Appendix B

Data for IEEE 30-bus test system

The IEEE 30-bus test system is shown in Fig. B.1 The system data is taken from [3] and buses are renumbered. The base MVA is 100. The relevant data are provided in following tables.

Table B.1: Generator bus data

Bus no.	Scheduled real power generation (P_g)(MW)	Specified voltage magnitude (V_g)(pu)	Load demand	
			P_d(MW)	Q_d (MVAR)
1(slack)	23.54	1.00	0	0
2	60.97	1.00	21.7	12.7
13	37	1.00	0	0
22	23.50	1.00	0	0
23	19.2	1.00	3.2	1.6
27	29.50	1.00	0	0

Table B.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	80	0	150	-20	1.05	0.95
2	80	0	60	-20	1.1	0.95
13	40	0	44.7	-15	1.1	0.95
22	50	0	62.5	-15	1.1	0.95
23	30	0	40	-10	1.1	0.95
27	55	0	48.7	-15	1.1	0.95

Table B.3: Load bus data

Bus no.	Load		Voltage magnitude limit (pu)		External shunt susceptance (pu)
	P_d(MW)	Q_d(MVAR)	V_{max}	V_{min}	
3	2.4	1.2	1.05	0.95	0
4	7.6	1.6	1.05	0.95	0
5	0	0	1.05	0.95	**+0.19**
6	0	0	1.05	0.95	0
7	22.8	10.9	1.05	0.95	0
8	30	30	1.05	0.95	0
9	0	0	1.05	0.95	0
10	5.8	2	1.05	0.95	0
11	0	0	1.05	0.95	0
12	11.2	7.5	1.05	0.95	0
14	6.2	1.6	1.05	0.95	0
15	8.2	2.5	1.05	0.95	0
16	3.5	1.8	1.05	0.95	0
17	9	5.8	1.05	0.95	0
18	3.2	0.9	1.05	0.95	0
19	9.5	3.4	1.05	0.95	0
20	2.2	0.7	1.05	0.95	0
21	17.5	11.2	1.05	0.95	0
24	8.7	6.7	1.05	0.95	**+0.04**
25	0	0	1.05	0.95	0
26	3.5	2.3	1.05	0.95	0
28	0	0	1.05	0.95	0
29	2.4	0.9	1.05	0.95	0
30	10.6	1.9	1.05	0.95	0

Table B.4: 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	1	2	0.02	0.06	0.03	130	0
2	1	3	0.05	0.19	0.02	130	0
3	2	4	0.06	0.17	0.02	65	0
4	3	4	0.01	0.04	0	130	0
5	2	5	0.05	0.2	0.02	130	0
6	2	6	0.06	0.18	0.02	65	0
7	4	6	0.01	0.04	0	90	0
8	5	7	0.05	0.12	0.01	70	0
9	6	7	0.03	0.08	0.01	130	0
10	6	8	0.01	0.04	0	65	0
11	6	9	0	0.21	0	65	1.015
12	6	10	0	0.56	0	32	0.962
13	9	11	0	0.21	0	65	0
14	9	10	0	0.11	0	65	0
15	4	12	0	0.26	0	65	1.012
16	12	13	0	0.14	0	65	0
17	12	14	0.12	0.26	0	32	0
18	12	15	0.07	0.13	0	32	0
19	12	16	0.09	0.2	0	32	0
20	14	15	0.22	0.2	0	16	0
21	16	17	0.08	0.19	0	16	0
22	15	18	0.11	0.22	0	16	0
23	18	19	0.06	0.13	0	16	0
24	19	20	0.03	0.07	0	32	0
25	10	20	0.09	0.21	0	32	0
26	10	17	0.03	0.08	0	32	0
27	10	21	0.03	0.07	0	32	0
28	10	22	0.07	0.15	0	32	0
29	21	22	0.01	0.02	0	65	0
30	15	23	0.1	0.2	0	16	0
31	22	24	0.12	0.18	0	16	0
32	23	24	0.13	0.27	0	16	0
33	24	25	0.19	0.33	0	16	0
34	25	26	0.25	0.38	0	16	0
35	25	27	0.11	0.21	0	16	0
36	28	27	0	0.4	0	65	0.958
37	27	29	0.22	0.42	0	16	0
38	27	30	0.32	0.6	0	16	0
39	29	30	0.24	0.45	0	16	0
40	8	28	0.06	0.2	0.02	32	0
41	6	28	0.02	0.06	0.01	32	0

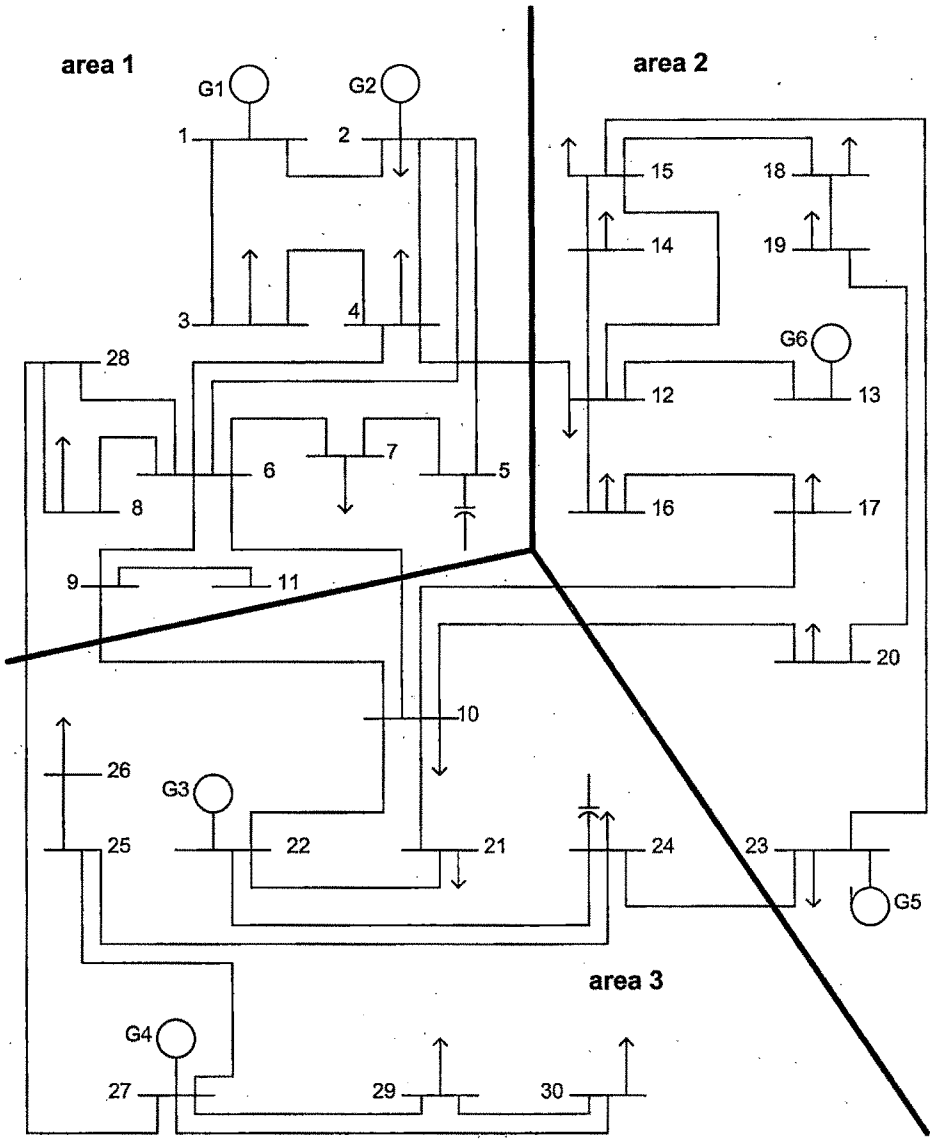

Figure B.1: IEEE 30-bus test system

Table B.5: Generator active power cost functions

Gen. no.	a_m ($/MW^{2}h)	b_m($/MWh)	c_m
1	0.00375	2	0
2	0.0175	1.75	0
5	0.0625	1	0
8	0.00834	3.25	0
11	0.025	3	0
13	0.025	3	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 B.6: Generator reactive power cost functions

Gen no.	a_m ($/MVAR^{2}H)	b_m($/MVARH)	c_m
1	0.00037	0.2	10
2	0.00175	0.17	10
5	0.00625	0.1	10
8	0.00083	0.32	10
11	0.0025	0.30	10
13	0.0025	0.30	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 B.7: Consumers bid functions

For all Load buses	a_n ($/MW^{2}h)	b_n($/MWh)	c_n
	-0.15	40	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 cost coefficients
P_{Dn}: Active power demand of a n^{th} consumer

Table B.8: Generator bid functions

Gen. no.	a_m ($/MW^2-DAY)	b_m($/MW-DAY)	c_m
1	11	0	0
2	17	0	0
3	19	0	0
4	20	0	0
5	15	0	0
6	10	0	0

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