Appendix A

Data for the IEEE 24 bus Reliability Test System

The IEEE 24 bus Reliability Test System (or IEEE 24 bus RTS) [193], as shown in Fig.A.1, is used in the thesis for different simulations conducted in Chapter 4, Chapter 5, Chapter 6 and Chapter 7. The bus data and transmission line data are given at 100 MVA in Table A.1 and Table A.2 respectively. The market data for reactive power offers (Bids) [57], as used in Chapter 5 and Chapter 7, is given in Table A.3.

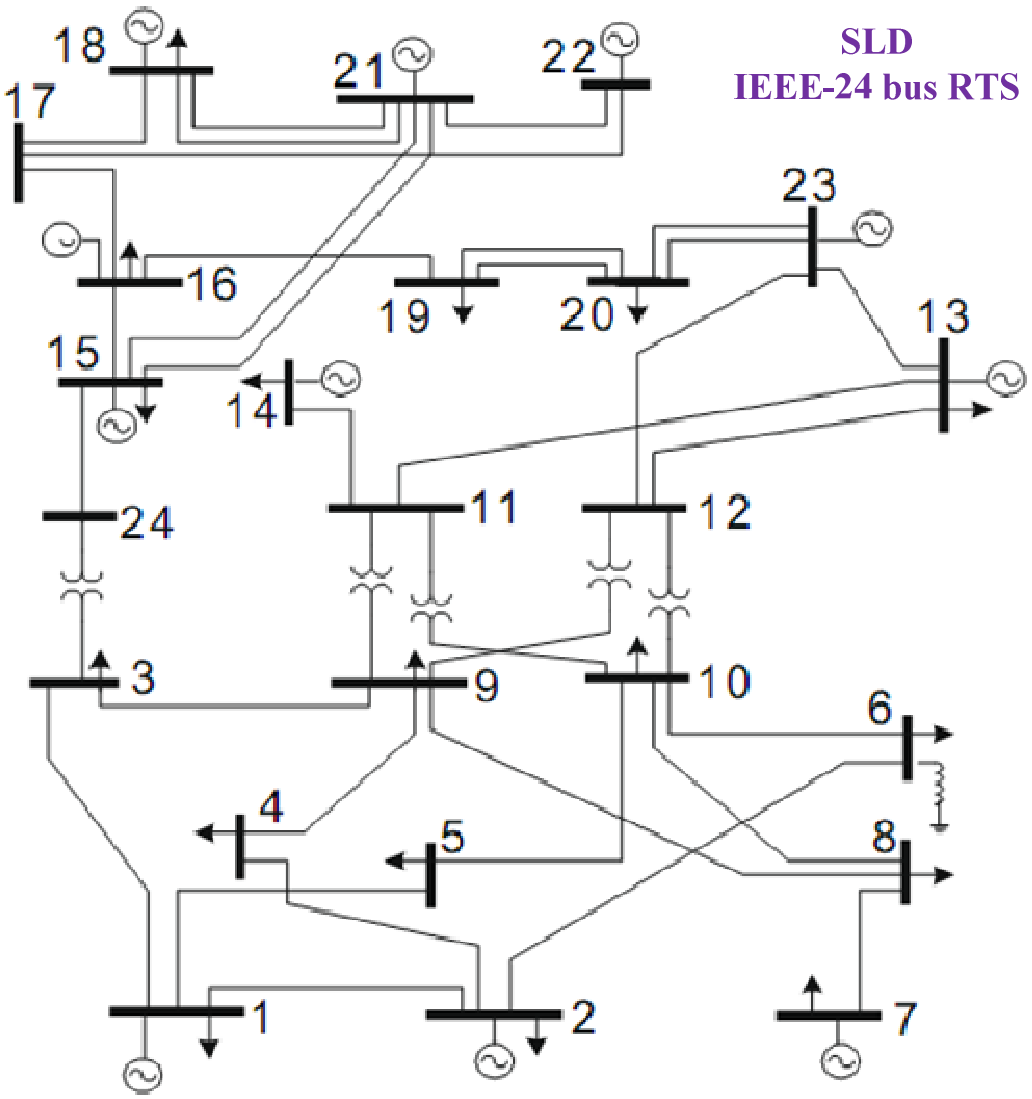

Fig.A.1: Single line diagram of the IEEE 24 bus Reliability Test System

Table A.1: Bus data for the IEEE 24 bus Reliability Test System (in p.u.)

Bus No.	$P_{G,i}$	$P_{D,i}$	$Q_{D,i}$	V_i	V_i^{max}	V_i^{min}	Base KV
1	1.3796	1.0800	0.2200	1.0350	1.05	0.95	138
2	1.3796	0.9700	0.2000	1.0350	1.05	0.95	138
3	0.0000	1.8000	0.3700	0.9913	1.05	0.95	138
4	0.0000	0.7400	0.1500	0.9982	1.05	0.95	138
5	0.0000	0.7100	0.1400	1.0186	1.05	0.95	138
6	0.0000	1.3600	0.2800	1.0126	1.05	0.95	138
7	2.7231	1.2500	0.2500	1.0250	1.05	0.95	138
8	0.0000	1.7100	0.3500	0.9923	1.05	0.95	138
9	0.0000	1.7500	0.3600	1.0022	1.05	0.95	138
10	0.0000	1.9500	0.4000	1.0283	1.05	0.95	138
11	0.0000	0.0000	0.0000	0.9892	1.05	0.95	230
12	0.0000	0.0000	0.0000	1.0017	1.05	0.95	230
13	4.6406	2.6500	0.5400	1.0200	1.05	0.95	230
14	0.0000	1.9400	0.3900	0.9800	1.05	0.95	230
15	1.4069	3.1700	0.6400	1.0140	1.05	0.95	230
16	1.4069	1.0000	0.2000	1.0170	1.05	0.95	230
17	0.0000	0.0000	0.0000	1.0392	1.05	0.95	230
18	3.6307	3.3300	0.6800	1.0500	1.05	0.95	230
19	0.0000	1.8100	0.3700	1.0231	1.05	0.95	230
20	0.0000	1.2800	0.2600	1.0382	1.05	0.95	230
21	3.6307	0.0000	0.0000	1.0500	1.05	0.95	230
22	2.7228	0.0000	0.0000	1.0500	1.05	0.95	230
23	5.9907	0.0000	0.0000	1.0500	1.05	0.95	230
24	0.0000	0.0000	0.0000	0.9818	1.05	0.95	230

Table A.2: Transmission line data for the IEEE 24 bus Reliability Test System (in p.u.)

Line No.	From Bus No.	To Bus No.	R	X	B_{ch} (Full)	Max. Line Rating
1	1	2	0.0026	0.0139	0.4611	1.7500
2	1	3	0.0546	0.2112	0.0572	1.7500
3	1	5	0.0218	0.0845	0.0229	1.7500
4	2	4	0.0328	0.1267	0.0343	1.7500
5	2	6	0.0497	0.1920	0.0520	1.7500
6	3	9	0.0308	0.1190	0.0322	1.7500
7	3	24	0.0023	0.0839	0.0000	4.0000
8	4	9	0.0268	0.1037	0.0281	1.7500
9	5	10	0.0228	0.0883	0.0239	1.7500
10	6	10	0.0139	0.0605	2.4590	1.7500
11	7	8	0.0159	0.0614	0.0166	1.7500
12	8	9	0.0427	0.1651	0.0447	1.7500
13	8	10	0.0427	0.1651	0.0447	1.7500
14	9	11	0.0023	0.0839	0.0000	4.0000
15	9	12	0.0023	0.0839	0.0000	4.0000
16	10	11	0.0023	0.0839	0.0000	4.0000
17	10	12	0.0023	0.0839	0.0000	4.0000
18	11	13	0.0061	0.0476	0.0999	5.0000
19	11	14	0.0054	0.0418	0.0879	5.0000
20	12	13	0.0061	0.0476	0.0999	5.0000
21	12	23	0.0124	0.0966	0.2030	5.0000
22	13	23	0.0111	0.0865	0.1818	5.0000
23	14	16	0.0050	0.0389	0.0818	5.0000

Table A.2 Contd…

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24	15	16	0.0022	0.0173	0.0364	5.0000
25	15	21	0.0063	0.0490	0.1030	5.0000
26	15	21	0.0063	0.0490	0.1030	5.0000
27	15	24	0.0067	0.0519	0.1091	5.0000
28	16	17	0.0033	0.0259	0.0545	5.0000
29	16	19	0.0030	0.0231	0.0485	5.0000
30	17	18	0.0018	0.0144	0.0303	5.0000
31	17	22	0.0135	0.1053	0.2212	5.0000
32	18	21	0.0033	0.0259	0.0545	5.0000
33	18	21	0.0033	0.0259	0.0545	5.0000
34	19	20	0.0051	0.0396	0.0833	5.0000
35	19	20	0.0051	0.0396	0.0833	5.0000
36	20	23	0.0028	0.0216	0.0455	5.0000
37	20	23	0.0028	0.0216	0.0455	5.0000
38	21	22	0.0087	0.0678	0.1424	5.0000

Table A.3: Market data of reactive power offers (Bids) for the IEEE 24 bus Reliability Test System

Bus No.	**Unit No.**	a_0 **($)**	m_1 **($/MVAr-h)**	m_2 **($/MVAr-h)**	m_3 **($/MVAr-h^2)**	Q_G^{max} **(MVAR)**	Q_G^{min} **(MVAR)**
1	1	0.96	0.86	0.86	0.46	10	0
	2	0.94	0.82	0.82	0.45	10	0
	3	0.85	0.79	0.79	0.39	30	-25
	4	0.83	0.82	0.82	0.40	30	-25
2	1	0.50	0.54	0.54	0.28	10	0
	2	0.42	0.42	0.42	0.35	10	0
	3	0.69	0.68	0.68	0.39	30	-25
	4	0.65	0.62	0.62	0.37	30	-25
7	1	0.75	0.61	0.61	0.43	60	0
	2	0.80	0.75	0.75	0.36	60	0
	3	0.70	0.65	0.65	0.32	60	0
13	1	0.68	0.50	0.50	0.31	80	0
	2	0.70	0.54	0.54	0.39	80	0
	3	0.75	0.60	0.60	0.50	80	0
14[a]	1	0.94	0.81	0.81	0.00	200	-50
15	1	0.65	0.60	0.60	0.30	6	0
	2	0.50	0.58	0.58	0.25	6	0
	3	0.60	0.73	0.73	0.38	6	0
	4	0.55	0.61	0.61	0.27	6	0
	5	0.52	0.50	0.50	0.26	6	0
	6	0.51	0.51	0.51	0.27	80	-50
16	1	0.50	0.50	0.50	0.30	80	-50
18	1	0.90	0.85	0.85	0.48	200	-50
21	1	0.80	0.75	0.75	0.41	200	-50
22	1	0.42	0.42	0.42	0.17	16	-10
	2	0.50	0.48	0.48	0.20	16	-10
	3	0.45	0.42	0.42	0.38	16	-10
	4	0.48	0.44	0.44	0.35	16	-10
	5	0.49	0.45	0.45	0.33	16	-10
	6	0.55	0.46	0.46	0.32	16	-10
23	1	0.90	0.85	0.85	0.48	80	-50
	2	0.95	0.89	0.89	0.55	80	-50
	3	0.86	0.80	0.80	0.45	150	-25

[a] **Synchronous condenser (SC)**