Direct-through wind power generation system control

What is the topology of direct-drive wind power generation systems?
The topology of the direct-drive wind power generation systems connected to the weak power grid is illustrated in Fig. 1, including the wind turbine, Permanent Magnet Synchronous Generator (PMSG), machine-side converter (MSC), DC capacitor, grid-side converter (GSC), filter inductors, and the AC power grid.

How does a weak grid affect direct-drive wind power generation?
The interaction between the direct-drive wind power generation system and the weak grid involves multiple time scales with overlapping interactions. The main reason for instability is that the introduction of loops 2 and 3 by the weak grid reduces the bandwidth of the current loop, causing frequency band overlap.

What is the GSC of a direct-drive wind power generation system?
The GSC of direct-drive wind power generation systems typically uses the conventional stationary coordinate system. The open-loop transfer function of the PLL is (6) H PLL (s) = (k ppll + k ipll s) 1 s Where kppll and kipll are the proportional and integral parameters of the PI controller in the PLL, respectively.

How does wind power affect system stability?
Key control loops affecting stability are identified, and a targeted parameter design process is proposed to enhance overall system performance. The interaction between wind power generation systems and weak power grids can easily lead to system instability, characterized by multiple-time-scales dynamics.

How are synchronous motors used in a wind turbine?
Two identical permanent magnet synchronous motors are used to simulate the wind turbine and generator, with the two machines connected via a drive shaft. The two motors are controlled by the RTU-BOX204 digital controller.

What is a reference in wind power design?
Reference [,,] optimized the layout and control strategies for wind power systems using various methods; however, these works primarily focus on stability issues within the low- or mid-frequency range, limiting their ability to comprehensively address instability phenomena in the high-frequency range.

This paper analyzed the principle and performance characteristics of PR controller, and proposed a control strategy based on improved PR controller of direct-driven permanent ...

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The focus lies on a comprehensive examination of the microgrid configuration linked to a wind turbine, encompassing aspects such as the wind power generation system, ...

Wind energy is becoming more important in recent years due to its contribution to the independence of power generation industry from traditional fossil energy resources and ...

Direct active and reactive powers control of double-powered asynchronous generators in multi-rotor wind power systems using modified synergetic control

The exemplary WPGS comprises a wind turbine, a connected generator, an advanced interconnection framework, and an extensive control mechanism [7]. Variable-speed ...

Compared to the traditional three-phase wind power generation, multiphase wind power generation systems have obvious advantages in low-voltage high-power operation, ...

uses the Simulink platform to build the permanent magnet direct-drive wind power generation system. On this basis, improve the control strategy to improve the wind power ...

Wind energy is the most promising renewable energy, and it plays a crucial role in sustainable development. This paper"s research content is the converter control strategy of a ...

Direct-drive permanent magnet synchronous wind power generation systems can reserve spare power through pitch angle control and actively participate in system FR when ...

Wind power generation systems (WPGSs) have emerged as a vital source of clean energy, appreciated for their renewable nature and zero fuel costs. However, controlling these ...

Firstly, a virtual synchronous generator (VSG) control strategy is adopted in the grid side converter, which can provide power support at the moment of grid frequency changes; ...

Here, the structure and basic principles of the direct-drive wind power system was studied, mathematical model of the dq generator and ...

Aiming at the problems of low power generation efficiency and large grid-connected current harmonics of the grid-side converter in the direct-drive permanent magnet ...

Direct-drive permanent magnet synchronous wind power systems, characterized by their simple structure and high reliability, have gradually become the mainstream in wind ...

The simulation results showed that the simulation model reflected the operating characteristics of the

direct-drive wind power generation system ...

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