FIREFLY MPPT ALGORITHM BASED VOLTAGE REGULATION FOR LOW POWER PV MODULES UNDER PARTIAL SHADED CONDITIONS

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Abstract-The demand for electrical energy is rapidly increasing for the production of fossil fuel-based energy is declining and by this the obvious choice of clean energy source is more in use and helps for the future development of sun's energy. This paper is summarized for voltage regulation of low power PV modules under partial shaded conditions by the use of Firefly MPPT algorithm. The power voltage characteristic of photovoltaic array is non-linear and it exhibits multiple peaks and one global peak under non-uniform irradiances. In order to track the global peak, MPPT is the important component of PV system. Thereby the theoretical analysis and the experimental results reported in this prove that the optimal inductor current does not depend on the power generated by the PV module provided that the control circuit is powered from the output, but it does on the output voltage level of the storage unit. The proposed experiment shows that the Firefly MPPT algorithm is superior to the other method in tracking speed, convergence to track GMPP and process good tracking efficiency.

Index Terms- Maximum power point tracking (MPPT), Firefly algorithm (FFA), Photovoltaic (PV) panel, Global maximum power point (GMPP), global peak, fireflies, efficiency.

I. INTRODUCTION

In the PV panel, the maximum power point keeps on changing with changing environmental conditions such as irradiance of solar and temperature of cell. Therefore, the output power in a PV module depends on insolation of solar and also on the temperature of the solar cells. By the use of MPPT algorithm PV arrays have a nonlinear voltage current characteristic. To determine the characteristics of the PV module the current vs voltage curves and the power vs voltage curve need to be constructed. The manufacturer of the PV module provides these three parameters namely short circuit current (Isc), open circuit voltage (Voc) and maximum power point (Vmpp, Impp) which is used for the production of the PV characteristics of solar PV module. The unique maximum power point on the PV curve in which PV cell generates the maximum power point (Vmpp, Impp).

Firefly algorithm is considered because of its simplex computational steps, faster convergence and implemented in low cost microcontroller. In case of partially shaded PV systems, the PV curve possesses multiple peaks and convergence to the global MPP is compulsory for resulting maximum power from the PV system.

II. METHODOLOGY

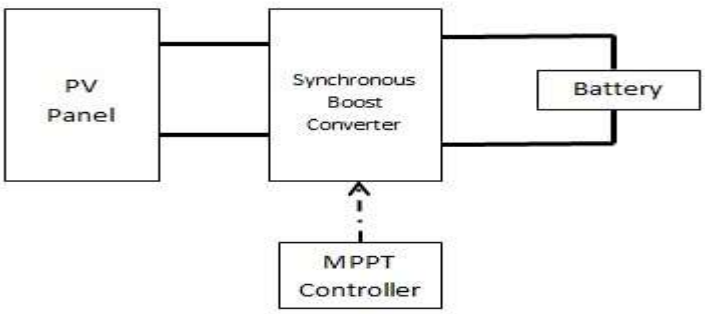

Fig 1: Block diagram of the proposed system

The block diagram for the proposed system is shown in the Fig 1. It consists of the following components.

PV PANELS:

Numerous Solar cells are series in arrangement or parallel association with acquire photovoltaic module in this way as the sun-based cell increments as needs be module watt rating increments. Sun powered module likewise called as Solar Panel uses sun's vitality and creates power in this manner utilized for domestic(residential) applications. Sun based (Solar) cells are associated in series arrangement to acquire favoured yield voltage and in parallel arrangement to accomplish favoured current. Such Solar PV modules can be associated in arrangement in series or parallel to achieve sought power requirements (Watt or KW or MW range).

BOOST CONVERTER:

Boost is a DC into DC converter which step up the input voltage utilizing circuit made with two switches and inductors and capacitors. It is used for boosting the voltage in the circuit.

MPPT CONTROLLER:

Firefly MPPT algorithm is made use in this paper. It is simplex in computational steps, faster convergence and implemented in low cost microcontroller.

BATTERY:

Battery is used as an energy storage system. The energy can be stored and can be used whenever required. They store the energy in the form of DC.

II. WORKING PRINCIPLE

Lower PV modules are used in the input side. The converter depends on the inductor and two IGBT. Due to the two IGBT switches it operates in the two states namely active and inactive state. Firefly algorithm is used because the maximum power can be tracked. The source is taken from the PV panel and by the use of the boost converter the voltage gets boosted. The boosted voltage can be maintained constant by the use of firefly algorithm. Hence the maximum voltage is maintained throughout.

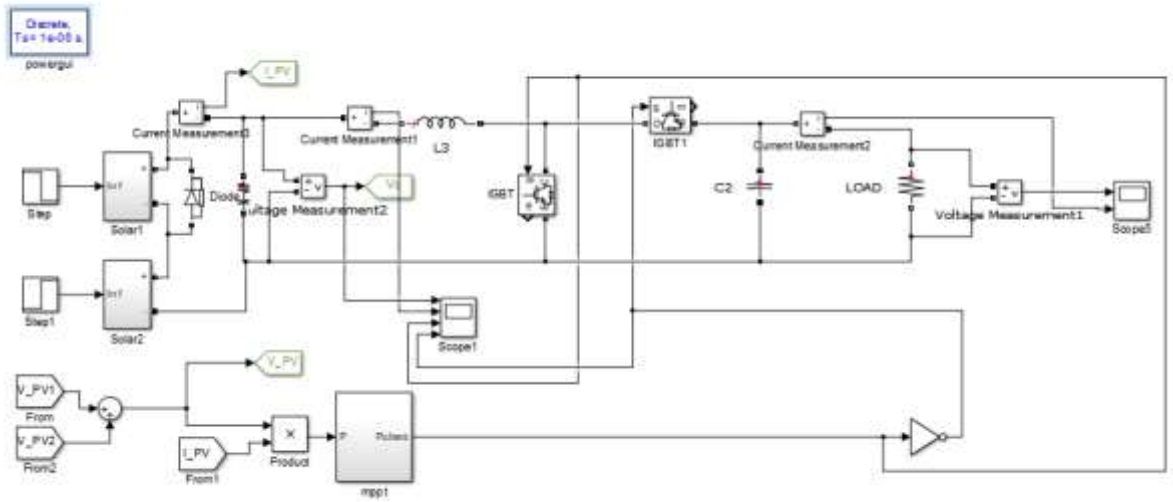

Fig 1: Circuit simulation

IV. SIMULATION AND RESULTS

The simulation of the proposed is obtained using MATLAB and Simulink. The waveform of the power switches and the output waveforms are obtained. The results are obtained using the Firefly MPPT algorithm in the circuit simulation.

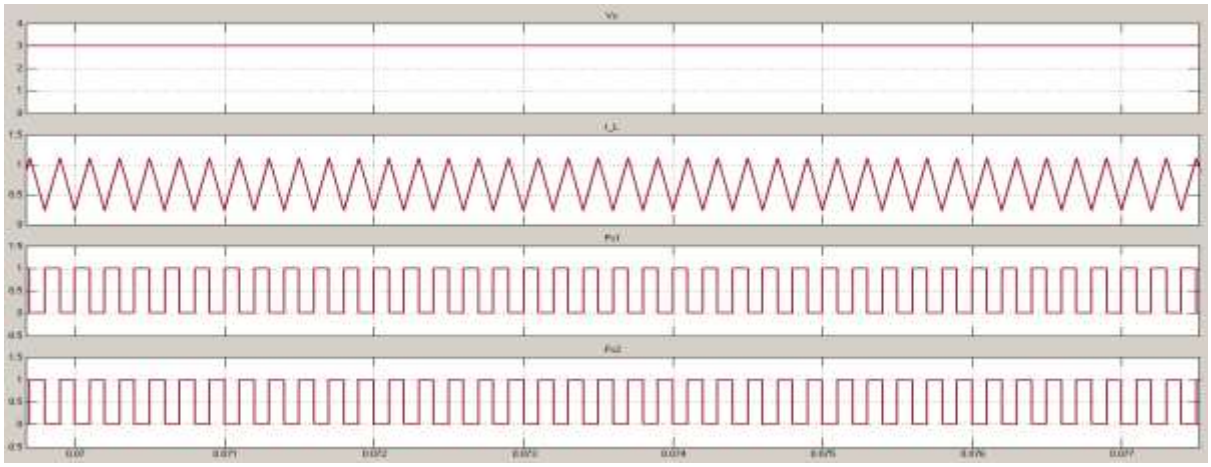

Fig 1.2: Waveform of power switches

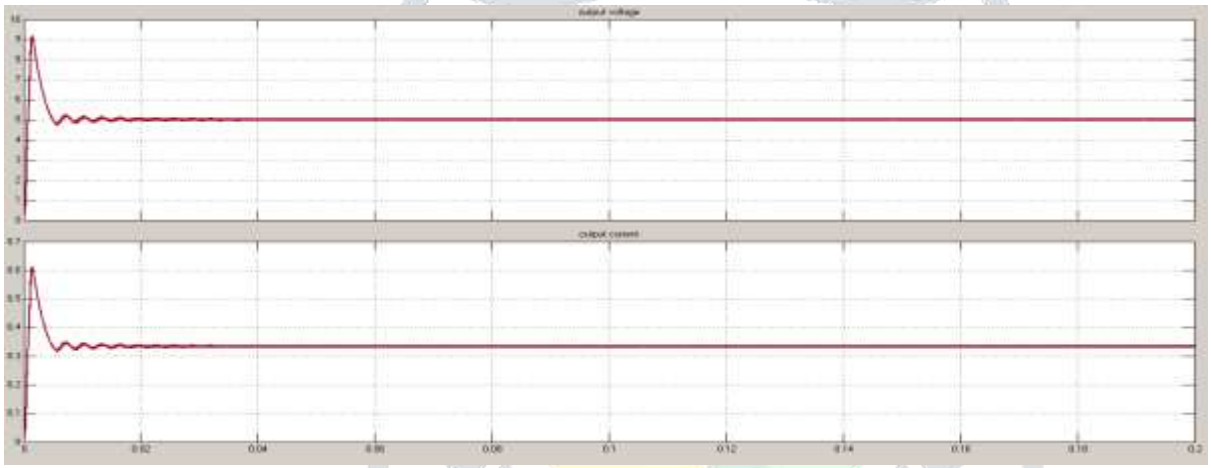

Fig 1.3: Output waveform

VI. CONCLUSION

The proposed MPPT computational method is based on a dc-dc converter control with firefly algorithm. By this it can be concluded that firefly algorithm is superior to other method in terms of tracking speed, fast convergence to track GMPP and possesses good tracking efficiency. Thus, firefly algorithm is of the faster convergence, computational steps are simplex and can be implemented in low cost microcontroller.

VII. REFERENCES

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