

# List of Tables

<i>Tables</i>	<i>Title</i>	<i>page</i>
1.1	PQ Disturbances in Power System	2
2.1	PQ Disturbances Classification Based on UNE Standard	20
2.2	Computational Efficiency of PQ Detection Techniques	23
2.3	Comparison of Main Methods of PQ Disturbances Analysis	23
2.4	Strength and Weakness of AI Techniques	24
2.5	Comparison of PQ Events Classification Methods	25
2.6	Comparative Study of 3P3W DSTATCOM Topologies	30
2.7	Comparison of Isolated VSC Based 3P4W DSTATCOM Topologies	31
2.8	Comparison of Nonisolated VSC-Based 3P4W DSTATCOM Topologies without Transformer	32
2.9	Comparative Study of Nonisolated VSC Based 3P4W DSTATCOM Topologies	33
2.10	Comparison of DSTATCOM Control Techniques.	34
2.11	Selection of Active and Hybrid Filters for Specific Applications	34
2.12	Comparison of Transformers Used for Neutral Current Compensation	35
2.13	Advantages and Disadvantages of Transformers Used for Neutral Current Compensation	36
2.14	Technical and Economic Comparison of PQ Improvement Techniques	37
3.1	Mathematical Modeling of Simulated Single Stage PQ Disturbances	43
3.2	Mathematical Modeling of Simulated Complex PQ Disturbances	45
3.3	S-Transform Based Features of Single Stage PQ Disturbances Used for Decision Rules	53
3.4	Classification Results of Single Stage PQ Disturbances Using Decision Tree	54
3.5	Classification Results of Single Stage PQ Disturbances Using Decision Tree Initialized Fuzzy C-Means Clustering	59
3.6	Performance Comparison of Single Stage PQ Disturbances in Terms of Correct Classification of Results	60
3.7	Features of Complex PQ Disturbances Used for Decision Rules	76
3.8	Classification Results of Complex PQ Disturbances	77
3.9	Performance Comparison of Complex PQ Disturbances	77
4.1	Technical Specifications of DFIG and Wind Turbine	84
4.2	Loading Status at PCC with Wind Energy System	84
4.3	Operating Events of Wind Energy System used for PQ Measurement	85
4.4	Total Harmonic Distortions of Current and Voltage with Wind Energy System	90
4.5	Maximum Frequency Deviations and Power Quality Index with Wind Energy System	91
4.6	Characteristic of Solar Cell Module	92
4.7	Loading Status at PCC with Solar Energy System	92
4.8	Operating Events of Study with Solar Energy System	93
4.9	Total Harmonic Distortions of Current and Voltage with Solar Energy System	97
4.10	Maximum Frequency Deviations and Power Quality Index with Solar Energy System	98
5.1	Loading and Generator Status of Test System	102
5.2	Transformer Data of Test System	102
5.3	Feeder Data of Test System	103

5.4	Kp and Ki Controller Gains of WECS	105
5.5	Total Harmonic Distortions of Voltage and Current with Wind Energy Penetration	110
5.6	Maximum Frequency Deviations and Power Quality Index with Wind Energy Penetration	115
5.7	Total Harmonic Distortions of Voltage and Current with Solar Energy Penetration	116
5.8	Maximum Power Frequency Deviations with Solar PV Energy Penetration	119
5.9	Power Quality Index with Solar Energy Penetration	120
5.10	Total Harmonic Distortions of Voltage and Current in Hybrid Power System	128
5.11	Maximum Frequency Deviations and Power Quality Index in Hybrid Power System	130
5.12	Features of Negative Sequence Component of Voltage	130
6.1	THD of Voltage with Grid Disturbances	149
6.2	THD of Voltage with Wind Energy Penetration	152
6.3	THD of Voltage with Solar Energy Penetration	155
6.4	THD of Voltage in Hybrid Power System with Wind and Solar Energies Penetration	159