



Intelligent control of wind power generation system





Overview

Wind turbine control systems serve as the central intelligence of each turbine, managing functions such as blade pitch, yaw adjustments, energy conversion, and fault detection.

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This study develops a robust nonlinear control, using an integral sliding mode control (ISMC) associated to an artificial neural network (ANN) approach for a variable-speed wind turbine (VSWT). At below rated speed of wind, the control aims to extract the maximum energy from the wind by the WT as.

This evolution calls for next-generation wind turbine control systems—a fusion of intelligent automation, digitalization, and adaptive control technologies. Wind turbine control systems serve as the central intelligence of each turbine, managing functions such as blade pitch, yaw adjustments.

To address this issue, this paper proposes a cloud-based intelligent PI controller designed to enhance the performance of LFC in smart grids with large-scale wind power integration. By using the error and the rate of change of error as the antecedent inputs of the cloud model-based controller and.

The wind power generation system is fundamental in harnessing offshore wind energy, where the control and design significantly influence the power production performance and the production cost. As the scale of the wind power generation system expands, traditional methods are time-consuming and.



Intelligent control of wind power generation system

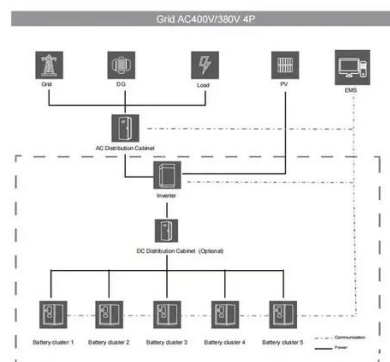


[Intelligent approach to maximum power point tracking control ...](#)

In the variable-speed generation system, the wind turbine can be operated at the maximum power operating point for various wind speeds by adjusting the shaft speed. These ...

[Hybrid ANFIS-PI-Based Robust Control of Wind Turbine Power Generation](#)

Abstract This paper introduces a novel hybrid controller designed for a wind turbine power generation system (WTPGS) that utilizes a permanent magnet synchronous ...



ESS



[Intelligent control of flywheel energy storage system ...](#)

The paper concentrates on performance benefits of adding energy storage system with the wind generator in order to regulate the electric power delivered into the power grid. Compared with ...

[Review on the Application of Artificial Intelligence Methods in the](#)

In recent years, artificial intelligence technology has significantly increased in the research field of control and design of offshore wind power systems. In this paper, 135 highly ...



[Wind Turbine Control Systems , Wind Research](#)

The tool allows researchers and wind power plant designers to examine and minimize the impact of turbine wakes on overall plant ...



[Intelligent control strategy for a grid connected PV/SOFC/BESS ...](#)

In this paper, an intelligent control strategy for a grid connected hybrid energy generation system consisting of Photovoltaic (PV) panels, Fuel Cell (FC) stack and Battery ...



[Power Generation TYING MULTIPLE POWER SYSTEMS ...](#)

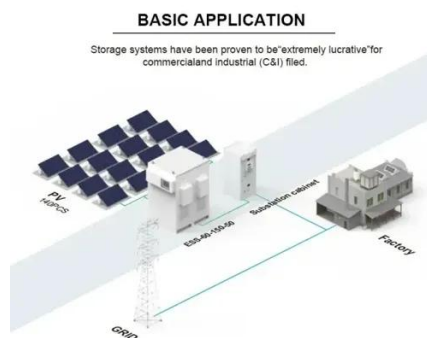
The growing need for dispatchable generation The world continues to shift toward renewable energy sources such as solar, wind and biogas-powered components. More than 60% of new ...



[The Future in Motion: Next-Generation Wind Turbine Control Systems](#)



Next-generation wind turbine control systems are evolving with intelligent automation, predictive monitoring, and grid-aware design to drive efficiency, resilience, and ...

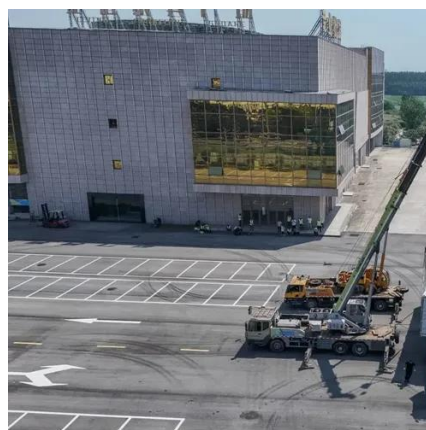


[Coordinated neural adaptive active power control of wind turbines](#)

Abstract Active power control (APC) is an effective way to deal with the instability problem caused by high wind energy penetration in power systems. This study presents a ...

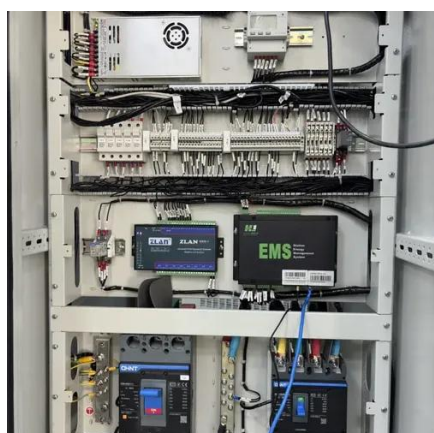
[Review on the Application of Artificial Intelligence ...](#)

As the scale of the wind power generation system expands, traditional methods are time-consuming and struggle to keep pace with ...



[Cloud model-based intelligent controller for load frequency control ...](#)

To address this issue, this paper proposes a cloud-based intelligent PI controller designed to enhance the performance of LFC in smart grids with large-scale wind power ...



[Modeling and Control Strategy of Wind-Solar Hydrogen ...](#)



Abstract: Hydrogen production by wind and solar hybrid power generation is an important means to solve the strong randomness and high volatility of wind and solar power generation. In this ...

ESS

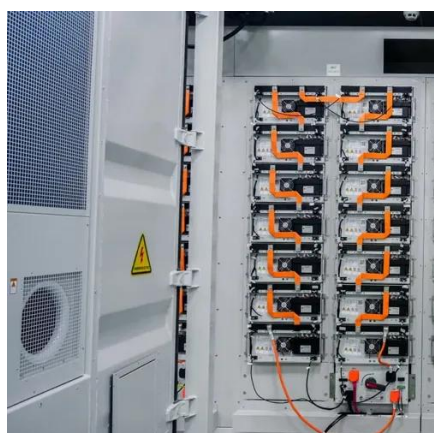


[A comprehensive review of artificial intelligence applications in wind](#)

Among other renewable energy resources, wind energy is an exciting prospect that offers much to study as it is the most efficient and cleanest energy source available, and its ...

[Optimized Fuzzy Based MPPT Control for Wind Power ...](#)

This document presents a direct design of the MPPT controller for PMSG variable speed wind turbines. In this, the wind generator produces maximum power regardless of the conditions or ...



[INTELLIGENT CONTROL OF VERTICAL AXIS WIND ...](#)

California State University, Los Angeles December 2022 ABSTRACT Intelligent Control of Vertical Axis Wind Turbines for High Efficiency Energy Generation By Alexis Ruiz

[Optimizing weak grid integrated wind energy systems using ...](#)



This paper proposes an intelligent control strategy based on the adaptive neuro-fuzzy inference system (ANFIS) to enhance power quality in wind energy systems connected ...



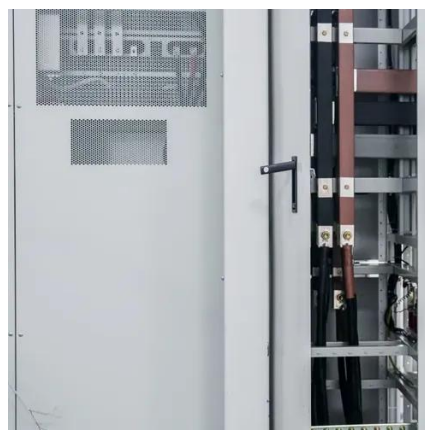
[Design of Intelligent Wind Pumping Power Generation System ...](#)

This research provides new technical approaches and practical experience for the intelligent upgrade of wind-powered water pumping and electricity generation systems, holding ...



[Intelligent control of flywheel energy storage system associated ...](#)

Intelligent control of flywheel energy storage system associated with the wind generator for uninterrupted power supply by Bensaïd Amel, Zebirate Soraya, Chaker ...



[Intelligent backstepping control of power grid-connected wind power](#)

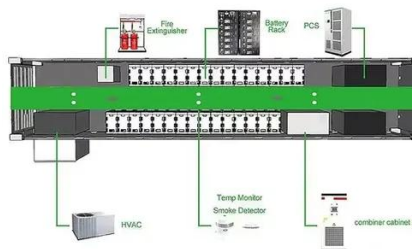
This scholarly paper offers a wind power generation system (WPGS) that utilizes a configuration of parallel five-phase permanent magnet synchronous generators (PMSGs).



[An adaptive frame and intelligent control approach for an ...](#)



For example, suppose deliverable power is unavailable within a short period due to solar and wind radiation failure, in that case, a backup FC system can be included for long ...



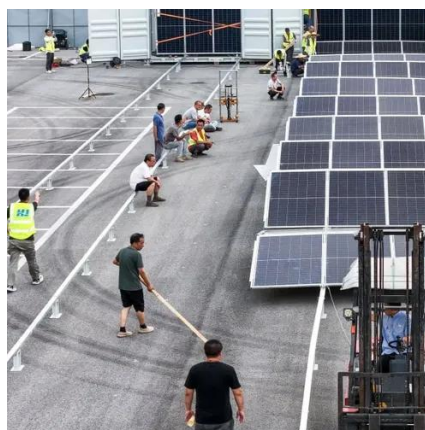
Intelligent load frequency control for improving wind power ...

The subordinate cloud parameters are designed considering randomness of wind power, which effectively solves the problems of poor parameter robustness in traditional PI ...



Optimization and intelligent power management control for an ...

The integration of photovoltaic (PV) solar and wind energy, along with diesel generators in off-grid or grid-connected systems, presents numerous advantages. Despite ...



Intelligent Predictive Control for Enhancing the Efficiency and Grid

Using a permanent magnet synchronous generator (PMSG) model, the NN predictive control is applied to the boost converter and DC/AC inverter, maintaining a stable voltage output despite ...



The Future in Motion: Next-Generation Wind ...



Next-generation wind turbine control systems are evolving with intelligent automation, predictive monitoring, and grid-aware design ...



[Intelligent Control for Increasing Maximum Extracted Power of a Wind](#)

The contribution of this paper, motivated by the existing works, consists of proposing an intelligent control for increasing maximum generation power efficiency of a VSWT.



[Intelligent control of flywheel energy storage ...](#)

The paper concentrates on performance benefits of adding energy storage system with the wind generator in order to regulate the ...



[AI-Controlled Wind Turbine Systems: Integrating IoT and ...](#)

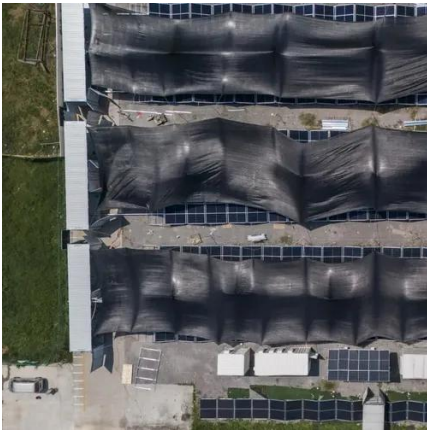
This paper reviews advancements in intelligent control systems, notably those proposed by Smart Wind technologies. These systems leverage a network of sensors and IoT devices to gather ...



[Intelligent Control for Increasing Maximum Extracted Power of a Wind](#)



Request PDF , On Jul 2, 2025, I. Elidrissi and others published Intelligent Control for Increasing Maximum Extracted Power of a Wind Generation System , Find, read and cite all the research ...



[Hybrid ANFIS-PI-Based Robust Control of Wind Turbine Power Generation](#)

This paper introduces a novel hybrid controller designed for a wind turbine power generation system (WTPGS) that utilizes a permanent magnet synchronous generator (PMSG).



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