

Introduction to the Special Section on Control and Grid Integration of Wind Energy Systems—Part II

WIND ENERGY systems have attracted considerable attention due to growing environmental concerns, increasing cost of fossil fuel and concern about the long-term supply of oil and natural gas. The increasing penetration of wind energy in the power system has, however, produced stringent modifications into grid codes worldwide. Nowadays, it is expected that wind energy conversion systems (WECSs) remain temporarily connected during typical grid faults, e.g., voltage sags. Additionally, it is expected that WECSs could be operated as conventional power plants and provide frequency and voltage support to the power system, for instance, using droop-based controllers.

The connection of relatively large wind farms located in remote or offshore locations has also become an active research field. New high-voltage direct current (HVDC) transmission systems have been proposed to transfer the energy from offshore to the mainland power system.

Equally important are grid issues, related to the impact on the grid of WEC control systems, synchronization and operation of WECSs in distorted and unbalanced grids, multilevel converter topologies in the operation of wind energy systems in medium/high-voltage grids, to name a few.

This “Special Section on Control and Grid Integration of Wind Energy Systems—Part II” of the IEEE TRANSACTIONS ON INDUSTRIAL ELECTRONICS presents the more recent advances in the following topics:

- 1) HVDC systems for the connection of wind farms to the main power systems;
- 2) novel topologies for offshore wind energy systems;
- 3) control of WECSs: e.g., sensorless control of electrical generators, brushless doubly fed induction generators, new topologies of permanent-magnet generators, etc.;
- 4) grid issues: e.g., low-voltage ride-through (LVRT) control, frequency support using grid control, stability issues, etc.;
- 5) power converter topologies and control systems: e.g., multilevel power converters, parallel connection of multiple converters, modulations issues, etc.

It is our pleasure to present this Special Section. Due to the high number of papers, this Special Section has been divided

into two parts. The papers of the second part are grouped as follows:

- i) grid-related issues;
- ii) power converter topologies and control systems.

I. GRID-RELATED ISSUES

- 1) “Overview of Control Systems for the Operation of DFIGs in Wind Energy Applications,” R. Cárdenas, R. Peña, S. Alepuz, and G. Asher.
- 2) “Stability Enhancement of a Power System With a PMSG-Based and a DFIG-Based Offshore Wind Farm Using a SVC With an Adaptive-Network-Based Fuzzy Inference System,” L. Wang and D.-N. Truong.
- 3) “Coordinated Control of DFIG’s RSC and GSC Under Generalized Unbalanced and Distorted Grid Voltage Conditions,” J. Hu, H. Xu, and Y. He.
- 4) “An LVRT Control Strategy based on Flux Linkage Tracking for DFIG-Based WECS,” S. Xiao, G. Yang, H. Zhou, and H. Geng.
- 5) “Crowbarless Fault Ride-Through of the Brushless Doubly Fed Induction Generator in a Wind Turbine Under Symmetrical Voltage Dips,” T. Long, S. Shao, P. Malliband, E. Abdi, and R. A. McMahon.
- 6) “Advanced Fault Ride-Through Technique for PMSG Wind Turbine Systems Using Line-Side Converter as STATCOM,” T. H. Nguyen and D.-C. Lee.
- 7) “StatCom Control at Wind Farms With Fixed-Speed Induction Generators Under Asymmetrical Grid Fault,” C. Wessels, N. Hoffmann, M. Molinas, and F. W. Fuchs.
- 8) “Utilization of Wind Turbines for Upregulation of Power Grids,” M. Juelsgaard, J. Bendtsen, and R. Wisniewski.
- 9) “A Calibration Test Platform of Power Quality Instruments for Grid Integration of Wind Energy System,” C.-I. Chen.
- 10) “A Control Technique for Integration of DG Units to the Electrical Networks,” E. Pouresmaeil, C. Miguel-Espinar, M. Massot-Campos, D. Montesinos-Miracle, and O. Gomis-Bellmunt.

II. POWER CONVERTER TOPOLOGIES AND CONTROL SYSTEMS

- 1) “An Improved Control Strategy of Triple Line-Voltage Cascaded Voltage Source Converter Based on Proportional-Resonant Controller,” C. Xia, Z. Wang, T. Shi, and X. He.
- 2) “Flying Supercapacitors as Power Smoothing Elements in Wind Generation,” S. D. G. Jayasinghe and D. M. Vilathgamuwa.

- 3) “Vienna-Rectifier-Based Direct Torque Control of PMSG for Wind Energy Application,” A. Rajaei, M. Mohamadian, and A. Y. Varjani.
- 4) “Offshore-Wind-Farm Configuration Using Diode Rectifier With MERS in Current Link Topology,” T. Kawaguchi, T. Sakazaki, T. Isobe, and R. Shimada.

The Guest Editors hope that this Special Section is useful for this research area and will increase the interest of the scientific community in this field.

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ROBERTO CÁRDENAS, *Guest Editor*
Department of Electrical Engineering
University of Chile
Santiago 8370451, Chile

MARTA MOLINAS, *Guest Editor*
Norwegian University of Science and Technology
7034 Trondheim, Norway

JAN T. BIALASIEWICZ, *Guest Editor*
Department of Electrical Engineering
University of Colorado Denver
Denver, CO 80217-3364 USA



Roberto Cárdenas (S'95–M'97–SM'07) was born in Punta Arenas, Chile. He received the B.S. degree from the University of Magallanes, Punta Arenas, in 1988 and the M.Sc. and Ph.D. degrees from the University of Nottingham, Nottingham, U.K., in 1992 and 1996, respectively.

From 1989 to 1991 and from 1996 to 2008, he was a Lecturer with the University of Magallanes. From 1991 to 1996, he was with the Power Electronics Machines and Control Group (PEMC group), University of Nottingham. From 2009 to 2011, he was with the Electrical Engineering Department, University of Santiago, Chile. He is currently a Professor of power electronics and drives with the Electrical Engineering Department, University of Chile, Santiago, Chile. His main interests include control of electrical machines, variable-speed drives, and renewable energy systems.

Dr. Cárdenas received the Best Paper Award from the IEEE TRANSACTIONS ON INDUSTRIAL ELECTRONICS in 2005.



Marta Molinas (M'94) received the Diploma degree in electromechanical engineering from the National University of Asuncion, San Lorenzo, Paraguay, in 1992, the M.Sc. degree from the University of the Ryukyus, Nishihara, Japan, in 1997, and the Dr.Eng. degree from the Tokyo Institute of Technology, Meguro, Japan, in 2000.

In 1998, she was a Guest Researcher with the University of Padua, Padua, Italy. From 2004 to 2007, she was a Postdoctoral Researcher with the Norwegian University of Science and Technology (NTNU), Trondheim, Norway, where she has been a Professor since 2008. From 2008 to 2009, she was a JSPS Research Fellow with the Energy Technology Research Institute, National Institute of Advanced Industrial Science and Technology, Tsukuba, Japan. Her research interests include wind/wave energy conversion systems and power electronics and electrical machines in distributed energy systems.



Jan T. Bialasiewicz received the M.S. degree from Warsaw University of Technology, Warsaw, Poland, and the Ph.D. and D.Sc. degrees from the Silesian University of Technology, Gliwice, Poland.

He is a Professor with the Electrical Engineering Department, University of Colorado Denver, Denver, CO, USA. He is also a Professor with the Polish–Japanese Institute of Information Technology, Warsaw. In 1997, he was a Visiting Professor with the Faculty of Electronics, Warsaw University of Technology. In 2005, he was a Visiting Professor with Catalonia University of Technology, Barcelona, Spain. For over ten years, he has been cooperating on research with the National Renewable Energy Laboratory's National Wind Technology Center, Golden, CO. His research interests include control theory, modeling and identification of dynamic systems, renewable energy systems, and theory and applications of wavelets.