AIN SHAMS UNIVERSITY

FACULTY OF ENGINEERING

Electronics Engineering and Electrical Communications

Design and Experimental Investigation of Maximum Power Point Tracking For Photovoltaic Generation Energy System

A Thesis submitted in partial fulfilment of the requirements of the degree of

Master of Science in Electrical Engineering

(Electronics Engineering and Electrical Communications)

By

Hazem Hossam EL-din Mostafa

Bachelor of Science in Electrical Engineering

(Electronics Engineering and Electrical Communications)

Faculty of Engineering, Higher institute of engineering and technology fifth settlement, 2012

Supervised By

Prof. Wagdi Refaat Anis

Dr. Amr Mohamed Ibrahim

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AIN SHAMS UNIVERSITY
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ELECTRONICS & COMMUNICATION ENGINEERING
Department

Thesis Title: Design and Experimental Investigation of Maximum Power Point Tracking For Photovoltaic Generation Energy System

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.**Degree:** Master of Science in Electronics and Communication Engineering.

Examiners' Committee

Name and Affiliation	**Signature**
Prof. Abdelmoneim Mohammed El-Mahdy	
National Authority for Remote Sensing and Space Sciences	
Prof. Abdelhalim Abdelnaby Zekry	
Faculty of Engineering, Ain Shams University	
Prof. Wagdy Refaat Anis	
Faculty of Engineering, Ain Shams University	
Ass.Prof. Amr Mohamed Ibrahim	
Faculty of Engineering, Ain Shams University	

Date: 12/10/2019

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Name and Affiliation	**Signature**
Prof. Wagdy Refaat Anis Faculty of Engineering, Ain Shams University	
Ass.Prof. Amr Mohamed Ibrahim Faculty of Engineering, Ain Shams University	

Date: 12/10/2019

RESEARCHER DATA

Name	: Hazem Hossam El-din Mostafa
Date of birth	: 21/12/1990
Place of birth	: Cairo/ Egypt
Last academic degree	: Bachelor Science
Field of specialization	: Electronics and Communication
University issued the degree	: Higher Institute of Engineering and Technology Fifth Settlement
Date of issued degree	: 7/2012
Current job	: Teacher Assistant at Egyptian Chinese University

STATEMENT

This thesis is submitted as a partial fulfilment of Master of Science in Electrical Engineering 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.

Hazem Hossam El-din Mostafa

Signature:

Date: 12/10/2019

ABSTRACT

The use of new renewable energy sources has extended rapidly for many reasons, including the dwindling conventional sources, environmental problems, and scorbutic fuel price dispersion. PV System (PVS) represents a promising sustainable energy source. An MPPT extracts the highest power from the PVS and transfers it to the load. Many developments are done trying to advance the drawback efficiency of the PVS. Many algorithms to track the MPP of PVM have been introduced to resolve the drawback of efficiency.Typical PVS consists of PVM, DC-DC Converter (DDC) and an MPPTC. MPPTC controls the DDC that acts as a coupling stage between PVM and load. A DDC is a device that transfers a DC supply's voltage from a level to another. The power electronics engineers face many challenges in designing converters with maximum efficiency, small size, reduced cost, and minimize switching losses. For the PVS applications, a conservative step-up (boost converter) can be used. This converter has a simple structure. The step-up (boost) converter is pulse controlled, when the duty cycle is near to hundred percent, the gain approaches infinity. But, practically, the static gain is restricted because of losses associated with the inductor, switch, diode, and capacitor. This thesis pursues a complete analysis of the DDC (buck and boost), involving the parasitic elements effect. Simulation model & experimental examination are utilized confirming the recommended analysis.

In this thesis, four MPPT algorithms are written in MATLAB m-files and investigated by simulations. Oscillation-Less P&O (OLPO), Golden Section Search assisted P&O (GSS-PO), Grey Wolf Optimization (GWO), and Multi-Verse Optimization Algorithm (MVOA) are tested under load variation and under environmental (irradiance) condition variation. Also for more validation a hardware experimental investigation for OLPO & GSS-PO is done to validate the efficiency and tracking performance of the proposed MPPTCs.

The simulated results & practical investigation of the complete PV system show that the performances of the PV panel using the GSS-PO MPPT algorithm provides better steady state and fast transient characteristics when compared with the other three methods. It yields not only a reduction in convergence time to track the maximum power point MPP, but also a significant reduction in power fluctuations around the MPP due to its very small step-size.

Keywords:

Photovoltaic; MPPT; DC-DC Converters

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