風力発電システムの出力平滑化とFRT考慮のための制御手法

Form 3

論 文 要 旨

Abstract

論 文 題 目

Title

Control Methods for Smoothing Output Power of WECS and Fault-Ride Through Consideration

(和文：風力発電システムの出力平滑化と FRT 考慮のための制御手法)

Due to the crisis of fossil fuels and considering green-house effect, it is predicted that over the next twenty years, fossil fuels contribute 64% of the growth in energy. Among the renewable sources, wind energy is one of the most rapidly growing renewable power source. To utilize wind energy proficiently, there is no alternative of the variable speed wind turbines (VSWTs). The VSWT systems are equipped with doubly fed induction generators (DFIGs) or permanent magnet synchronous generators (PMSGs). The popularity of the PMSG based wind energy conversion system (WECS) has increased because of its simple structure, availability and efficient power production capability. Wind energy is a developed renewable energy source that has been successfully utilized in many countries. The power generated from the wind energy depends on weather conditions which makes the frequency fluctuates and may cause voltage variations which create instability during grid fault.

Firstly, in this thesis, smoothing technique of PMSG-based WECS has been proposed. It concentrates on the smoothing control method for output power fluctuations due to wind speed variations and the enhancement of Fault-Ride Through (FRT) during grid fault. Secondly, the control methods are used: pitch angle control system, inertia control of wind turbine, and DC-link voltage control. The PMSG-based WECS used adopts an AC-DC(generator-side converter) and DC-AC (grid-side inverter). When the wind speed is greater than the rated wind speed, the output power of PMSG is controlled by the pitch angle control method. The generator-side converter controls the generator torque of the PMSG, while the grid-side inverter controls the DC-link and grid voltages. The torque command for the generator-side converter is determined by using fuzzy logic. The kinetic energy stored by the inertia control of a wind turbine can be used to smooth the power fluctuations of the PMSG. The DC-link voltage command is based on the output power fluctuations of the PMSG. A chopper circuit is used in the DC link for stable operation of the WECS during grid fault. The FRT requirement is used such that the grid will stay operational during the grid fault and provides fast restoration of active power once the fault is cleared. Finally, all the proposed methods are summarized and future scopes are also been discussed.

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