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Transient Stability Improvement of Grid Connected DFIG based on Wind Farm

M.Sc. Thesis
By

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A thesis submitted in partial fulfillment of the requirements for the M.Sc. degree in Electrical Engineering

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STATEMENT

This thesis is submitted to Ain Shams University as one of the requirements for Master of Science degree in Electrical Engineering.

The work in this thesis has been carried out by the author, and no part of this thesis has been submitted for a degree or qualification at any other university or institution.

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ABSTRACT

Wind energy is playing a significant role in turning the world into a green source of energy. Therefore, the worldwide share of wind energy in the overall power capacity is soaring upwards. Lately, lots of attention has been directed towards the notion of a variable-speed wind turbine (WT) given its relatively high quality, controllability and efficiency. As a result of the rise in demand for variable speed WTs, the demand for control rises. Consequently, it is necessary to examine the wind turbine-generator systems (WTGSs) techniques that could precisely simulate the performance of the WTGS components.

To obtain a stable WTGS power output, control techniques need to be improved by taking into consideration the previously obtained WTGS models' results. The given regulation strategies consist of the grid, generator converter side controls, maximum power point tracking control and pitch angle control. The grid converter side is applied to stabilize the DC-link voltage and generate a unity power factor considering the grid-side WTGS. The regulator of the generator-side converter is capable of regulating the reactive power as well as torque. At the stator terminals, the active power reference values are delivered using the maximum power point tracking controller. The pitch-angle control is meant to limit the maximum output power equal to the rated power and only activated at high wind speeds.

In this thesis, an artificial intelligence controller is used when varying the rotor speed for getting different operating modes at sever conditions. The results of both PI and ANN controllers are then compared. The validity of the proposed model is designed through MATLAB/SIMULINK. The adaptive neural network system focuses on improving the use of wind power while connecting to the grid. Nowadays, the variable speed-pitch control Doubly Fed Induction Generator (DFIG) constructed WT with variable-scheme has become the most well-known wind energy generator. This machine can operate at different modes either when its grid-connected or standalone mode. An understanding is necessary for the modeling, control scheme, and dynamic also the stable machine state analysis in the functional modes to extract the optimal wind energy power while giving an accurate predication for its performance and behavior.

ACKNOWLEDGMENT

Thank God, for the wisdom, knowledge and his countless blessings on me.

I would like to thank my supervisors: Prof. Dr. Hussein Faried Soliman, Prof. Dr. Hany Mohamed Hasanien and Dr. El-Hussien Abbas Mahmoud for their continuous guidance, support, and encouragement throughout my research study. I have learned valuable lessons from their wisdom, carefulness, and vision. They have been wonderful advisors to me and have left a major impact on my life. I cannot possibly list all that I have learned from them.

I would also like to express my sincere gratitude and appreciation to the committee members and the professors for the time they dedicated to examining and reviewing my work, their valuable feedback and useful suggestions which helped make this thesis a more comprehensive one.

I am grateful for my parents, my wife and my brother, who helped me throughout the thesis. Thank you for supporting me every day. Finally, I would like to dedicate this work to the memory of my father.

Mohamed Magdy Mahmoud

Cairo, 2018

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