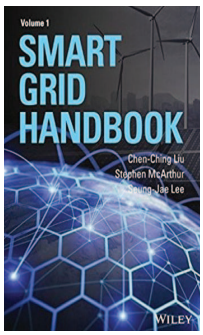
by Marian P. Kazmierkowski and Fernando A. Silva

Smart Grid Handbook



By Chen-Ching Liu, Stephen McArthur, and Seung-Jae Lee (Editors), Wiley, 2016, three-volume set, 1,900 pages, ISBN: 978-1-118-75548-8.

This handbook deals with emergent topics related to embedding artificial intelligence (AI) into electrical grids. Smart grids are cyberphysical-social systems [1], which include information and communication technology (ICT), computer-implemented human concepts and actions, sensors, controllers, distributed energy resources, and social and economic issues. Now pervasive realities in the ICT age, the Internet of Things, distributed control, and cybersecurity are powerful enablers for smart grids. Smart grids use the cyberphysical social sensing paradigm to integrate the social aspect in engineering, which is a key concept and action to increase gender balance in engineering.

The handbook is divided into three volumes, six parts, and 82 chapters. It is written by leading professionals from around the world, covering smart grid research and development, technology, standards, industry practice, and socioeconomic aspects. Volume One includes Part I, "Smart Grids Vision and Drivers," and Part II, "Transmission."

Digital Object Identifier 10.1109/MIE.2018.2791097
Date of publication: 21 March 2018

Part I Smart Grid

Part I is organized into nine chapters:

1) "Definitions, Scope, Visions, and Benefits"
2) "Evolution of Power Transmission Grids"
3) "Evolution of the Smart Distribution Grid"
4) "New Technologies and Standards Enabling Grid Modernization"
5) "Global Survey of Smart Grid Activities"
6) "Role of Renewable Energy"
7) "Role of Demand Response"
8) "Role of Energy Storage"
9) "Workforce Training and Education on Smart Grids."

Part II Transmission

Part II is organized into 18 chapters:

1) "Wide Area Monitoring Through Synchrophasor Measurement"
2) "Online Monitoring of Dynamics with Phasor Measurement Unit (PMU) Data"
3) "Synchrophasor Device Testing and Related Standards"
4) "Cascading Failures in Power Systems"
5) "Remedial Action Schemes and Defense Systems"
6) "Modern Energy Management Systems: Real-Time Management of the Interconnected Electricity Grid"
7) "Dynamic Security Assessment"
8) "Dynamic-State Estimation"
9) "FACTS, HVdc, and Supergrid"
10) "Grid Codes in Power Systems with Large Renewable-Based Generation"
11) "Substation Automation Systems"
12) "Cybersecurity of SCADA Within Substations"
13) "Standards—Focus on IEC 61970 Transmission Series"
14) "PMU Hardware and Algorithms"
15) "Industry Practice and Operational Experience of Key Transmission Applications of Smart Grid Technologies"
16) "Power System Restoration"
17) "Load Modeling: Composite System Reliability Evaluation"
18) "HVDC Networks for Offshore Wind Power."

Part III Distribution

Volume Two contains Part III, "Distribution," with the following 27 chapters:

1) "Introduction to Distribution Systems"
2) "Control and Management Architectures"
3) "Communication Solutions for Distribution Systems"
4) "Overview of Distributed Energy Resources"
5) "Active Management of Electric Vehicles Acting as Distributed Storage"
6) "Renewable Energy Forecasting"
7) "Conservation Voltage Reduction"
8) "Grid Monitoring and State Estimation"
9) "Advanced Protection Systems"
10) "Power Quality"
11) "Defining, Measuring, and Improving Resilience of Electric Power Systems"
12) "Power Electronics for Flexible Distribution Networks"
13) "Active Network Management"
14) "Electric Vehicles and V2G Operation"
15) "Feeder Automation"
16) "Distribution Management System (DMS) Integrated Voltage-VAR Control"
17) "Reliability Indices"
18) "Cybersecurity of Distribution Devices and Systems"
19) "Condition Monitoring and Asset Management of Smart Grid"

20) "IEC 61850 for Distribution System"
21) "Overview of Smart Grid Project in Korea and Smart Power Grid Field Test"
22) "Industry Practice and Operational Experience of Key Distribution Applications of Smart Grid Technologies"
23) "Microgrids in Distribution"
24) "Integration of Solar Photovoltaics"
25) "Distributed Energy Resources Using IEC 61580 with Cyber Security and Resilience Guidelines"
26) "IEC 61968: Integration of Distribution Systems"
27) "Phasor Measurements for Distribution System Applications."

Volume Three includes Part IV, "Smart Meters," Part V, "ICT," and Part VI, "Socioeconomic Issues."

Part IV Smart Meters and Customers

Part IV is made up of the following 11 chapters:

1) "Smart Meters and Residential Customers"
2) "Meter Data Collection, Management, and Analysis"
3) "Utilization and Customer Behavior: Smart Choices for the Smart Grid"
4) "Cyber Security of Smart Meters"
5) "Demand Response at Distribution Grids: Exploiting Flexible Power Electronics Interfaces"
6) "Operational Experience of Microgrids"
7) "Demand-Side Response/Home Energy Management"
8) "Demand Response"
9) "Standards, Security, and Smart Meters"
10) "Factors Influencing Adoption of Smart Meters"
11) "Smart Meter Health and Exposure Assessment Research."

Part V Information and Communication Technologies

Part V includes eight chapters:

1) "New Approaches to Interoperability"
2) "Smart Grid Interoperability Standards"
3) "Application of Distributed Intelligence to Industrial Demand Response"
4) "Industry Practice and Operational Experience of ICT"
5) "Transactive Energy Systems"
6) "Physical Hardware-in-the-Loop Modeling and Simulation"
7) "Data Analytics for Transmission and Distribution"
8) "System-Level Simulation for Future Smart Grids."

Part VI Socioeconomic Issues

Part VI is organized into nine chapters:

1) "The Socioeconomics of the Smart Grid—An Introduction"
2) "Data Privacy and Social Acceptance of Smart Meters"
3) "Cost-Benefit Analysis of Smart Connections of Renewable Distributed Generation Projects: A Guide"
4) "Impact on Electricity Markets"
5) "Behavioral Aspects of Smart Meters"
6) "Market Design in the Smart Grid"
7) "Platform Markets and Energy Services"
8) "Implications of Smart Grid Innovation for Organizational Models in Electricity Distribution"
9) "Regulation of Smart Grids."

The handbook also includes a table of contents, a list of contributors, prefaces, abbreviations and acronyms, references, and an index.

Editors Chen-Ching Liu, IEEE Fellow and Boeing Distinguished Professor in the Electrical Engineering and Computer Science School at Washington State University, Pullman; Stephen McArthur, head of the Electronic and Electrical Engineering Department at University of Strathclyde, United Kingdom; and Seung-Jae Lee, professor at Myongji University's Department of Electrical Engineering and director of the Next-Generation Power Technology Center and Yongin Gyeonggi-Do, Korea, are international leaders in smart grid research and AI/ICT applications in power engineering.

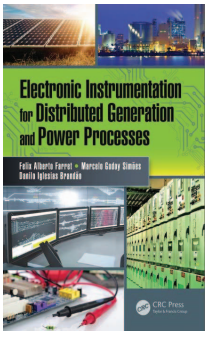
The three-volume handbook is unique in highlighting successful state-of-the-art smart grid technology, research, and frontiers. Its 82 chapters contain high-quality, valuable reference work useful for advanced students, engineers, and researchers in the fields of distributed electrical power generation, transmission, distribution, and socioeconomic impacts of smart grid engineering. This knowledge, together with predictive and nonlinear control [2]–[4] of power electronics interfaces, is essential for the development of a low-carbon energy infrastructure. The handbook is also valuable for network operators, energy regulators, and government officials, as well as for test and certification laboratories and organizations in the smart grid industry.

—Fernando A. Silva
Instituto Superior Técnico, INESC-ID, Universidade de Lisboa, Portugal

References

[1] S. Suryanarayanan, R. Roche, and T. M. Hansen, Eds. *Cyber-Physical-Social Systems and Constructs in Electric Power Engineering*. London, U.K.: IET, 2016.
[2] M. Chaves, E. Margato, J. F. Silva, S. F. Pinto, and J. Santana, "HVDC transmission systems: Bipolar back-to-back diode clamped multilevel converter with fast optimum-predictive control and capacitor balancing strategy," *Elect. Power Syst. Res.*, vol. 81, no. 7, pp. 1436–1445, 2011.
[3] J. F. Silva and S. F. Pinto, "Linear and nonlinear control of switching power converters," in *Power Electronics Handbook*, 4th ed. New York: Elsevier, 2017, pp. 1141–1220.
[4] J. F. A. Martins, A. J. Pires, and J. F. Silva, "A novel and simple current controller for three-phase PWM power inverters," *IEEE Trans. Ind. Electron.*, vol. 45, no. 5, pp. 802–805, 1998.

Electronic Instrumentation for Distributed Generation and Power Processes



By Felix Alberto Farret, Marcelo Godoy Simões, and Danilo Iglesias Brandão, CRC Press Taylor & Francis Group, 2018, hardback, 283 pages, ISBN-13: 978-1-4987-8241-8.

The new book *Electronic Instrumentation for Distributed Generation and Power Processes* creates a bridge between modern power systems and analog/digital electronic instrumentation required in contemporary signal processing and monitoring as well as digital control systems. The authors present and discuss

Digital Object Identifier 10.1109/MIE.2018.2791138
Date of publication: 21 March 2018

(continued on page 64)