AIN SHAMS UNIVERSITY
FACULTY OF ENGINEERING
Electronics Engineering and Electrical Communications

DESIGN OF MAXIMUM POWER TRACKING CIRCUIT FOR PHOTOVOLTAIC WATER PUMPING SYSTEMS

A Thesis
Submitted in partial fulfillment of the requirements of the degree of
Master of Science in Electrical Engineering

By
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Bachelor of Science in Electrical Engineering
(Electronics Engineering and Electrical Communications)
Faculty of Engineering, 2011

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STATEMENT

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

Yasmin Gharib Mohamed Mousa

Signature

…………..……….

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ABSTRACT

Solar photovoltaic (PV) systems are distributed energy sources that are an environmentally friendly and renewable source of energy. However, solar PV power fluctuates due to variations in radiation and temperature levels. Furthermore, when the solar panel is directly connected to the load, the power that is delivered isn’t optimal. A maximum power point tracking (MPPT) is therefore necessary for maximum efficiency.

This thesis presents a study of MPPT for PV system. The study includes discussion of various MPPT algorithms and performs comparative tests of the two MPPT algorithms the perturbation and observation (P&O) algorithm and Incremental Conductance (INC) under varying irradiation. The application of the MPPT for PV water pumping system are described, the modeling and the simulation of the PV module and the DC/DC converter is carried out using MATLAB/SIMULINK software.

After that a study of PV water pumping system has been undertaken using DC motor coupling with a centrifugal pump. A comparison between the performances of those systems with MPPT in terms of PV total power produced is carried out. Results show that The INC algorithm shows smother power tracking; less oscillating and better stable operation and the implementation of the algorithm is considered to be complex. But P&O has oscillator around the MPP However, The P&O algorithm has a fast response time and it is not complex and easy to implement.

Also, results have shown that efficiency of P&O has reached a comparable level to that of INC.

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List of Nomenclatures

Symbols	Nomenclatures	Units
a, a_2	diode ideality constant	
AC	alternative current	
A_1	load friction	Nm
A_3	motor friction	Nm
B_1	Damping	$Nm.s.rad^{-1}$
C	boost capacitor	Farad
CdTe	cadmium telluride	
CE	change of error	
CIS	copper indium diselenide	
C_{min}	minimum value capacitance	farad
C_1	diode constant	
D	duty cycle	
E	error	
FLC	fuzzy logic controller	
f_s	switching frequency	Hertz
G	irradiance	W/m^2
G_n	nominal solar irradiation	W/m^2
I	PV current	A
I_a	output current of boost converter	A
I_d	diode current	A
I_m	current source	
I_{mo}	armature current	A
I_{mp}	current at MPP	A