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Nota di contenuto	Offshore Wind Energy Generation; OFFSHORE WINDENERGY GENERATIONCONTROL, PROTECTION, ANDINTEGRATION TO ELECTRICALSYSTEMS; Contents; Preface; About the Authors; Acronyms and Symbols; 1 Offshore Wind Energy Systems; 1.1 Background; 1.2 Typical Subsystems; 1.3 Wind Turbine Technology; 1.3.1 Basics; 1.3.2 Architectures; 1.3.3 Offshore Wind Turbine Technology Status; 1.4 Offshore Transmission Networks; 1.5 Impact on Power System Operation; 1.5.1 Power System Dynamics and Stability; 1.5.2 Reactive Power and Voltage Support; 1.5.3 Frequency Support; 1.5.4 Wind Turbine Inertial Response 1.6 Grid Code Regulations for the Connection of Wind GenerationAcknowledgement; Acknowledgements; References; References; 2 DFIG Wind Turbine; 2.1 Introduction; 2.1.1 Induction Generator (IG); 2.1.2 Back-to-Back Converter; 2.1.3 Gearbox; 2.1.4 Crowbar Protection; 2.1.5 Turbine Transformer; 2.2 DFIG Architecture and Mathematical Modelling; 2.2.1 IG in the abc Reference Frame; 2.2.2 IG in the dq0 Reference Frame; 2.2.3 Mechanical System; 2.2.4 Crowbar

Protection; 2.2.5 Modelling of the DFIG B2B Power Converter; 2.2.6 Average Modelling of Power Electronic Converters; 2.2.7 The dc Circuit
2.3 Control of the DFIG WT 2.3.1 PI Control of Rotor Speed; 2.3.2 PI Control of DFIG Reactive Power; 2.3.3 PI Control of Rotor Currents; 2.3.4 PI Control of dc Voltage; 2.3.5 PI Control of Grid-side Converter Currents; 2.4 DFIG Dynamic Performance Assessment; 2.4.1 Three-phase Fault; 2.4.2 Symmetrical Voltage Dips; 2.4.3 Asymmetrical Faults; 2.4.4 Single-Phase-to-Ground Fault; 2.4.5 Phase-to-Phase Fault; 2.4.6 Torque Behaviour under Symmetrical Faults; 2.4.7 Torque Behaviour under Asymmetrical Faults; 2.4.8 Effects of Faults in the Reactive Power Consumption of the IG
2.5 Fault Ride-Through Capabilities and Grid Code Compliance 2.5.1 Advantages and Disadvantages of the Crowbar Protection; 2.5.2 Effects of DFIG Variables over Its Fault Ride-Through Capabilities; 2.6 Enhanced Control Strategies to Improve DFIG Fault Ride-Through Capabilities; 2.6.1 The Two Degrees of Freedom Internal Model Control (IMC); 2.6.2 IMC Controller of the Rotor Speed; 2.6.3 IMC Controller of the Rotor Currents; 2.6.4 IMC Controller of the dc Voltage; 2.6.5 IMC Controller of the Grid-Side Converter Currents; 2.6.6 DFIG IMC Controllers Tuning for Attaining Robust Control
2.6.7 The Robust Stability Theorem References; 3 Fully-Rated Converter Wind Turbine (FRC-WT); 3.1 Synchronous Machine Fundamentals; 3.1.1 Synchronous Generator Construction; 3.1.2 The Air-Gap Magnetic Field of the Synchronous Generator; 3.2 Synchronous Generator Modelling in the dq Frame; 3.2.1 Steady-State Operation; 3.2.2 Synchronous Generator with Damper Windings; 3.3 Control of Large Synchronous Generators; 3.3.1 Excitation Control; 3.3.2 Prime Mover Control; 3.4 Fully-Rated Converter Wind Turbines; 3.5 FRC-WT with Synchronous Generator; 3.5.1 Permanent Magnets Synchronous Generator
3.5.2 FRC-WT Based on Permanent Magnet Synchronous Generator

Sommario/riassunto

The offshore wind sector's trend towards larger turbines, bigger wind farm projects and greater distance to shore has a critical impact on grid connection requirements for offshore wind power plants. This important reference sets out the fundamentals and latest innovations in electrical systems and control strategies deployed in offshore electricity grids for wind power integration. Includes: All current and emerging technologies for offshore wind integration and trends in energy storage systems, fault limiters, superconducting cables and gas-insulated transformers
