

琉球大学学術リポジトリ

グリーンハウス用風力発電の渦電流ブレーキシステムに関する研究

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Abstract

Title: Study on wind turbine braking system based on eddy current applied on DC green house

The demand for the renewable energy is increasing because of its benefits comparing to the fossil power. Renewable energy such as wind power, solar power are cheaper and never expire comparing to the fossil fuels. Therefore, it is necessary to conduct more research works on renewable energy to maximize its power generating ability. In this regard wind turbine power generation control is a necessary topic to be investigated. In this research work regarding wind turbine stall control and power analyzing we conduct several proposed methods.

This research aims to develop an eddy current based wind turbine brake system for the small-scaled wind turbine and analyze the power supply performance of the DC green house. Here, DC green house is a vegetable or fruit planting farm which is control under DC current. We proposed two methods to control the small-scaled turbine rotation.

First proposed method is an eddy current based wind turbine for stall control. This system developed in a simulation-based environment. MATLAB/Simulink application is used as the software platform of the system. We did the simulation for different wind velocity patterns including high wind and gust occurrence.

Second proposed method is MPPT control using eddy current brake. We added the MPPT control to the proposed wind turbine brake system. In this system there are two brake systems which are MPPT control brake system to produce maximum power and emergency control brake system to control the over-rotation for high wind velocity occurrence. We analyze the generator power behavior, battery voltage of the system. The load data is collected from a mango farm in Okinawa prefecture.

Modern wind turbine brake systems use the brake pad based wind turbines to control the angular velocity of the system. However, these brake pads could be running out of time because of the friction. But the eddy current brake system doesn't have a contact with the rotor. Therefore, the friction loss is not occurring in the eddy current based brake system. Furthermore, we believe this brake can use for longer time than the normal friction brake pad-based wind turbine system. Also, the energy loss will be reduced. Eventually the feasibility of eddy current brake system is confirmed in simulation results.

Keywords: Small Wind Turbine, Eddy current brake, over rotation, stall control, MATLAB/Simulink

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