Maximum Power Point Tracking For PV Based Solar System: A Review

Devendra Singh, Gyanendra yadav, DivyaPratap Singh and GyanRanjan Gupta

Abstract- **The amount of power generated from aphotovoltaic (PV) system mainly depends on the following factors, such as temperatures and solar irradiances. According to the high cost and low efficiency of a PV system, it should be operated at the maximum power point (MPP) which changes with solar irradiances or load variations. This paper presents an improved maximum power point tracking (MPPT) algorithm of a PV system under real climatic conditions. The proposed MPPT is based on the perturbation and observation (P&O) strategy and the variable step method that control the load voltage to ensure optimal operating points of a PV system. The experimental results show that the PV power system, using the proposed MPPT algorithm, is able to accurately track maximum power points (with minimum steady-state power oscillations) under rapid irradiance variations.**

Keywords-Photovoltaic generation system, Maximum power point tracking, Perturbation and Observation algorithm.

I.Introduction

The optimal operation of a PV system is important due to the low efficiency of solar panels. The output characteristic of a PV system is nonlinear and varies with ambient temperatures and solar irradiance levels. Therefore, a MPPT technique is required to obtain maximum power from a PV system. A number of MPPT techniques have been developed for PV systems, and for all conventional MPPT techniques the main problem is how to obtain optimal operating points (voltage and current) automatically at maximum PV output power under variable atmospheric conditions. The majority of MPPT control strategies depend on characteristics of PV panels in real time, such as the duty cycle ratio control and using a look-up table. MPPT techniques can be generally classified into four types:
(i) the perturbation and observation (P&O) algorithm (ii) the hill-climbing algorithm (iii) the incremental conductance (INC) algorithm; and (iv) the constant voltage algorithm, and also in this method the effect of solar irradiance variations is neglected. The developed mathematical electrical-thermal model of a PV module depending on ambient temperature, wind speed, wind direction, relative humidity and electrical operating point (voltage and current values) proposed a new MPPT control method for solar electric vehicles based on an offline artificial neural network (ANN), trained using a back-propagation with a gradient descent momentum algorithm, which is used for the online generation of a reference voltage. The obtained simulation and experimental results showed that the proposed control system was efficient.

Devendra Singh, Gyanendra yadav, DivyaPratap Singh and GyanRanjan Gupta are with Electrical and Electronics Engineering, Galgotias College of Engineering and Technology Greater Noida, India, Emails: gyanendra.pmi2047@gmail.com, dps5498@gmail.com, gyanrocket@gmail.com

II. Literature Survey

In this paper, rigorous analysis and review has been done towards the tracking of MPPT through efficient algorithm.In photovoltaic (PV) system applications, it is very important to design a system for operating of the solar cells (SCs) under best conditions and highest efficiency. Maximum power point (MPP) varies depending on the angle of sunlight on the surface of the panel and cell temperature. Hence, the operating point of the load is not always MPP of PV system. Therefore, in order to supply reliable energy to the load, PV systems are designed to include more than the required number of modules. The solution to this problem is that switching power converters are used, that is called maximum power point tracker (MPPT).

The general idea of MPPT is that a solar panel behaves similarly to a nonlinear current source that has maximum power at a specific output voltage for each environmental condition (temperature, illumination, etc.). By inserting a DC-DC converter between the solar array and the load, it is possible to adjust the duty ratio of the converter to match the impedance of the array to the load, producing the maximum output power of the array.

There are different type of MPPT algorithm are use for the purpose of improving the efficiency of solar panel-

Perturb and observe[1]algorithm consists in varying the voltage of the capacitor located in parallel with the solar modules, measuring the power obtained in each situation. This In P&O algorithm, a small increase in operating voltage of PV array is realized, and the amount of change in power (ΔP) is measured. If ΔP-value is positive, operating voltage is increased again to reach MPP, thus, sign of power error track by these small voltage errors.

Incremental conductance algorithm[2] consists in studying the slope of the module power-voltage curve. Incremental conductance (IC) algorithm is based on that the derivative of PV power by the voltage is equal to zero.

Accordingly, at the maximum power point, $dP/dV = d(IV)/dV = I + V\,dI/dV = 0$.

In constant voltage/current algorithm[3], solar panel is temporarily separated from MPPT, and open-circuit voltage is measured. Later, voltage at MPP is calculated by Vmax/VO C□ $K < 1$.

III. Method Adopted

The objective of this thesis is firstly to review different MPPT algorithms. Then themost popular, *perturb and observe* (P&O), *incremental conductance* (InCond) and *fuzzylogic control* (FLC) are analyzed in depth and tested according to the standard mentioned. After that, improvements to the P&O and the InCond algorithms are suggested to succeed in the MPP tracking under conditions of changing irradiance. To
test the MPPT algorithms according to the irradiation profiles proposed in the standard,
a simplified model was developed, because the simulation time required in some of the
cases cannot be reached with the detailed switching model of a power converter in a normal desktop computer. The reason for that is that the computer runs out of memory
after simulating only a few seconds with the complete model. Finally, the simplified model is verified by comparing its results with those obtained from a model containing
a detailed model of an inverter.

IV. Conclusion

The paper studies three MPPT methods and analyses their behaviour when they have to follow a sudden change in irradiance or when significant noise is present in the voltage and current measurements.

The first method, three-point perturb and observe, is the simplest to implement, but it shows the worst behaviour in power tracking both with and without noise. The two incremental conductance methods are more difficult to implement, but they have better power tracking characteristics (slightly better for the variable step system). The fixed-step method is the one showing higher immunity to noise measurements, since it only requires the evaluation of the sign of the generated power derivative. Therefore, in the real systems, the existent noise in the measurements, although this is very low, has a significant effect in the performance of the algorithms compared with obtained results in ideal simulations, reducing the global system performance.

Reference

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