

An Intelligent Tracking Algorithm on Solar Cell Using Boost Converter

Pouya Pourmaleki ^{1*}, Reza Soltanmoradi ²

¹ University of Kermanshah, Department of Electrical and Computer Engineering, Kermanshah, Iran

² Ashtian University, Department of Electrical and Computer Engineering, Ashtian, Iran

* Corresponding author email address: poko99maleki@yahoo.com

Abstract

Solar energy can be regarded the most potent source of renewable energy as the globe shifts to renewable energy. The most prevalent device for generating electricity from light energy is solar photovoltaic cells. The final aim of this paper is to create a new Maximum Power Point Tracking (MPPT) approach based on a Fuzzy Logic Control (FLC) and a step up converter that can go Maximum Power Points (MPPs) rapidly, and adapt to changing environmental conditions. The simulation results indicated that the fuzzy tracking system can find the maximum point under quick sun radiation changing.

Keywords: Solar System, Fuzzy Logic Controller (FLC), DC to DC Step up Converter, Maximum Power Point Tracking

1. Introduction

The globe is on the lookout for potential renewable and sustainable energy sources (Li et al., 2021). New sources of energy, including solar and wind have piqued the interest of experts in recent years since they are inexhaustible, non-polluting, and cost-free (Gopi, Lalitha, & Bhanu, 2021). Solar energy is becoming a more attractive source of energy due to significant improvements in efficiency and lower production costs of Photovoltaic (PV) cells (Rabaia et al., 2021). The Direct Current (DC) appliances require a converter to provide the appropriate DC voltage for their purposes (Sedaghati & Pourjafar, 2019). The step up converter is a converter that convert a lower voltage to a higher range (Sayed, Gronfula, & Ziedan, 2020). PV system is one of the applications that may necessitate the use of a boost converter. At least three factors influence the efficiency of PV modules: the efficiency of the module which is about 15%, inverter efficiency, and the tracking system efficiency (Motahhir, El Hammoumi, & El Ghzizal, 2020). Increasing the efficiency of solar panels and inverters is difficult and dependent on the available technology. However, improving the MPPT's control algorithm is easier and less expensive. The maximum power concept states that if the PV system's internal resistance is equal to its external resistance, the source will provide maximum power to the load (Aldalbahi, Shahabi, & Jasim, 2021; Bollipo, Mikkili, & Bonthagorla, 2020). There are numerous MPPT algorithm techniques. The complexity, accuracy, and time-to-response of these technologies vary one to another. To illustrate procedures

for designing fuzzy controllers, a fuzzy control technique will be used in this article (Macaulay & Zhou, 2018; Taremi, Shahri, & Kalareh, 2019; Yousefiankalareh, Najari, & Hosseynzadeh, 2020). The simulation program MATLAB is used. The test results show that simulation graphics can display strong static and dynamic tracking effects by using FLC with a step up converter (Attou, Massoum, & Saidi, 2014).

2. PV system design

The PV system which is investigated in this paper is using a DC to DC step up and the FLC system (Balal & Shahabi, 2021b; Fathah, 2013).

A. Characteristics of the proposed PV system

Each PV system has its own features. Table 1 indicates the features of the proposed panel.

Table 1. Characteristics of the solar panel

Cells	96	Tilt angle	28°
Temperature	-40 - 85 °C	Latitude angle	27.93°
Panels	14	Longitude	-82.46°
Efficiency	14.8%	Azimuth	180° South
DC power	331 W	Frame	Al
V _{OC}	69 V	Weight	16.6 kg
I _{SC}	5.88 A	SIZE	(1.66 * 0.99) m
I _{MPP}	5.67 A	Type of module	Mono-Silicon
V _{MPP}	67 V	Mounting system	Fixed rack