

Analysis of P&O and Inc Algorithms for Effective Photovoltaic System Using MATLAB

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Abstract

The power crisis faced in India can be overcome by introducing different non-traditional control age tactics. Sunlight-based electricity is the most well-known out-of-the-box technology. Since the sun is the major source of energy for this method, the facility age may vary due to the natural factors like as irradiance, temperature variations, and abrupt impedance of mists, which cannot be controlled or prevented by humans. Irrespective of temperature, irradiance, or shading effects, the Maximum Power Point Tracker (MPPT) method is employed to see the utmost power age point. By applying MPPT methods, the required amount of energy is controlled with a smaller number of boards, lowering the value of adding to a PV framework. This research presents a comparable analysis of two MPPT procedures, Perturb and Observe (P&O) and Incremental Conductance (INC) methods in light of the very fact that these computations are often used due to their low effort and simple recognition when using MATLAB/SIMULINK. To imitate the MPPT algorithm, the basic quantities like voltage and current of a board have been used.

Keywords: Photovoltaic System, Perturb and Observe, Incremental Conductance

1. Introduction

Since the beginning of the industrial revolution,, the demand for energy in many forms has expanded, forcing scientists to research and build innovative methods to maximize energy extraction. Alternative energy is one among the foremost current energies with a promising future since, as compared to other energies, it's clean and environmentally friendly. There are numerous methods to utilize this energy to get electricity, but the

foremost significant technique and therefore the one that is concerned during this study is that the photovoltaic approach, which has the benefits of being non-polluting, adaptable, and dependable. A part of the solar power is converted into electricity using photovoltaic technology. This modification takes happen without making any noise or emitting any gases, hence it's natural and totally free of contaminants.

Resolving the electrical device with difficulty in efficacy and achieve optimum efficiency, all components of the photovoltaic (PV) system must be designed optimally. Furthermore, the DC\DC converters utilized because the PV generator's interfacing the load must be optimized so as to extract the best power and, as a result, run the solar electric (GPV) generator at greatest potential electric outlet utilizing a maximum outlet tracking controller. As a result, attaining a maximum electrical phenomenon when the load and ambient conditions (brightness and temperature) change could be a challenge. The work is meant to analyze the MPPT using two famous approaches; PO and IOC, among the various strategies accustomed compute the MPP of the GPV (IC).

2. Block Diagram

As indicated in Figure 1, a photovoltaic system is formed from four (04) blocks. The source of power (photovoltaic module) is represented by primary block , a static converter from DC to DC is represented by the second block, the appliances load is represented by the third block, and therefore the procedure algorithms is represented by the fourth block the system algorithms is represented by the fourth block.

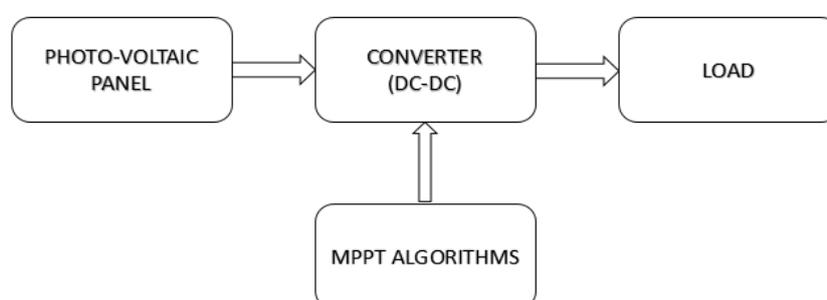


Figure 1. Block diagram of MPPT

3. Techniques for MPPT

MPPTs are classified as either conventional or evolving approaches that are supported the procedure for adjusting the boost converter's switching frequency and V_{out} . For the photoelectric system to function effectively the efficient tracking method is mandatory. The basis of this system is based on an automatic pulse width modification in order to enhance the PV panel's facility by pushing something to a parameter. Therefore, the most prevalent control algorithms are discussed.

3.1 Perturb and Observe Method

And it's the most often used Predictive control method since it is simple and has a minimal implementation cost. The cost of implementation is inexpensive since just one detector, a voltage detector, is required. One purpose with this method would be to produce a voltage intermission in the solar module when it's on pulse width. Eventually, within the aftermath of this disruption, the Solar panel facility computed at period t , then evaluate this to the previous the first at time. When the ability is increased, The phase shift variation remains in almost the same orientation as one faces the 'maximum possible power'. On the opposite hand, when the ability drops, it moves removed from the most point.

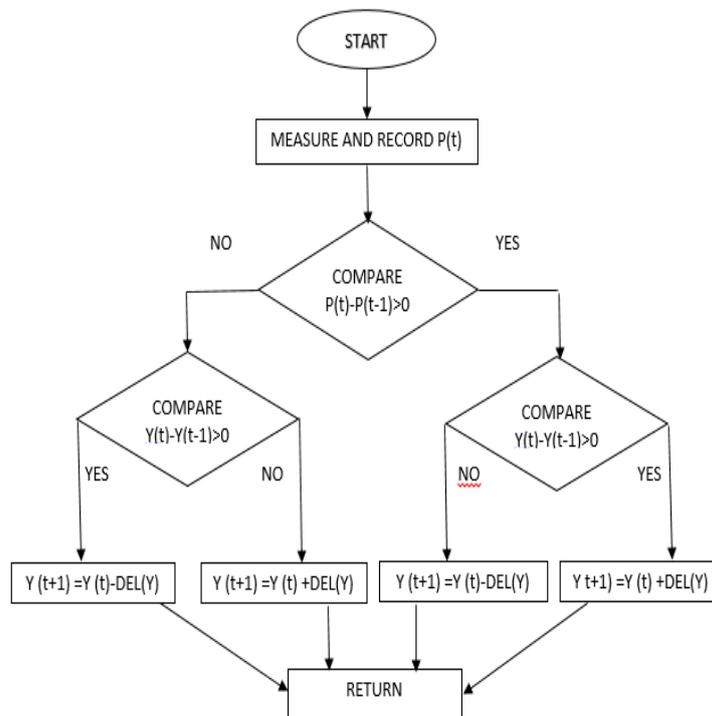


Figure 2. Flowchart for perturb and observe method

3.2 Incremental Conductance Method

This algorithm's basis is predicated on knowing the sensitivity value and incrementing the conductance to determine the optimum position with respect to the max power goal. The duty cycle may be reduced if conductance increment is above the opposing conductance increment. If the increase in permeability is well below the permeability alternative, the duty cycle is raised. This technique has been followed on until ability point has been attained.

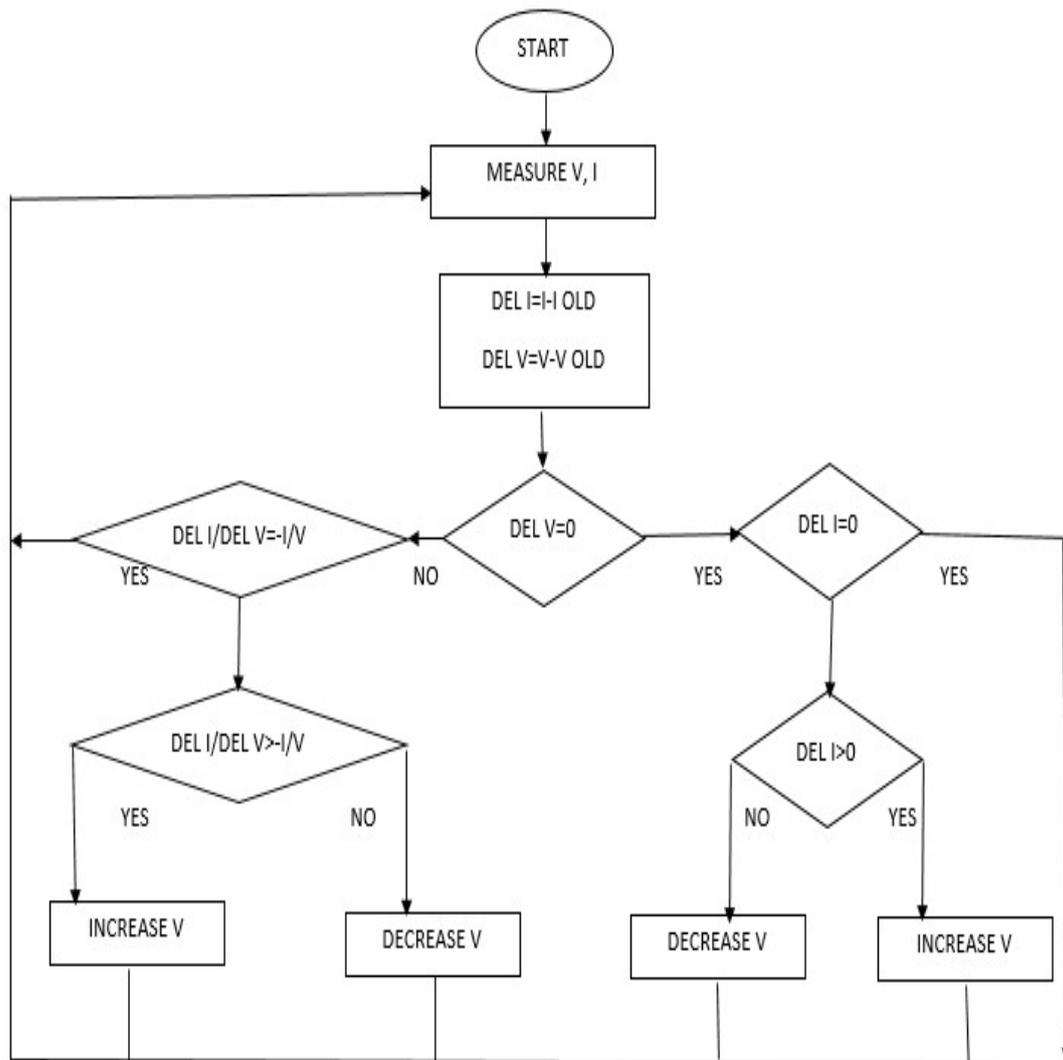


Figure 3. Flowchart for incremental conductance method

4. Outcomes and Discussion

A consumer, a solar concentrator, a Dc power exchanger, and a Predictive control controller are shown with in the diagram created with in the MATLAB / SIMULINK.

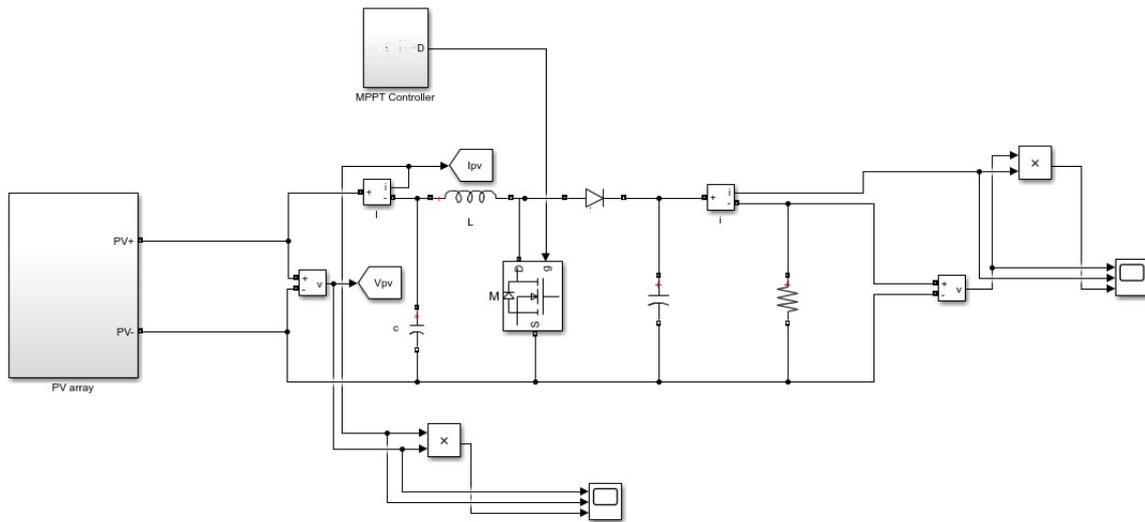


Figure 4. Circuit diagram in MATLAB/SIMULINK

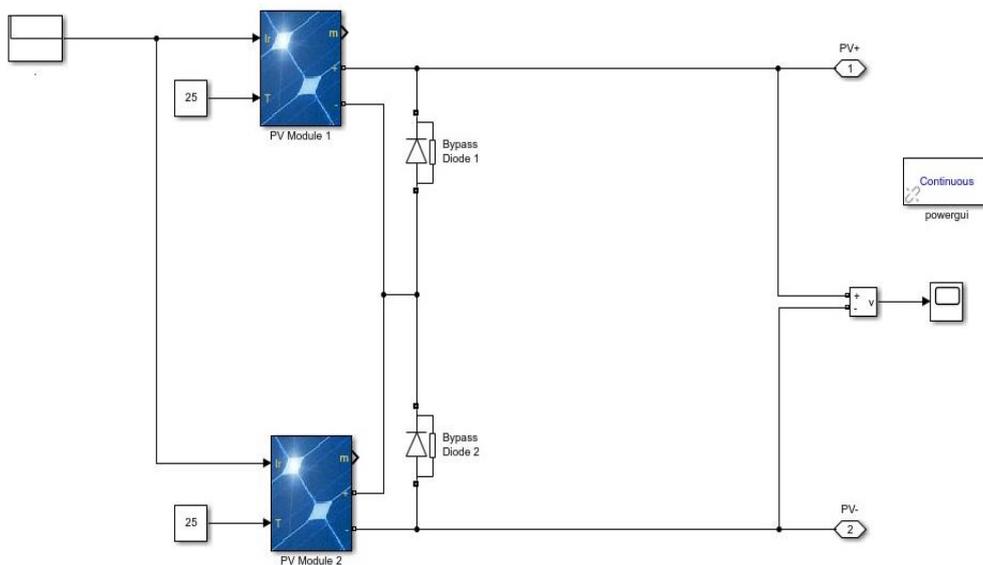


Figure 5. Solar panel connection

In a connected in series, the wire of one panel is connected to the negative of the other panel, as shown in fig 7, and it has been tested under various working circumstances.

4.1 Perturb and observe output

The volts, amperage, and wattage of the output of a solar panel are depicted through fig 8 above under the constant temperature of 25 degree and varying irradiance of 1000,800,600 watt/square meter.

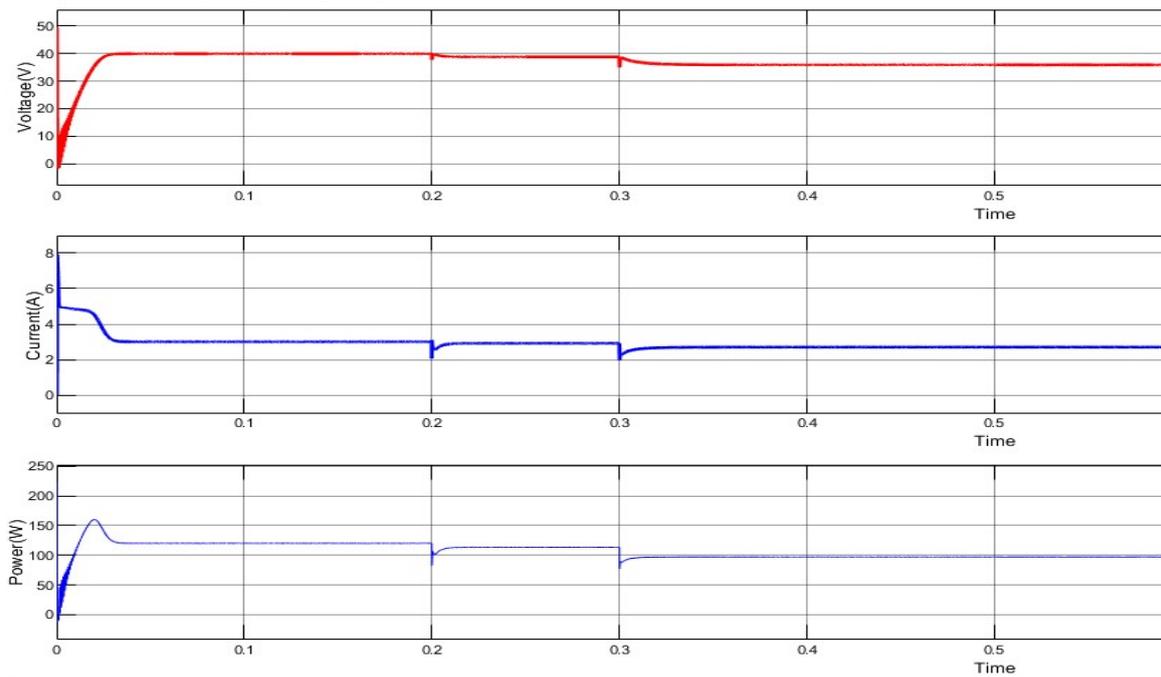


Figure 6. Output of solar panel using P&O algorithm

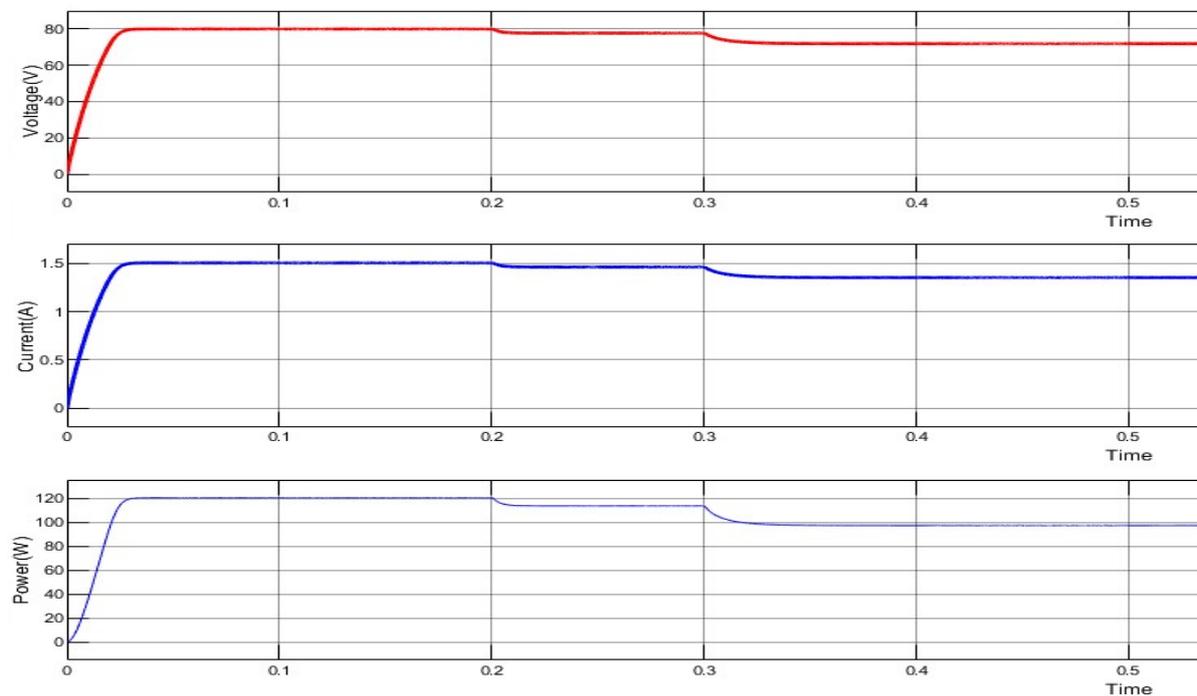


Figure 7. Boost converter output using P&O algorithm

The volts, amperage, and wattage of the output of a booster converter are depicted through fig 9 above under the constant temperature of 25 degree and varying irradiance of 1000,800,600 watt/square meter.

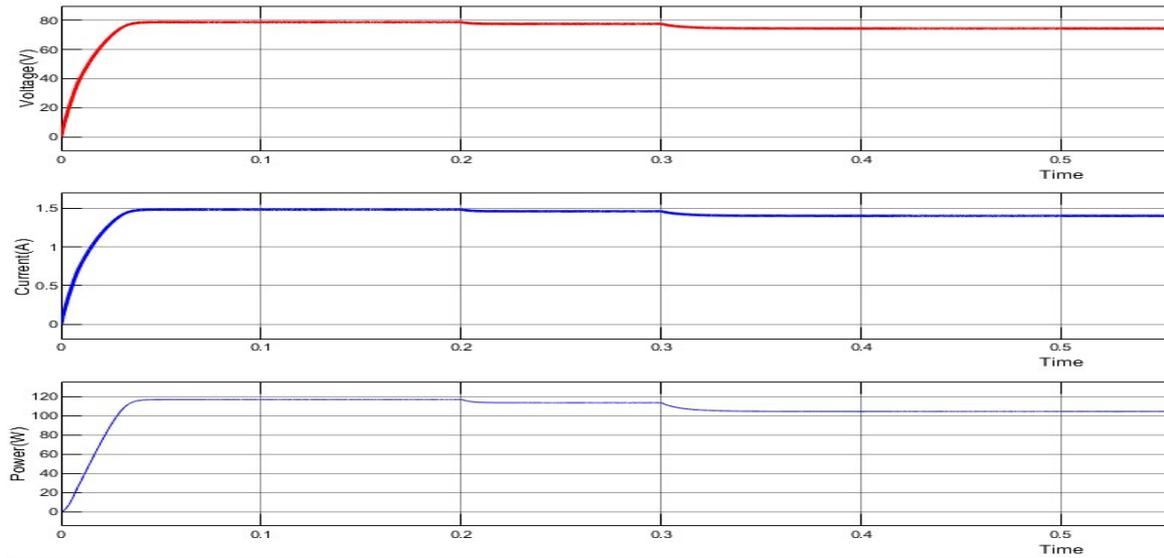


Figure 8. Output under partial shading conditions using P&O algorithm

The volts, amperage, and wattage of the output of a booster converter are depicted through fig 10 above under the constant temperature of 25 degree and varying irradiance of 800,700,600 watt/square meter under partial shading conditions.

4.2 Incremental Conductance Output

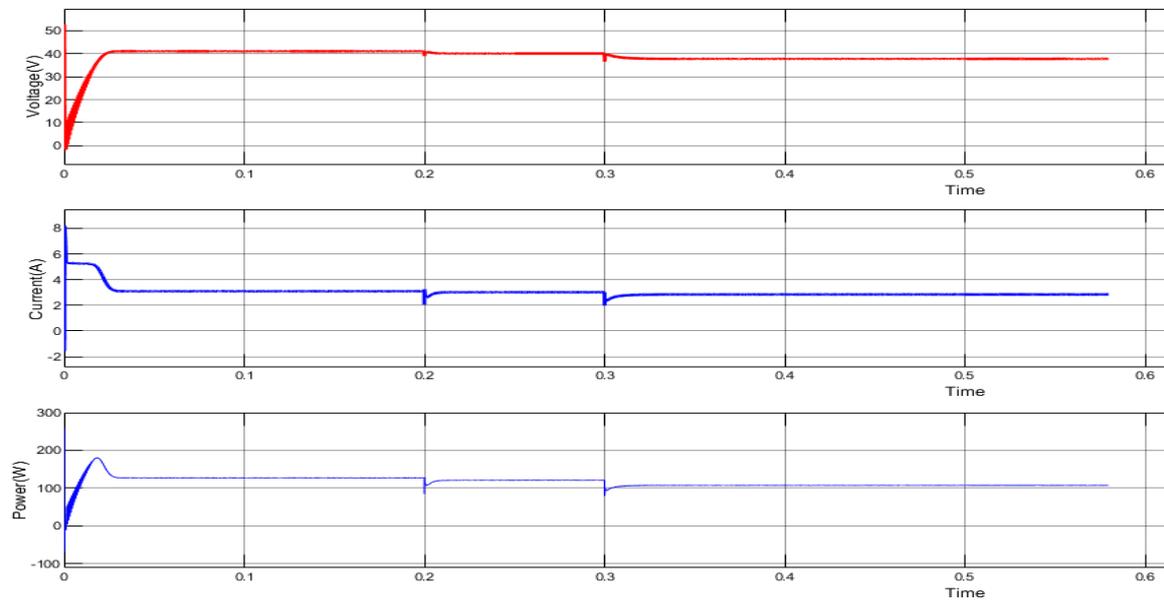


Figure 9. Output of solar panel using INC algorithm

The volts, amperage, and wattage of the output of a solar panel are depicted through fig 11 above under the constant temperature of 25 degree and varying irradiance of 1000,800,600 watt/square meter.

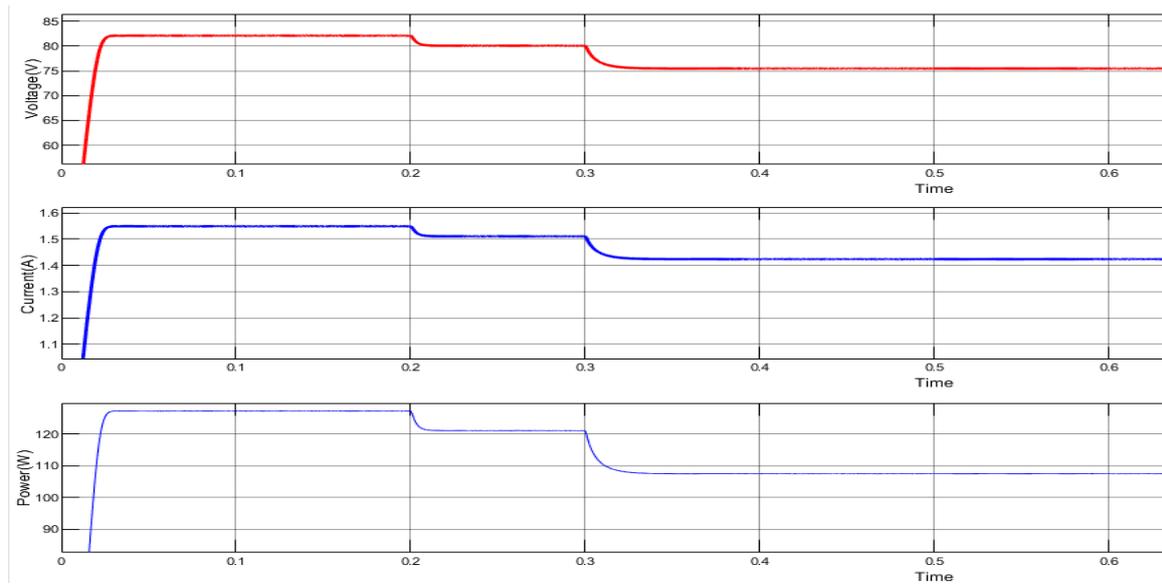


Figure 10. Boost converter output using INC algorithm

The volts, amperage, and wattage of the output of a booster converter are depicted through fig 12 above under the constant temperature of 25 degree and varying irradiance of 1000,800,600 watt/square meter.

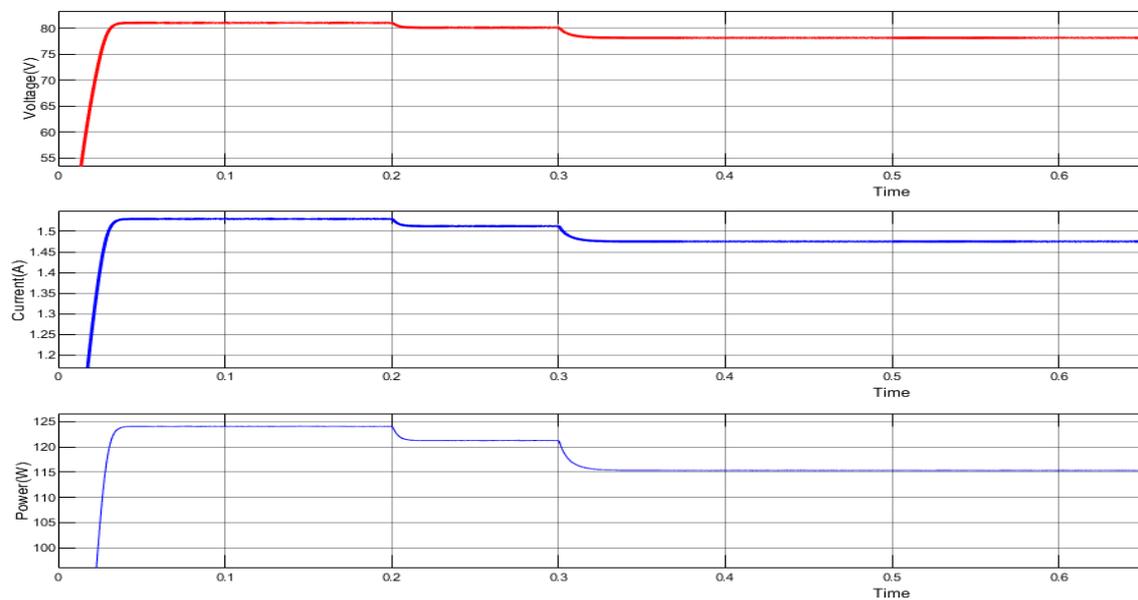


Figure 11. Output under partial shading conditions using INC algorithm

The volts, amperage, and wattage of the output of a booster converter are depicted through fig 13 above under the constant temperature of 25 degree and varying irradiance of 800,700,600 watt/square meter under partial shading conditions.

Table 1. Comparison of P&O and INC algorithms in constant irradiance condition.

Parameters	P&O			INC		
	1000	800	600	1000	800	600
Irradiation	1000	800	600	1000	800	600
Voltage (V)	80	77.5	72	82	80	75
Current (I)	1.5	1.46	1.35	1.55	1.5	1.42
Power	120	114	97	127	121	107
Convergence Time(s)	0.03	0.21	0.34	0.25	0.20	0.31

Table 2. Comparison of P&O and INC algorithms in partial shading condition.

Parameters	P&O			INC		
	800	700	600	800	700	600
Irradiation	800	700	600	800	700	600
Voltage (V)	78.5	77	74	82	80	78
Current (I)	1.48	1.46	1.4	1.53	1.51	1.47
Power	116	113	104	124	122	115
Convergence Time (s)	0.04	0.21	0.32	0.035	0.20	0.305

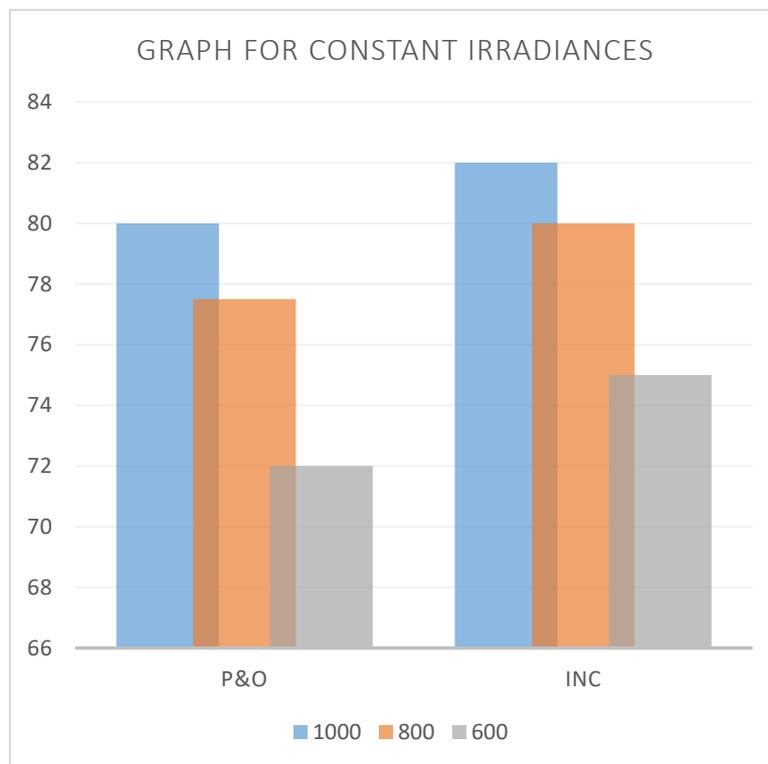


Figure 12. Graphical representation of P&O and INC algorithms in constant irradiances

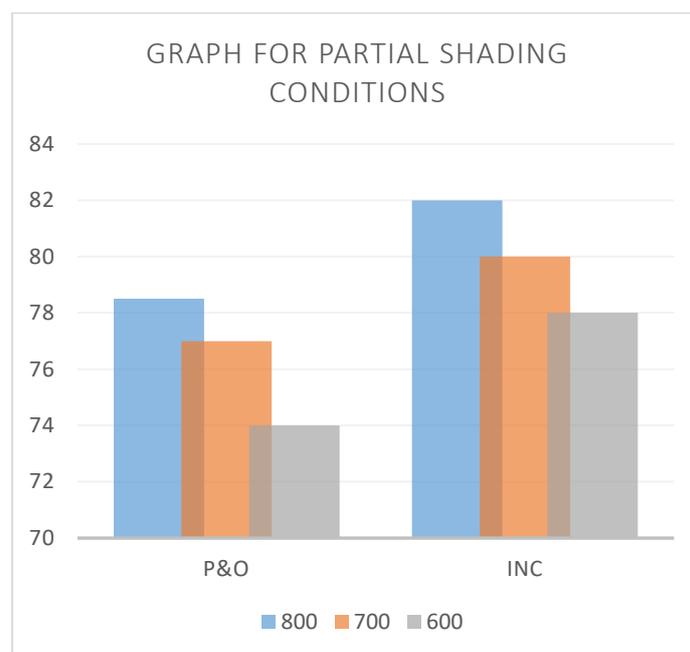


Figure 13. Graphical representation of P&O and INC algorithms in partial shading conditions

5. Conclusion and Future Scope

With the identical meteorological circumstances, under constant circumstances, the PO and INC Computational approaches are evaluated and tested. and therefore, the partial shading condition. The PO MPPT approach swings wildly in terms of efficient tracking when weather patterns are steady or fluctuate slowly; nevertheless, when atmospheric conditions change fast, the PO method is ineffective; yet, In continuously evolving meteorological circumstances, the INC technique reliably determines the efficient point as well as the convergence time is shorter compared with the P&O algorithm. For future studies, this study will be further extended by comparing with optimization techniques like grey wolf optimization techniques for an efficient system.

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