

### **SolarInvert Energy Solutions**

# Intelligent control system for wind power generation





#### **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. What is SMart Wind Technology?

To address these challenges, an intelligent control system that Smart Wind technologies has been proposed. The system utilizes a network of sensors and loT devices to collect real-time data on wind speed, temperature, humidity, and other relevant parameters. Access to this full-text is provided by EDP Sciences. This content is subject to copyright.

Can a hybrid controller improve the performance of a PMSG-based wind turbine?

In this paper, the proposed WTPGS system is designed in MATLAB/Simulink software where a hybrid controller (ANFIS-PI) is implemented in the machine-side converter (MSC) and grid-side converter (GSC) of a variable speed PMSG-based wind turbine to enhance its performance subjected to wind variations.

Can a permanent magnet synchronous generator be used as a hybrid controller?

This paper introduces a novel hybrid controller designed for a wind turbine power generation system (WTPGS) that utilizes a permanent magnet synchronous generator (PMSG). This hybrid controller combines the adaptability of an adaptive neuro-fuzzy inference system (ANFIS) with the simplicity of a proportional-integral (PI) controller.

Can DFIG-based wind turbines improve transient stability during weak grid faults?

Optimized Design of Demagnetization Control for DFIG-Based Wind Turbines to Enhance Transient Stability During Weak Grid Faults. IEEE Transactions on Power Electronics, 1–5. doi: 10.1109/TPEL.2024.3457528. Chhipa, A. et al. Rajkumar Soni, and Tulika Chakrabarti.



Does a PI controller stabilize the rotor speed of a wind turbine?

In Figure 10, the performance of the wind turbine model's rotor speed is showcased over time, comparing the performance of both the PI and hybrid controllers. Initially, the PI controller effectively stabilizes the rotor speed within the first 10 seconds of simulation.

What are some examples of intelligent control mechanisms?

They also compared hybrid solar PV and wind turbines. Artificial neural networks, fuzzy inference systems, fuzzy logic, and neuro-fuzzy are examples of intelligent control mechanisms that have been implemented in numerous scientific and technology domains as convincing alternatives to the traditional.



### Intelligent control system for wind power generation



# 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, ...

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## Successful Deployment of Intelligent Operation ...

Oct 26, 2023 · Coordinated wake control within existing wind farms holds immense potential for maximizing overall power generation and currently



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### INTELLIGENT CONTROL SYSTEM FOR WIND

The intelligent control system for wind turbine farms using IoT and ML technologies has the potential to significantly improve the efficiency and reliability of wind energy generation, while ...

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## 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 ...

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## Effective optimal control of a wind turbine system with ...

Dec 3, 2024 · It maximizes the wind power thus minimizing stress on the storage system. For storage, batteries are important in isolated renewable energy systems due the interminent ...

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## Artificial Intelligence Control System Applied in ...

Sep 5, 2022 · Such resource combinations into the existing smart grid system cause open-ended problems regarding the security and reliability of power ...

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Intelligent speed sensorless maximum power point tracking control ...





Nov 1, 2012 · In these systems, the variable-speed generation system is more attractive than the fixed speed system because of the improvement in wind energy production and the reduction ...

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# 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 ...



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## Successful Deployment of Intelligent Operation ...

Oct 26, 2023 · The system marks the first-ever implementation of large-scale offshore wind farm wake optimization control technology and has received ...

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# Intelligent Control of Power Electronic Systems for Wind Turbines



The PES employed in the wind power generation (WPG) system can effectively face the challenges of grid connection requirements (GCRs). Computational intelligence (CI) ...

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## Intelligent MPPT and coordinated control for voltage

...

Jul 2, 2025 · This research develops a novel control approach for improving voltage stability and maximizing power extraction in Brushless Doubly Fed Induction Generator (DFIG) based Wind

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### Al Applications in Wind-Energy Systems

Feb 15, 2023 · Large-scale expansion of wind-power generation hinges on optimized control and operation of wind turbines and power systems -- which, ...



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### INTELLIGENT CONTROL SYSTEM FOR WIND





The intelligent control system utilizes a network of sensors and IoT devices to collect real-time data on wind speed, temperature, humidity, and other relevant parameters. [2] The data is ...

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## **Enhanced grid integration in hybrid power systems using**

Jan 16, 2025 · This study proposes an innovative approach to integrating hybrid photovoltaic (PV) and wind energy systems into the electrical grid using an Adaptive Neuro-Fuzzy Inference



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## 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 ...

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## 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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### Review of the Intelligent Frameworks for Pitch Angle Control in Wind

Feb 10, 2025 · It highlights the advantages of intelligent control strategies over traditional control methods in mitigating the challenges posed by system non-linearities.

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## (PDF) Intelligent Control System for Wind ...

May 15, 2023 · To address these challenges, an intelligent control system that Smart Wind technologies has been proposed. The system utilizes a network of ...

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Intelligent Control of DFIG-Based Wind Energy Conversion Systems ...





Apr 24, 2025 · This chapter presents a sensorless control technique of wind speed for controlling wind-driven doubly fed induction generators (DFIGs) energy systems. A concept behind this ...

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#### **Wind Power Generation**

Wind power generation is defined as the conversion of wind energy into electrical energy using wind turbines, often organized in groups to form wind farms, which provides a clean and ...



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### INTELLIGENT CONTROL SYSTEM FOR WIND

Oct 22, 2023 · The intelligent control system for wind turbine farms using IoT and ML technologies has the potential to significantly improve the efficiency and reliability of wind energy ...

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## Automatic control system of wind power generation in ...

Aug 21, 2022 · Wind power generation technology, as one of the methods of



utilizing wind energy, has become increasingly mature, and its economic benefits have approached those of ...

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## An adaptive frame and intelligent control approach for an ...

Feb 1, 2025 · The study's key discoveries include the construction of an autonomous model with intelligent control methodologies, as well as a dynamic framework for a hybrid renewable ...

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# An overview of control techniques for wind turbine systems

Nov 1, 2020 · This review paper presents a detailed review of the various operational control strategies of WTs, the stall control of WTs and the role of power electronics in wind system ...



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Aug 21, 2022 · Wind power generation technology, as one of the methods of utilizing wind energy, has become increasingly mature, and its economic benefits have approached thos

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## 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. ...







## Wind Turbine Control Systems: A Comprehensive Review

The Problem: Challenges in Wind Farms Monitoring and Control Systems When it comes to wind power generation, there are many challenges that researchers are faced with when developing ...

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## Intelligent approach to maximum power point tracking control ...



Jun 1, 2010 · To achieve maximum power point tracking (MPPT) for wind power generation systems, the rotational speed of wind turbines should be adjusted in real tim...

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## Artificial Intelligence and Machine Learning in ...

Feb 3, 2023 · As grid-connected wind farms become more common in the modern power system, the question of how to maximize wind power generation while ...

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

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



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Design of Intelligent Wind Pumping Power Generation System ...





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

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LiFepo4 battery will not burn when overchargedover discharged, overcurrent or short circuitand canwithstand high temperatures without decomposition.



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### The Future in Motion: Next-Generation Wind Turbine Control Systems



May 21, 2025 · This evolution calls for next-generation wind turbine control systems--a fusion of intelligent automation, digitalization, and adaptive control technologies. Wind turbine control ...

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### **Control System of Wind Power Generation Based on Artificial**

Jan 1, 2022 · The results show that the scheme can improve the intelligence of the wind power generation control system, and improve the productivity and benefit of the wind power ...

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## Artificial Intelligence and Machine Learning in ...

Feb 3, 2023 · Abstract and Figures As grid-connected wind farms become more common in the modern power system, the question of how to maximize wind ...



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