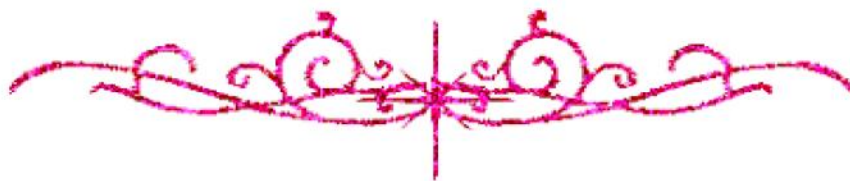بسم الله الرحمن الرحيم

شبكة المعلومات الجامعية
التوثيق الالكتروني والميكروفيلم

جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم
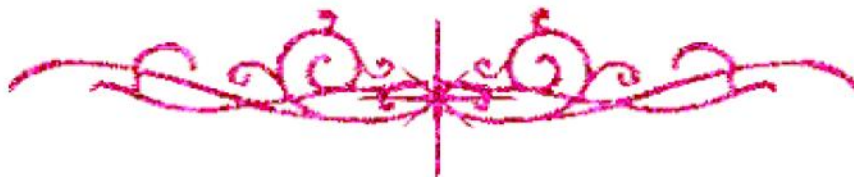
قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها علي هذه الأقراص المدمجة قد أعدت دون أية تغيرات

يجب أن

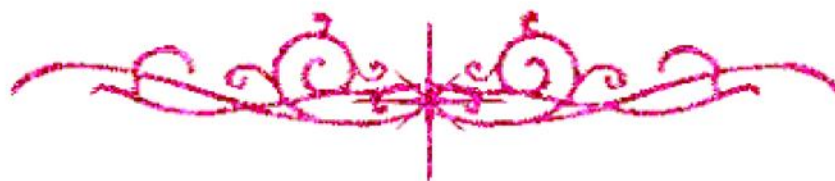**تحفظ هذه الأقراص المدمجة بعيدا عن الغبار**

بعض الوثائق الأصلية تالفة

بالرسالة صفحات

لم ترد بالأصل

AIN SHAMS UNIVERSITY

FACULTY OF ENGINEERING

Engineering Physics and Mathematics Department

Optimal Reactive Power Control using Artificial Intelligence Methods

A Thesis submitted in partial fulfillment of the requirements of the degree of Master of Science in Engineering Mathematics

By

Mohamed El-Sayed Mohamed Ali

Bachelor of Science in Electrical Engineering

Faculty of Engineering, Ain Shams University, 2013

Supervised By

Prof. Dr. / Niveen Mohamed Khalil Badra

Prof. Dr. /Almoataz Youssef Abdelaziz

Dr. / Mahmoud Abd-Allah Attia

Cairo – (2020)

Optimal Reactive Power Control using Artificial Intelligence Methods

A Thesis
Submitted to Faculty of Engineering
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Engineering Mathematics
(Engineering Physics and Mathematics Department)

Prepared by
Mohamed Elsayed Mohamed Ali

B.Sc. in Electrical Engineering, June 2013
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Date: …../04/2020

DEDICATION

This work took years from my life. I wish to dedicate it to who suffered
to educate, prepare and help me to be as I am,
TO MY FATHER AND MY MOTHER

Also, I wish to dedicate my thesis **to my Wife for her support**

Finally I dedicated this thesis to my brother, my sisters and my son
for their encouragement and help to complete this work.

`

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Statement

This thesis is submitted as a partial` fulfillment for the degree of Master of Science in Engineering Mathematics at 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.

Student name: Mohamed Elsayed Mohamed Ali

Signature: …………..……….

Date: …. /.... /………

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First, and foremost, thanks are due to **Allah***,*
the most beneficent and merciful of all.

In the beginning, I would like to extend my sincere thanks and respect to **Prof. Dr. Niveen Badra** Professor of Engineering Mathematics, Faculty of Engineering, Ain-Shams University who helped and supported me to finish this work. She was always available whenever I needed any advice and giving me the positive energy to achieve what I want. She also enriched this work a lot with her experience.

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Publications

[1] Mohamed S.Ghayad, Niveen M. Badra, Almoataz Y. Abdelaziz, Mahmoud A. Attia,et al, "Gravitational Search Algorithm and Sine Cosine Algorithm to Enhance The VSC HVDC System Performance Under Different Disturbances" , Second IEEE International conference on Power and Advanced Computing Technologies i-PACT 2019, India, March 2019.

[2] Mohamed S.Ghayad, Niveen M. Badra, Almoataz Y. Abdelaziz, Mahmoud A. Attia, "Reactive power control to enhance the VSC-HVDC system performance under faulty and normal conditions", International Journal of Applied Power Engineering (IJAPE),August 2019.

Thesis Summary

This thesis focuses in studying the dynamic response of reactive power in the Voltage Source Converters High-Voltage Direct Current (VSC- HVDC) system. In order to get better and faster response, reactive power values should be controlled. Optimizing the parameters of PI (proportional & integration) controller is necessary to control these values.

Four meta-heuristic optimization methods which are Gravitational Search Algorithm (GSA), Sine Cosine algorithm (SCA), Particle Swarm Optimization (PSO) and Modified PSO are used to get optimal parameters of PI controller. These algorithms have an efficient global Search capability.

Using MATLAB™ Simulink, model of VSC- HVDC system is presented. This system is exposed to different disturbances for checking its dynamic response of reactive power. Simulation results show that the dynamic response is improved with the optimal gains than the default ones.

At the end of this thesis, it is noted that the response of reactive power is improved with using optimized parameters. The Modified PSO presented the best response among the other proposed methods as it is based on mathematical modification to update the value of parameters in each iteration. The mathematical modification is based on calculating the error in the objective value between two successive iterations in order to obtain better values of parameters.

<u>Keywords:</u> High Voltage Direct Current (HVDC), Voltage Source Converter (VSC), Reactive power, Gravitational Search Algorithm (GSA), Sine Cosine algorithm (SCA), Particle Swarm Optimization (PSO).

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