



Ain Shams University
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Electrical Power and Machines Department

Investigating the maximum power point tracking of PV array under partial shading conditions

A Thesis Submitted in Partial Fulfillment of the Requirement for the Degree of Master of
Science in Electrical Engineering
(Electrical Power and Machines Engineering)

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M.Sc. Thesis

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A thesis Submitted to the Faculty of Engineering, Ain Shams University in partial fulfillment of the requirements for the M.Sc. degree in Electrical Power and Machines Engineering

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STATEMENT

This Thesis is submitted to Ain Shams University in partial fulfillment of the requirements for M.Sc. degree in Electrical Engineering.

The included work in this thesis has been carried out by the author at the department of electrical power and machines, Ain Shams University. No part of this thesis has been submitted for a degree or a qualification at any other university or institution.

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Abstract

Solar energy is one of the best renewable energy sources as it is one of the cleanest, most efficient sources of energy. Also the capital costs of PV cell decreases day by day which is good for investment opportunity. Nowadays, many countries decrease the reliance on fossil fuel consumption to reduce the greenhouse gas emissions and increase the dependence on renewable energy especially solar energy. Therefore, extracting the maximum power from Photovoltaic (PV) modules is very essential to increase the utilization efficiency. One of the most used methods to increase the efficiency of solar cells is using the Maximum Power Point tracking (MPPT) techniques.

Under partially shading conditions, conventional MPPT techniques are not sufficient as the P-V curve exhibits multiple peaks. So these techniques cannot differentiate between the global maximum power point and the local maximum power points.

This thesis proposes a design of maximum power point tracking technique based on the fuzzy logic control (FLC) in addition to the scanning system that tracks the global power point region. First, the scanning system is used to track a point nearest to the global maximum power point to overcome the problem of trapping in any local maximum power point. Then, FLC is used to track the actual global maximum power point. The system under study consists of a PV system connected to a DC microgrid through a DC-DC boost converter. The proposed MPPT technique is modeled using MATLAB/SIMULINK software to evaluate the tracking performance of global maximum power point under various partial shading patterns.

Keywords-- Fuzzy logic control, Maximum power point tracking, Partial Shading, Photovoltaic.

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LIST OF ABBREVIATIONS

ANN	Artificial Neural Network
CV	Constant Voltage
FLC	Fuzzy Logic Control
IC	Incremental Conductance
P	Power
P&O	perturb and observe
PV	Photovoltaic
PS	Partial Shading
PSO	Particle Swarm Optimization
MPP	Maximum Power Point
MPPT	Maximum Power Point Tracking
Sec	Second
W	Watt
V	Voltage