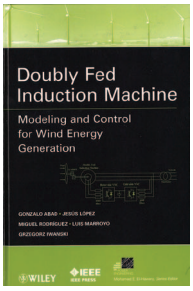
Book News

by Fernando A. Silva, and Marian P. Kazmierkowski

Doubly Fed Induction Machine—Modeling and Control for Wind Energy Generation



By Gonzalo Abad, Jesús López, Miguel Rodríguez, Luis Marroyo, and Grzegorz Iwanski, Wiley, 2011, 625 pages, ISBN: 978-0-470-76865-5 (Hardcover).

Wind-energy-based electrical generation is playing an increasingly important role in the production of power. This has been possible because of the deployment of innovative technologies to improve the mechanical and electrical subsystems. Several new enhanced solutions were given for the turbine electric generator and power converter. The doubly fed induction machine (DFIM)-based wind turbine is now one of the leading technologies, and it has been adopted by several wind energy turbine manufacturers.

Although there are many books addressing the drive and adjustable-speed generator issues, usually the DFIM is only briefly considered. Therefore, the vast majority of electrical engineers are not sufficiently familiar with DFIM-equipped wind turbines.

Doubly Fed Induction Machine—Modeling and Control for Wind Energy Generation, by Abad et al., covers the modeling, testing, and control of DFIMs under several situations, like the control behavior under voltage dips and standalone DFIM-based systems.

The book is very well written and provides in-depth coverage of the analysis, modeling, testing, and control of DFIM-based wind power systems. Topics such as offline estimation of DFIM model parameters are uniquely treated, while the DFIM control methods are thoroughly covered, including predictive control at constant switching frequency.

The book can be considered a reference on DFIM-based wind energy electrical generators. The text introduces the wind energy electrical generation system, where the DFIM is used as an adjustable-speed electrical generator. Practical and commercial illustrative information is given. The modeling of the DFIG and power electronic converter operation is then presented, including the power electronics converters with appropriate control and block diagrams for the offline model parameter estimation. The DFIM analysis under voltage dips, including the solutions for this issue, is also avidly explained. Some particular aspects as the starting process and standalone operations, are described. As a final point, new trends for wind power energy innovation are discussed.

The book includes a preface, table of contents, appendix, and index. It is divided into 12 chapters:

1) "Introduction to a Wind Energy Generation System"
   - 1.1) "Introduction"
   - 1.2) "Basic Concepts of Fixed Speed Wind Turbine"
   - 1.3) "Variable Speed Wind Turbines"
   - 1.4) "Wind Energy Generation System Based on DFIM VSWT"
   - 1.5) "Grid Code Requirements"
   - 1.6) "Voltage Dips and LVRT"
   - 1.7) "VSWT Based on DFIM Manufacturers"
   - 1.8) "Introduction to the Next Chapters"
2) "Back-to-Back Power Electronic Converter"
   - 2.1) "Introduction"
   - 2.2) "Back-to-Back Converter Based on Two-Level VSC Topology"
   - 2.3) "Multilevel VSC Topologies"
   - 2.4) "Control of Grid Side System"
   - 2.5) "Summary"
3) "Steady State of the DFIMs"
   - 3.1) "Introduction"
   - 3.2) "Operation Modes Attending to Speed and Power Flows"
   - 3.3) "Per Unit Transformation"
   - 3.4) "Steady State Curves: Performance Evaluation"
   - 3.5) "Design requirements for the DFIM in Wind Energy Generation Applications"
   - 3.6) "Summary"
4) "Dynamic Modeling of the DFIMs"
   - 4.1) "Introduction"
   - 4.2) "Dynamic Modeling of the DFIM"
   - 4.3) "Summary"
5) "Testing the DFIM"
   - 5.1) "Introduction"
   - 5.2) "Off-Line Estimation of DFIM Model Parameters"
   - 5.3) "Summary"
6) "Analysis of the DFIM Under Voltage Dips"
   - 6.1) "Introduction"
   - 6.2) "Electromagnetic Force Induced in the Rotor"
   - 6.3) "Normal Operation"
   - 6.4) "Three-Phase Voltage Dips"
   - 6.5) "Asymmetrical Voltage Dips"
   - 6.6) "Influence of the Rotor Currents"
   - 6.7) "DFIM Equivalent Model During Voltage Dips"
   - 6.8) "Summary"

Digital Object Identifier 10.1109/MIE.2015.2454041
Date of publication: 21 September 2015

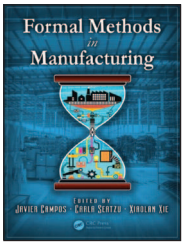
7) "Vector Control Strategies for Grid-Connected DFIM Wind Turbines"
   7.1) "Introduction"
   7.2) "Vector Control"
   7.3) "Small Signal Stability of the Vector Control"
   7.4) "Vector Control Behavior Under Unbalanced Conditions"
   7.5) "Vector Control Behavior Under Voltage Dips"
   7.6) "Control Solutions for Grid Disturbances"
   7.7) "Summary"
8) "Direct Control of the DFIM"
   8.1) "Introduction"
   8.2) "Direct Torque Control (DTC) of the DFIM"
   8.3) "Direct Power Control (DPC) of the DFIM"
   8.4) "Predictive Direct Torque Control (P-DTC) of the DFIM at Constant Switching Frequency"
   8.5) "Predictive Direct Power Control (P-DPC) of the DFIM at Constant Switching Frequency"
   8.6) "Multilevel Converter Based Predictive Direct Power and Direct Torque Control of the DFIM at Constant Switching Frequency"
   8.7) "Control Solutions for Grid Voltage Disturbances, Based on Direct Control Techniques"
   8.8) "Summary"
9) "Hardware Solutions for LVRT"
   9.1) "Introduction"
   9.2) "Grid Codes Related to LVRT"
   9.3) "Crowbar"
   9.4) "Braking Chopper"
   9.5) "Other Protection Techniques"
   9.6) "Summary"
10) "Complementary Control Issues: Estimator Structures and Start-Up of Grid-Connected DFIM"
   10.1) "Introduction"
   10.2) "Estimator and Observes Structures"
   10.3) "Start-up of the DFIM Based Wind Turbine"
   10.4) "Summary"
11) "Stand-Alone DFIM Based Generation Systems"
   11.1) "Introduction"
   11.2) "Mathematical Description of the Stand-Alone DFIM System"
   11.3) "Stator Voltage Control"
   11.4) "Synchronization Before Grid Connection by Superior PLL"
   11.5) "Summary"
12) "New Trends on Wind Energy Generation"
   12.1) "Introduction"
   12.2) "Future Challenges for Wind Energy Generation: What Must Be Innovated"
   12.3) "Technological Trends: How They Can Be Achieved"
   12.4) "Summary."

The book was written by a team of five experts on the control of DFIM. Gonzalo Abad, Jesús López, Luis Marroyo, and Grzegorz Iwanski are academic professors whose expertise in this subject is well recognized. Miguel Rodriguez is the power electronics manager at Igeteam Technology. He has successfully developed new power electronics converters for transmission and distribution systems.

This book is a reference for researchers, scientists working on wind power systems, professors, professional engineers in the field, graduate students interested in wind energy electrical generators, and librarians.

—Gil Marques and Fernando A. Silva
Instituto Superior Técnico,
Universidade de Lisboa, Portugal

Formal Methods in Manufacturing



By Javier Campos, Carla Seatzu, and Xiaolan Xie (Editors), CRC Press, 2014, 728 pages, ISBN: 978-1-4665-6155-7 (Hardcover).

This book—coedited by Javier Campos, professor of computer science at the University of Zaragoza, Spain; Carla Seatzu, associate professor of automatic control at the University of Cagliari, Italy; and Xiaolan Xie, professor of industrial engineering and the head of the Department of Health-Care Engineering, Ecole Nationale Supérieure des Mines, Saint Etienne, France—is part of the CRC Press Industrial Information Technology Series.

It presents a current, state-of-the-art solution to common problems in manufacturing systems, and all chapters are written by leading experts in their respective fields. The book consists of 23 chapters grouped into four parts as follows:

Part I: Modeling and Simulations of Manufacturing Systems

1) "Modeling Manufacturing Systems with Place/Transition Nets and Timed Petri Nets" by Maria P. Cabasino, Mariagrazia Dotoli, and Carla Seatzu
2) "Modeling Manufacturing Systems in a Dioid Framework" by Thomas Brunsch, Laurent Hardouin, and Jörg Raisch
3) "Modeling Manufacturing Systems and Inventory Control Systems with Hybrid Petri Nets" by Maria P. Cabasino, Alessandro Giua, and Carla Seatzu
4) "Hybrid Models for the Control and Optimization of Manufacturing Systems" by Christos G. Cassandras and Chen Yao
5) "Freight Transportation in Distributed Logistic Chains" by Angela Di Febbraro and Nicola Sacco

Part II: Supervisory Control of Manufacturing Systems

6) "Deadlock Avoidance Policies for Automated Manufacturing Systems Using Finite State Automata" by Spyros Reveliotis and Ahmed Nazeem
7) "Structural Deadlock Prevention Policies for Flexible Manufacturing Systems: A Petri Net Outlook" by Juan-Pablo López-Grao, José-Manuel Colom, and Fernando Tricas
8) "Deadlock Avoidance Policies in Production Systems by a Digraph Approach" by Maria Pia Fanti, Bruno Maione, and Biagio Turchiano
9) "Supervisory Control of Manufacturing Systems Using Petri Nets" by Carla Seatzu and Xiaolan Xie
10) "Supervisory Control of Manufacturing Systems Using Extended Finite Automata" by Martin Fabian, Zhennan Fei, Sajed Miremadi, Bengt Lennartson, and Knut Åkesson
11) "Inference-Based and Modular Decentralized Control of Manufacturing

Digital Object Identifier 10.1109/MIE.2015.2454042
Date of publication: 21 September 2015