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Maximum Power Point Tracking of PV System

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ABSTRACT

Depletion of fossil fuels has forced the world to consider other alternatives to satisfy its energy needs, which means that when we photograph renewable energy sources, we are dealing with sources that are continuously regenerated in nature. They are wind, solar, biomass, etc. Among all energy sources, solar energy has a great advantage. Because what is available in each climate and technologies have been developed to produce thousands of megawatts.

Photovoltaic (PV) systems that convert solar energy directly into electricity. The main elements of a PV system are the solar cell. The efficiency of PV cells is very lower because currently available PV cell technologies range from 15% to 70% PV cell efficiency to improve system efficiency. It is necessary to observe the maximum power of the solar energy system. For which maximum power trackers (MPPT) have been developed.

The main MPPT techniques are perturb and tracking technique and incremental conduction technique. Not all MPPT techniques are suitable for a particular PV system. One technology may work more efficiently than other technologies in a given PV system. So many MPPT techniques are developed. In the present work, an efficient technology is developed among the basic technologies.

Keywords: Renewable energy, Solar photovoltaic, perturb and observe method, Incremental conductance method, DC-DC Boost converter.

1. Introduction

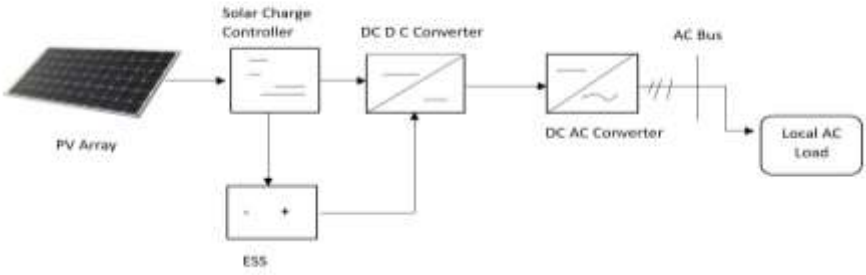
Many methods are commonly used in MPPT of PV systems, such as Disturbance and Observation (Pando), Incremental Conductance (INC), and Partial Open Circuit Voltage (FOCV). These algorithms continuously monitor the voltage and current of the PV array and adjust the operating point to ensure that it is operating at maximum capacity. Using MPPT, PV systems can significantly improve their efficiency and effectiveness, resulting in better energy performance and better utilization of solar resources.

1. Perturb and Observe (Pando): This method involves slightly disturbing the operating system of the PV system and observing the resulting power change. As the power increases, the system continues in that direction until further disturbance causes the power to decrease. At this point, the system changes direction. This iterative process continues gradually, approaching the maximum power point.

2. Incremental Conductance (INC): Unlike Pando, the INC method takes into account the change in both power and conductance (derivative of power with respect to voltage). It adjusts the operating point depending on whether the system is operating at maximum capacity or not, resulting in faster and more accurate monitoring.

2. Solar Photovoltaic

Maximum Power Point Tracking (MPPT) is a critical technology used in photovoltaic systems to maximize power generation efficiency. It works by continuously adjusting the operating point of the solar panels to ensure their maximum output under different environmental conditions such as temperature and sunlight intensity. By doing this, the MPPT allows the system to extract the maximum possible power from the solar panels, which ultimately increases the overall efficiency and power of the solar system. MPPT algorithms are typically implemented in the charge controllers or inverters of solar systems. These algorithms use various techniques, such as mix and see, incremental conductivity or hill climbing, to continuously monitor the maximum power (MPP) of solar panels.



The MPP is the operating point at which a solar panel produces maximum power under certain environmental conditions. conditions Because these conditions can vary throughout the day and between seasons, MPPT ensures that the system is always operating at MPP, optimizing energy production. By dynamically adjusting the operating voltage and current of the solar panels, MPPT controllers maximize harvested energy. panels, which are then used to charge batteries (in off-grid systems) or feed into the grid (in grid-connected systems) through inverters. In general, MPPT technology plays a vital role in improving efficiency, performance and reliability. photovoltaic systems, which makes them a more cost-effective and sustainable energy solution.

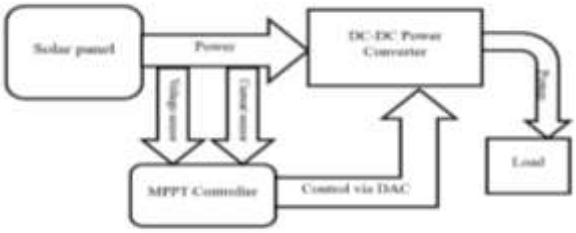
3. DC-DC Boost Converter

DC/DC converters are utilized in applications that require an middle of the road yield voltage that can be higher or lower than the input voltage. The choice of a reasonable DC/DC converter for the usage of the MPPT framework as well as for the integration of the station gather has not been examined independently, in spite of the fact that it has a noteworthy impact on the ideal operation of the photovoltaic system.

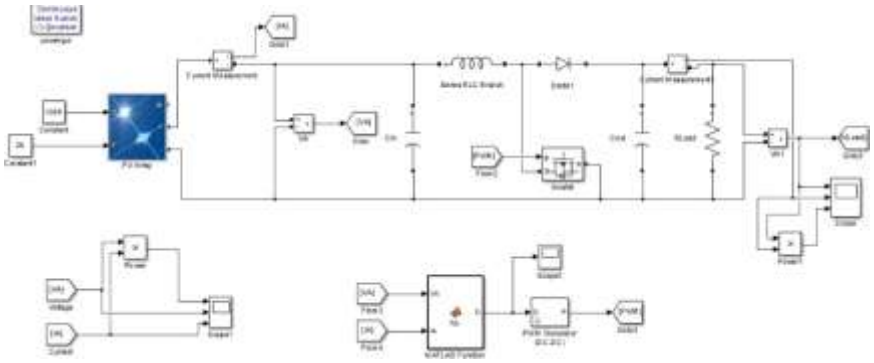
The point of this work is to compare the execution of a photovoltaic framework utilizing three fundamental topologies of DC-DC converter (Buck and Boost converter) and MPPT tracker.

For this we require DC/DC converters, particularly for the input impedance they require beneath certain working conditions. So, you can choose on the best setting to utilize.

DC-DC BOOST CONVERTER

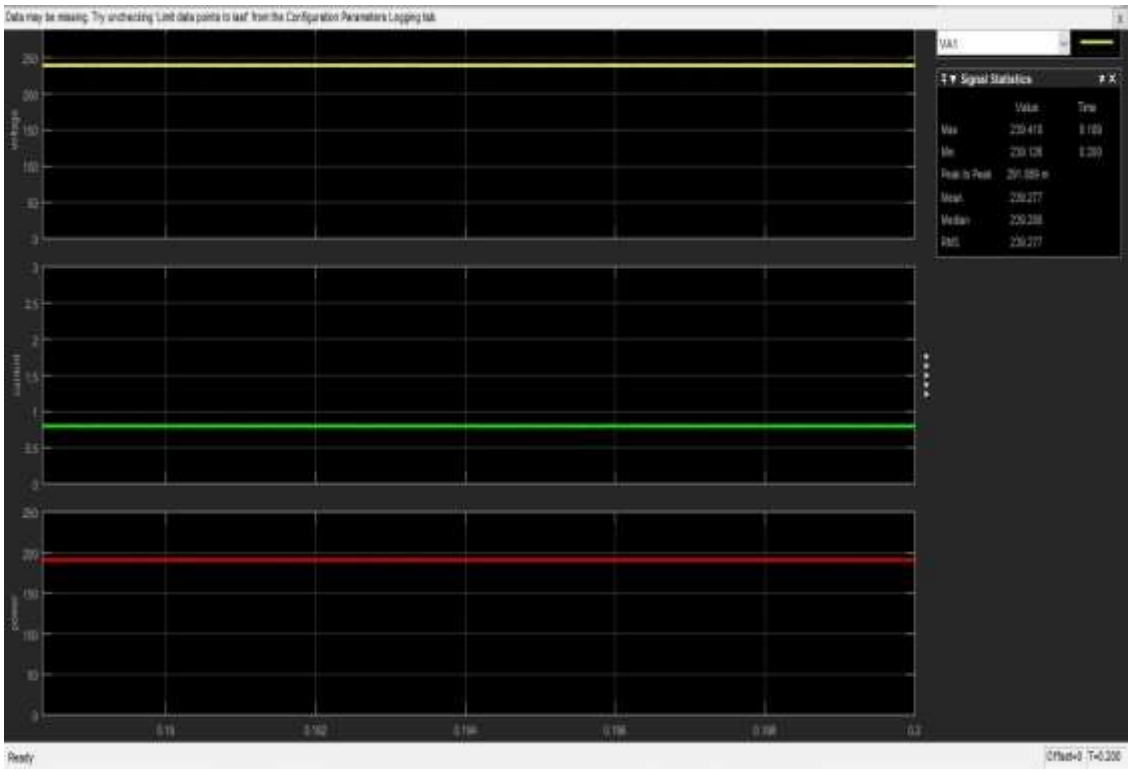


4. Incremental Conductance Simulink Model:

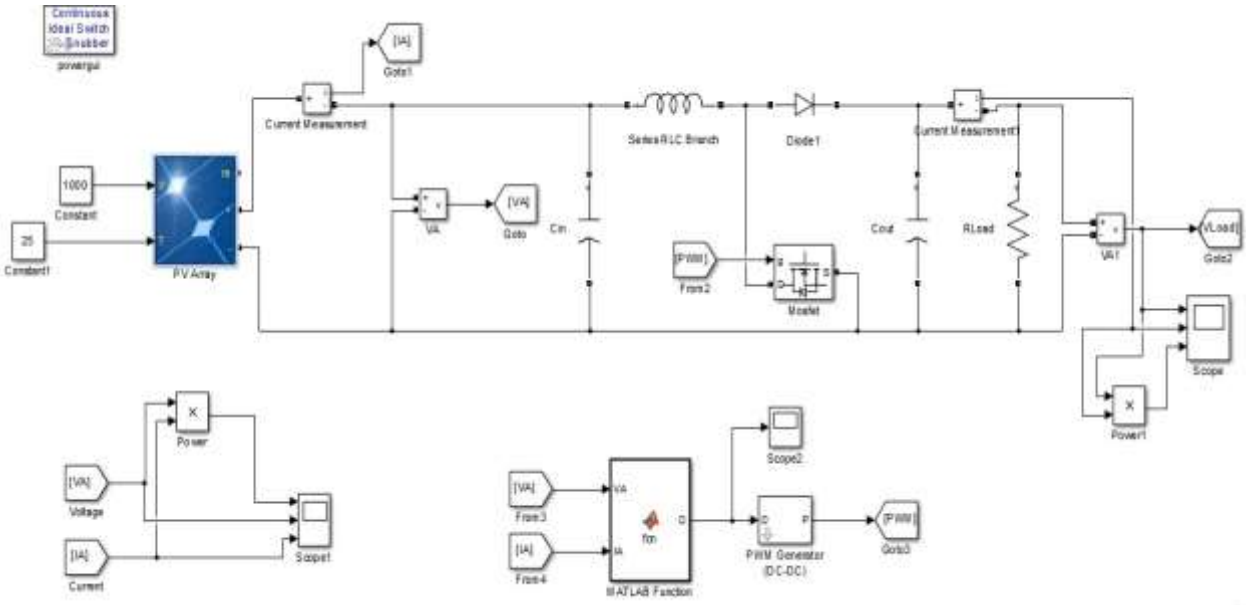


O/P GRAPH :

Voltage, Current and Power with Incremental Conductance

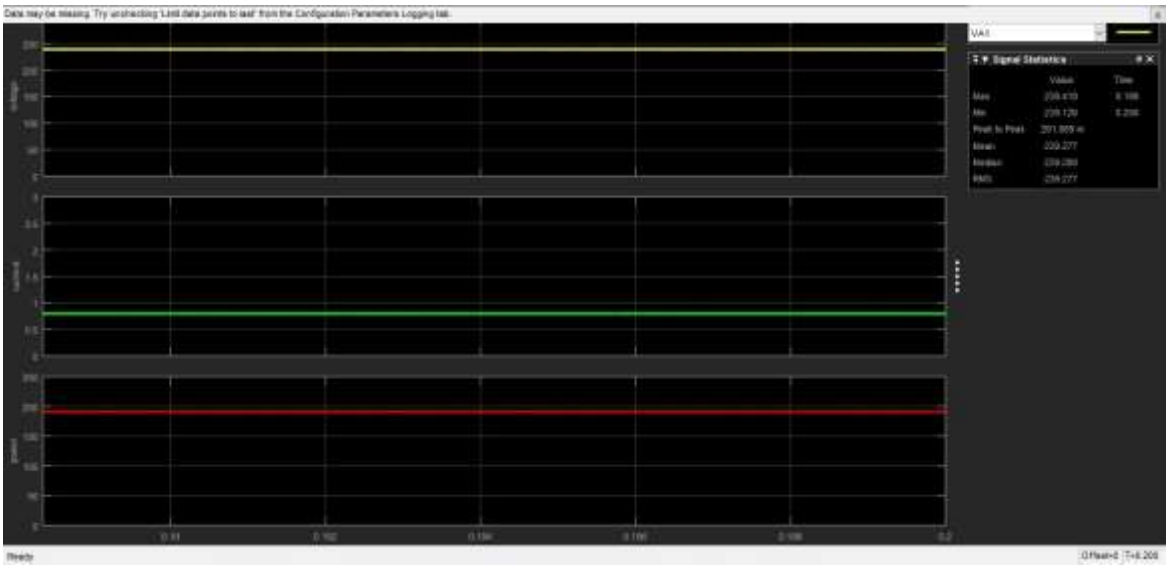


I. perturb and observe method Simulink model:



O/P GRAPH:

Voltage,Current and Power with Perturb Observe Method



COMPARISION BETWEEN PERTRUB & OBSERVE METHOD AND INCREMENTAL CONDUCTANCE METHODS:-

MEASUREMENTS	PERTRUB & OBSERVE METHOD	INCREMENTAL CONDUCTANCE METHOD
VOLTAGE	**239.567V**	**239.277V**
CURRENT	**0.798A**	**0.797A**
POWER	**191.308W**	**190.845W**

Not all mpptechinques suitable for all systems allmppt techniques will not work efficiently for a given system.In this work the P&O(Perturb and Observe) maximun power obtained is 191.30W.By incremental conductance method the maximum power obtained is 190.84w.Hence,by comparing the result for present system the best suitable method is perturb and observe method.

SYSTEM SPECIFICATIONS:

In this work P&O(Perturb and Observe) and incremental conductance mppt technique are developed for the following system.

PARAMETERS	VALUES
No. of Parallel Strings	1
No. of Series-connected modules per String	1
Max.Power(w)	200.143
Cells per module (N CELL)	54
Open Circuit Voltage V_{oc}(V)	32.9
Short Circuit Current I_{sc}(A)	8.21
Voltage at Max.Power Point V_{mp}(V)	26.3
Current at Max.Power Point I_{mp}(I)	7.61

Temp.Coefficient of V_{oc}(%/deg.c)	-0.35502
Temp.Coefficient of I_{sc}(%/deg.c)	0.06
Light-generated current IL(A)	8.2288
Diode saturation current I_o(A)	2.3246e-10
Diode ideality factor	0.97736
Shunt resistance R_{sh}(ohms)	150.6921
Series resistance R_{se}(ohms)	0.34483

Table:system values in MATLAB

And simulink model are developed. Simulink models are implemented in R2015a matlab environment.

5. CONCLUSION

This work has presented a comparison of P&O (Perturb and Observe) and IC (Incremental Conductance) MPPT technique for a PV system.It is concluded that P&O(Perturb and Observe) method gives best result for this system.Finally it is observed that p& o method has better performance than incremental conductance method for this system

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