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

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 into the power system has, however, produced stringent modifications in 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 I” 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, modulation 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 first part are grouped as follows:

i) HVDC systems;
ii) offshore grid topologies;
iii) control of wind energy systems;
iv) grid-related issues.

I. HVDC Systems


II. Offshore Grid Topologies


III. Control of Wind Energy Systems

IV. GRID-RELATED ISSUES


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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