

# Contribution to the Fault Diagnosis of a Doubly Fed Induction Generator for a Closed-loop Controlled Wind Turbine System Associated with a Two-level Energy Storage System

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**Abstract:** In this article, a contribution to the fault diagnosis of a doubly fed induction generator for a closed-loop controlled wind turbine system associated with a two-level energy storage system using an on-line fault diagnostic technique is proposed. This technique is proposed to detect the rotor fault in the doubly fed induction generator under non-stationary conditions based on the spectral analysis of stator currents of the doubly fed induction generator by an adaptive fast Fourier transform algorithm. Furthermore, to prevent system deterioration, a fractional-order controller with a simple design method is used for the control of the whole wind turbine system. The fractional-order controller ensures that the system is stable in both healthy and faulty conditions. Additionally, to improve the production capacity under wind speed fluctuations and grid demand changes, a two-level energy storage system consisting of a supercapacitor bank and lead-acid batteries is proposed. The obtained simulation results show that the objectives of the fault diagnosis procedure and control strategy are reached.

**Keywords :** Wind energy conversion systems, adaptive Fast Fourier transform, doubly fed induction generator, fault detection and diagnosis, fractional-order control, two-level energy storage system