

Reliability Analysis Of Wind Turbine And Maximization Of Power Output

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Abstract

With continuous depletion of conventional sources of energy, Wind Energy Conversion Systems (WECSs) are turning out to be one of the major players with immense potential to meet the future energy demands. These Wind Energy Conversion System (WECSs) are quickly becoming primary source of energy. In this paper, reliability analysis of wind turbine and maximum extraction of power output using (LPPT) Limited Power Point Tracking is presented.

The functional reliability and operational reliability of existing wind turbine is calculated based on previous data. The reliability of existing wind turbine is increased using parallel redundant subsystems in wind turbine system which is mathematically shown.

The proposed control strategy(LPPT) enables limited as well as maximum power extraction from WECSs. In the present work, real power control is attained by field-oriented control (FOC) of permanent magnet synchronous generator (PMSG). The operating point of the WECS is decided based on the wind turbine characteristics and the demanded power. Proper decoupling and feed-forward techniques have been deployed to eliminate cross-coupling and the effect of load side disturbances. Simulations are carried out under load and no load conditions.

A mathematical model of a permanent magnet synchronous generator (PMSG) is designed for a direct-driven wind turbine. The simulation model is carried out in MATLAB SIMULINK to determine Wind turbine power output for different wind speeds. To improve the dynamic behaviour of the system, a controller based on Limited Power Point (LPPT) control technique is used. A detailed electromechanical model of a PMSG wind turbine connected to power grid is developed in MATLAB SIMULINK environment and its corresponding control structure is implemented in existing Wind Turbine. As a result Power output is increased also operates turbine within safe limits. **Keywords:** Reliability, Availability, Capacity factor, Limited Power Point Tracking.