CHAPTER VIII

RESULTS

Example. The example used in this paper is the same one in Ward and Hale "Digital Computer Solution of Power-Flow Problems". The results of method being considered are exactly the same, if the turn-ratio of the transformers

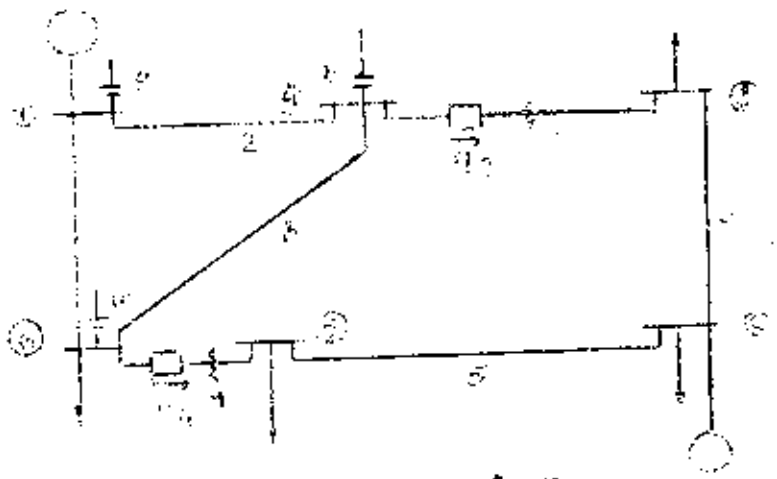

Fig. 23 Sample system

are the same. In this method, one of the two busbars is considered an important and will be adjusted as near its reference as possible. Hence the results of this solution is not the same as in Ward and Hale's report.

Branch Impedance, Per Unit

Branch	Impedance		Admittance	
No.	R	X	G	B
1	0.123	0.518	0.433934	-1.827463
2	0.080	0.310	0.558269	-2.581996
3	0.091	0.401	0.554102	-2.324944
4	0.000	0.300	0	-3.33333
5	0.282	0.640	0.576541	-1.308462
6	0.723	1.050	0.444860	-0.646063
7	0.000	0.133	0	-7.518791
8	0.000	-34.100	0	0.029326
9	0.000	-29.500	0	0.033898
10	0.000	-28.500	0	0.035088

Line parameters are given in the table , the admittance values are the same parameters as the impedance. Specified load and generation are added together and the results is shown in the table . The results of all steps were shown step by step. The accumacy of voltages, if there is a tap changes exceeds the 3rd dicimal points. The accuracy of powers exceed 5th dicimal point.

Table II Specified Terminal Condition, Per Unit.

Bus No.	E	Angle	P	Q
1	1.05	0	0.	
2	1.10		0.5	
3			-0.55	-0.13
4			0	0
5			-0.3	-0.18
6			-0.50	-0.5

Results of the input programme.

```
INJECT. CURRENT FOR VOLT. SOLUTION
   ACT. CURR.     REACT. CURR.
         .00000000          .00000000
        .00000000           .00000000
         .00000000          .00000000
         .58618283        -2.71109560
         .00000000          .00000000
         .45563109        -1.91883660
 ADMITTANCE FOR INVERT MATRIX
    K     J   A(K,J)        B(K,J)
   2     2    1.021401    -1.954524
   2     3     -.444860      .646062
   3     3      .444860    -8.164859
   2     4      .000000      .000000
   3     4      .000000     7.518796
   4     4    1.112371   -12.396409
   2     5     -.576540     1.308461
   3     5      .000000      .000000
   4     5      .000000      .000000
   5     5      .576540    -4.641794
   2     6      .000000      .000000
   3     6      .000000      .000000
   4     6     -.554102     2.324943
   5     6      .000000     3.333333
   6     6      .988036    -7.450652
 ADMITTANCE FOR OUT-PUT PROGRAM
    K     J   A(K,J)        B(K,J)
   1     1      .992203    -4.375561
   1     2      .000000      .000000
   2     2    1.021401    -1.954524
   1     3      .000000      .000000
   2     3     -.444860      .646062
   3     3      .444860    -8.164859
   1     4     -.558269     2.581995
   2     4      .000000      .000000
   3     4      .000000     7.518796
   4     4    1.112371   -12.396409
   1     5      .000000      .000000
   2     5     -.576540     1.308461
   3     5      .000000      .000000
   4     5      .000000      .000000
   5     5      .576540    -4.641794
   1     6     -.433934     1.827463
   2     6      .000000      .000000
   3     6      .000000      .000000
   4     6     -.554102     2.324943
   5     6      .000000     3.333333
   6     6      .988036    -7.450652
STOP 0000
```

Results of the admittance matrix inversion

INVERSE MATRIX

ROW	COL	R	X
1	1	.2[illegible]	.75753696
1	[illegible]	.03066247	.26[illegible]
2	2	.06507609	.37667000
1	3	.03049636	.2[illegible]
2	3	.06114134	.25571596
3	3	.05[illegible]	.26161[illegible]
1	4	.0043557[illegible]	.[illegible]1133337
2	4	.02405767	.1[illegible]
3	4	.03174209	.1716334[illegible]
4	4	.0945[illegible]	.53479408
1	5	.06660067	.2[illegible]126255
2	5	.03293297	.16671663
3	5	.03454378	.15031447
4	5	.07722577	.2[illegible]
5	5	.0738[illegible]	.30[illegible]15

END

Results of the voltage solution programme, tap changing is shown every step from the beginning to converge with a number of cycle indicated.

4	1.08476080	.0[illegible]
8	1.12816920	1.08539770
12	1.11010430	1.10[illegible]
16	1.10907290	1.11[illegible]
20	1.10922030	1.11274[illegible]
24	1.09357610	1.11254[illegible]
28	1.09357610	1.11166[illegible]
32	1.09357610	1.11110160
36	1.09357610	1.11108610
40	1.09357610	1.11108610
46		
1	TRANSFORMER	
1	1.09357610	
2	1.11108610	
1	ACT. VOLT	REACT. VOLT
2	[illegible]	.05728401
3	.[illegible]	.22030021
4	.[illegible]	.1566736.
5	.02946715	.[illegible]
6	.[illegible]	.19075322

STOP 0000

Actual taps were selected in the actual tap selected programme.....

And the solution of the system is obtained from the output programme.

TRANSFORMER 1 1.0[illegible]

TRANSFORMER 2 1.[illegible]

I	ACTIVE VOLT	REACTIVE VOLT
2	1.0[illegible]	.05767356
3	.[illegible]	.220[illegible]
4	.[illegible]	.15672631
5	.[illegible]	.[illegible]
6	.88163135	-.19083152

STOP 0000

I	VOLT(MAG)	DEGREES	P.	Q.
1	1.050000	.00000	.[illegible]	.[illegible]
2	1.0[illegible]	3.00541	.50000	.13402
3	.[illegible]	-12.73143	-.54999	.12998
4	.920815	-9.79965	-.00000	.00001
5	.951385	-12.30690	-.30000	.17999
6	.902047	-12.21339	-.49998	.05000

TOTAL LOSS = .10139

I	J	P(I-J)	Q(I-J)	P(J-I)	Q(J-I)
2	3	.176501	.000356	-.157886	-.027389
1	4	.508500	-.294786	-.483432	.178845
2	5	.323503	-.134376	-.294904	.069470
1	6	.442887	-.236124	-.414783	.117769
4	6	.091314	-.022509	-.090303	.018263

EX. 2

Some part of the whole system in Thailand is taken for load flow studied. The system taken consists of 6 busbars, the line parameters are shown in Table III and the sum of specified generation and load in Table IV and V. Power specified in table IV is the maximum generation case, 308.6mw, 19.30 Monday 30 January 1967. The date specified in table V is a min. case of the same system. All values are given in per unit.

Base VA = 100 KVA and Bus KVA base.

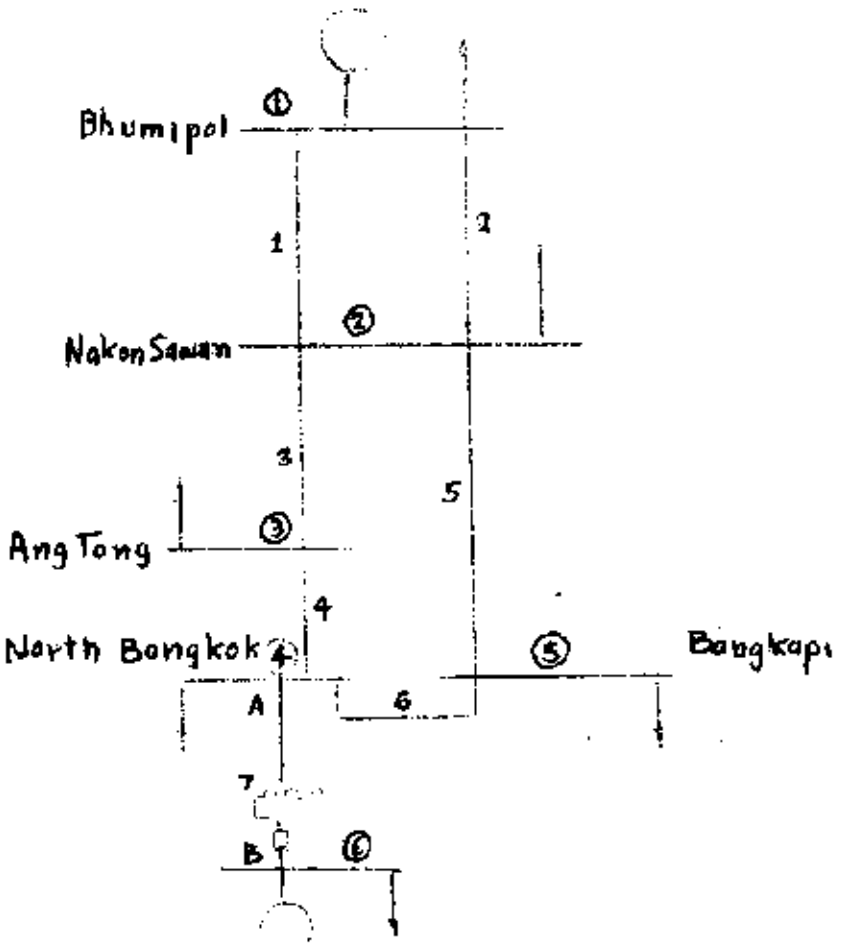

Table III

Branch Impedance, Per Unit

Branch	Impedance		Shut admittance
No.	R	X	B
1	.0226	.1582	.1760
2	.0226	.1582	.1760
3	.0136	.0960	.10625
4	.00992	.0694	.0768
5	.0253	.1782	.1898
6	.0018	.0128	.0069
7	0	.0996	-

The system nodal admittance is shown as follow:-

```
INJECT. CURRENT FOR VOLT. SOLUTION
    ACT. CURR.      REACT. CURR.
         .00000000          .00000000
         .46460176        -3.25221240
         .00000000          .00000000
         .00000000          .00000000
         .00000000          .00000000
         .00000000          .00000000
ADMITTANCE FOR INVERT MATRIX
   K     J A(K,J)        B(K,J)
   2     2    2.670115  -18.161810
   2     3   -1.446660   10.211723
   3     3    3.465067  -24.149384
   2     4     .000000     .000000
   3     4   -2.018407   14.120711
   4     4   12.791689 -100.687170
   2     5    -.780976    5.500792
   3     5     .000000     .000000
   4     5  -10.773282   76.610007
   5     5   11.554250  -81.914099
   2     6     .000000     .000000
   3     6     .000000     .000000
   4     6     .000000   10.040160
   5     6     .000000     .000000
   6     6     .000000  -10.040160
ADMITTANCE FOR OUT-PUT PROGRAM
   K     J  A(K,J)        B(K,J)
   1     1    .442477   -2.745345
   1     2   -.442477    3.097345
   2     2    2.670115  -18.161810
   1     3     .000000     .000000
   2     3   -1.446660   10.211723
   3     3   3.465067  -24.149384
   1     4     .000000     .000000
   2     4     .000000     .000000
   3     4   -2.018407   14.120711
   4     4   12.791689 -100.687170
   1     5     .000000     .000000
   2     5    -.780976    5.500792
   3     5     .000000     .000000
   4     5  -10.773282   76.610007
   5     5   11.554250  -81.914099
   1     6     .000000     .000000
   2     6     .000000     .000000
   3     6     .000000     .000000
   4     6     .000000   10.040160
   5     6     .000000     .000000
   6     6     .000000  -10.040160
STOP 0000
```

Case I Maximum Generation.

Table II Specify terminal condition, Per unit.

Bus No.	E	P	Q
1	1.05 0		
2		.0773	+.0478
3		.1460	+.090
4		.60	+.55
5		.556	+.325
6	1.00	.08	+.37 to -.63

The results is shown as follow:-

TRANSFORMER = .977777

I	VOLT(MAG)	DEGREES	P.	Q.
1	1.050000	.00000	1.59067	.04731
2	.994115	-27.06597	-.07729	.04769
3	.979535	-32.12387	-.14600	.08997
4	.967239	-34.62115	-.60036	.54913
5	.965850	-34.54937	-.55571	.32580
6	.999959	-35.10346	-.07992	-.54464

TOTAL LOSS = .13137

I - J	P(I-J)	Q(I-J)	P(J-I)	Q(J-I)
1 2	1.590674	.047313	-1.482179	-.070829
2 3	.763140	.034139	-.755064	.115747
2 5	.641736	.084388	-.630921	.204063
3 4	.609056	-.025772	-.605118	.143765
4 5	-.075172	-.109106	.075208	.121730
4 6	.079928	.514461	-.079928	-.544645

Case II Minimum Generation.

Table III Specified terminal condition, Per Unit.

Bas No.	E	Angle	P	Q
1	1.05	0		
2			-.02319	+.01434
3			-.0438	.027
4			-.2	-.07
5			-.203	-.001
6			-.07	-.03 to .97

TRANSFORMER = 1.059648

I	VOLT(MAG)	DEGREES	P.	Q.
1	1.050000	.00000	.56037	.53451
2	1.084246	-9.29704	-.02314	.01416
3	1.059432	-10.48366	-.04380	.02698
4	1.030423	-11.13269	-.19987	-.07239
5	1.036078	-11.15208	-.20310	.00125
6	.999984	-11.49867	-.07002	.92247

TOTAL LOSS = .02041

I - J	P(I-J)	Q(I-J)	P(J-I)	
1 2	.560373	.534518	-.546620	.171097
2 3	.282195	-.117940	-.280592	.350782
2 5	.241279	-.038993	-.238548	.446623
3 4	.236785	-.323794	-.234804	.477677
4 5	-.035093	.457539	.035439	-.445365
4 6	.070023	-1.005596	-.070023	.920693