

Appendix C

Data for UPSEB 75-bus system

The UPSEB 75-bus test system is shown in Fig.C.1. The bus, line and generator data have been taken from [7]. The base MVA is 100. The relevant data are provided in the following tables.

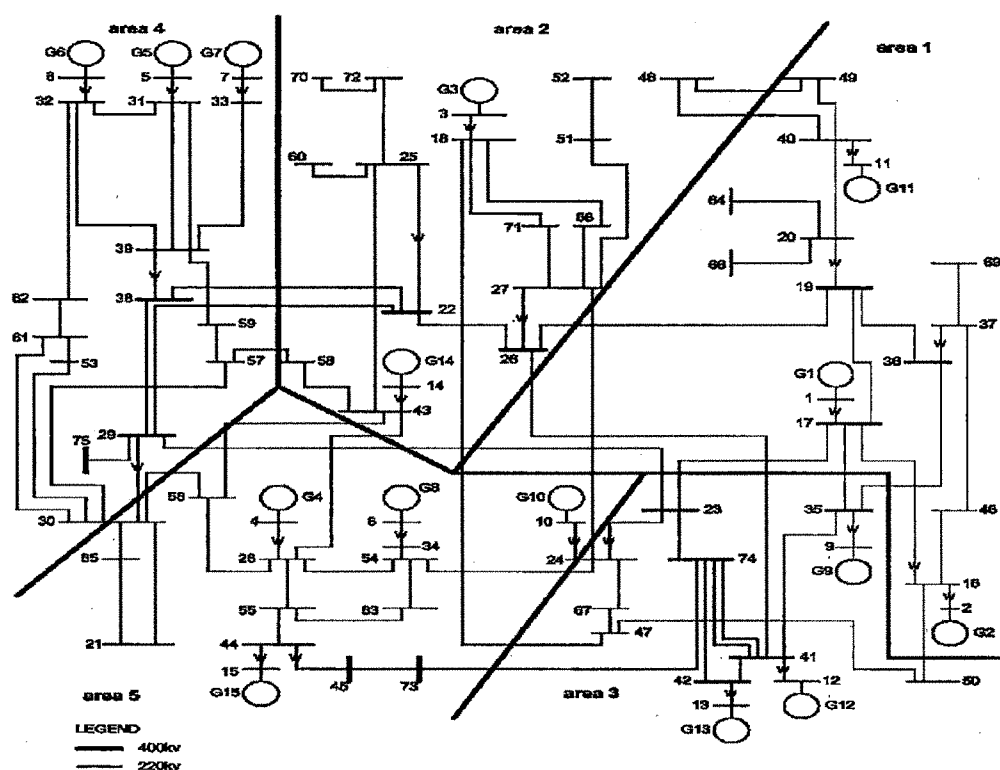


Figure C.1: UPSEB 75-bus test system

Table C.1: Generator bus data

Bus no.	Scheduled real power generation (P_g)(MW)	Specified voltage magnitude (V_g)(pu)	Load demand	
			Real, (P_d)(MW)	Reactive, (Q_d)(MVAR)
1(slack)	725	1.030	1600	1600
2	260	1.030	500	500
3	180	1.050	0	500
4	200	1.030	500	500
5	500	1.050	500	1000
6	400	1.050	0	0
7	212.83	1.050	0	500
8	80	1.050	0	60
9	550	1.050	0	0
10	80	1.020	0	700
11	109	1.020	0	0
12	500	1.050	0	875
13	900	1.050	0	0
14	150	1.030	0	50
15	454	1.010	0	550

Table C.2: Generator data

Gen. no.	Real power generation limit (MW)		Reactive power generation limit (MVAR)		Voltage magnitude limit (pu)	
	P_{max}	P_{min}	Q_{max}	Q_{min}	V_{max}	V_{min}
1	2000	10	1700	-10	1.05	0.95
2	500	100	1500	-10	1.1	0.95
3	200	40	1500	-10	1.1	0.95
4	500	40	1500	-10	1.1	0.95
5	800	0	1500	-10	1.1	0.95
6	700	0	1500	-10	1.1	0.95
7	400	0	1500	-10	1.1	0.95
8	500	20	1500	-10	1.1	0.95
9	770	60	1550	-10	1.1	0.95
10	500	30	1500	-10	1.1	0.95
11	200	40	1500	-10	1.1	0.95
12	1800	100	1544	-10	1.1	0.95
13	1300	100	580	-10	1.1	0.95
14	500	50	200	-10	1.1	0.95
15	654	50	200	-30	1.1	0.95

Table C.3: Load bus data

Bus no.	Load		Voltage magnitude limit (pu)	
	P_d (MW)	Q_d (MVAR)	V_{max}	V_{min}
16	25	75	1.05	0.95
17	0	0	1.05	0.95
18	0	0	1.05	0.95
19	0	50	1.05	0.95
20	75	33.93	1.05	0.95
21	0	0	1.05	0.95
22	0	0	1.05	0.95
23	0	0	1.05	0.95
24	10	10.53	1.05	0.95
25	25	10.43	1.05	0.95
26	0	0	1.05	0.95
27	10	10.70	1.05	0.95
28	20	10.35	1.05	0.95
29	0	0	1.05	0.95
30	20	10.24	1.05	0.95
31	0	0	1.05	0.95
32	30	11.59	1.05	0.95
33	0	0	1.05	0.95
34	20	10	1.05	0.95
35	0	0	1.05	0.95
36	0	0	1.05	0.95
37	20	10.93	1.05	0.95
38	0	0	1.05	0.95
39	20	10.46	1.05	0.95
40	0	0	1.05	0.95
41	0	0	1.05	0.95
42	20	0	1.05	0.95
43	0	0	1.05	0.95
44	0	0	1.05	0.95
45	0	0	1.05	0.95
46	20	20.36	1.05	0.95
47	30	8.77	1.05	0.95
48	50.83	13.97	1.05	0.95
49	30	15.58	1.05	0.95
50	50	15.94	1.05	0.95
51	25	0.62	1.05	0.95

Table C.4: Load bus data.....Contd.

Bus no.	Load		Voltage magnitude limit (pu)	
	P_d (MW)	Q_d (MVAR)	V_{max}	V_{min}
52	30	18.15	1.05	0.95
53	25	0.33	1.05	0.95
54	50	29	1.05	0.95
55	50	31.08	1.05	0.95
56	30	34.32	1.05	0.95
57	50	18.53	1.05	0.95
58	30	11.29	1.05	0.95
59	20	11.01	1.05	0.95
60	30	7.42	1.05	0.95
61	25	6.58	1.05	0.95
62	25	18.13	1.05	0.95
63	58.03	5.31	1.05	0.95
64	15	13.33	1.05	0.95
65	30	12.81	1.05	0.95
66	31.24	15.18	1.05	0.95
67	40	10.55	1.05	0.95
68	42.87	33.60	1.05	0.95
69	55.94	32.53	1.05	0.95
70	23.34	2.30	1.05	0.95
71	91.73	21.36	1.05	0.95
72	52.52	11.76	1.05	0.95
73	20	0	1.05	0.95
74	10	0	1.05	0.95
75	50	0	1.05	0.95

Table C.5: Reactor data

Bus no.	Resistance (pu)	Susceptance (pu)	Rating (MVAR)
17	0	-0.907	100
19	0	-0.453	50
22	0	-0.453	50
23	0	-0.907	100
26	0	-1.478	163
29	0	-0.453	100
35	0	-0.453	50
36	0	-0.453	50
41	0	-2.022	223
42	0	-0.571	63
73	0	-0.453	50
74	0	-2.476	283

Table C.6: Transmission line data

Line no.	From bus	To bus	Series impedance		Total shunt susceptance, b(pu)	Rating (MVA)	Tap settings
			Resistance, r(pu)	Reactance, x(pu)			
1	19	20	0.00065	0.00260	0	50	1.00
2	17	16	0.00065	0.00260	0	480	1.00
3	22	25	0.00065	0.02060	0	100	0.98
4	23	24	0.00065	0.0026	0	480	0.95
5	26	27	0.00065	0.0026	0	480	0.89
6	29	30	0.00043	0.9017	0	720	1.0
7	36	37	0.00065	0.00604	0	480	0.97
8	38	39	0.00130	0.0052	0	240	0.98
9	45	44	0.00056	0.0022	0	630	0.87
10	16	2	0.00123	0.0024	0	472	0.89
11	18	3	0.00001	0.0029	0	480	0.97
12	17	1	0.00073	0.0014	0	960	0.85
13	28	4	0.00306	0.0061	0	185	0.89
14	31	5	0.0023	0.0047	0	276	0.88
15	32	6	0.0051	0.0028	0	124	0.98
16	33	7	0.00549	0.0109	0	100	0.88
17	34	8	0.00001	0.0048	0	250	0.89
18	35	9	0.00049	0.0019	0	720	0.95
19	24	10	0.00243	0.0048	0	250	0.94
20	40	11	0.0077	0.0027	0	375	0.99
21	41	12	0.0001	0.0059	0	2376	0.89
22	42	13	0.0003	0.0011	0	1176	0.95
23	43	14	0.00001	0.0028	0	528	0.98
24	44	15	0.00001	0.0022	0	660	0.97
25	16	46	0.0081	0.0038	0.280	300	0
26	16	50	0.0099	0.0474	0.772	450	0
27	17	19	0.0046	0.0477	1.249	500	0
28	17	23	0.0078	0.0799	2.094	500	0
29	23	29	0.0080	0.0816	2.136	500	0
30	20	64	0.0183	0.0927	0.147	150	0
31	19	26	0.0029	0.0299	0.781	550	0
32	47	50	0.010	0.0522	0.377	300	0
33	47	67	0.0066	0.031	0.114	300	0
34	24	27	0.0050	0.024	0.174	300	0
35	24	54	0.0129	0.0617	0.446	300	0
36	27	51	0.0160	0.0810	0.128	150	0
37	51	52	0.0155	0.0794	0.126	150	0
38	25	60	0.0166	0.0843	0.134	150	0
39	25	43	0.0127	0.0641	0.104	150	0
40	34	54	0.0177	0.0851	0.605	300	0

Table C.7: Transmission line data..... Contd

Line no.	From bus	To bus	Series impedance		Total shunt susceptance, $b(\text{pu})$	Rating (MVA)	Tap settings
			Resistance, $r(\text{pu})$	Reactance, $x(\text{pu})$			
41	54	28	0.0106	0.0506	0.3664	300	0
42	28	43	0.0058	0.0290	0.0474	180	0
43	28	56	0.0037	0.0178	0.1288	300	0
44	56	30	0.0049	0.0237	0.1718	300	0
45	30	57	0.0075	0.0384	0.0622	180	0
46	53	30	0.0067	0.0341	0.0556	180	0
47	53	61	0.0066	0.0339	0.0534	150	0
48	30	61	0.0144	0.0731	0.117	150	0
49	57	58	0.0067	0.0339	0.053	180	0
50	57	59	0.0058	0.0295	0.046	180	0
51	59	39	0.0141	0.0718	0.114	150	0
52	39	31	0.0144	0.0725	0.118	150	0
53	39	33	0.0070	0.0359	0.228	300	0
54	54	63	0.0099	0.0509	0.080	150	0
55	55	63	0.0078	0.0398	0.0628	180	0
56	61	62	0.0116	0.0583	0.095	150	0
57	62	32	0.0069	0.035	0.225	300	0
58	31	32	0.0005	0.0025	0.016	360	0
59	35	36	0.0047	0.0488	1.272	500	0
60	46	37	0.0173	0.0878	0.139	150	0
61	19	36	0.0025	0.0258	0.675	500	0
62	17	35	0.0005	0.0051	0.135	600	0
63	20	40	0.0058	0.0294	0.188	300	0
64	40	48	0.0083	0.0424	0.066	150	0
65	74	41	0.0092	0.0942	2.465	500	0
66	74	41	0.0083	0.0847	2.217	500	0
67	74	73	0.005	0.0568	1.487	500	0
68	26	22	0.0065	0.0661	1.730	500	0
69	29	22	0.0026	0.0264	0.692	550	0
70	26	41	0.0082	0.0837	2.190	500	0
71	48	49	0.0093	0.0475	0.074	150	0
72	49	40	0.0133	0.0668	0.108	150	0
73	38	29	0.0037	0.0376	0.977	550	0
74	38	22	0.0032	0.0330	0.865	550	0
75	18	47	0.0043	0.0255	0.187	360	0
76	30	65	0.0024	0.0118	0.085	360	0
77	41	42	0.0003	0.0031	0.081	600	0
78	42	74	0.0091	0.0930	2.433	500	0
79	20	66	0.0132	0.0666	0.108	150	0
80	23	74	0.0001	0.0015	0.054	1200	0

Table C.8: Transmission line data..... Contd..

Line no.	From bus	To bus	Series impedance		Total shunt susceptance, b(pu)	Rating (MVA)	Tap settings
			Resistance, r(pu)	Reactance, x(pu)			
81	24	67	0.0012	0.0059	0.0429	360	0
82	18	68	0.0033	0.0019	0.0361	180	0
83	18	71	0.0134	0.0078	0.1446	170	0
84	27	68	0.0134	0.0070	0.1446	170	0
85	27	71	0.0033	0.0096	0.0361	180	0
86	25	72	0.0159	0.0081	0.1280	150	0
87	43	58	0.0131	0.0066	0.1055	150	0
88	43	56	0.0049	0.0023	0.1704	300	0
89	55	44	0.0099	0.0079	0.3409	300	0
90	73	45	0.0012	0.0011	1.4563	1000	0
91	29	75	0.0005	0.0051	0.1352	600	0
92	37	69	0.0121	0.0061	0.0991	300	0
93	70	72	0.0087	0.0043	0.716	180	0
94	21	65	0.0008	0.0003	0.0286	350	0
95	21	30	0.0069	0.0035	0.0568	150	0
96	28	55	0.0199	0.1001	0.1610	500	0
97	35	41	0.0003	0.0003	0.0811	500	0
98	39	32	0.0144	0.0072	0.118	150	0



Table C.9: Generator active power cost function (bid function)

Gen no.	a_m (\$/MW ² h)	b_m (\$/MWh)	c_m
1	0.00375	30	0
2	0.0175	20	0
3	0.0625	15	0
4	0.00834	02	0
5	0.025	01	0
6	0.025	03	0
7	0.00375	09	0
8	0.0175	15	0
9	0.0625	12	0
10	0.00834	06	0
11	0.025	15	0
12	0.00375	10	0
13	0.0175	11	0
14	0.0625	08	0
15	0.00834	10	0

- Active power cost function:

$$C_{Gm}(P_{Gm}) = a_m(P_{Gm})^2 + b_m(P_{Gm}) + C_m$$

where, a_m , b_m and c_m are pre-determined cost coefficients

P_{Gm} : Active power output of a m^{th} generator

Table C.10: Generator reactive power cost function

Gen no.	a_m (\$/MVAR ² h)	b_m (\$/MVARh)	c_m
1	0.0003	0.2	10
2	0.0017	0.17	10
3	0.0062	0.1	10
4	0.0008	0.32	10
5	0.0025	0.30	10
6	0.0025	0.30	10
7	0.0003	0.2	10
8	0.0017	0.17	10
9	0.0062	0.3	10
10	0.0008	0.42	10
11	0.0025	0.40	10
12	0.0003	0.30	10
13	0.0017	0.28	10
14	0.0062	0.15	10
15	0.0008	0.42	10

- Reactive power cost function:

$$C_{Gm}(Q_{Gm}) = a_m(Q_{Gm})^2 + b_m(Q_{Gm}) + c_m$$

where, a_m , b_m and c_m are pre-determined cost coefficients

Q_{Gm} : Reactive power output of a m^{th} generator

Table C.11: Consumers bid functions

Load bus	a_n (\$/MW ² h)	b_n (\$/MWh)	c_n
16	-0.15	40	0
17	-0.30	50	0
18	-0.25	30	0
19	-0.20	20	0
20	-0.15	35	0
21	-0.17	31	0
22	-0.22	45	0
23	-0.30	40	0
24	-0.25	32	0
25	-0.30	40	0
26	-0.27	20	0
27	-0.40	30	0
28	-0.45	40	0
29	-0.20	10	0
30	-0.25	15	0
31	-0.35	17	0
32	-0.40	18	0
33	-0.45	20	0
34	-0.50	10	0
35	-0.60	15	0
36	-0.20	20	0
37	-0.25	30	0
38	-0.30	35	0
39	-0.35	25	0
40	-0.40	20	0
41	-0.45	10	0
42	-0.50	05	0
43	-0.55	40	0
44	-0.30	15	0
45	-0.35	20	0

- Consumer bid function:

$$B_{Dn}(P_{Dn}) = a_n(P_{Dn})^2 + b_n(P_{Dn}) + C_n$$

where, a_n , b_n and c_n are pre-determined bid coefficients

P_{Dn} : Active power demand of a n^{th} consumer

Table C.12: Consumers bid functions.....Contd.

Load bus	a_n (\$/MW ² h)	b_n (\$/MWh)	c_n
46	-0.40	10	0
47	-0.45	15	0
48	-0.30	20	0
49	-0.25	10	0
50	-0.27	15	0
51	-0.30	20	0
52	-0.35	30	0
53	-0.40	40	0
54	-0.45	30	0
55	-0.30	10	0
56	-0.35	20	0
57	-0.40	40	0
58	-0.45	30	0
59	-0.30	20	0
60	-0.35	40	0
61	-0.40	20	0
62	-0.20	10	0
63	-0.25	25	0
64	-0.30	27	0
65	-0.35	35	0
66	-0.20	20	0
67	-0.25	25	0
68	-0.10	15	0
69	-0.30	15	0
70	-0.32	35	0
71	-0.45	25	0
72	-0.32	20	0
73	-0.25	30	0
74	-0.30	10	0
75	-0.35	20	0

- Consumer bid function:

$$B_{Dn}(P_{Dn}) = a_n(P_{Dn})^2 + b_n(P_{Dn}) + c_n$$

where, a_n , b_n and c_n are pre-determined bid coefficients

P_{Dn} : Active power demand of a n^{th} consumer