

**UNIVERSITI TEKNOLOGI MARA**

**A SINGLE MEASUREMENT OF COMBINED  
DIRECT AND INDIRECT MPPT ALGORITHM  
FOR MISMATCH PV MODULE APPLICATION**

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## ABSTRACT

The use of module integrated converter (MIC) topologies for photovoltaic (PV) system is to harvest the maximum power point of PV module from solar irradiance. MIC is a promising method to keep the electrical power output from PV module at maximum capacity through maximum power point tracking (MPPT) algorithm during full-sun and mismatch module occurrence. This thesis focussed on the development of PV module integrated with positive output (PO) buck-boost converter by intelligent control of MPPT technique. A novel of combination direct and indirect (CoDID) MPPT algorithm is implemented for solving mismatch losses from existing PV system by employing the implementation of system identification approach. System identification is established via utilization of multi-input single-output (MISO) model and incorporation with simple iteration scheme. The main intention of this study is to develop a single sensor measurement of instantaneous output current from PV system in order to track maximum power point of the PV module. The signal from the sensor is then applied for power switching devices of the PO buck-boost converter by the attained maximum power point current from CoDID MPPT method. The system is constructed from model-based design (MBD) of the PV system. The MBD is divided into four parts; executable system properties, design and simulation of the properties, execution and implementation for code generation and verification process. The properties dataset of building integrated PV system located in Malaysian Green Technology Corporation are taken as requirement and specification for the MBD system. The second aim is to provide a constant desired output DC voltage of the system. The criterion of maximum power produce from PV system is to produce the DC voltage from unregulated DC output voltage due to mismatch losses. Two control schemes; logic control and current closed-loop control are developed for retaining the required DC output voltage. The system also offer a flexibility of using different electrical specification of PV module in string connection solving the issue of the selection of PV module should be in similar specification. The development of the system is carried out using Matlab/Simulink incorporated with MPLAB programming for evaluating and validating the system. The ability of the system to track maximum power point regardless mismatching condition are assessed through simulation study and proved in the experimental work for different PV module specification and variable of solar irradiances.

## TABLE OF CONTENTS

	<b>Page</b>
<b>CONFIRMATION BY PANEL OF EXAMINERS</b>	ii
<b>AUTHOR'S DECLARATION</b>	iii
<b>ABSTRACT</b>	iv
<b>ACKNOWLEDGEMENTS</b>	v
<b>TABLE OF CONTENTS</b>	vi
<b>LIST OF TABLES</b>	x
<b>LIST OF FIGURES</b>	xi
<b>LIST OF SYMBOLS</b>	xvii
<b>LIST OF ABBREVIATIONS</b>	xix
<b>CHAPTER ONE: INTRODUCTION</b>	1
1.1 Preamble	1
1.2 Demands and Standard for PV System Applications	2
1.2.1 Demands of the PV System Design	2
1.3 Problem Statement and Motivation	4
1.3.1 Mismatch Module Effects and Solution	7
1.4 Research Objectives	11
1.5 Scope and Structure of the Thesis	11
1.6 Thesis Organisation	13
<b>CHAPTER TWO: LITERATURE REVIEW</b>	15
2.1 Introduction	15
2.2 Local and Global Perspective	16
2.2.1 Tracking Approach for Maximum Power of PV System	20
2.2.1.1 Direct method	22
2.2.1.2 Indirect method	24

# CHAPTER ONE

## INTRODUCTION

### 1.1 PREAMBLE

The tremendous growth of photovoltaic (PV) power system throughout the world as a clean, quiet and reliable renewable energy sources has formulated a continuous research and development to enhance the capability of the system to harvest maximum energy and provide economical approach. The dramatic increase of production and research in this renewable energy sources areas are inspired by radiation of sun energy received by means of light or heat, which converted into usable form of energy such as electric power. For optimal electricity, the design of the system in terms of the operation and selection of component including the location which influence to the solar radiation and temperature, type of the system and load requirement are important to ensures maximum energy yield over the minimum expenditure [1].

Since the renewable energy sources (RES) such as solar photovoltaic, which comes directly from the sun, assures clean and sustainable energy, thus the attention in this field becomes extremely important for generating electrical power. Other attractions over solar PV apart from free emission are high reliability, long life and low maintenance due to no moving parts, ownership of power source to individuals and companies. The system also reduce distribution losses as it is installed close to the point of use, reach rural environment and necessarily suitable for widespread deployment in the urban environment either for typical PV system or solar farm system. Consequently, the technologies from RES can assist and support the countries to secure, reliable and affordable energy in order to expand the electricity access, generation and development.

Generally, PV systems can be installed on the roof of residential or commercial building. Most of the PV systems are connected to a local distribution power generator as grid-connected system. One of the policies that encouraging the use of PV system as clean and environmental friendly electricity is known as feed-in tariff (FIT) program [2]. FITs are considered as most of the effective system which stimulating a rapid development of renewable energy sources (RES) either in reducing