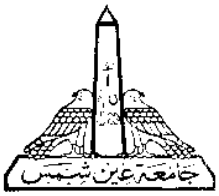

AIN SHAMS UNIVERSITY
FACULTY OF ENGINEERING
ELECTRICAL POWER AND MACHINES DEPARTMENT

ON THE STUDY OF EQUIVALENT WIND FARM WITH REACTIVE POWER COMPENSATION

A thesis submitted in partial fulfillment of the requirements of the degree
of Master of Science in Electrical Engineering
(Electrical Power and Machines Engineering)

by

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Bachelor of Science in Electrical Engineering
(Electrical Power and Machines Engineering)
Faculty of Engineering, Ain Shams University, 2008

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Date:01 August 2016

Statement

This thesis is submitted as a partial fulfillment of Master of Science in Electrical Engineering, Faculty of Engineering, Ain shams University.

The author carried out the work included in this thesis, and no part of it has been submitted for a degree or a qualification at any other scientific entity.

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ABSTRACT

The exhaustion of fossil fuels made it vital to search for renewable energy resources. In this regard, wind energy offers the most promising solution. There are two main types of wind turbines that are used recently: the variable speed wind turbines (VSWT) and the fixed speed wind turbines (FSWT). Although the VSWT are used in modern wind turbine generation systems, yet FSWT are the subject of the presented work because they were vastly installed worldwide over the past years. The interconnection of the wind energy conversion systems (WECS) to the grid caused an increase in the short circuit level and a decay in the fault ride through capability of WECS. Compensation techniques such as pitch control, series and shunt techniques were introduced to resolve these problems. An electrical system consisting of a single fixed speed wind turbine connected to the electricity grid is simulated on the PSCAD/EMTDC software during faults at the point of common coupling (PCC). In addition, a system consisting of a wind farm, containing eleven fixed speed wind turbines connected to the grid and subjected to several three-phase faults, is considered. An aggregated model for the wind farm is obtained and simulated on the PSCAD/EMTDC software to study its dynamic behavior during the grid faults.

The thesis presents a compensation technique based on a Bridge-Type Fault Current Limiter (FCL) with a discharging resistor to ameliorate the system performance under grid faults. A simple cascaded control strategy is proposed to control the FCL. The compensated system is simulated on PSCAD/EMTDC software. The proposed system succeeds to limit the current, to regulate the terminal voltage of the generator, and to enhance the dynamic performance of the WECS during grid faults for both, the single unit system and the wind farm system. The simulation results show the potentials of the FCL as a simple and effective method for solving grid interconnection problems of WECS.

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