



بسم الله الرحمن الرحيم

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تم رفع هذه الرسالة بواسطة / حسام الدين محمد مغربي

بقسم التوثيق الإلكتروني بمركز الشبكات وتكنولوجيا المعلومات دون أدنى

مسئولية عن محتوى هذه الرسالة.

ملاحظات : لا يوجد





PROPOSED RANKED STRATEGY OF ELECTRIC VEHICLES CHARGING FOR TECHNICAL AND ECONOMICAL ENHANCEMENT

By

Norhan Mohamed Mokhtar Mohamed

A thesis submitted to the

Faculty of Engineering at Cairo University

In Partial Fulfillment of the

Requirements for the Degree of

MASTER OF SCIENCE

In

Electrical Power and Machines Engineering

FACULTY OF ENGINEERING, CAIRO UNIVERSITY
GIZA, EGYPT
2022

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Under supervision of

Prof. Dr. Doaa Khalil Ibrahim

Electrical Power Engineering Department

Faculty of Engineering

Cairo University

Assoc. Prof. Dr. Hebatallah Mohamed Sharaf

Electrical Power Engineering Department

Faculty of Engineering

Cairo University

Assoc. Prof. Dr. Aboul'fotouh Abd-Elreheem Mohamed

Electrical Power and Machines Department,

Higher Institute of Engineering at El-Shorouk City, Cairo, Egypt

FACULTY OF ENGINEERING, CAIRO UNIVERSITY

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Approved by the Examining Committee:

Prof. Dr. Doaa Khalil Ibrahim

Thesis Main Advisor

Assoc. Prof. Dr. Hebatallah Mohamed Sharaf

Advisor

Prof. Dr. Mohamed Salah El-Sobky

Internal Examiner

Prof. Dr. Ebtisam Mostafa Mohamed Saied

External Examiner

Faculty of Engineering at Shoubra, Benha University

FACULTY OF ENGINEERING, CAIRO UNIVERSITY

GIZA, EGYPT

2022

Engineer's Name: Norhan Mohamed Mokhtar Mohamed
Date of Birth: 23/8/1992
Nationality: Egyptian
E-mail: Norhan_mokhtar@hotmail.com
Phone: +201019680906
Address: 4 Panorama El-shorouk, El-shorouk City, Egypt
Registration Date: 1/10/2016
Awarding Date:/....../2022
Degree: Master of Science
Department: Electrical Power and Machines Engineering
Supervisors:



Prof. Dr. Doaa Khalil Ibrahim
Assoc. Prof. Dr. Hebatallah Mohamed Sharaf
Assoc. Prof. Dr. Aboul'fotouh Abd-Elreheem Mohamed
Higher Institute of Engineering at El-Shorouk City

Examiners:

Prof. Dr. Doaa Khalil Ibrahim (Thesis Main Advisor)
Assoc. Prof. Dr. Hebatallah Mohamed Sharaf (Advisor)
Prof. Dr. Mohamed Salah El-Sobky (Internal Examiner)
Prof. Dr. Prof. Dr. Ebtisam Mostafa Saied (External Examiner)
Faculty of Engineering at Shoubra, Benha University

Title of Thesis:

**Proposed Ranked Strategy of Electric Vehicles Charging
for Technical and Economical Enhancement**

Key Words:

Charging Cost, Coordinated charging, Electric Vehicle (EV),
Multi-Objective Function, and Particle swarm optimization (PSO).

Summary:

Car exhaust is one of the most common causes of ozone hole aggravation. Electrical vehicles (EVs) represent a promising solution to avoid this problem. Despite the benefits of EVs, their random charging behavior causes some difficulties regarding the electric network performance, such as increased energy losses and voltage deviations. This thesis aims to achieve the proper scheduling of the EVs charging process, avoid its negative impacts on the network, and satisfy the EVs users' requirements. The EVs charging process is formulated as an optimization problem and solved using particle swarm optimization. The optimization problem formulation considers the EV arrival and departure times and the state of charge required by the user. Different strategies such as separated, accumulated, and ranked strategies with continuous or interrupted fixed charging have been applied to solve the uncoordinated EVs charging problem. These strategies are extensively tested on the modified IEEE 31 bus system (499-node network), using the combination of both Open Distribution System simulator (Open DSS) and MATLAB m-files. The simulation results confirm the effectiveness of the proposed accumulated ranked strategy with interrupted fixed charging in improving the overall power system performance. The achieved improvements include minimizing: the peak power capacity, the peak power losses, and the voltage drop. Moreover, the cost of the EVs charging in most of the feeders has been decreased to a satisfying value. A comparison between the proposed strategy and some previously reported strategies has been performed to ensure the technical and economic enhancement of the proposed strategy.

DISCLAIMER

I hereby declare that this thesis is my original work and that no part of it has been submitted for a degree qualification at any other university or institute.

I further declare that I have appropriately acknowledged all sources used and have cited them in the references sections.

Name: Norhan Mohamed Mokhtar Mohamed

Date: / / 2022

Signature:

ACKNOWLEDGMENT

Thanks to ALLAH who gives us the power and hope to succeed.

Thanks must go to Allah the creator of this universe who ordered us to study and explore his creations to know him better. However, as I come to understand more, I find that there is so much more knowledge to absorb and to get to grips with.

I would like deeply to express my thanks and gratitude to my supervisors; Prof. Dr. Doaa Khalil Ibrahim, Associate Prof. Dr. Hebatallah Mohamed Sharaf, and Associate Prof. Dr. Aboul' Fotouh Abdel-Rheem Mohamed for their faithful supervision, enormous efforts, and their great patience during the period of the research.

I would like to thank my father, my mother, my husband, my daughter, and my brothers for their great inspiration, kind support, and continuous encouragement.

Thank you all.

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