

UNIVERSITI TEKNOLOGI MARA

**PREDICTION OF PHOTOVOLTAIC
SYSTEM OUTPUT USING HYBRID
CUCKOO SEARCH LEAST SQUARE
SUPPORT VECTOR MACHINE**

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Thesis submitted in fulfillment
of the requirements for the degree of
Master of Science
(Electrical engineering)

Faculty of Electrical Engineering

October 2019

ABSTRACT

The electrical system photovoltaic (PV) modules for special design considerations due to unpredictable and sudden changes in weather conditions such as the solar irradiation level as well as the cell operating temperature. This thesis presents a practical and reliable approach for the prediction of PV power output using an intelligent-based technique namely Cuckoo Search Algorithm – Least Square Support Vector Machine (CS-LSSVM). Available historical output power data are analyzed and appropriate features are selected for the model. There are two input vectors to the model consist of solar irradiation and ambient temperature. Therefore, Cuckoo Search Algorithm (CS) is hybrid with LS-SVM in order to optimize the RBF parameters for a better prediction performance. The CS algorithm is inspired by the life of a bird family, called Cuckoo. This algorithm imitated from the effort of the cuckoos to survive. The performance of CS-LSSVM is compared with those obtained from LS-SVM using cross-validation technique in terms of accuracy. In this thesis, Mean Absolute Percentage Error (MAPE) is used to quantify the performance of the prediction. Besides that, evaluation also carried out by calculating the correlation of determination. The historical PV data is utilized to validate the workability of the proposed technique. The results showed that CS-LSSVM provides better performance in predicting photovoltaic system power output as compared to conventional LS-SVM using cross-validation technique.

ACKNOWLEDGEMENT

Thanks to Allah, finally I managed to finish this report within the time given. A lot of thank to my supervisors, Dr. Zuhaila binti Mat Yasin and Professor Dr Zuhaina Zakaria for their guidance and contribution along the progression period during completing this project. This project gives me a valuable knowledge that I believe can only be attained with the help of my supervisors. Through completing this study, I realized that photovoltaic system is one of the important area that need to be considered in the power industry and I am really thankful to my supervisor for giving me the chance to be put under her supervision.

My appreciation goes to people that involved in helping me to make this project a success. Thank you so much for your cooperation and guidance.

Finally, this thesis is dedicated to the loving memory of my very dear father and mother for the vision and determination to educate me. This piece of victory is dedicated to both of you. Alhamdulillah.

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CHAPTER ONE

INTRODUCTION

1.1 Research Background

A Photovoltaic (PV) system is also known as solar power system usually consist of arrangement of several components including solar panels to absorb and convert sunlight into electricity which is a solar inverter to change the electric current from DC to AC as well as mounting, cabling and other electrical accessories to set up a working system [1]. It may also use a solar tracking system to improve the system's overall performance and include an integrated battery solution as prices for storage devices.

A solar array only encompasses the ensemble of solar panels, the visible part of the PV system and summarized as balance of system. Moreover PV system convert light directly into electricity and should not be confused with other technology such as concentrated solar power or solar thermal used for heating and cooling [2].

PV made from semiconducting materials similar to those used in computer chips. Thus, when sunlight is absorbed by these materials, the solar energy knocks electrons loose from their atoms, allowing the electrons to flow through the material to produce electricity. This process of converting light (photons) to electricity (voltage) is called the photovoltaic (PV) effect [3]. Some solar cells are designed to operate with concentrating sunlight. These cells are built into concentrating collectors that use a lens to focus the sunlight onto the cells.

The performance of a solar cell is measured in terms of its efficiency at turning sunlight into electricity. Only sunlight of certain energies will work efficiently to create electricity, and much of it is reflected or absorbed by the material that make up the cell. Because of this, a typical commercial solar cell has an efficiency of 15% about one sixth of the sunlight striking the cell generates electricity [4]. Low efficiencies mean that larger arrays are needed, and that means higher cost.