AN ANALYSIS OF DC-DC CONVERTER WITH SOLAR PV SYSTEM BY IMPLANTATION PERTURB & OBSERVE MPPT TECHNIQUE

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***Abstract*-Power generation from solar source is increasing exponentially as requirement of power and load increasing. Due to thread of collapsing conventional sources, power generation from renewable sources is needed to adopt to fulfill future requirements. There are some problems faced in their generation are their variable inputs from solar radiations in case of solar energy source. This variation in radiations causes variation in output power and this is not healthy for output power requirements. It causes distortions in system parameters. From last few years, researchers are working on converter control techniques. These are used to control duty cycle of converter thyristor. In this purposed work perturb and observe (P&O) technique are implemented with Buck, Boost and Buck-Boost converters to observe the various output response. Comparison is carried out for the analysis of these controllers and a system that is not controlled for outcome with the specific requirement of particular converter and compatibility of control techniques.**

***Keywords*-Maximum power point tracking (*MPPT*),photo-voltaic (*PV*),perturb and observe (*P&O*)**

I. INTRODUCTION

PV solar cell converts sun light into electricity. Since, the generation from PV systems has two major problems: the low efficiency of conversion of electric power and high cost of PV cell. As the generation of PV system depends on the weather condition so under low irradiation conditions the efficiency of conversion is 9-16%[2]. The solar cell V-I characteristic is nonlinear (figure1) and changes with irradiation, temperature (figure3&4) and load impedance where irradiation and temperature are dynamic. The maximum power point location continuously change and not known, but can be located by calculation models or by search algorithms. Hence Maximum Power Point Tracking (MPPT) techniques are basically used to maintain the PV array's operating point at the Maximum Power Point[3].Usually, The PV modules used commercially are having efficiency between 6 to 16% and the variation in their efficiency depends on the technology used [1],[2],[10]. The second one is totally based on electrical equipment which are helpful to vary the electrical parameters at the output of the solar PV module because of which the PV module allows to operate in the optimal operating point [1]. Figure 2 shows a basic MPPT system.

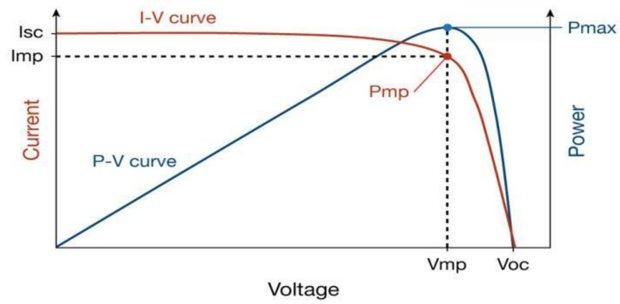

Figure 1:Power-voltage and current-voltage curve

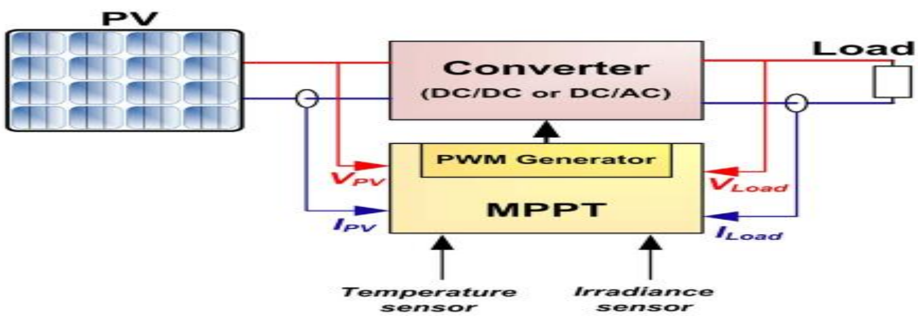

Figure2: Blockdiagramofa MPPT controlled PV system [1

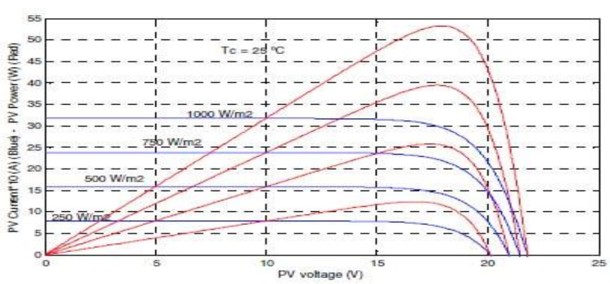

Figure 3 :Power–voltage characteristics and current–voltage characteristics of a PV module for different radiation levels at constant cell temperature [1]

It is clear fromfigure3, the output power of PV module is directly proportional totheirradiationandfigure4showsthatthe output power of PV array is inversely proportional to the temperature.

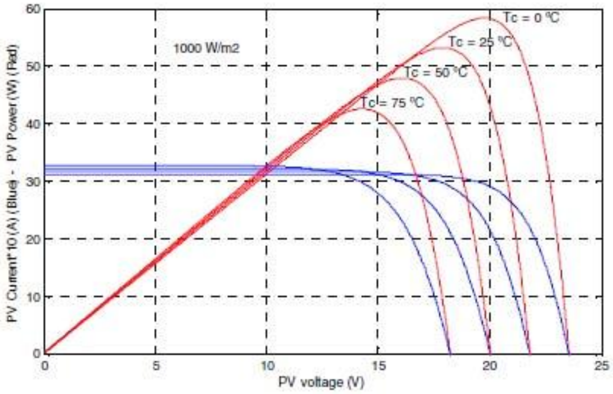

Figure 4: Power–voltage characteristics and current–voltage characteristics of a PV module for different cell's temperature at constant radiation level[1]

II. OVERVIEWOFMPPT TECHNIQUE

A. PERTURB-AND-OBSERVE(P&O) TECHNIQUE

The Perturb-and-observe algorithm for maximum power point tracking is simplest techniques among all the MPPT techniques in literatures. It is based on the simple mathematical condition, i.e. dP/dV = 0, where P and V are power and voltage at output of PV module respectively.

From figure 1, it can be seen that increase in voltage increases power when the PV array operates in the left of MPP and power decreases on increasing voltage when the same is operates in the right of MPP. Hence if dP/dV> 0, the perturbation should be same and if dP/dV< 0, the perturbation should be reversed. The process should be repeated periodically until dP/dV = 0 reached (maximum power point) [1], [3], [4], [9].

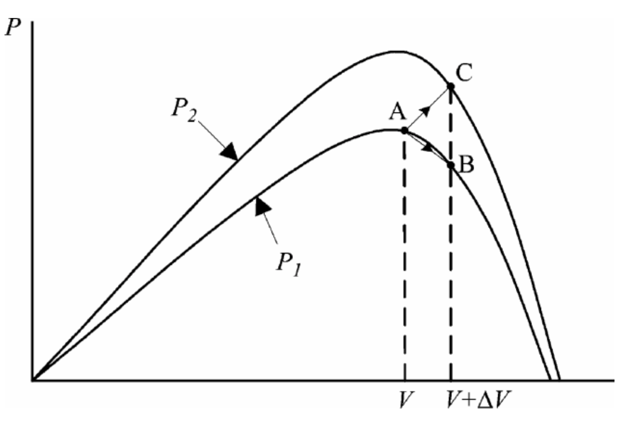

Figure5:Divergence of P&O from MPP[4]

Under sudden changing atmospheric conditions P&O method does not respond well as illustrated in figure 5.Due to small perturbation of ΔV in the PV voltage V under constant atmospheric conditions the operating point moves from A to B. Since power decreases to B so according to P & O algorithm the perturbation should be reversed. And when the power curve shifts from P1 to P2 due to increase in irradiance the operating point will change from A to C. Now there is increase in power so again according to P & O algorithm the perturbation should be kept same which results in the divergence of operating point from Maximum Power Point [3],[4].So we need some change in P & O technique to track MPP correctly even under rapid change in irradiance. For example the three-points P & O algorithms [3]-[5].

III. MTHEMATICAL MODELING OF CONVERTERS

DC-DC converters are designed using mathematical equations and design resented in MATLAB modelling. Buck, Boost and Buck-Boost Converters are shown in fig. 6 to 8 and the parameters are given in table.1.1.

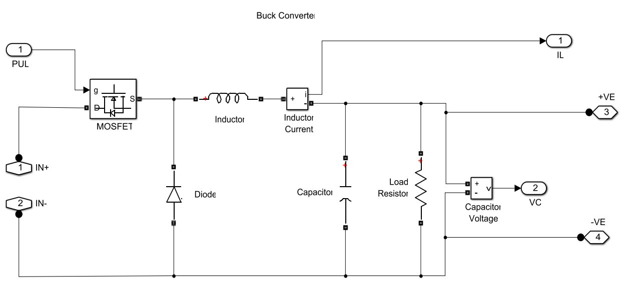

Fig. 6. MATLAB model Buck converter

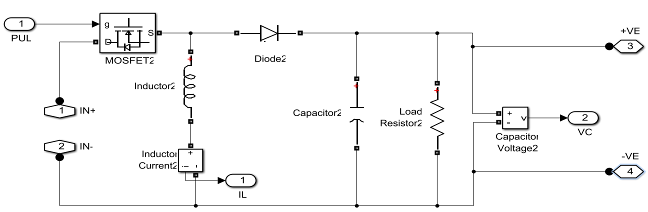

Fig.7. MATLAB model Buck-Boost Converter

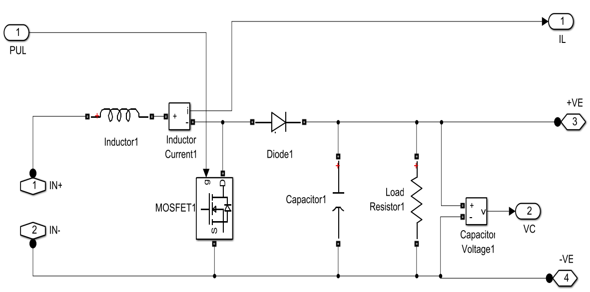

Fig.8. MATLAB model Boost Converter

Table 1.1 RLC parameters of converters

S.No	Converter	R(Ohm)	L(H)	C(F)
1	Buck	15	145.83e-5	20e-5
2	Boost	15	145.83e-5	20e-5
3	Buck Boost	15	1.5e-3	250e-6

The proposed system is implemented MPPT technique and the mathematical modelling is performed in MATLAB /Simulink software.

IV. SIMULATION OF PROPOSED MPPT METHOD

MPPT controller based on the Perturb & Observe algorithm implemented in proposed system and represented in fig.9. D output is the Duty cycle of the boost converter (value between 0 and 1), Enabled input is 1 to enable the MPPT controller, V input is PV array terminal voltage (V) and I input = PV array current (A). This algorithm is programmable based.

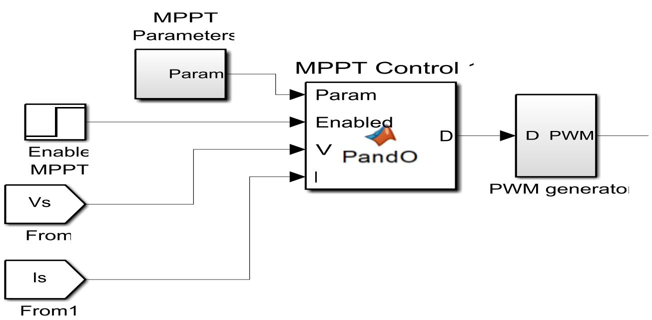

Fig.9. MATLAB model of MPPT P&O technique for converters

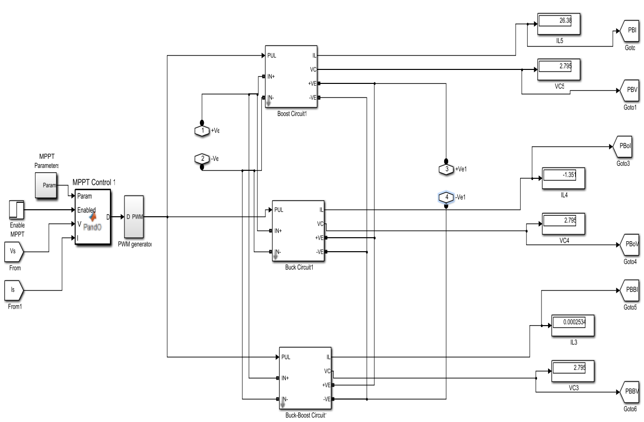

Fig.10. MATLAB model for proposed MPPT P&O with converter

V. SIMULATION RESULTS

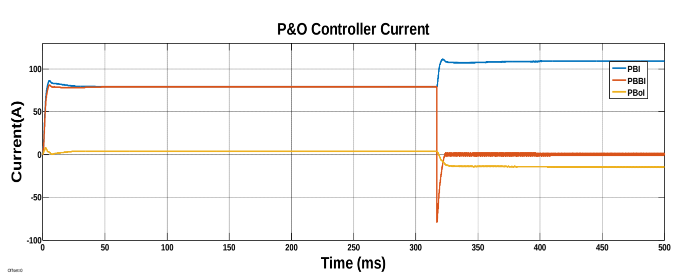

Fig.11. outputs waveform of converters voltage with P&O Controller

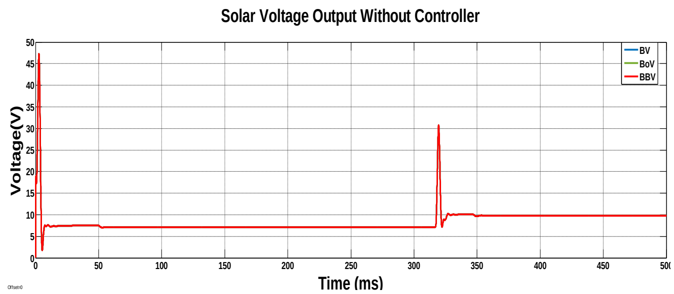

Fig.12. Outputs waveform of converter current with P&O Controller

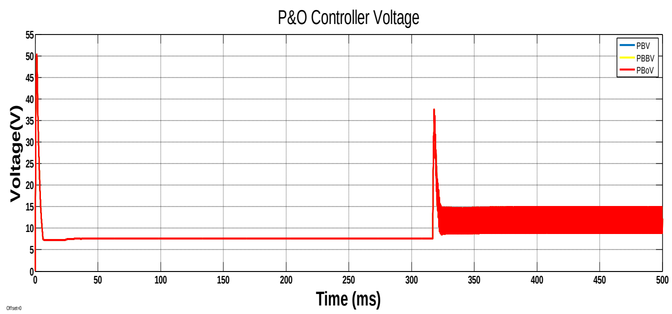

Fig.13. Output waveform of converter voltage without controller

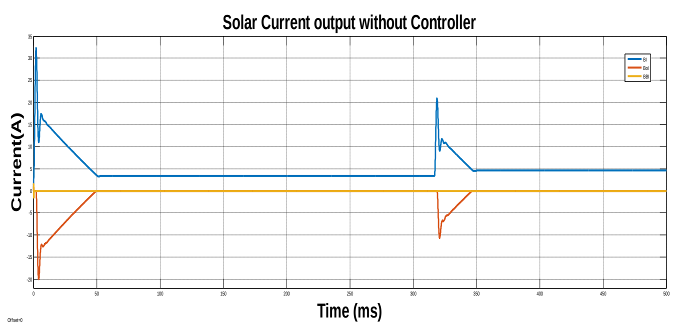

Fig.14. Outputs waveform of converter current without control.

Table.1.2 Comparative analysis of Current in control techniques for converters

S.No	Converter	Controller (Current) (A)			
		P&O		Normal Case	
		50-300 msec	350-500msec	50-300 msec	350-500msec
1	Buck	3.6	-14.5	8.00E-06	6.00E-06
2	Boost	79.2	109	3.35	3.5
3	Buck-Boost	79.2	0.52	8.00E-05	0.000403

Table.1.3 Comparative analysis of Voltage in control techniques for converters.

S.No	Converter	Controller Voltage(V)		
			P&O	Normal Case
1	Buck		10	8.8
2	Boost		12	9.8
3	Buck-Boost		11	7.8

The work proposed, its analysis and outcomes from the controllers used to control different DC/DC converters. P&O controller is implemented to Buck, Boost and Buck-Boost Converters for the analysis outcomes that gives the appropriate requirement of controller with suitable converter.

VI. CONCLUSION

The proposed system is implemented with purpose of comparison of different types of DC convertersto identify best converter combination with P&O technique. This is simulated on 2.5KWp Solar PV generation and then the output power is supplied to the controllers so it can control it for converts as Buck, Boost and Buck-Boost Converter. A non-controlled system is taken for result validations.

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