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SOLAR ENERGY HARNESSING USING MPPT

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ABSTRACT

The paper deals with the Maximum Power Point Tracking (MPPT) using perturb and observe algorithm for PhotoVoltaic (PV) systems. MPPT plays an important role in PV systems because it maximize the power output from a PV system for a given set of conditions, and therefore maximize the array efficiency and minimize the overall system cost. Since the maximum power point (MPP) varies, based on the irradiation and cell temperature, appropriate algorithms must be utilized to track the MPP. Matlab/Simulink is used to establish a model of PV system with MPPT function. This system is developed by combining the models of solar PV module and DC-DC BOOST Converter. The system is simulated under non uniform irradiation and temperature conditions. Simulation results show that the photovoltaic simulation system can track the maximum power point accurately.

Keywords: PhotoVoltaic(PV), Maximum Power Point Tracking (MPPT),Perturb and observe algorithm.

I. INTRODUCTION

Solar energy is the most readily available source of energy and it is free. Moreover, solar energy is the best among all the renewable energy sources since, it is non-polluting. Energy supplied by the sun in one hour is equal to the amount of energy required by the human in one year. PV arrays are used in many applications such as street lighting in rural town, water pumping, battery charging, solar water heater grid connected PV systems,Earth orbiting satellites, handheld calculators and remote radiotelephones .Another advantage of using solar energy is the portable operation whenever wherever necessary. But the cost of extracting the solar energy using the PV cells is high because of its product cost. Fig.1 gives amount of solar energy reach the earth. All chemical and radioactive polluting by products of the thermonuclear reactions remain behind on the sun, while only pure radiant energy reaches the Earth.

Due to the high cost of solar cells, it is necessary that PV module operate at its maximum power point, but solar cell produces the solar power changes according to change in solar radiation and temperature. As irradiation and temperature level changes rapidly, the voltage produced fluctuates and become inconstant. As known from a Power-Voltage curve of a solar panel, there is an optimum operating point such that the PV delivers the

There are three ways to increase the efficiency of a solar photovoltaic system. By proper selection of material for the solar cell.By employing a solar panel tracking system. Maximizing the energy conversion from the solar panel by using MPPT controller . The tracking system consists of two basic components Switch mode converter and a control tracking capability. All MPPT methods follow the same goal which is maximizing the PV array output power by tracking the maximum power on every operating condition.

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II. PROPOSED SYSTEM

The basic design for the photovoltaic system peak power tracker consists of the solar Panel, DC-DC converter (Buck- Boost) connected in a series, the microcontroller, Voltage and current sensors and the load (R). This model is known to have better accuracy when the irradiance varies slowly that allows for a more accurate prediction of PV system performance.

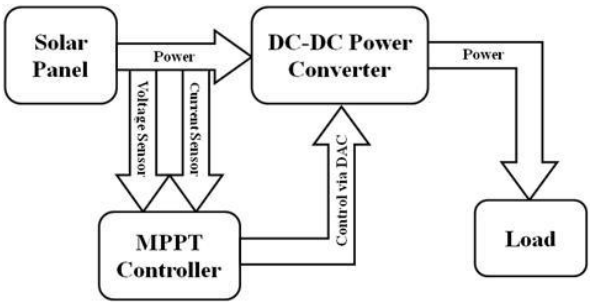

Fig. system design of MPPT.

The Peak Power Tracker is a microprocessor controlled DC/DC converter used by a photovoltaic power system. The microprocessor tries to maximize the output power from the solar panel by controlling the conversion ratio of the DC/DC converter to keep the solar panel operating at its MPPT. A DC-DC converter acts as an interface between the load and the module. The Buck-Boost mode DC/DC converter is the last and most important type of switching regulator. In this converter, the buck and boost topologies are combined into one. The buck-boost converter steps the voltage down when the duty cycle is less than 50% and steps it up when the duty cycle is greater than 50%. The Peak Power Tracker uses an iterative approach to finding this constantly changing power.

III. CONTROL ALGORITHM

The concept behind the "perturb and observe" (P&O) method is to modify the operating voltage or current of the photovoltaic panel until you obtain maximum power from it. For example, if increasing the voltage to a panel increases the power output of the panel, the system continues increasing the operating voltage until the power output begins to decrease.

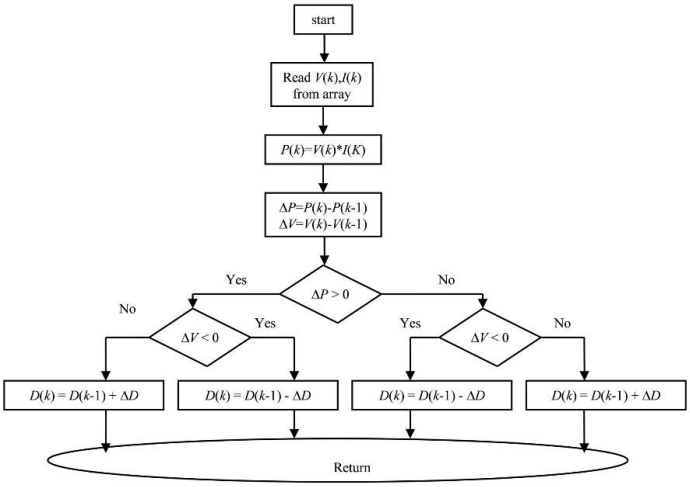

Fig. control algorithm (P and O)

Once this happen, the voltage is decreased to get back towards the maximum power point. This perturbation continues indefinitely. Thus, the output power oscillates around a maximum power point and never stabilizes. The perturb & observe (P&O) algorithm, also known as the "hill climbing" method, is very popular and the most commonly used in practice because of its simplicity in algorithm and the ease of implementation.

IV. RESULTS

This section presents in details implementation of P&O MPPT technique using buck-boost converter. Some results such as current, voltage and output power for different solar irradiation levels have been recorded. The simulation has been accomplished in MATLAB/SIMULINK software.

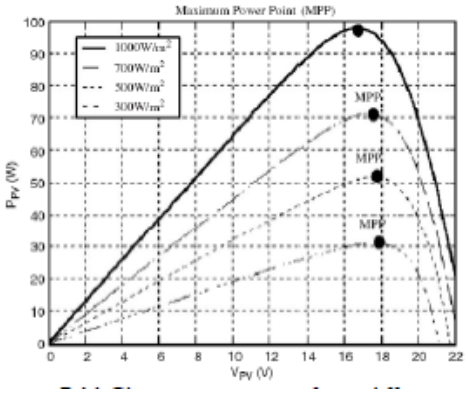

FIG. P-V chractristics

V. CONCLUSION

When MPPT is used, there is no need to input the duty cycle, the algorithm decides the duty cycle by itself. But if MPPT had not been used, then the user would have had to input the duty cycle to the system. When there is change in the solar irradiation the maximum power point changes and thus the required duty cycle for the operation of the model also changes. But if constant duty cycle is used then maximum power point cannot be tracked and thus the system is less efficient. The various P-V and I-V Characteristics of PV array, Inductor current Load voltage, Load current, Load power were obtained by using the plot mechanism in MATLAB. In the Simulink models the solar irradiation and the temperature can be given as variable inputs was done here.
The basic design of the peak power tracker is to read the voltage and current levels at the solar panel simulator output, process these values using the P&O algorithm, and then adjust the voltage in order to obtain maximum power. The obtained results and theoretical operation are confirmed the effectiveness of peak power tracking technique.

REFERENCES

[1]. Dylan D .C. Lu , R.H. Chu, S. sathiakumar& V.G Agilides , "A Converter with simple Maximum Power Point Tracking for Power Electronics Education On Solar Energy System" in IEEE transs. On power electronics, 2012

[2]. S. B. Kjaer, J. K. Pedersen, and F. Blaabjerg, "A Review of Single-Phase Grid Connected Inverters for Photovoltaic Modules," in IEEE Transs. on Power Electron., Vol. 41, No. 5, pp. 1292–1306, Sep. /Oct. 2005

[3]. Literature survey onMaximum Power Point tracking technique for PV system, Umesh T. Kute, Preeti S. Ratanparkhi, IJAREAS Volume II no.12 Dec-2013

[4]. Comparison for algorithms for DC-DC converter based PV system, A.Pradeep Kumar Yadav, S.Thirumaliah, G.Haritha IJAREEIE volume I, Issue 1, July-2012

[5]. Photovoltaic Solar Simulation Of Shockley Diode parameters in MATLAB, Awodugba, A.O, Sanusi,Y.K., and Ajayi, J.O, International Journal of physical sciences Volume 8(22), PP.1193-1200, 16 June 2013.

[6]. A new technique for tracking the Global maximum power point of PV array operating under partial-shading conditions, EftichiosKoutroulis, Member, IEEE and FredeBlaabjerg, Fellow, IEEE, IEEE Journal Of Photovoltaics, Volume 2, No.2 April-2012