

Comparative Analysis of Different Maximum Power Point Techniques Using Boost Converter

Joshi Sarthak Krishna, SESGOIFE Diksal, Raigad¹
Dr. B. R. Patil, Principal, Vishwaniketan IMEET, Khalapur, Raigad²
Sharvari Sane, Head Of Department & Assistant Professor, SESGOIFE Diksal, Raigad³

Abstract:- Current scenario of the globe is that sources for energy are lagging behind the current demand so most concentration is on renewables. Solar performance efficiency mainly depends on cell structure, maximum power point tracking technique and converter circuit used. MPPT operation executes a key part in raising the strength of PV system. A p & o, incremental conductance, Fuzzy based MPPT algorithmic principle is anticipated with a boost converter. Two in and single out Mamdani's fuzzy framework with triangular membership is used to concoct the controlled current. The anticipated procedure is upheld in MALAB/SIMULINK and in this way the maximum power point tracking performance is evaluated. The anticipated system tracks the most in operation reason with no wavering and enhanced exactness. The reproduction results demonstrate the adequacy of the anticipated method.

Keywords- MPPT method; p & o, incremental conductance, fuzzy system; current control; DC-DC converter.

I. INTRODUCTION

Solar vitality is a portal that will in a perfect world lead us a long way from our petroleum subordinate sources. The critical issue with sun based load up advancement is that the efficiencies for sun based force systems are still poor and the costs per kilo-watt-hour (Kwh) are not engaged, a significant part of the time, to equal traditional sources in the utilization. Sunlight based centered sheets themselves are exceptionally inefficient (pretty much 30%) in their ability to change over light to imperativeness. Regardless, the charge controllers and diverse contraptions that make up the sun based force system are in like manner to some degree inefficient and costly. Our goal is to plot a Maximum Power Point Tracker (MPPT), a specific kind of charge controller that will utilize sun fueled board to its most extreme potential. The MPPT is an energize controller that makes for the changing Voltage Current normal for a PV module. The MPPT traps the sheets into yielding a substitute voltage and current allowing more vitality to go into the battery or batteries by making the sun based cell think the store is changing when you genuinely are not ready to change the heap [1]. The MPPT screens the yield voltage and current from the sun controlled board and chooses the working point that will pass on that most prominent measure of force available to the batteries. If our adjustment of the MPPT can decisively track the ceaselessly changing working point where the power is at its most great, then the viability of the sun controlled cell will be extended. Various estimations have been made for taking after most amazing force reason for a PV generator.

These figurings change in viability, unpredictability, blending speed, sensors obliged and cost [2]. Three diverse sort of MPPT is proposed in this present paper to demonstrate its prevalence.

In this work, irritate and watch, incremental conductance, fluffy obstruction framework (FIS) is presented with a help converter for accomplishing the greatest force working purpose of photovoltaic frameworks. The inputs to the fluffy framework are the change in PV terminal force and the change in PV voltage. The yield is the reference current of frameworks to create beats.

II. PV CELL MODEL

PV cells are essential units in the structure of a PV module. In light of the photoelectric marvel, they can transform heat energy to electrical energy. Since the measure of created force created by a sun based cell is little, very nearly 45 milli-watts, they must be composed and introduced in arrangement or parallel to deliver a helpful scope of utilization for electrical power whether for industry or local.

$$I_{ph} = (I_{ph0} + k_i \Delta T) \frac{G}{G_n} \dots (1)$$

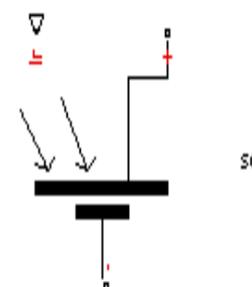


Fig. 1 solar cell

The nonlinear and exponential association amidst current and voltage of a PV module is broadly portrayed in the delivered current by a sun based cell is gained in perspective

of the scientific proclamation in underneath (Rahmani et al., 2011) Equation 1 and 2: where, I_{ph} is called photocurrent made by the effect of sun based light and cell's temperature. ΔT is the qualification of temperature from the reference STC ($T_0 = 25^\circ C$). G is the security and G_n is its average assessed quality which is proportional to 100 mW m^{-2} . While k_i is the temperature coefficient of short out current. The essential well known correlation of a PV cell is as take after (Rahmani et al., 2011):

$$I_c = I_{ph} - I_0 \left[\exp\left(\frac{V_c + R_s I_c}{m \cdot V_t}\right) - 1 \right] \dots(2)$$

Where, I_c and V_c square measure the output current and voltage of the cell severally. I_0 is that the diode reverse saturation current and R_s is that the series resistance sculptures que for the cell. American state is termed temperature voltage and its applied 25mV and m is that the diode issue that is capable one.5 in follow and its I-V and P-V characteristics square measure portrayed in Fig. 3-4 severally.

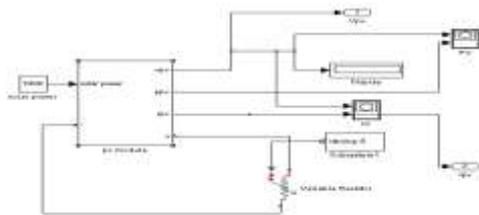


Fig. 2 MPPT with resistive load

The resultant waveforms show the consequences of atmospheric condition within the generated current and output power (Etier et al., 2011).

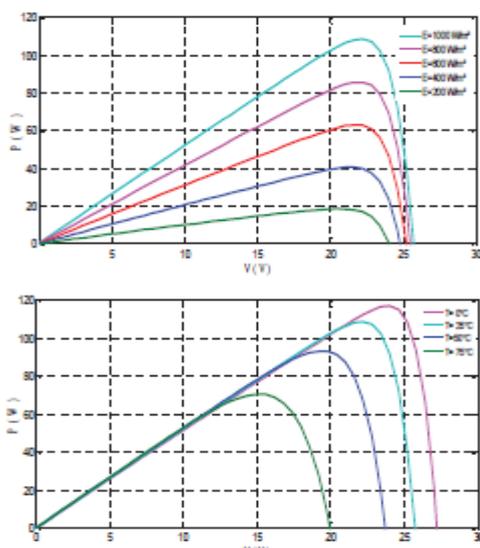


Fig. 3-4 Characteristics of PV under variable conditions

III. BOOST CONVERTER

In figure 5 the schematic of the support converter force stage is given. It comprises of the force switch K (MOSFET transistor), help inductor L , channel capacitor C_2 , yield diode D and burden resistor R_{Load} [4].

When the switch $1 S$ is closed for time duration $1 t$, the inductor current rises and the energy is stored in the inductor. If the switch $1 S$ is opened for time duration $2 t$, the energy stored in the inductor is transferred to the load via the diode $D1$ and the inductor current falls. The waveform of the inductor current is shown in fig.

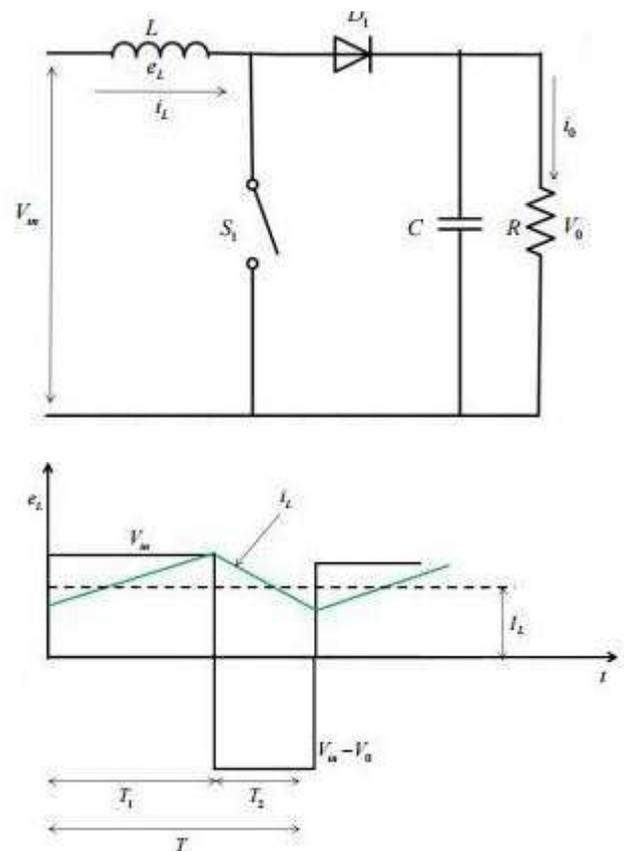


Fig.5 Boost converter & its inductor current waveform

Following observations can be made:

- The voltage across the load can be stepped up by varying the duty ratio D
- The minimum output voltage is V_s and is obtained when $D = 0$
- The converter cannot be switched on continuously such that $D = 1$. For values of D tending to unity, the output becomes very sensitive to changes in D For values of D tending to unity; the output becomes very sensitive to changes in fig.

A boost convertor may be a sort of switched mode power offer performance like different SMPS styles, it provides a regulated DC output voltage from either associate degree AC or a DC input. The convertor continuously matches the output characteristic considering of the PV generator to the input characteristic of the load.

IV. Different types of MPPT algorithm

To enhance the effectiveness of the sun oriented board MPPT systems are utilized. As per most extreme force point hypothesis, yield force of any circuit can be amplify by altering source impedance equivalent to the heap impedance, so the MPPT calculation is equal to the issue of impedance coordinating. In present work, the help Converter is utilized as impedance coordinating gadget amongst information and yield by changing the obligation cycle of the converter circuit. Yield voltage of the converter is rely on upon the obligation cycle, so MPPT is utilized to figure the obligation cycle for acquire the most extreme yield voltage in light of the fact that if yield voltage increments than force additionally increments. In this paper Perturb and Observe (P&O), incremental conductance, fluffly rationale calculations are concentrated on .execution checked with various mppt system.

1. Perturb and Observe (P&O)

It is the simplest method of MPPT to implement. In this method only voltage is sensed, so it is easy to implement. In this method power output of system is checked by varying the supplied voltage. If on increasing the voltage, power is also increases then further ‘δ’ is increased otherwise start decreasing the ‘δ’. Similarly, while decreasing voltage if power increases the duty cycle is decreased. These steps continue

2. Incremental conductance

The IC can determine that the MPPT has reached the MPP and stop perturbing the operating point. If this condition is not met, the direction in which the MPPT operating point must be perturbed can be calculated using the relationship between dI/dV and $-I/V$ This relationship is derived from the fact that dP/dV is negative when the MPPT is to the right of the MPP and positive when it is to the left of the MPP. This algorithm has advantages over P&O in that it can determine when the MPPT has reached the MPP, where P&O oscillates around the MPP. Also, incremental conductance can track rapidly increasing and decreasing irradiance conditions with higher accuracy than P and O

$$\frac{dI}{dV} = -\frac{I}{V} \text{ at MPP} \quad \dots(3)$$

$$\frac{dI}{dV} > -\frac{I}{V} \text{ left of MPP} \quad \dots(4)$$

$$\frac{dI}{dV} < -\frac{I}{V} \text{ right of MPP} \quad \dots(5)$$

3. FUZZY LOGIC CONTROLLER

FUZZY reason controller is a one sort non direct controller and modified. This kind of the control moving nearer the human feeling that makes the usage of the affirmation, defenselessness, imprecision and featheriness in the decision making methodology, makes sense of how to offer an incredibly appealing execution, without the need of an ordered numerical model of the structure, just by intertwining the masters' learning into the fluffly. Fig 6 shows the FL controller piece diagram. The FL control system is in perspective of the MAMDANI fluffly model. This structure contains four standard parts. At first, by using the information cooperation limits, inputs are Fuzzified then in perspective of rule bases and the inferencing structure, yields are conveyed finally the cushy yields are Defuzzified and they are associated with the key control system.

Blunder of inputs from their references and error deviations in at whatever time between time are picked as MATLAB. The yield of FLC is the value that should be added to the previous respect make new reference yield.

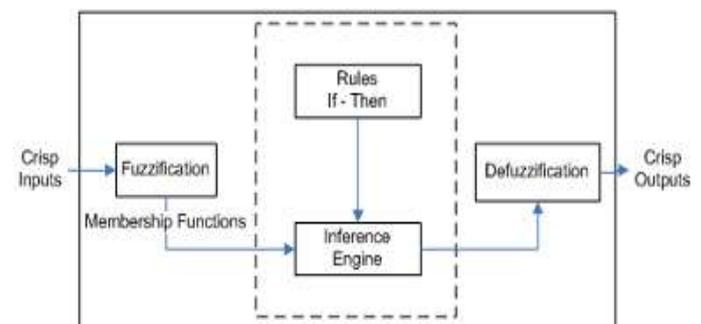


Fig 6: Block Diagram of fuzzy logic controller

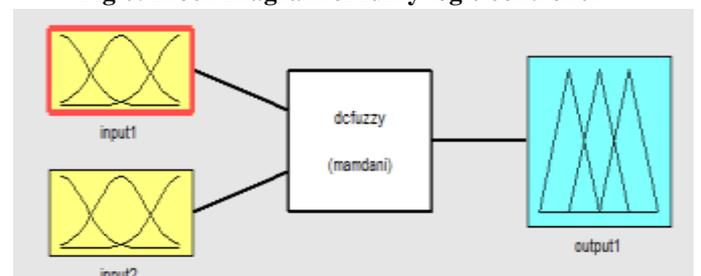


Fig 7: selection of input and output variables

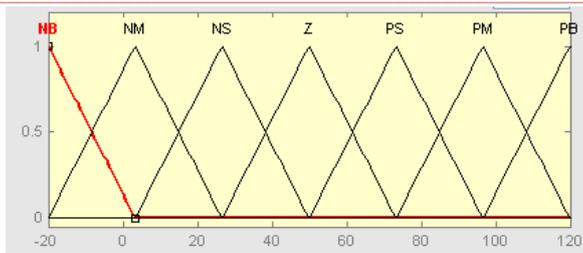


Fig 8: Input 1 membership function

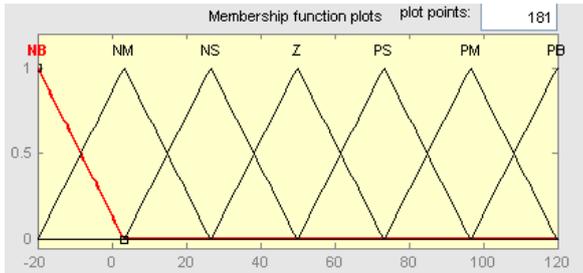


Fig 9: Input 2 membership function

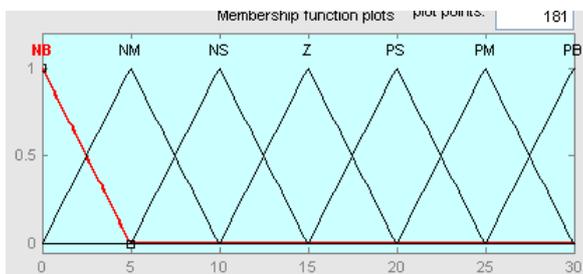


Fig 10: Output membership function

V. SIMULATION RESULTS

Simulation is performed using MATLAB/SIMULINK code. Simulink library files embrace intrinsic models of the many electrical and physical science parts and devices like diodes, MOSFETS, capacitors, inductors, motors, power provides and then on. The circuit parts are connected as per style while not error, parameters of all parts are organized as per demand and simulation is performed

SIMULATION DATA:

Parameter	Value
V _{pv}	24v
L	0.25mh
C	220uf
R	50ohm
Power	60w
Fill factor,FF	0.72
Module Efficiency, Eff,m	11.41%
Cell Efficiency, Eff,c	13.36%

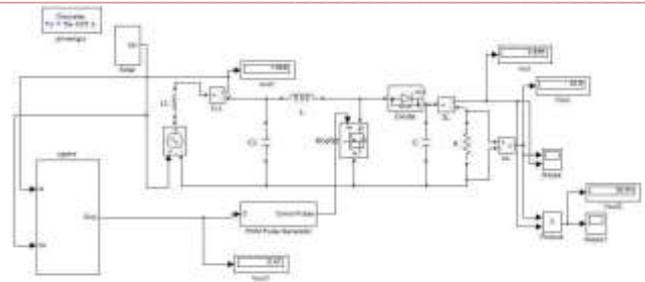
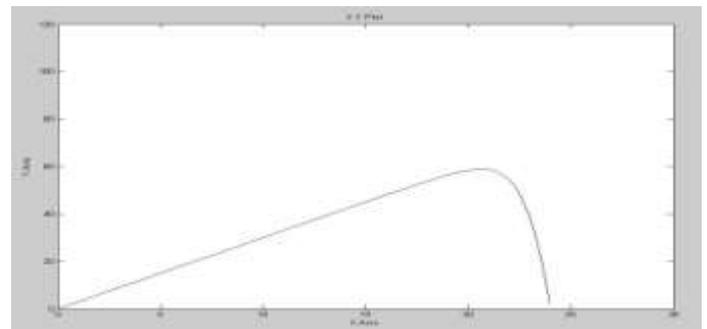


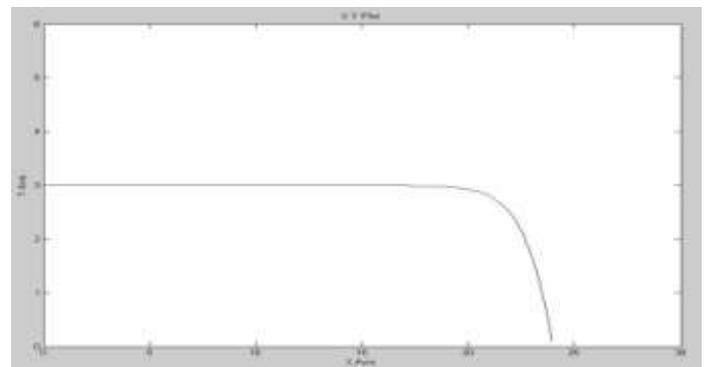
Fig.11 Simulation circuit

OUTPUT WAVEFORMS:

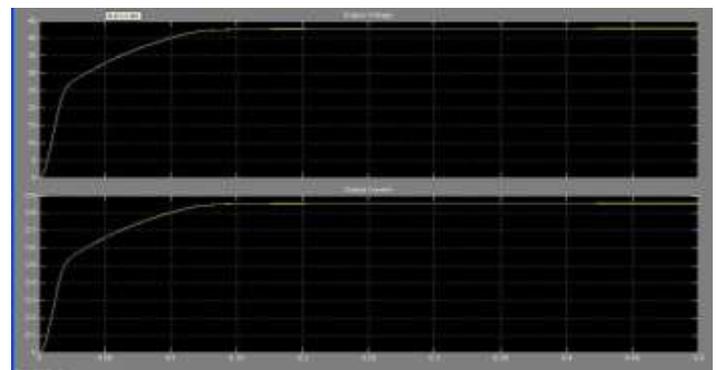
a) PV Curve of Panel At Constant Irradiance and Temperature



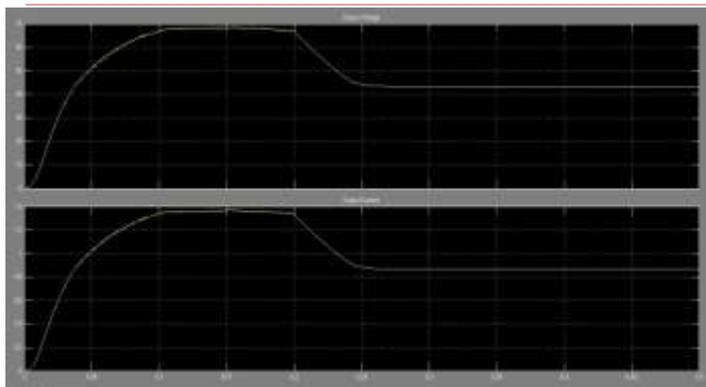
b) IV curve of Panel At Constant irradiance and Temperature



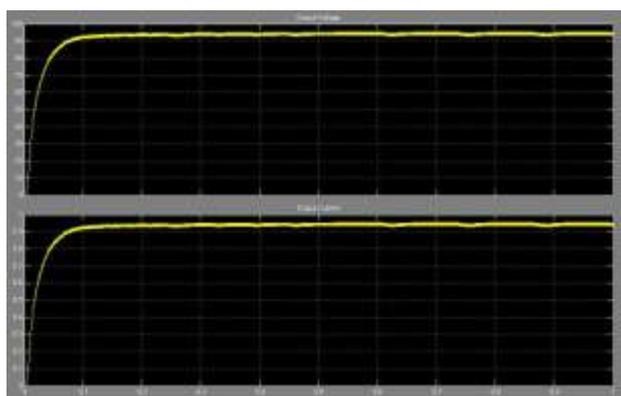
c) Output voltage using p & o



d) Output voltage using incremental conductance



e) Output power using fuzzy



VI CONCLUSION

In this work, different MPPT technique was proposed by using a boost converter. The inputs of the proposed MPPT controller were the change of power and change of voltage of PV system, voltage and current characteristics were analyzed for the p & o, incremental conductance, fuzzy. Maximum power point increases & oscillation get vanished completely by using proposed controller. The analysis shows the effectiveness and the efficiency of the proposed fuzzy based MPPT controller. Form the above results we can conclude that Fuzzy mppt having fast response.

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