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Analysis & Simulation of Two Different MPPT Techniques for Photovoltaic System

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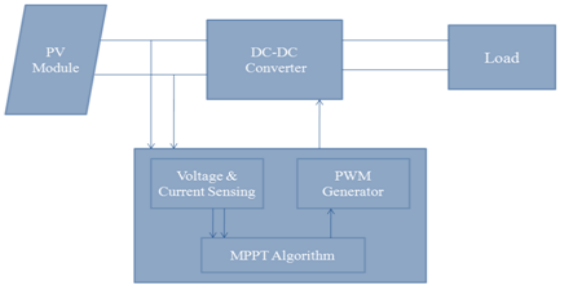
Abstract: **Photovoltaic (PV) is a technical name in which radiant (photon) energy from the sun is converted to direct current (dc) Electrical Energy. PV power output is still low, continuous efforts are taken to develop the PV converter and controller for maximum power extracting efficiency and reduced cost factor. The maximum power point tracking (MPPT) is a process which tracks one maximum power point from array input, varying the ratio between the voltage and current delivered to get the most power it can. In this paper the MPPT algorithm is implemented using Boost & Buck converter. The dynamics of PVA is simulated at different solar irradiance and cell temperature. The P&O MPPT technique is a direct control method enables ease to implement and less complexity.**

Key words: **Photovoltaic (PV), Maximum power point tracking (MPPT), Perturb and observe (P&O), Maximum power point (MPP)**

I. INTRODUCTION

Introduction: Solar energy is one of the non-convectional energy which is renewed automatically and available at free of cost. As the solar energy is non-convectional and large amount of availability without pollution, the making PV technology is a popular research topic. Due to large amount of combustion of fossil fuels for generating electricity, the quantity green house gases in atmosphere is increases up to 17% from year 2004-2014. Oil reserves would have been exhausted by 2040, natural gas by 2060, and coal by 2300. Currently more research works has been focused on how to generate more power from the PV cells. There are two ways such as solar tracking system and Maximum Power Point Tracking (MPPT). In the survey, the maximum energy extracted from the sun without MPPT is only about 30-40 %. The state of the art techniques to track the maximum available output power of PV systems are called the maximum-power point tracking (MPPT).

MPPT is usually used as online control strategy to track the maximum output power from photovoltaic panel. There are many techniques have been developed to implement MPPT, these techniques are different in their efficiency, speed, hardware implementation, cost, popularity. In this paper only two techniques are studied and results of that algorithm are observed which are P&O and INC. The overall block diagram of PV panel with Dc-Dc converter and MPPT is shown in this figure 1



II. MODELING OF PV CELL

The solar cell is the basic unit of a PV system. An individual solar cell produces direct current and power typically between 1 and 2 W, hardly enough to power most applications. Solar Cell or Photovoltaic (PV) cell is a device that is made up of semiconductor materials such as silicon, gallium arsenide and cadmium telluride, etc. that converts sunlight directly into electricity. The voltage of a solar cell does not depend on solar irradiance but it is depend upon temperature of solar cell. The voltage in PV module is generated by connecting the PV cells in series and these series cells are connected in parallel for generating current. When solar cells absorb sunlight, free electrons and holes are exited and travels from negative to positive junction and positive to negative junction respectively. If the positive and negative junctions of solar cell are connected to DC electrical equipment, current is delivered to operate the electrical equipment. The equivalent circuit of the PV cell is shown in figure.

III. PERTURB AND OBSERVE MPPT ALGORITHM

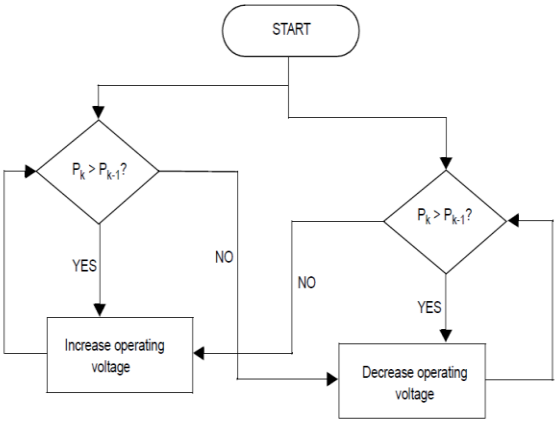


Fig. algorithm of P&O

The algorithm involves introducing a perturbation in the panel operating voltage. Modifying the panel voltage is done by modifying the converter duty cycle.

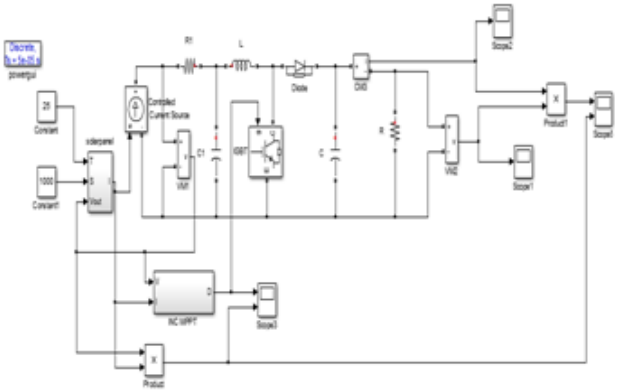


Fig. Diagram of P&O

IV. INCREMENTAL-CONDUCTANCE MPPT ALGORITHM

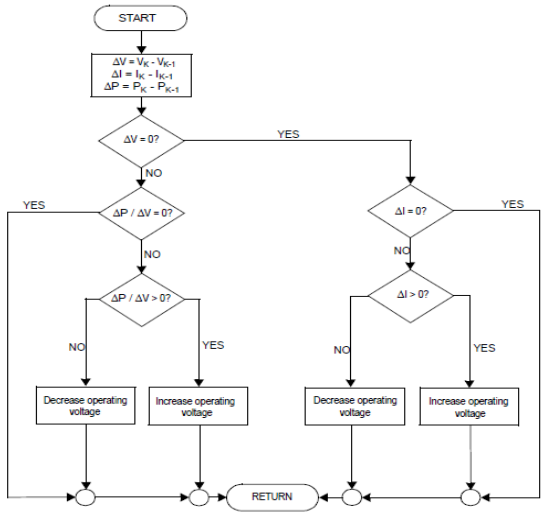


Fig. Algorithm of INC

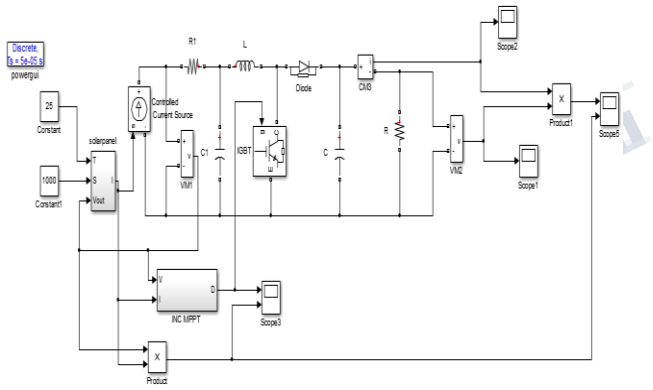


Fig. Diagram of INC

V. SIMULATION AND RESULTS

5.1 PERTURB AND OBSERVE

Fig shows the simulation of P&O MPPT. The modeling diagram of figure represents the whole PV system with MPPT along with the boost converter has been implemented in the Matlab/ simulink.

Table 1 shows the output voltage of P&O MPPT along with different irradiation and temperature.

Solar Irradiance W/m^2	MPPT Output Voltage (P&O)				
	25^0 C	30^0 C	35^0 C	40^0 C	45^0 C
600	16.8	16.7	16.6	16.5	16.4
750	16	15.8	15.5	15.2	15.2
1000	13	13	13	12.8	12.7
1250	11	10.5	10.2	10	9.9

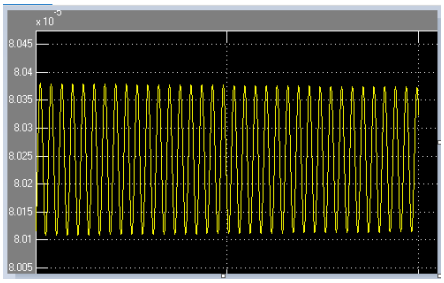


Fig. waveform of P&O

5.2 INCREMENTAL CONDUCTANCE

Fig shows the simulation of INC MPPT. The modeling diagram of figure represents the whole PV system with MPPT along with the boost converter has been implemented in the Matlab/ simulink.

Table 2 shows the output voltage of INC MPPT along with different irradiation and temperature.

Solar Irradiance W/m^2	MPPT Output Voltage (INC)				
	25^0 C	30^0 C	35^0 C	40^0 C	45^0 C
600	8	7.9	8	8	8
750	9.5	9.5	9.5	9.4	9.4
1000	12	11.5	11.5	11.5	11.5
1250	13.5	13.4	13.4	13.4	13.3

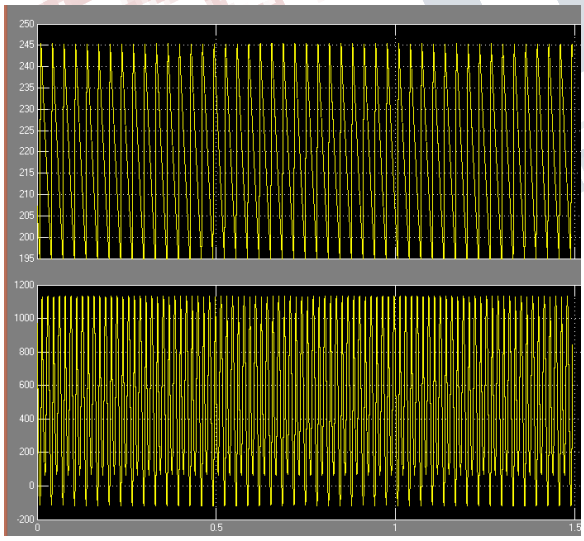


Fig. waveform of INC

VI. CONCLUSION

The results of the analysis have shown that the tracking performances of *P&O* and *INC* are largely identical under both static and dynamic conditions. They both are based on the same mathematical relation of the derivative of power with voltage, and it has been shown that the only difference between them is that the *INC* neglects the second-order term in the discrete differentiation of the power.

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