Wind turbine generator air gap

What is a wind turbine generator failure analysis & fault diagnosis?
In this article, a comprehensive and up-to-date review of wind turbine generators failure analysis and fault diagnosis are presented. First, the electrical and mechanical failures of various WTG components, including stator, rotor, air gap, and bearings, are analyzed. Then, the fault characteristics and root causes of WTG are studied.

What is the apparent power of air gap in a radial-flux generator?
The apparent power of the air gap of a radial-flux generator (SR g R) versus the main dimensions of the machine is as follows : ... ... Ratio KR L R=L/D is chosen in the range of 0.14 and 0.50 based on the main design and available backgrounds .

What causes wind turbine downtime?
Numerous statistical studies have pointed out that generator failuresare a main cause of wind turbine system downtime. The generator,as one of the core components,converts rotating mechanical energy into electrical energy.

Can a double rotor machine be used for a low power wind türbine?
Finite element analysis of an axial flux, permanent magnet, coreless stator, double rotor machine designed for a low power wind türbine application is presented. A real size model of the machine has been prepared by using Ansoft Maxwell, and electromagnetic analysis has been conducted.

What are the common faults of a wind turbine generator?
Common faults of wind turbine generator. Generator electrical faults are mainly stator eccentricity,rotor eccentricity,broken rotor bars,and looseness. The main manifestations of generator stator faults are overheating of stator windings,insulation damage,and grounding.

How does a direct drive wind turbine work?
The direct drive wind turbine eliminates the speed-up gearbox,as the turbine rotor shaft is directly coupled to the generator,which is mostly a synchronous generator with a permanent magnet rotor structure without external supply for excitation.

At the shaft rotational frequency, strong vibration will be introduced once the rotor is unbalanced. It finally arrives at the generator after traveling along the wind turbine drive train. As a result, air-gap eccentricity fault is commenced into the generator.

One example of a direct-drive air-cored generator in a wind turbine is given in Bumby and Martin"s study. ... designs are an important candidate for wind turbines. However, the air gap magnetic ...

This paper provides design aspects of coreless axial flux permanent magnet generators for low cost wind power applications. Such wind turbines are particularly suitable for rural...

With the capacities of large-scale turbine generators increase, higher electrical and thermal loads may cause higher risk of thermal faults. Especially, for those air cooling machines with single channel ventilation system, the comparatively poor thermal conductibility of air makes the air-gap become a critical part in thermal transmission network. Thus, the heat ...

For one thing, the air gap of generators could be closed by the pitch or roll rotations, especially for the direct-drive type [67]. ... Investigations on drivetrains in high-power wind turbines. Contemporarily, the power of state-of-the-art wind turbines has exceeded 12 MW, while this power is much larger than that used in most research such as ...

5 Generator/wind turbine bearing type, stiffness, conditioning, and arrangement influence rotor/stator structural stiffness requirements, ... Such a bearing can be placed at the generator air gap; hence, generator rotor/stator structural stiffness requirements and mass are lowered. The roller geometry and the number of rollers, raceway ...

However, the generators can hardly operate reliably towards the end of the turbine life owing to the variable-speed conditions and harsh electromagnetic environments. This article first provides a comprehensive and up-to-date review of the electrical and mechanical failures of various parts (stator, rotor, air gap and bearings) of the generator.

Direct control of the air-gap torque also aids in minimizing gearbox torque fluctuations. Since there is a frequency converter between the wind turbine generator and the power grid, it becomes possible to decouple ...

Direct-drive (DD) permanent magnet (PM) wind turbine generators (WTGs) require a substantial amount of expensive rare-earth PM material in their construction. The quantity of PM material required depends on the air-gap clearance, yet despite the importance of this parameter studies on DD PM WTG design commonly employ simple "rules of thumb" to determine its value. ...

To design the generator, the relationship between the outer diameter and the output power should first be calculated by, where ?, A c, k w, w s, B mg, ? p, ?, and cos (?) $cos (phi)$ are efficiency, electrical loading, winding factor, 20 rated speed (rpm), maximum air gap flux density (T), magnet width to pole pitch ratio, the ratio of magnet width to pole pitch, the ...

The wind turbine is a rotary device that can convert wind energy into electrical energy. The main operating parts of a wind turbine generator system (WTGS) are turbine, nacelle, and tower; the nacelle consists of a generator, the mechanical gearing, wind and speed sensors, a control system, and a yaw mechanism system [46].Accurate wind turbine modeling is required due to ...

The wind turbines are classified as small wind turbines (SWTs) and large wind turbines. According to the International Electrotechnical Commission (IEC) Standard 61400-2, wind turbines whose blade sweep area is <200 m 2 are called SWTs, and their electric energy production is up to 500 kW.

This paper proposes an Improved Magnetic Circuit (IMC) model for the optimal design and characteristics evaluation of the Five-Phase Permanent Magnet Synchronous Generator (FP-PMSG) for wind power ...

Efficient condition monitoring is essential for reliable wind energy from turbines. Asymmetricity in Permanent Magnet Synchronous Generators (PMSGs), stemming from various factors like rotor core, stator core and air gap, is often related to imbalances, affecting efficiency and performance due to uneven design or operation, causing fluctuations in voltage and ...

Abstract: Multi-megawatt permanent magnet (PM) direct-drive (DD) wind turbine generators (WTGs) require a substantial amount of expensive rare-earth PM material in their construction ...

Typical megawatt direct-drive permanent magnet (PM) generators have mean air-gap diameters (Dairgap) between 4-6 m. Machines may weigh about 0:6T0:6 in ton3 where T is the rated torque in kNm and cost approximately 219P in ... both generator and wind turbine rotors and are arranged in single, double, or triple arrangements located in front of ...

Request PDF | Proposal and Development of Radial Air-Gap Coreless Generator Suitable for Small Wind Turbine Used in Urban Area | Independent distributed generations using small wind turbines are ...

428 6 Permanent Magnet Generators (PMG) for Wind Turbines and Micro Hydro Turbines It results from Eq. 6.4 that flux density in the air gap B i is determined by the magnetomotive force of operating winding I eW e, or otherwise said, by the surface of the window reservedfor winding.The biggeris the lengthof air gapi, the smaller is the inductionB i

Abstract--Magnetic force excitations in the air gap of gen-erators can lead to tonal noise emissions of direct-drive wind turbines. Besides the magnetic circuit design, the generator air gap topology has an impact on the excited vibration modes and their frequencies, respectively. For the model-based analysis

Air-gap flux density; according to PMs excitation and current phases no-load and on-load condition, its domain will be selected. Output power; according to user requirement. Rated speed; according to the application of the generator. For example, for a wind turbine without a gearbox, a low-speed generator is designed.

addition to supporting the turbine rotor, some direct-drive congurations require the main bearing to also support the generator rotor while maintaining an appropriate generator air gap. Coupled approaches to the modeling and assessment of wind turbine drivetrain systems will therefore become increasingly important.

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The wind turbine generator includes a core and a plurality of stator windings circumferentially spaced about a generator longitudinal axis, a rotor rotatable about the generator longitudinal axis wherein the rotor includes a plurality of magnetic elements coupled to a radially outer periphery of the rotor such that an airgap is defined between ...

Superconducting (SC) wind turbine generators offer 5 to 10 times the air-gap flux density of a PM generator, and a corresponding increase in specific power and power density. Previous MW scale SC wind turbines designs used heavy back iron in the design, iron saturation limits the achievable air-gap flux density in the designs and resulted in bulky generators and moderate efficiency.

For the purpose of calculations, the Tip-Speed-Ratio (TSR) ? is set to five for the three-blade rotor to maintain optimum performance of variable speed rotor [].The rated wind speed v is set to 11 m/s, while the turbine rotor diameter D R ${D_R}$ is set to 2 m and the turbine rotor area A R ${A_R}$ is determined in m 2.The air density ? is set to 1.23 kg/m 3 and the ...

2.1.3 Air gap eccentric. The generator air gap eccentric fault means that the unevenness of the air gap between the stator and rotor of the motor exceeds the standard range. When the generator is running, the stator and rotor in the magnetic field will be subjected to air gap electromagnetic force.