Intelligent Wind Power Generation System

Overview

Can artificial intelligence control wind energy?

Although traditional control systems can also deal with the variability and fluctuations of wind energy, control systems based on artificial intelligence can do so more efficiently, especially with a greater penetration of wind farms in the power grid .

What is a wind power generation system (WPGS)?

This scholarly paper offers a wind power generation system (WPGS) that utilizes a configuration of parallel five-phase permanent magnet synchronous generators (PMSGs). The control mechanism for this system is based on a fifteen-switch rectifier (FSR) topology, which is specifically designed for grid-connected applications.

Can artificial intelligence be used in wind turbine maintenance?

The application of artificial intelligence (AI) in wind turbine maintenance has evolved over the past decades, with significant progress being made in recent years.

Can AI improve the life cycle of wind turbines?

Based on an analysis of the latest scientific literature, this article examines AI applications for the entire life cycle of wind turbines, including planning, operation and decommissioning. A key focus is on AI-driven maintenance, which reduces downtime, improves reliability and extends the lifetime of the turbines.

Can AI improve wind power generation forecasting?

As a result, energy production increases and overall efficiency is higher. According to some studies, AI can improve the efficiency of wind turbines by up to 20% . Below are some of the most important research and applied AI methods related to wind power generation forecasting.

How is artificial intelligence transforming wind farms into smart grids?

Artificial intelligence plays a very important role in the integration of wind farms into smart grids, where the stability and real-time control of the grid are key aspects .

Intelligent Wind Power Generation System

Design of Off-Grid Wind-Solar Complementary Power Generation System ...

Feb 29, 2024 · The control module of the complementary power generation system is an intelligent controller integrating wind power generation and photovoltaic power generation.

Design of Intelligent Wind Pumping Power Generation System ...

May 13, 2025 · This study designed and implemented an intelligent wind-powered water pumping and electricity generation system based on a microcontroller. The system utilizes optimized ...

A comprehensive review of artificial intelligence applications in wind

Jun 1, 2025 · In recent years, the use of Machine Learning (ML) techniques and Artificial Intelligence (AI) in the O& M and overall improvement of energy systems has been trending, ...

Wind power generation forecasting system based on multi ...

However, due to the intermittent and instantaneous fluctuations of wind power, large-scale wind power grid integration and stable operation of power systems face difficult tests. Therefore, ...

IoT-enabled intelligent fault detection and rectifier ...

Mar 1, 2025 · Based on the preceding discussion, although IoT technology and intelligent optimization algorithms have shown great potential in fault detection and rectifier optimization, ...

Hybrid ANFIS-PI-Based Robust Control of Wind Turbine Power Generation

Sep 18, 2024 · This paper introduces a novel hybrid controller designed for a wind turbine power generation system (WTPGS) that utilizes a permanent magnet synchronous generator ...

Maximum power point tracking in wind energy conversion system ...

Dec 1, 2019 · In this paper, a neural network tuned controller for maximum power point tracking (MPPT) in wind energy conversion system (WECS) is proposed. This technique utilizes radial ...

Renewables integration into power systems through intelligent

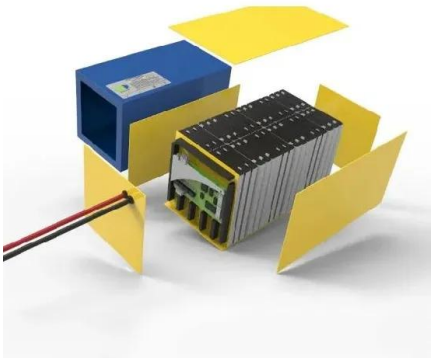
Dec 1, 2023 · The intelligent integration into ESS emphasizes the possibility of enhancing the storage backup for RESs connected power distribution systems. The review analysis signifies ...

Intelligent backstepping control of power grid-connected wind power

Feb 17, 2025 · Abstract This scholarly paper offers a wind power generation system (WPGS) that utilizes a configuration of parallel five-phase permanent magnet synchronous generators ...

WO/2025/058163 INTELLIGENT WIND POWER GENERATION SYSTEM

The intelligent wind power generation system according to the present invention comprises: a wind power generator including a plurality of wind power generator rotors; a wind generation ...



Intelligent backstepping control of power grid-connected wind power

Feb 17, 2025 · This scholarly paper offers a wind power generation system (WPGS) that utilizes a configuration of parallel five-phase permanent magnet synchronous generators (PMSGs). The ...

Power electronics in wind generation systems

Mar 26, 2024 · This Review discusses the current capabilities and challenges facing different power electronic technologies in wind generation systems from single turbines to the system ...

Achieving wind power and photovoltaic power prediction: An intelligent

Nov 15, 2023 · But how to optimize the system deployment capacity, to achieve a smooth docking and real-time scheduling of wind and solar energy, and to integrate renewable power ...

A Review of Intelligent Systems for the Prediction of Wind ...

Jul 14, 2022 · Optimized software models have been developed for forecasting power generation in WT systems, but the accuracy is reduced due to erratic and turbulent wind conditions. ...

Design of Intelligent Accumulator Charger for wind power Generation System

Jan 1, 2012 · In-depth analysis of the conventional battery charging method and charging technical requirements of lead-acid battery in small wind power system, designed a three ...

Enhancing stability of wind power generation in microgrids ...

Mar 1, 2025 · This paper addresses the challenges posed by wind power fluctuations in the application of wind power generation systems within grid-connected microgr...

Intelligent approach to maximum power point tracking ...

Jun 1, 2010 · A variable-speed wind power generation system (WPGS) needs a power electronic converter and inverter, to convert variable-frequency, variable-voltage power into constant ...

Optimizing power generation in a hybrid solar wind energy system ...

Mar 27, 2025 · The rising demand for renewable energy has recently spurred notable advancements in hybrid energy systems that utilize solar and wind power. The Hybrid Solar ...

Application of Artificial Intelligence in Wind ...

Feb 25, 2025 · Based on an analysis of the latest scientific literature, this article examines AI applications for the entire life cycle of wind turbines, including ...

Design of Intelligent Accumulator Charger for wind ...

Dec 28, 2023 · To improve battery life and performance protection, this paper aimed at 500W, 24V AC output voltage wind power generation system and 24V/200AH batteries designed a ...

Wind power generation forecasting system based on multi ...

Based on the multi-model fusion strategy, a wind prediction model with high accuracy, reliability and uncertainty analysis ability is established. Horizontal de-noising and vertical granulation ...

Control System of Wind Power Generation Based on Artificial

Jan 1, 2022 · In order to improve the intelligence and production efficiency of the wind power generation control system, a wind power generation control system based on artificial ...

Intelligent wind power smoothing control with ...

Jan 17, 2017 · An intelligent wind power smoothing control using recurrent fuzzy neural network (RFNN) is proposed in this study. First, the modeling of wind ...

Smart Fuzzy Control Based Hybrid PV-Wind Energy Generation System

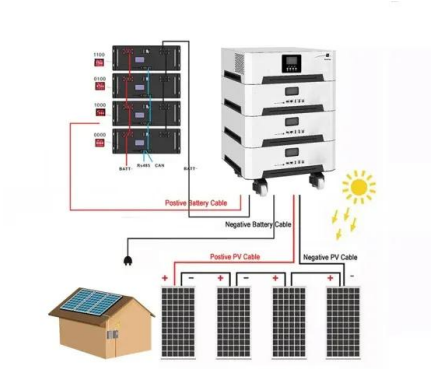
Jan 1, 2023 · The manuscript presents the smart view of hybrid PV-wind power generation system by implementing the fuzzy logic at required stages for exploiting the...

Adaptive optimal secure wind power generation control for ...

Jan 1, 2024 · Adaptive optimal secure wind power generation control for variable speed wind turbine systems via reinforcement learning Mahmood Mazare Show more Add to Mendeley

Small-Scale Hybrid Solar and Wind Power Generation System

Apr 9, 2022 · The importance of renewable power generation is taking a major role in present research work. The consumption of energy has spiked and significant changes in technology ...



A comprehensive review of artificial intelligence applications in wind

Jun 1, 2025 · Renewable energy sources have seen significant improvements in the past 50 years, with wind energy being a particularly promising solution to the global energy crisis. ...

A review of hybrid renewable energy systems: Solar and wind ...

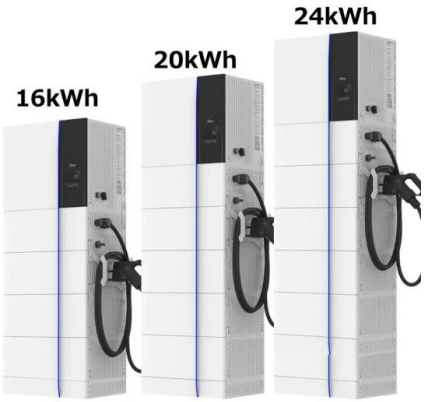
Dec 1, 2023 · However, such systems mitigate the intermittency issues inherent to individual renewable sources, enhancing the overall reliability and stability of energy generation. Solar ...

Integrating data-driven and physics-based approaches for robust wind

Aug 8, 2025 · Wind power fluctuations can cause frequency deviations and voltage instability, making accurate forecasting essential for grid operators to anticipate variations and maintain ...

AI-enabled and multimodal data driven smart health monitoring of wind

Apr 1, 2023 · The system applies innovative multimodal data fusion to fan blade detection. Through the system, fan fault detection is realized faster, with more accuracy and intelligence, ...



A comprehensive review of wind power integration and ...

May 15, 2024 · Integrating wind power with energy storage technologies is crucial for frequency regulation in modern power systems, ensuring the reliable and cost-effective operation of ...

A review of applications of artificial intelligent algorithms in wind

Oct 24, 2019 · Applications of artificial intelligent algorithms in wind farm controllers, Mach number, wind speed prediction, wind power prediction and other problems of wind farms are ...

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