بسم الله الرحمن الرحيم

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بقسم التوثيق الإلكتروني بمركز الشبكات وتكنولوجيا المعلومات دون أدنى مسئولية عن محتوى هذه الرسالة.

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Ain Shams University
Faculty of Engineering
Power & Electrical machines Dept.

A Novel Technique for Rotor Side Converter Protection in Doubly Fed Induction Generators

A Thesis
Submitted in partial fulfillment of the requirements for the degree of
Doctor of Philosophy
In Electrical Engineering

Submitted by
Ahmed Mohamed Khaled Mohamed

Supervised by
Prof. Dr. Almoataz Y. Abdelaziz

Electrical Power & Machines Department
Faculty of Engineering
Ain Shams University

Prof. Dr. Hadi El_Helw

Electrical and Control Department
Faculty of Engineering
Arab Academy for Science, Technology and Maritime Transport

Dr. Mohamed Ezzat

Electrical Power & Machines Department
Faculty of Engineering
Ain Shams University

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Statement

This thesis is submitted to Faculty of Engineering, Ain Shams University in partial fulfillment of the requirements for the Doctor of Philosophy Degree in Electrical Engineering. The work included in this thesis is carried out by the author at Faculty of Engineering, Ain Shams University. No part of this thesis has been submitted for a degree or a qualification at any other university or institute.

Name: **Ahmed Mohamed Khaled Mohamed**

Signature:

Date: **/ /2022**

Researcher Data

Ahmed Khaled was born in Egypt in 1983 and received my bachelor degree in electrical engineering from faculty of engineering (Shoubra), Benha university, Cairo, Egypt and a master degrees in the same field from the Arab Academy for Science, Technology and Maritime Transport, Cairo, Egypt, in 2006 and 2013, respectively.

I posses more than 15 years of progressive experience in the engineering field from both design and maintenance point of view at Omega Co, Mantrac, Egypro FME & JLL. Most recently, my responsibilities as Facilities manager at JLL are to manage & lead various O&M activities in HSBC head office and some branches.

Thesis abstract

Recently, wind energy is considered as one of the most important energy resources and the growing share of the wind energy in the electrical grids made many countries introduced new grid codes to identify the responsibilities and rights of the wind farms during all grid conditions.

Nowadays, the Doubly Fed Induction Generator (DFIG) becomes one of the most popular generators in variable wind turbine systems. The DFIG has the advantages of; low cost, low weight, and high efficiency. However, one of its main disadvantages is its sensitivity to the voltage dips. Therefore, there are various techniques were developed to protect the DFIG and enhance its performance during the faults so as to meet the grid codes requirements.

In this thesis, DFIG theory was discussed along with its control techniques, also various protection techniques of the DFIG were discussed and their advantages and disadvantages are highlighted.

Two novel proposed techniques in protecting DFIG`s Rotor Side Converter (RSC) are presented and discussed. To evaluate the behavior of the new proposed protection schemes, a network consisting of a 2MW wind turbine connected to an infinite bus bar via a 0.69 /20 kV transformer is considered using EMTDC/PSCAD software. A 3-phase to ground fault with different levels at the high voltage side of the transformer is introduced at different generator speeds. The results showed a noticeable enhancement in the DFIG performance when the proposed techniques are applied specially regarding rotor current and DC link voltage which have a direct effect on RSC and its components.

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