Appendix B

Data of the New England power system and wind parks

The following parameters are used for simulation of the SAVNW - New England Test System by PSS/E in Chapter 5. The one line diagram of the system can be found in the manual of PSS/E.

Table B.1 Data of the synchronous generators

Generator	1	2	3	4	5	6
Rated MVA	900	900	1000	725	1000	130
Voltage (kV)	21.6	21.6	230.0	20.0	18.0	13.8

Voltage (p.u.)	1.0200	1.0200	1.0400	1.0408	1.0233	1.0200
Power angle (degree)	16.54	16.54	-0.01	12.91	-2.98	-4.08
x_d (p.u.)	1.80	1.80	1.60	1.00	1.40	1.60
x_q (p.u.)	1.75	1.75	1.50	0.75	1.35	1.55
x'_d (p.u.)	0.60	0.60	0.70	0.40	0.50	0.70
x'_q (p.u.)	0.80	0.80	0.85	0.56	0.70	0.85
T'_{d0} (s)	6.5	6.5	5.0	5.0	4.5	5.0
T_J (s)	8.0	8.0	6.0	10.0	5.0	6.0

Table B.2 Data of the exciters

Exciter	1	2	3	4	5	6
K_A	400	400	100	200	40	100
T_E (s)	0.04	0.04	0.10	0.05	0.60	0.10

The following parameters are used for simulation of the DFIG wind parks by PSS/E in Chapter 5.

Table B.3 Data of the DFIG wind turbines

Rated MVA	5
Maximum active power (MVA)	5

Minimum active power (MVA)	0.1
Maximum reactive power (MVA)	2.8
Minimum reactive power (MVA)	-2.8
DFIG impedance (p.u.)	0.8
Equivalent reactance for current injection (p.u.)	0.8
First integrator gain of phase locked loop	30
Second integrator gain of phase locked loop	0
Maximum limit of phase locked loop	0.1
Initial wind (p.u.)	1.25
Total inertia constant (second)	4.95
Machine damping factor (p.u.)	0
Aerodynamic gain factor	0.007
Blade pitch at twice rated wind speed (Degree)	21.98
Turbine inertia fraction	0.875
First shaft torsional resonant frequency (Hz)	1.8
Shaft damping factor (p.u.)	1.5
Filter time constant in voltage regulator (second)	0.15
Proportional gain in voltage regulator (p.u.)	18
Integral gain in voltage regulator (p.u.)	5

Line drop compensation reactance (p.u.)	0
Filter time constant in torque regulator (second)	0.05
Proportional gain in torque regulator (p.u.)	3
Integrator gain in torque regulator (p.u.)	0.6
Max limit in torque regulator (p.u.)	1.12
Min limit in torque regulator (p.u.)	0.1
Max limit in voltage regulator (p.u.)	0.309
Min limit in voltage regulator (p.u.)	-0.309
Max reactive current limit (A)	1.1
Voltage sensor time constant	0.05
Max power order derivative	0.45
Min power order derivative	-0.45
Power filter time constant (second)	5
Blade response time constant (second)	0.3
Proportional gain of PI regulator (p.u.)	150
Integrator gain of PI regulator (p.u.)	25
Proportional gain of the compensator (p.u.)	3
Integral gain of the compensator (p.u.)	30
Low pitch angle limit (degree)	0

Upper pitch angle limit (degree)	27
Upper pitch angle rate limit (degree/second)	10
Power reference (p.u.)	1

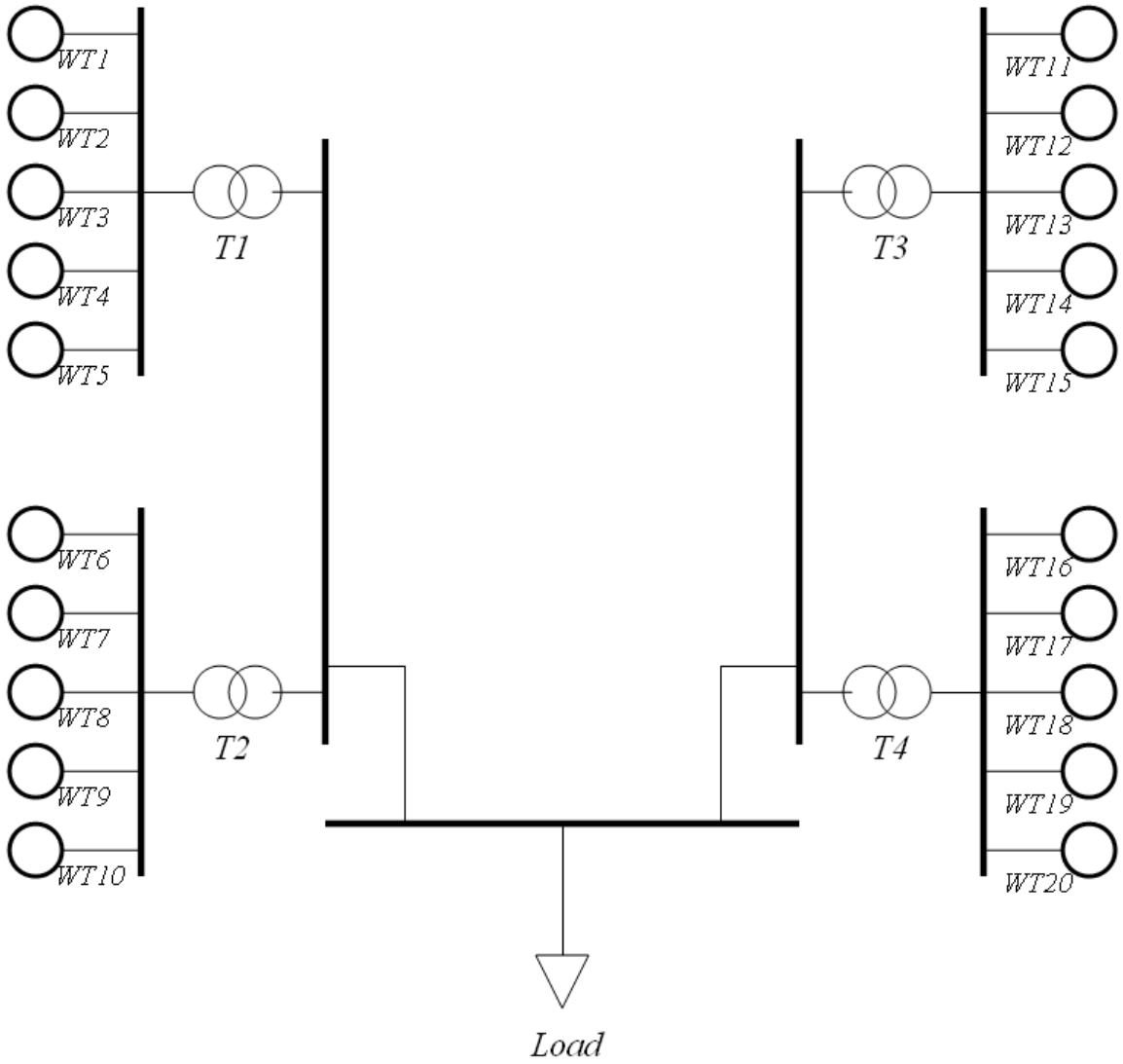

Figure B.1 Model of the 100MVA Wind Park connected in New England network

In the above figure, *WT* stands for wind turbine and *T* stand for transformers.

Table B.4 Data of the wind turbine transformers

Rated MVA	5
Voltage on primary side (kV)	10.5
Voltage on secondary side (kV)	135
Transformer impedance (p.u.)	0.0073 + j0.0600
Minimum reactive power (MVA)	-2.8