Chapter 7

Development of The Load-Flow Program and Discussion of Result

7.1. Program Development

The Load-Flow program was written in Fortran-77, and the mini-computer VAX 11/750 has been used to develop and test for the desired result. As stated earlier in Chapter 4, the Diakoptics method was applied in the modified FDLF. The program module comprises 21 sub-programs, and each sub-program has its own function which may be called as needed. Nevertheless, the structure of the program is allowed to include new functions of sub-program. The program flow-chart was illustrated in Fig. 4.7, it describes steps of processing : input data of Power System, automatic sectionalization, matrices construction and factorization (see Appendix C), iteration process of Load-Flow calculation, and finally the Load-Flow output results. Various data covering all possible cases presented in technical papers, text books, PSS/E operation manual (61) and practical Power Systems, were chosen to test the program. The satsfied output results had been obtained. Appendix F is devoted as a guide for operation manual of the program and also the

details of input data and examples of tested system. The listing of the program and sub-programs functionally described are shown in Appendix G.

Example A practical, EGAT-Western area, data is as below:

Total Buses	Total Lines	Total Transformers	Total Areas	Base MVA	Tolerance
25	24	5	4	100.0	0.001

Transmission lines data:

Bus	to Bus	R	X	Y
1	3	0.00426	0.03142	0.28242
1	4	0.00270	0.01966	0.68200
2	5	0.03097	0.09092	0.01163
4	9	0.00205	0.01476	0.12964
5	8	0.04625	0.13581	0.01738
6	7	0.03366	0.10099	0.01246
6	13	0.01161	0.03482	0.00429
6	13	0.01218	0.03587	0.00455
6	14	0.02537	0.07433	0.00949
7	8	0.01279	0.03835	0.00473
9	18	0.00971	0.07061	0.62672
10	11	0.05805	0.12470	0.01483
11	19	0.03211	0.09632	0.01188
11	20	0.05454	0.16029	0.02048
12	17	0.00170	0.00810	0.00410
12	19	0.05401	0.16211	0.02001
13	16	0.02642	0.07926	0.00976
13	17	0.03647	0.10943	0.01350
15	16	0.01352	0.04055	0.00500
15	24	0.01148	0.03445	0.00425
17	22	0.03880	0.11828	0.01413
20	21	0.06334	0.18623	0.02379
22	23	0.03267	0.09745	0.01206
23	24	0.00913	0.02724	0.00337

Buses data:

Bus no.	Type	Volt	Load (MW/MVAr)		Generation (MW/MVAr)		Base KV	Shunt (MVAr)
1	3	1.045	0.0	0.0	0.0	0.0	230.0	0.0
2	1	1.0	0.3	0.2	0.0	0.0	115.0	0.0
3	2	1.055	0.0	0.0	240.0	0.0	230.0	0.0
4	1	1.0	191.2	21.2	0.0	0.0	230.0	0.0
5	2	1.05	0.0	0.0	30.0	0.0	115.0	0.0
6	1	1.0	40.5	25.1	0.0	0.0	115.0	0.0
7	1	1.0	10.8	6.7	0.0	0.0	115.0	0.0
8	1	1.0	16.2	10.0	0.0	0.0	115.0	0.0
9	1	1.0	0.0	0.0	0.0	0.0	230.0	0.0
10	2	1.05	0.0	0.0	13.0	0.0	115.0	0.0
11	2	1.04	22.7	14.1	0.0	0.0	115.0	0.0
12	1	1.0	6.0	3.7	0.0	0.0	115.0	0.0
13	1	1.0	35.1	21.8	0.0	0.0	115.0	0.0
14	1	1.0	15.6	9.7	0.0	0.0	115.0	0.0
15	2	1.03	52.6	32.6	64.2	0.0	115.0	0.0
16	1	1.0	52.6	32.6	0.0	6.0	115.0	0.0
17	1	1.0	11.5	7.1	0.0	0.0	115.0	0.0
18	1	1.0	0.0	0.0	0.0	0.0	230.0	0.0
19	1	1.0	15.4	9.6	0.0	0.0	115.0	6.3
20	1	1.0	10.7	6.6	0.0	0.0	115.0	6.3
21	1	1.0	83.8	6.2	0.0	0.0	115.0	20.0
22	1	1.0	16.9	10.5	0.0	0.0	115.0	0.0
23	1	1.0	23.4	14.5	0.0	0.0	115.0	0.0
24	2	1.02	23.4	14.5	0.0	0.0	115.0	0.0
25	1	1.0	2.5	1.6	0.0	0.0	115.0	0.0

Transformers data:

Bus	to Bus	X	Turn-ratio
2	1	0.11970	1.0125
25	3	0.16500	1.0125
6	4	0.03075	0.9625
12	9	0.06150	0.9750
21	18	0.05940	1.0000

**** OUT PUT ****

BUS NO.	VOLT PU.	VOLT KV	ANGLE (DEGREE)	GENERATION MW	GENERATION MVAR	DEMAND MW	DEMAND MVAR	SHUNT MVAR
1	1.0450	240.35	0.0000	299.47	-5.91	0.00	0.00	0.00
2	1.0453	120.21	-1.1520	0.00	0.00	0.30	0.20	0.00
3	1.0550	242.65	3.8604	240.00	-4.77	0.00	0.00	0.00
4	1.0265	236.09	-5.3596	0.00	0.00	191.20	21.20	0.00
5	1.0500	120.75	-2.1803	30.00	8.91	0.00	0.00	0.00
6	1.0458	120.27	-7.7387	0.00	0.00	40.50	25.10	0.00
7	1.0334	118.84	-6.3508	0.00	0.00	10.80	6.70	0.00
8	1.0323	118.72	-5.6340	0.00	0.00	16.20	10.00	0.00
9	1.0307	237.06	-6.7608	0.00	0.00	0.00	0.00	0.00
10	1.0500	120.75	-12.1283	13.00	1.63	0.00	0.00	0.00
11	1.0400	119.60	-12.9043	0.00	10.85	22.70	14.10	0.00
12	1.0447	120.14	-9.2283	0.00	0.00	6.00	3.70	0.00
13	1.0370	119.26	-8.7544	0.00	0.00	35.10	21.80	0.00
14	1.0353	119.06	-8.2291	0.00	0.00	15.60	9.70	0.00
15	1.0300	118.45	-12.3106	64.20	82.57	52.60	32.60	0.00
16	1.0205	117.35	-11.7437	0.00	6.00	52.60	32.60	0.00
17	1.0423	119.87	-9.3811	0.00	0.00	11.50	7.10	0.00
18	1.0500	241.51	-10.3345	0.00	0.00	0.00	0.00	0.00
19	1.0376	119.32	-12.0121	0.00	0.00	15.40	9.60	6.78
20	1.0469	120.39	-13.5097	0.00	0.00	10.70	6.60	6.90
21	1.0566	121.51	-13.0803	0.00	0.00	83.80	6.20	22.33
22	1.0194	117.24	-11.5691	0.00	0.00	16.90	10.50	0.00
23	1.0153	116.76	-12.6700	0.00	0.00	23.40	14.50	0.00
24	1.0200	117.30	-12.6942	0.00	9.88	23.40	14.50	0.00
25	1.0394	119.53	3.6422	0.00	0.00	2.50	1.60	0.00

**** LINE FLOW ****

LINE NO.	FROM BUS P	TO BUS Q	FLOW FROM P MW	FLOW FROM P MVAR	FLOW TO Q MW	FLOW TO Q MVAR	LOSS MW	LOSS MVAR
1	1	3	-235.338	-8.811	237.500	-6.379	2.162	15.948
2	1	4	516.690	14.101	-510.024	-38.732	6.666	48.538
3	2	5	17.823	-11.913	-17.697	11.006	0.126	0.370
4	4	9	168.263	-57.302	-167.663	47.910	0.600	4.323
5	5	8	47.695	-2.092	-46.740	3.012	0.955	2.804
6	6	7	-19.375	18.957	19.609	-19.601	0.234	0.703
7	6	13	57.756	7.398	-57.396	-6.782	0.360	1.081
8	6	13	56.002	6.838	-55.647	-6.286	0.355	1.045
9	6	14	15.681	8.900	-15.604	-9.700	0.078	0.227
10	7	8	-30.411	12.901	30.542	-13.012	0.131	0.394
11	9	18	90.355	-70.963	-89.479	9.494	0.876	6.370
12	10	11	13.000	1.631	-12.908	-3.053	0.092	0.198
13	11	19	-14.874	7.070	14.957	-8.102	0.083	0.250
14	11	20	5.081	-7.268	-5.049	5.133	0.032	0.095
15	12	17	40.468	21.776	-40.435	-22.065	0.033	0.157
16	12	19	30.836	-6.005	-30.354	5.284	0.483	1.448
17	13	16	69.702	-0.296	-68.508	2.844	1.194	3.581
18	13	17	8.233	-8.436	-8.190	7.107	0.043	0.129
19	15	16	-15.769	29.348	15.913	-29.444	0.143	0.430
20	15	24	27.368	20.621	-27.240	-20.683	0.128	0.384
21	17	22	37.126	7.858	-36.608	-7.778	0.519	1.582
22	20	21	-5.651	-4.828	5.676	2.272	0.026	0.075
23	22	23	19.706	-2.722	-19.582	1.842	0.123	0.368
24	23	24	-3.813	-16.342	3.837	16.066	0.024	0.073

**** SYSTEM TOTAL ****

	MW	MVAR
GENERATION	646.67	109.17
LOAD	631.20	248.30
LINE CHARGING	0.00	209.80
STATIC CAPACITOR	0.00	36.02
LOSS	15.47	106.68
MISMATCH	0.00	0.00

7.2. Discussion of Result

This system was processed by a standard package of Power Flow Program commercially available in market, Power System Simulator Engineering (PSS/E). The result is shown in a Load-Flow Diagram in Fig. 7.1. The program in this dessertation gives a solution close to PSS/E 's solution.

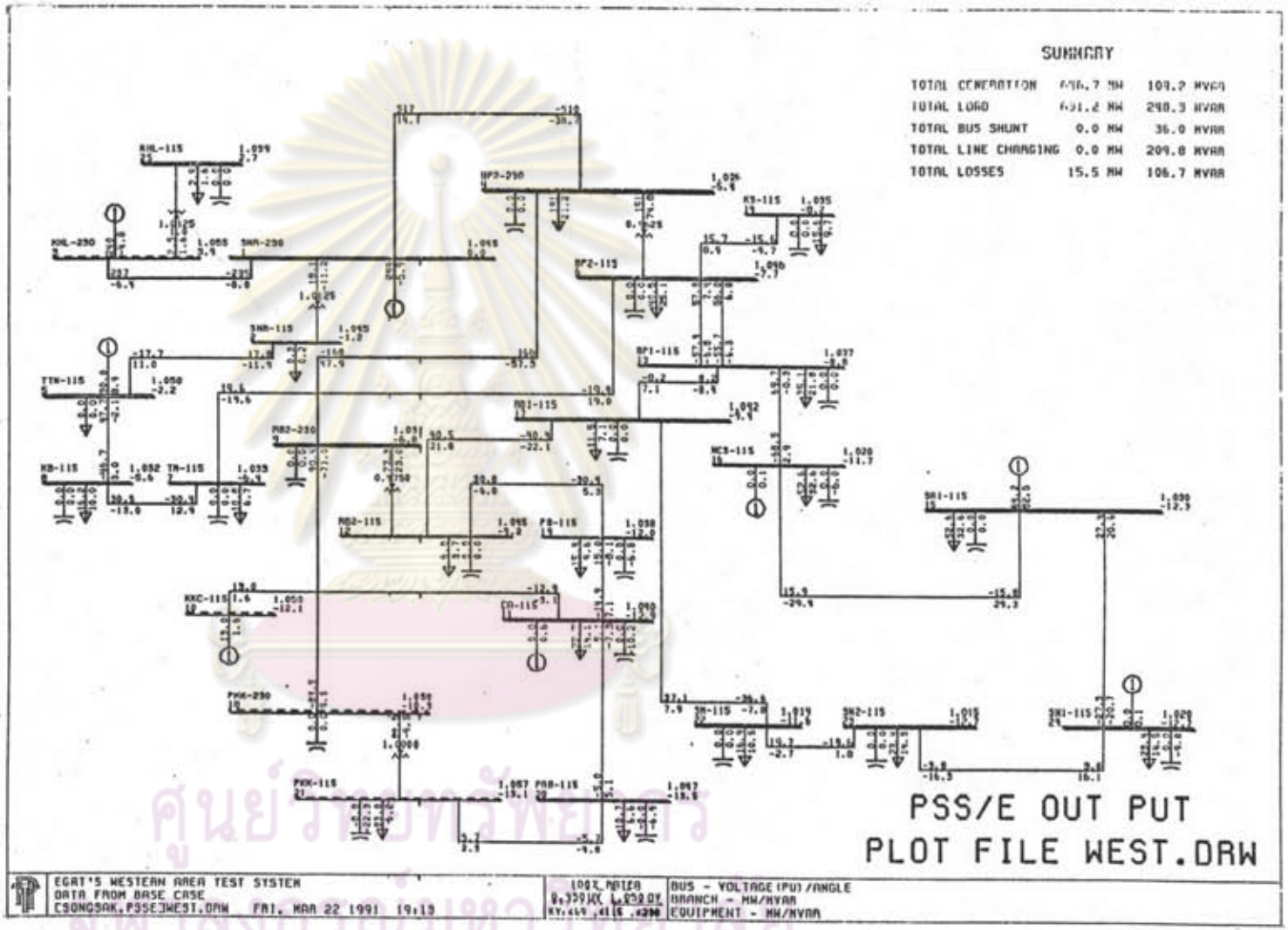

Fig. 7.1 PSS/E Output in A Load-Flow Diagram.