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PERTURB AND OBSERVATION (MPPT) ALGORITHM WITH BOOST CONVERTER TOPOLOGY FOR PV SYSTEM

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Abstract— this paper Presents utilization of a boost converter to control photovoltaic power system using Maximum Power Point Tracking (P& O method). In this paper a boost converter is used with a Maximum Power Point Tracking control mechanism. The Maximum Power Point Tracking is used to extract and maintain the maximum possible power from the photovoltaic cell output and feed it to the load through the boost converter.

Keywords— solar cell, Boost Converter, MPPT, MATLAB, SIMULINK.

I. INTRODUCTION

The photovoltaic (PV) system prepares one of the best efficient ways to produce energy, with actual perspectives in the future in the world. Generally, once a PV module is connected to a load directly, the operating point is rarely at the MPP. For MPPT purposes, the dc/dc boost converter is presented at the PV array output to extract the maximum possible power in the system. [2] Tracking the maximum power point is very important part of the photovoltaic system. So MPPT algorithm is required to achieve maximum available power from a PV system. Maximum Power Point Tracking is used in the PV system to maximize the photovoltaic array output power with the use of DC-DC converters like boost converter, buck converter and buck-boost converter. [1][2][3]

II. PROPOSED SYSTEM BLOCK DIAGRAM

The block diagram of the proposed system is shown in figure 1 that consists of PV panel, DC-DC boost converter, P& O method and R Load. The voltage and current values of the PV panel are connected to the MPPT. Then these values are used as input values for the MPPT algorithm to track the MPP of solar panel. The output of the MPPT block then is connected to the DC-DC boost converter as an input. The Boost converter is used to step up the output voltage of the PV panel at the maximum power point and is located between the solar panel and the load.

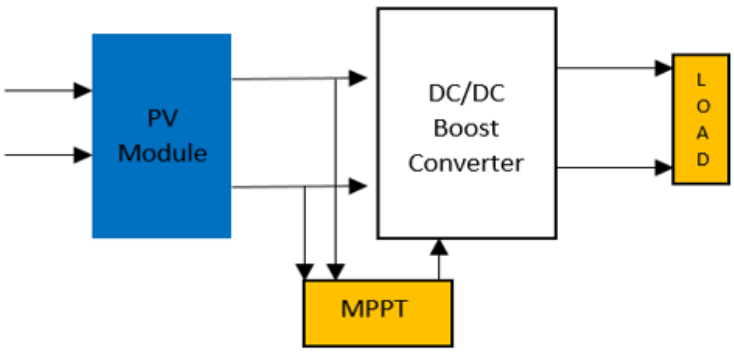

Fig.1 Basic block diagram of the proposed system

PV Specification

PV system consists of Rated power: 343W, Voltage at Maximum Power: 46.2 V, Current at maximum Power: 8.21 A, Open Circuit Voltage: 46.5 V, Short Circuit Current: 8.41 A, Total number of cells in series: 20.

III. BOOST CONVERTER

Boost converter simulation is shown in figure.3. In boost converter output voltage across the load is always greater than the input voltage. And steps up the voltage without transformer need.
Figure 3 shows schematic diagram of boost converter.

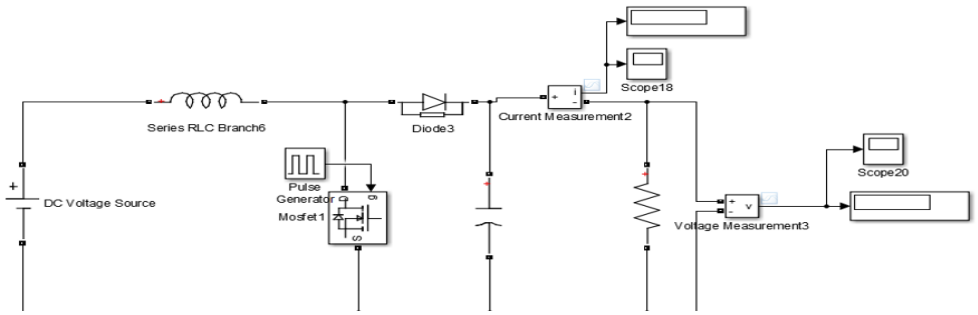

Fig.2 Simulation of boost converter

In continuous conduction mode, the value of inductance is given as, [5]

$L_{min}= (1-D)^2 *D*R/2*f$ (4)

The minimum value of capacitance is given as,

$C_{min}= D/ R*f*V_r$ (5)

IV. PERTURB AND OBSERVATION ALGORITHM

This algorithm is based on the observation of the output power of the array and on the perturbation of the power based on the increments of the array voltage or current. This perturbation is a cause for changing the power of the solar module. And due to the steady state condition this method wavers around the peak point. [1] [3] [5]

The flowchart of (P& O) Algorithm is shown in Figure 4.

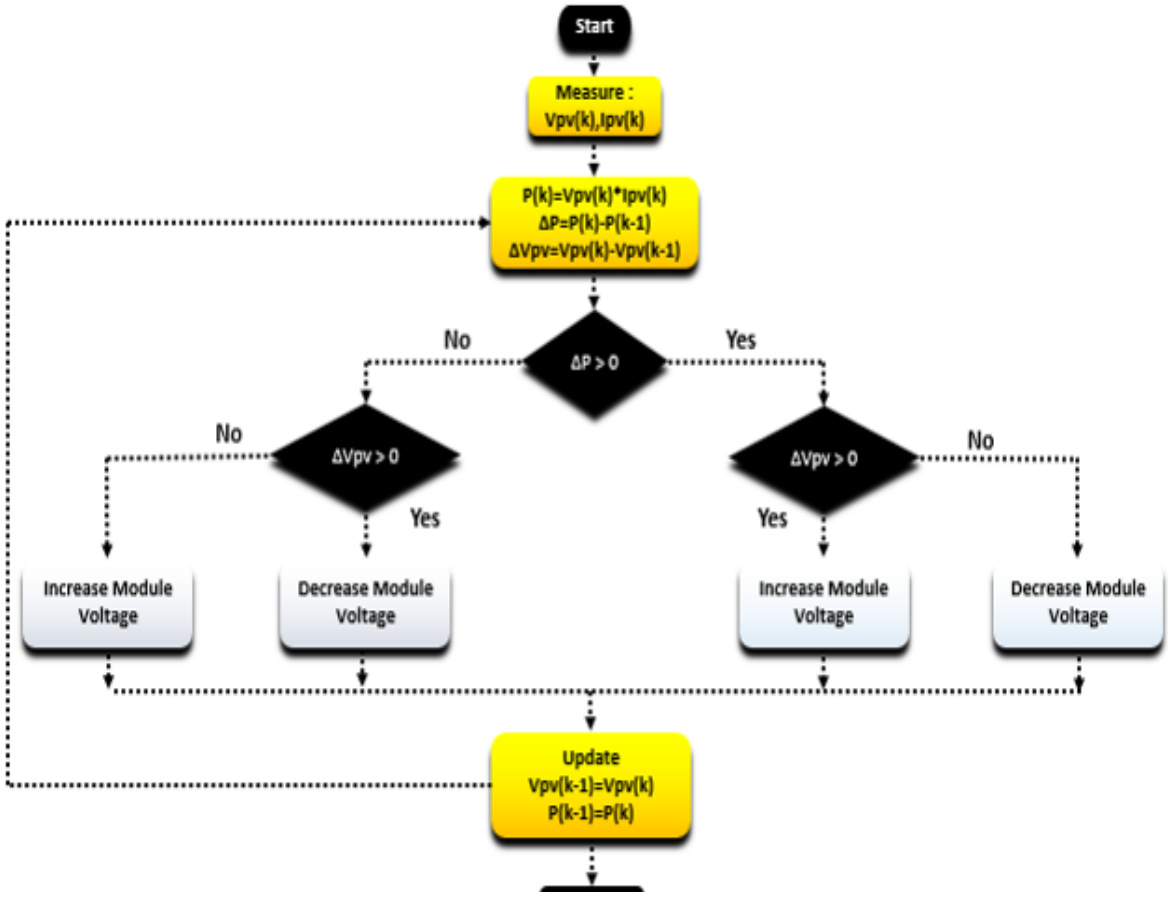

Fig.3 The flowchart of (P& O) algorithm

Due to a small increment of ΔV, the operating voltage of the PV system is perturbed, and then ΔP that is difference value between new power and old power, will be changed. If ΔP is bigger than zero or positive, the perturbation of the operating voltage will be in the same direction of the increment and if ΔP is smaller than zero or negative according to the flowchart, the operating voltage moves in the opposite direction of the increment. [5] [6]

Simulation of Perturb and observation (MPPT) algorithm and duty ratio is shown in figure 5.

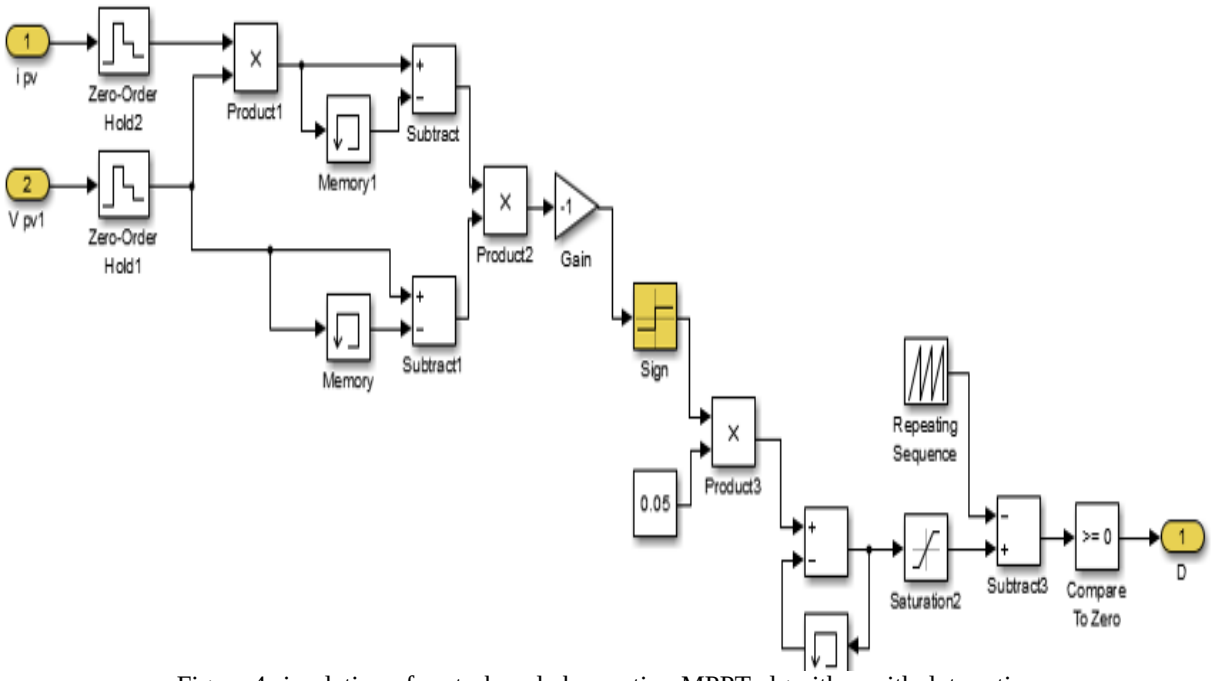

Figure.4 simulation of perturb and observation MPPT algorithm with duty ratio

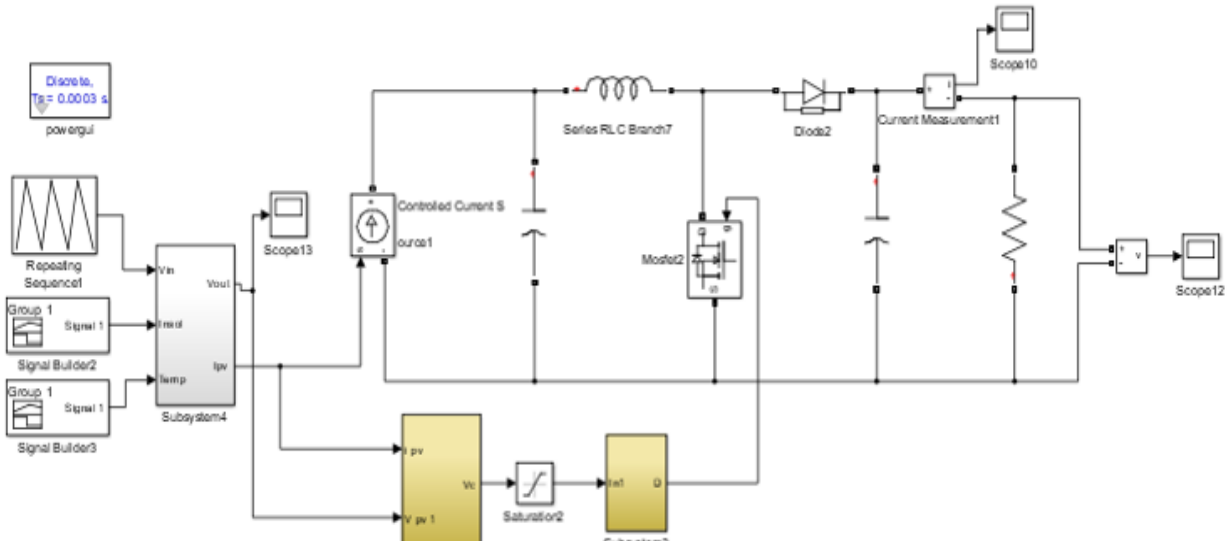

Fig.5 Complete model of the proposed system

V. SIMULATION RESULTS

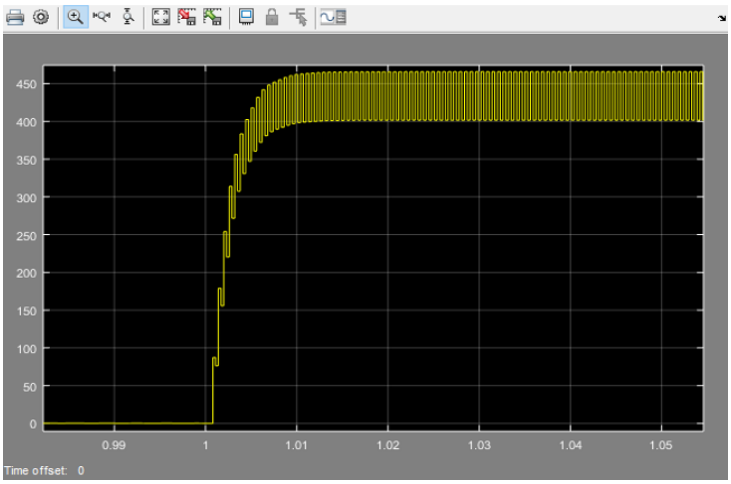

Fig.6 Output voltage of boost converter and MPPT

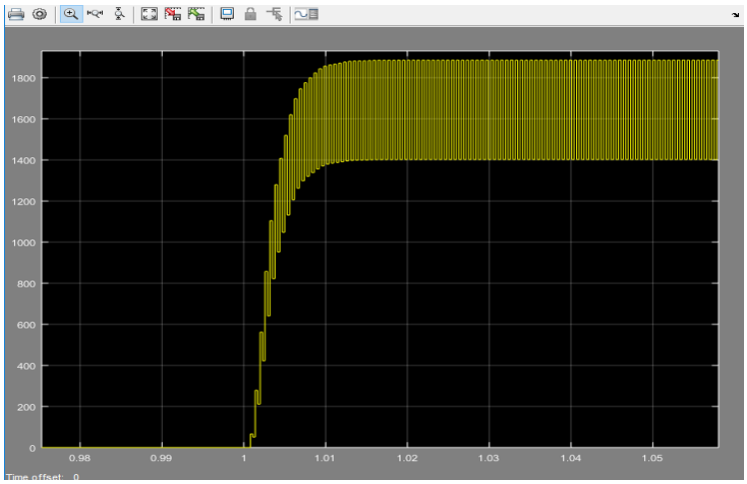

Fig.7 Output power of boost converter and MPPT

VI. CONCLUSION

The proposed system shows a complete model and simulation of Perturb and Observation (MPPT) algorithm. Perturb and observation MPPT algorithm is used to obtain and maintain the maximum power point of solar array. Therefore by using MPPT algorithm and boost converter solar array is operated at maximum power point.

VII. REFERENCES

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