823967	-0.000000	0.000000
11	-17.291935	1.208768	5.996914	-0.461821
12	-1.533725	-17.094318	0.461821	5.996914
13	6.206443	-0.510415	-14.591261	1.130409
14	0.510415	6.206443	-1.545082	-14.402481

Trianglar Angmentex Matrix

	1	2	3	4	5
1	1.000000	-0.028700	-0.151144	0.014925	-0.000000
2	0.000000	1.000000	0.000052	-0.160225	0.000000
3	0.000000	0.000000	1.000000	-0.325418	-0.342113
4	0.000000	0.000000	0.000000	1.000000	-0.031899
5	0.000000	0.000000	0.000000	0.000000	1.000000
6	0.000000	0.000000	0.000000	0.000000	0.000000
7	0.000000	0.000000	0.000000	0.000000	0.000000
8	0.000000	0.000000	0.000000	0.000000	0.000000
9	0.000000	0.000000	0.000000	0.000000	0.000000
10	0.000000	0.000000	0.000000	0.000000	0.000000
11	0.000000	0.000000	0.000000	0.000000	0.000000
12	0.000000	0.000000	0.000000	0.000000	0.000000
13	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.000000	0.000000	0.000000	0.000000	0.000000

	6	7	8	9	10
1	-0.000000	-0.243135	0.005306	-0.000000	-0.000000
2	0.000000	0.019717	-0.255798	0.000000	0.000000
3	0.082722	-0.109691	0.020172	-0.000000	0.000000
4	-0.303078	0.002919	-0.100257	0.000000	0.000000
5	0.005073	-0.355454	-0.001213	-0.332065	0.011597
6	1.000000	0.022215	-0.351147	0.009249	-0.329577

7	0.000000	1.000000	-0.039918	3.827476	-0.362399
8	0.000000	0.000000	1.000000	0.049134	-0.152400
9	0.000000	0.000000	0.000000	1.000000	-0.125444
10	0.000000	0.000000	0.000000	0.000000	1.000000
11	0.000000	0.000000	0.000000	0.000000	0.000000
12	0.000000	0.000000	0.000000	0.000000	0.000000
13	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.000000	0.000000	0.000000	0.000000	0.000000

	11	12	13	14	15
1	-0.000000	-0.000000	-0.232793	0.027839	0.000000
2	0.000000	0.000000	-0.005014	-0.247285	0.000000
3	-0.000000	0.000000	-0.103362	0.029618	0.000000
4	0.000000	0.000000	-0.006579	-0.096471	0.000000
5	-0.254620	0.009404	-0.011663	0.001270	0.000000
6	0.006586	-0.252744	-0.001588	-0.010758	-0.000000
7	-7.585166	0.520586	2.729781	-0.211364	0.000000
8	-0.082260	-0.317589	0.029078	-0.084566	-0.000000
9	-0.802267	0.078394	0.136484	-0.010148	0.000000
10	0.015320	-0.550360	-0.009811	-0.006325	-0.000000
11	1.000000	-0.079636	-1.749722	0.126421	0.000000
12	0.000000	1.000000	0.093651	-0.574236	-0.000000
13	0.000000	0.000000	1.000000	-0.068477	0.000000
14	0.000000	0.000000	0.000000	1.000000	-0.000000

Voltage correction E(i), F(i) :

1	1	2	2
0.000000	-0.000000	0.000000	-0.000000
3	3	4	4
0.000001	-0.000000	0.000000	-0.000000
5	5	6	6
0.000000	-0.000000	0.000000	-0.000000
7	7		
0.000000	-0.000000		

CHANGE OF P0,V**2,P0(I),Q0(I),V0(I)

I	P0(I)	Q0(I)
1	-5.401671e-08	-9.983778e-07
2	2.048910e-08	1.937151e-07
3	2.247980e-07	-7.227063e-07
4	0.000000e+00	3.576279e-07
I	P0(I)	V0(I)
5	1.408625e-07	7.040761e-02
6	5.094334e-07	1.012665e-01
7	-1.518056e-07	3.657002e-02
8	3.518713e-01	0.000000e+00

max error is: 9.98378e-07

J MATRIX(Jacobian)

	1	2	3	4	5
1	-8.006926	0.229801	1.210196	-0.119500	0.000000
2	-0.793247	-7.604236	0.119500	1.210196	-0.000000
3	1.122197	-0.207572	-2.688539	0.864547	0.861754
4	0.207572	1.122197	-0.366734	-3.003397	0.208371
5	0.000000	0.000000	0.871024	-0.118874	-8.115140
6	-0.000000	0.000000	0.118874	0.871024	-0.562235
7	1.437593	-0.000319	0.000000	0.000000	2.127614
8	0.000319	1.437593	-0.000000	0.000000	-0.017872
9	0.000000	0.000000	0.000000	0.000000	2.896565
10	-0.000000	0.000000	-0.000000	0.000000	0.267271
11	0.000000	0.000000	0.000000	0.000000	2.188411
12	-0.000000	0.000000	-0.000000	0.000000	0.146049
13	1.974301	-0.271803	0.000000	0.000000	0.000000
14	0.271803	1.974301	-0.000000	0.000000	-0.000000

	6	7	8	9	10
1	0.000000	1.946760	-0.042484	0.000000	0.000000
2	0.000000	0.042484	1.946760	-0.000000	0.000000
3	-0.208371	0.000000	-0.000000	0.000000	-0.000000
4	0.861754	0.000000	0.000000	0.000000	0.000000
5	-0.017456	2.681708	0.010545	2.594059	-0.090598
6	-8.156571	-0.010545	2.681708	0.090598	2.594059
7	0.017872	-3.130521	0.083924	0.000000	0.000000
8	2.127614	0.138022	-6.052120	-0.000000	0.000000
9	-0.267271	0.000000	0.000000	-17.464493	2.326227
10	2.896565	-0.000000	0.000000	-1.845907	-17.250187
11	-0.146049	1.424737	-0.035535	7.715674	-0.722318
12	2.188411	0.035535	1.424737	0.722318	7.715674
13	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.000000	-0.000000	0.000000	-0.000000	0.000000

	11	12	13	14
1	0.000000	0.000000	1.863960	-0.222905
2	-0.000000	0.000000	0.222905	1.863960
3	0.000000	-0.000000	0.000000	-0.000000
4	0.000000	0.000000	0.000000	0.000000
5	1.989065	-0.073463	0.000000	0.000000
6	0.073463	1.989065	-0.000000	0.000000
7	1.026114	0.009495	0.000000	0.000000
8	-0.009495	1.026114	-0.000000	0.000000
9	7.823969	-0.949149	0.000000	0.000000
10	0.949149	7.823969	-0.000000	0.000000
11	-17.291939	1.208770	5.996915	-0.461821

12	-1.533726	-17.094322	0.461821	5.996915
13	6.206444	-0.510415	-14.591264	1.130409
14	0.510415	6.206444	-1.545082	-14.402482

Trianglar Angmentex Matrix

	1	2	3	4	5
1	1.000000	-0.028700	-0.151144	0.014925	-0.000000
2	0.000000	1.000000	0.000052	-0.160225	0.000000
3	0.000000	0.000000	1.000000	-0.325418	-0.342113
4	0.000000	0.000000	0.000000	1.000000	-0.031899
5	0.000000	0.000000	0.000000	0.000000	1.000000
6	0.000000	0.000000	0.000000	0.000000	0.000000
7	0.000000	0.000000	0.000000	0.000000	0.000000
8	0.000000	0.000000	0.000000	0.000000	0.000000
9	0.000000	0.000000	0.000000	0.000000	0.000000
10	0.000000	0.000000	0.000000	0.000000	0.000000
11	0.000000	0.000000	0.000000	0.000000	0.000000
12	0.000000	0.000000	0.000000	0.000000	0.000000
13	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.000000	0.000000	0.000000	0.000000	0.000000

	6	7	8	9	10
1	-0.000000	-0.243135	0.005306	-0.000000	-0.000000
2	0.000000	0.019717	-0.255798	0.000000	0.000000
3	0.082722	-0.109691	0.020172	-0.000000	0.000000
4	-0.303078	0.002920	-0.100257	0.000000	0.000000
5	0.005073	-0.355454	-0.001213	-0.332065	0.011597
6	1.000000	0.022215	-0.351147	0.009249	-0.329578
7	0.000000	1.000000	-0.039918	3.827477	-0.362399
8	0.000000	0.000000	1.000000	0.049134	-0.152400
9	0.000000	0.000000	0.000000	1.000000	-0.125444
10	0.000000	0.000000	0.000000	0.000000	1.000000
11	0.000000	0.000000	0.000000	0.000000	0.000000
12	0.000000	0.000000	0.000000	0.000000	0.000000
13	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.000000	0.000000	0.000000	0.000000	0.000000

	11	12	13	14	15
1	-0.000000	-0.000000	-0.232793	0.027839	-0.000000
2	0.000000	0.000000	-0.005014	-0.247285	0.000000
3	-0.000000	0.000000	-0.103362	0.029618	0.000000
4	0.000000	0.000000	-0.006579	-0.096471	-0.000000
5	-0.254620	0.009404	-0.011663	0.001270	-0.000000
6	0.006586	-0.252744	-0.001588	-0.010759	0.000000
7	-7.585167	0.520587	2.729782	-0.211364	0.000000
8	-0.082260	-0.317589	0.029078	-0.084566	0.000000

9	-0.802267	0.078394	0.136484	-0.010148	-0.000000
10	0.015320	-0.550360	-0.009811	-0.006325	0.000000
11	1.000000	-0.079636	-1.749722	0.126421	0.000000
12	0.000000	1.000000	0.093651	-0.574236	0.000000
13	0.000000	0.000000	1.000000	-0.068477	-0.000000
14	0.000000	0.000000	0.000000	1.000000	0.000000

Voltage correction E(i), F(i) :

1	1	2	2
-0.000000	0.000000	-0.000000	0.000000
3	3	4	4
-0.000000	0.000000	-0.000000	0.000000
5	5	6	6
-0.000000	0.000000	-0.000000	0.000000
7	7		
-0.000000	0.000000		

CHANGE OF P0,V**2,P0(I),Q0(I),V0(I)

I	P0(I)	Q0(I)
1	-9.872019e-08	5.811453e-07
2	-2.747402e-08	-2.384186e-07
3	1.396984e-09	1.065433e-06
4	0.000000e+00	-4.172325e-07
I	P0(I)	V0(I)
5	-1.061708e-07	7.040785e-02
6	-2.591405e-07	1.012669e-01
7	6.984919e-08	3.657037e-02
8	3.518720e-01	0.000000e+00

max error is: 1.06543e-06

J MATRIX(Jacobian)

	1	2	3	4	5
1	-8.006922	0.229801	1.210196	-0.119500	0.000000
2	-0.793246	-7.604235	0.119500	1.210196	-0.000000
3	1.122196	-0.207571	-2.688539	0.864547	0.861754
4	0.207571	1.122196	-0.366733	-3.003396	0.208371
5	0.000000	0.000000	0.871024	-0.118874	-8.115135
6	-0.000000	0.000000	0.118874	0.871024	-0.562234
7	1.437593	-0.000319	0.000000	0.000000	2.127613
8	0.000319	1.437593	-0.000000	0.000000	-0.017872
9	0.000000	0.000000	0.000000	0.000000	2.896565
10	-0.000000	0.000000	-0.000000	0.000000	0.267271
11	0.000000	0.000000	0.000000	0.000000	2.188410
12	-0.000000	0.000000	-0.000000	0.000000	0.146049
13	1.974300	-0.271803	0.000000	0.000000	0.000000
14	0.271803	1.974300	-0.000000	0.000000	-0.000000

	6	7	8	9	10
1	0.000000	1.946759	-0.042484	0.000000	0.000000
2	0.000000	0.042484	1.946759	-0.000000	0.000000
3	-0.208371	0.000000	-0.000000	0.000000	-0.000000
4	0.861754	0.000000	0.000000	0.000000	0.000000
5	-0.017457	2.681707	0.010545	2.594058	-0.090597
6	-8.156572	-0.010545	2.681707	0.090597	2.594058
7	0.017872	-3.130520	0.083924	0.000000	0.000000
8	2.127613	0.138022	-6.052118	-0.000000	0.000000
9	-0.267271	0.000000	0.000000	-17.464491	2.326225
10	2.896565	-0.000000	0.000000	-1.845905	-17.250185
11	-0.146049	1.424736	-0.035535	7.715673	-0.722317
12	2.188410	0.035535	1.424736	0.722317	7.715673
13	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.000000	-0.000000	0.000000	-0.000000	0.000000

	11	12	13	14
1	0.000000	0.000000	1.863959	-0.222905
2	-0.000000	0.000000	0.222905	1.863959
3	0.000000	-0.000000	0.000000	-0.000000
4	0.000000	0.000000	0.000000	0.000000
5	1.989064	-0.073463	0.000000	0.000000
6	0.073463	1.989064	-0.000000	0.000000
7	1.026113	0.009496	0.000000	0.000000
8	-0.009496	1.026113	-0.000000	0.000000
9	7.823968	-0.949148	0.000000	0.000000
10	0.949148	7.823968	-0.000000	0.000000
11	-17.291933	1.208767	5.996914	-0.461821
12	-1.533724	-17.094320	0.461821	5.996914
13	6.206442	-0.510415	-14.591259	1.130408
14	0.510415	6.206442	-1.545081	-14.402481

Trianglar Angmentex Matrix

	1	2	3	4	5
1	1.000000	-0.028700	-0.151144	0.014925	-0.000000
2	0.000000	1.000000	0.000052	-0.160225	0.000000
3	0.000000	0.000000	1.000000	-0.325418	-0.342113
4	0.000000	0.000000	0.000000	1.000000	-0.031899
5	0.000000	0.000000	0.000000	0.000000	1.000000
6	0.000000	0.000000	0.000000	0.000000	0.000000
7	0.000000	0.000000	0.000000	0.000000	0.000000
8	0.000000	0.000000	0.000000	0.000000	0.000000
9	0.000000	0.000000	0.000000	0.000000	0.000000
10	0.000000	0.000000	0.000000	0.000000	0.000000
11	0.000000	0.000000	0.000000	0.000000	0.000000

12	0.000000	0.000000	0.000000	0.000000	0.000000
13	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.000000	0.000000	0.000000	0.000000	0.000000

	6	7	8	9	10
1	-0.000000	-0.243135	0.005306	-0.000000	-0.000000
2	0.000000	0.019717	-0.255798	0.000000	0.000000
3	0.082722	-0.109691	0.020172	-0.000000	0.000000
4	-0.303078	0.002920	-0.100257	0.000000	0.000000
5	0.005073	-0.355454	-0.001213	-0.332065	0.011597
6	1.000000	0.022215	-0.351147	0.009249	-0.329577
7	0.000000	1.000000	-0.039918	3.827476	-0.362399
8	0.000000	0.000000	1.000000	0.049134	-0.152400
9	0.000000	0.000000	0.000000	1.000000	-0.125444
10	0.000000	0.000000	0.000000	0.000000	1.000000
11	0.000000	0.000000	0.000000	0.000000	0.000000
12	0.000000	0.000000	0.000000	0.000000	0.000000
13	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.000000	0.000000	0.000000	0.000000	0.000000

	11	12	13	14	15
1	-0.000000	-0.000000	-0.232793	0.027839	0.000000
2	0.000000	0.000000	-0.005014	-0.247285	-0.000000
3	-0.000000	0.000000	-0.103362	0.029618	-0.000000
4	0.000000	0.000000	-0.006579	-0.096471	-0.000000
5	-0.254620	0.009404	-0.011663	0.001270	0.000000
6	0.006586	-0.252744	-0.001588	-0.010758	-0.000000
7	-7.585165	0.520586	2.729781	-0.211364	-0.000000
8	-0.082260	-0.317589	0.029078	-0.084566	-0.000000
9	-0.802266	0.078394	0.136484	-0.010148	-0.000000
10	0.015320	-0.550360	-0.009811	-0.006325	-0.000000
11	1.000000	-0.079636	-1.749722	0.126421	-0.000000
12	0.000000	1.000000	0.093651	-0.574236	-0.000000
13	0.000000	0.000000	1.000000	-0.068477	0.000000
14	0.000000	0.000000	0.000000	1.000000	-0.000000

Voltage correction E(i), F(i) :

1	1	2	2
0.000000	-0.000000	-0.000000	-0.000000
3	3	4	4
0.000000	-0.000000	0.000000	-0.000000
5	5	6	6
-0.000000	-0.000000	0.000000	-0.000000
7	7		
0.000000	-0.000000		

CHANGE OF P0,V**2,P0(I),Q0(I),V0(I)

I	P0(I)	Q0(I)

```
  1   -5.867332e-08   -3.129244e-07
  2   -3.259629e-09   -2.980232e-08
  3    4.365575e-08   -1.383945e-06
  4    0.000000e+00    1.788139e-07
  I       P0(I)           V0(I)
  5    1.096632e-07    7.040785e-02
  6   -1.559965e-07    1.012669e-01
  7    6.938353e-08    3.657025e-02
  8    3.518715e-01    0.000000e+00
max error is: 1.38395e-06

THE RESULT ARE:
BUS DATA
BUS      VOLTAGE       ANGLE(DEGS.)       BUS P          BUS Q
  1  9.24570e-01         3.10681     2.50000e-01    2.00000e-01
  2  8.67663e-01        -1.73334    -2.20000e-01   -1.30000e-01
  3  8.60333e-01         4.08829     2.50000e-01    0.00000e+00
  4  6.82590e-01         4.34427     0.00000e+00   -1.00000e+00
  5  9.64154e-01         0.81668    -2.33000e-01    9.99997e-02
  6  9.48015e-01         2.38533     1.50000e-01    9.99987e-02
  7  9.81545e-01         2.08757     2.00000e-01    9.99997e-02
  8  1.00000e+00         0.00000    -3.51871e-01    7.11037e-01
 LINE FLOW
 1       1           2 9.908906e-02 5.858002e-02 1.791976e-03 1.164782e-02
2          1-9.729709e-02-4.693220e-02
 2       1           4 7.198494e-03 4.723170e-01 9.415781e-03 1.235822e-01
4          1 2.217287e-03-3.487347e-01
 3       1           7 1.389882e-02-1.107176e-01 1.236657e-03 7.066607e-03
7          1-1.266216e-02 1.177842e-01
 4       1           8 1.298136e-01-2.201782e-01 2.522290e-03 2.522278e-02
8          1-1.272914e-01 2.454010e-01
 5       2           3-7.357261e-02 2.611024e-02 1.628250e-03 7.753551e-03
3          2 7.520086e-02-1.835669e-02
 6       2           8-4.913033e-02-1.091781e-01 3.661439e-03 1.830721e-02
8          2 5.279177e-02 1.274853e-01
 7       3           4 2.395452e-02 4.761450e-01 6.636914e-03 9.828937e-02
4          3-1.731761e-02-3.778556e-01
 8       3           5 1.138659e-01-2.790539e-01 4.314363e-03 4.044724e-02
5          3-1.095515e-01 3.195011e-01
 9       3           6 3.697864e-02-1.787341e-01 2.102181e-03 1.934004e-02
6          3-3.487646e-02 1.980741e-01
10       4           6 1.510032e-02-2.734100e-01 7.120715e-03 1.068107e-01
6          4-7.979603e-03 3.802207e-01
11       5           6-1.851811e-01 8.196502e-02 1.040116e-03-1.386065e-01
```

```
6           5 1.862212e-01-2.205716e-01
12        5           8 6.173259e-02-3.014668e-01 1.480818e-03-8.611441e-02
8           5-6.025177e-02 2.153524e-01
13        6           7 6.634964e-03-2.577243e-01 8.620173e-04-1.044884e-01
7           6-5.772946e-03 1.532359e-01
14        7           8 2.184349e-01-1.710188e-01 1.314789e-03-4.822064e-02
8           7-2.171202e-01 1.227982e-01
The total iterations is: 22
```